BITCOIN
AND
THE JAPANESE RETAIL INVESTOR

by

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Abstract

The objective of this research is to examine the Bitcoin rally of 2017 as it occurred in Japan and establish a greater context for why it was the Japanese retail investors that propelled the nation to being the largest trader of the cryptocurrency at the end of the year. This dissertation begins with the examination of the technical and economical properties of Bitcoin by classifying it as fulfilling two roles: that of a means of payment and that of an investment commodity. Following that is a description of Bitcoin's roots and the history of its non-speculative usage. These chapters serve as a base for examining the cryptocurrency's role in Japan. The third chapter examines the Japanese retail investor and the Japanese retail investment landscape with a focus on the question of the low rates of risk-asset participation in face of a favorable investment environment. Historical context is drawn upon to argue that the present situation, wherein most financial assets are kept as cash, is rather the result of the historical path dependence than the present-day conditions in which Japanese retail investors operate. The final chapter addresses the question of high-risk activities in the form of gambling and margin trading by a group of predominantly middle-aged men and connects this propensity to engage in zero-sum games with Bitcoin's success in Japan. The author argues that the solitary practice of high-risk financial activities enabled by trusted institutions is separate from the general savings tradition that suffered shocks following the low interest-rate regime and that it was the high-risk gambles that became the primary cause for the popularity of Bitcoin. The dissertation concludes with the argument that the success of Bitcoin in 2017 had been in no small part achieved precisely by inverting the hard-line libertarian values of its creators and making it a centrally-held commodity offered by a banking-like institution with a strong public presence.

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Introduction

Since the late 1970s, Japan has had a rather peculiar popular image that persists into the current day. The nation's rapid ascent from the poverty of the immediate postwar towards becoming one of the leaders—and, in many cases, the leader—in the most cutting edge fields of technology had been nothing but remarkable. Its automotive companies were so successful that voluntary limits had to be imposed on their exports; its electronics manufacturers had constructed the first quartz watch, the Walkman and one of the most successful entertainment consoles of all time; its imagined landscapes appeared on the silver screens of the world with many believing that the twenty-first century could well be "The Japanese Century". Conversely, the land of the rising sun had also maintained its mystique and remains seen as one where, in spite of the technological progress, tradition continues to reign supreme. The same economy that had leaped forth with such fervor had done so through the administrative guidance of the powerful ministries of the central bureaucracy, often to the chorus of protest of Japan's overseas allies; the employees of its companies joined the *kaisha* and remained with it for life, making the firm more akin to a family married into than an entity paying an hourly salary; its rich culture from the tea ceremony to traditional meals to the rigid etiquette dominating all relations both within the firm and outside had not disappeared either. This image of technology intertwined with tradition, however true or untrue it may correspond to the lived reality, has persisted into the present day. It is the image of the colorfully-clad geisha with a paper umbrella chatting on a mobile phone at a busy Kyoto crossing, the image of the massive Tokyo skyscrapers dwarfed by the colossus of Mt. Fuji looming on the horizon, the image of a solitary shrine to a Shinto deity found amidst the urban sprawl, unnoticed but not ignored by the river of gray suits of the salarymen moving past it.

It is thus perhaps unsurprising that it is Japan, and to a lesser degree its neighboring South Korea, that had quickly become associated with the rise of a new form of money. Appearing in the midst of the chaos that was the Global Financial Crisis and designed by a mysterious stranger known only as Satoshi Nakamoto, this new form of money promised to rectify the mistakes of the past and offer a new global currency. It would neither be limited by national borders nor controlled by any elected or unelected elites nor could

it be created out of thin air at a whim to shift the problems of today unto the future generations. No bank or government could ever revert a transaction, and neither could the money be confiscated from someone through a physical search. In the eyes of many, this new digital currency of the Internet known only as Bitcoin would be seen as the future of money.

Given its scarce nature, many began to buy this digital currency from those who had created it before through a process known as mining and, while discussions of the importance of spending it would arise throughout the entirety of Bitcoin's first decade, the lack of acceptability among merchants would make it only difficult to use it legally for anything other than stuffing it under the proverbial mattress. Whilst the cryptocurrency offered entirely new possibilities to those operating outside the law and a small handful of individuals exiled from utilizing banking services, simply going to a store and paying with bitcoins for a mundane daily purchase remained difficult, eventually leading to the creation of entire online communities that exchanged tips on how to live whilst transacting exclusively with Bitcoin. However, just as the project began with a Japanese-named man, word would soon spread that far away from the shores of both the Old and the New World in the futuristic land of Japan, Bitcoin had been gaining traction with major merchants and becoming accepted as a new mainstream payment method.

While this idea has thus far been nothing but an idea, imbued with a fair dose of othering and romanticization of a faraway country and torn out of the same book as the image of a society soaked in both modernity and tradition, Japan had indeed played a pivotal role in Bitcoin becoming what it is today. Most notably, the first major Bitcoin exchange that allowed individuals curious about the project to purchase the cryptocurrency with their dollars, euros or yen had been headquartered nowhere other than in the Shibuya ward of the Tokyo Metropolis. At one point, this one exchange accounted for as many as seventy percent of all transactions flowing through the network; the eventual heist on its vaults would later lead four percent of all bitcoins that can ever be created being stolen from their rightful owners by a single group of hackers. The firm, severely lacking in professionalism across all relevant departments, had lacked the necessary banking license and could only play out its part in history because it had not been shut down by the regulators for reasons unknown.

The collapse of the exchange resulted in a lengthy legal process that to an extent continues to this very day. Perhaps it is also precisely this early experience with the cryptocurrency that had also later led to Japan becoming one of the first nations to not only clarify its regulatory stance on the new technology but indeed to recognize it as a payment method. Not long thereafter, adoption had exploded among different demographics and some major Japanese retailers had indeed begun accepting bitcoins at

their cash registers. These events were unfolding at an ever-accelerating pace throughout most of 2017 as the marked increase both in bitcoin's news coverage and its market price had continued. The price would peak shortly before the Christmas of the same year and begin its slow yet steady decent, yet before that it was none other than Japan, with its aging population and a seeming adversity to both electronic payments and risky investments, that had become the world's leading nation in terms of Bitcoin transaction volume.

The objective of this dissertation is to provide a detailed account as to how and why Japan had found itself in the aforementioned situation shortly before the burst of what for all intents and purposes appears to have been a Bitcoin asset price bubble of 2017. Specifically, it seeks to answer the question of why Japanese retail investors had participated in Bitcoin to such a large degree, who these individuals are and where the Bitcoin bull rush of 2017 fits in the overall Japanese attitude towards saving, investing and money as a whole.

This book is divided into four chapters.

The first chapter provides a description of what Bitcoin is from a technical and economic point of view. It should equip the reader with a sufficient degree of understanding of the technology to dispel the many myths and misunderstandings perpetuated both by its less-knowledgeable proponents and its less-knowledgeable detractors. The chapter lays out a brief overview of the technology used and what Nakamoto had done to create this new technology. Thereafter, an attempt is made to classify what Bitcoin is from a utilitarian economic point of view and disentangle many of its inherent aspects in a reductionist manner that allows one to examine them on a case-by-case basis. Rather than discussing Bitcoin as a currency, an argument is presented that Bitcoin can be viewed as having two separate functions. The first of these is a payment method, the second is that of a pure investment commodity. This division is built upon the cryptocurrency's core aspects such as decentralization, non-reversibility, and permanence. The chapter concludes with its potential vulnerabilities.

In the second chapter, Bitcoin is examined from the historical point of view with an emphasis on its origins and the original intent behind the project. Rather than examining what it can and cannot be based on its inherent characteristics as done in the preceding chapter, Bitcoin if viewed in the light of what it has been used for and the challenges that its users faced since its inception. Many of these are apparent from the earlier description of the technology's attributes, but it is only after the examination of the project's ideological roots that it becomes clear why these attributes have been put into existence in the first place. The following history describes how this structure has played out and what functions other than speculative investing the cryptocurrency has come to

serve. The chapter offers an explanation as to why Bitcoin has succeeded in its current implementation where its predecessors had failed.

The third chapter departs from the topic of cryptocurrencies and focuses on Japanese retail investors. An outline of the Japanese financial markets' history as it is pertinent to the retail investor is laid out. Here a particular emphasis is placed upon the developments of the postwar on the one hand and the domestic asset performance following the bursting of the Bubble on the other hand. The chapter provides an overview of the retail investing environment as well as both the challenges faced by and the incentives offered to the retail investors in Japan. The present structure of the household financial assets is discussed in the context of this environment. Attempts are made to answer why the Japanese retail investors have been lead to assume the present low-risk indirect investment profile and whether it is indeed a result of the poorly performing market after the conclusion of the Bubble economy.

In the fourth and last chapter, a different aspect of the attitude towards money existing in Japan is examined as it is exhibited by the large spending on high-risk activities that would at first appear to run contrary to the financial asset structure of the previous chapter. Herein two major activities are discussed and connected to the popularization of Bitcoin in Japan. The first of these is gambling in its classical sense, the second is participation in the high-risk zero-sum games on the financial markets. The appearance of the phenomenon known as *Mrs. Watanabe* is described within its historical context as well as the Japanese retail investors' uncanny ability to influence the most liquid and efficient market of the foreign exchange pairs. Plausible attempts are made to link the functions of Bitcoin described in the first two chapters to the attitudes towards money in Japan and the use of Bitcoin within Japan in 2017. Finally, it is attempted to explain who and why participated in the Japanese Bitcoin rally in the last months of the aforementioned year, and how this brief episode interlocks with the greater tapestry of the Japanese savers' history.

Position within previous research

This research positions itself within the greater landscape of contemporary Japanese economic history literature in particular with regard to the behavior of the Japanese households. The high savings rate of these Japanese households during the second half of the twentieth century has unsurprisingly attracted copious research from the financial, governmental, and scholarly institutions. Of particular note among the latter are the works of Sheldon Garon and Charles Yuji Horioka. Whereas Garon provides an in-depth narrative exploring the interplay between the Japanese government and the activist groups of the middle class in the promotion of thrift and households savings,[1] Horioka examines the socio-economic aspects that had led to what the author argues to have been a temporary phenomenon of high savings rates.[2] Although Horioka's 1993 prediction appears to have held and the households savings rates proceeded to decline, the Abenomics era reinvigoration of savings as discussed by Tokuo Iwaisako et al. reformulated the question of whether it was not the decline of savings caused by the household income rather than the savings rate itself that may have been temporary.[3] Nonetheless, Horioka's research published in a number journals and edited volumes is likely the most comprehensive examination of the matter and has been expanded with new explanations of the Japanese savings rate over the years. As of 2008, these reasons have encompassed eight points: 1.) households saved more due to growth of spending not catching up with the growth of income; 2.) households saving to restore the prewar levels; 3.) lack of consumer credit leading to precautionary spending; 4.) a young population with few elderly[4] saving more as per life-cycle hypothesis–stating in general terms that consumers adjust their saving and spending patterns to even out their spending across the lifetime; 5.) the Japanese corporate system of semi-annual bonuses encouraging lump-sum saving; 6.) tax breaks on savings; 7.) low pensions until 1973 encouraging saving for retirement; and 8.) savings promoting activities both from the side of the government and that of activist groups.[5] To the best knowledge of this author, this list constitutes the most comprehensive list of factors published to date and draws from a wealth of previous research by Horioka and others. The eighth point as mentioned previously is based on the depth of work by Garon, and the fifth point pertaining to bonuses had been developed by Tsuneo Ishikawa

1. Sheldon Garon, *Molding Japanese Minds: The State in Everyday Life* (Princeton University Press, 1998), ISBN: 9780691001913.

2. Charles Yuji Horioka, "Consuming and Saving," *Postwar Japan as history*, 1993, 259–92.

3. Tokuo Iwaisako et al., "Impact of Population Aging on Household Savings and Portfolio Choice in Japan," *Available at SSRN 2908756*, 2016,

4. At the time of the high savings rate period.

5. Charles Yuji Horioka, "A Survey of Household Saving Behaviour," chap. 47 in *The demographic challenge: A handbook about Japan*, ed. Florian Coulmas et al. (Brill, 2008), 879–897.

and Kazuo Ueda in 1984.[6] The seventh point, although not explicitly mentioned as such, almost certainly derives from Martin Feldstein's observations in his 1974 paper "Social Security, Induced Retirement, and Aggregate Capital Accumulation" and is closely linked to the Ando and Modigliani life-cycle hypothesis also referenced in the fourth point.[7] Other points such as the expensiveness of marriage and its relationship with the high savings rate have also been examined and consecutively dismissed by Horioka.[8]

A closely related issue is that of Japanese pensions–a topic inextricably linked to the aging society that Japan has by now come to symbolize in popular discourse. While the topic itself is broad and can be approached from multiple angles, be that the effects of the changing family dynamics in the postwar, low population replacement rates or the changes in the role of Japanese women in the workforce, of particular note to this research are those publications principally focused on the role of savings vis-a-vis retirement, governmental and private pension structures as well as the application of the aforementioned life-cycle hypothesis to the said behavior. Of particular note is the research conducted over the past three decades by scholars Noriyuki Takayama and Yukinobu Kitamura with a number of publications both in Japanese and in English. Among them are *The Greying of Japan*,[9] *Sutokku Ekonomī*,[10] as well as various publications of the two authors for the National Bureau of Economic Research.

Lastly, there remains the matter of personal investing–or *retail investing* as referred to from hereon–for the purposes of accumulating wealth most pertinent for sustaining a degree of the previous standard of living after the earners of the household enter retirement. This aspect appears to so far have attracted little scholarly attention within the English-language economic history literature. The situation is somewhat different in Japanese literature with an increasing number of scholars examining the investing aspect of the households in Japan. This is not in the least prompted by the permeation of the defined-contribution plans from the early 2000s and again in the early 2010s and is visible by their weight in articles of pension researchers such as Takayama.[11] Questions such

6. Tsuneo Ishikawa and Kazuo Ueda, "The Bonus Payment System and Japanese Personal Saving," ed. Masahiko Aoki, 1984, 133–192.

7. Martin Feldstein, "Social Security, Induced Retirement, and Aggregate Capital Accumulation," *Journal of Political Economy* 82, no. 5 (1974): 905–926. Albert Ando and Franco Modigliani, "The 'Life Cycle' Hypothesis of Saving: Aggregate implications and tests," *The American Economic Review* 53, no. 1 (1963): 55–84.

8. Charles Yuji Horioka, "Nihon Ni Okeru Kekkon Hiyō To Sono Tame No Chochiku" [Marriage costs and savings in Japan], 1987,

9. Noriyuki Takayama, *The Greying of Japan: An Economic Perspective on Public Pensions*, Economic Research Series. The Institute of Economic Research, Hitotsubashi University (Oxford University Press, 1992), ISBN: 9784314100656.

10. Noriyuki Takayama, *Sutokku Ekonomī: Shisan Keisei To Chochiku Nenkin No Keizai Bunseki* [Stock Economy: Economic Analysis of Asset Formation, and Savings and Pensions] (Toyo Keizai, 1992).

11. Noriyuki Takayama, "Matching Defined Contribution Pension Schemes in Japan," ed. Richard Hinz et al., 2012, 145.

as the Japanese retail investor's risk profile and the negligible effects of the asset-price bubble on it have been extensively explored by scholars such as Takuya Yoshikawa.[12] A different source of qualitative research supported by quantitative data originates from the governmental and financial institutions within Japan. The most prominent example of the former are series such as the *Bank of Japan Review* and publications by the Financial Services Agency of Japan. The latter includes research groups under the umbrella of the financial institutions such as the Nikko Research Center and the Nomura Research Institute, which are mostly limited to the Japanese-language readership.

Nonetheless, the author of this book contends that this topic, while woefully underexplored in the English-language literature, is also becoming one of ever greater importance in post-high-growth Japan. This is in no small part due to the demographic change resulting in the unsustainable nature of the current pay-as-you-go pension system shifting an ever-greater burden on the fiscal budget and, by extension, the current and future working population. Whilst this issue may be resolved without direct action by the future retirees themselves, be that through a governmental shift to a funded pensions scheme or via a reversal of the demographic shift through increased fertility, at present personal retirement planning can be argued to remain, more so than in the past decades, in the hands of future retirees themselves. Given the perpetuation and promotion of tax-advantaged retirement and personal investing schemes following the financial liberalization, it appears that this is also implicitly the position upheld by the legislature. This book seeks to expand on this aspect of the household behavior by examining the Japanese retail investor and questioning how far the changes resulting from the turmoil of the collapse of the asset price bubble in the 1990s have led to the popularity of cryptocurrency trading in 2017. It concurs with previous research in as far as to the lack of variability in the risk-asset allocations, but seeks to explain the cryptocurrency phenomenon within the scope of what Yoshikawa describes as the changing environment.

12. Takuya Yoshikawa, "Nihon Ni Okeru Kakei No Aitaiteki Kiken Kaihi-do No Suii: 1970-nen 2002-nen," *Seijo University* 163 (2003): 73–87.

Chapter 1

What is Bitcoin?

1.1 Introduction

As Bitcoin rose to popularity throughout 2017, an ever vaster group of people begun to formulate their opinions on the matter based on what they had learned about the new technology through the increased media exposure. According to an August 2017 study by the financial services information provider LendEDU, as many as 78.6% of questioned Americans reported having heard of Bitcoin.[1] Unsurprisingly, a penetration was greater among younger responders than responders aged 55 and older, 76% of whom have nonetheless reported having heard of Bitcoin. In November of the same year, this ratio had been as high as 87.6% in Japan.[2]

One can thus postulate without much contention that the population as a whole knows about Bitcoin. That is not to say that the things the said population believes to know about the network are correct, as can be seen from the same study suggesting that as much as a tenth of the responders incorrectly believed that possession of Bitcoin is illegal in the United States. A further 48% responded that they do not know, clearly putting this specific topic into the largely misunderstood basket of general knowledge.

To understand the history of Bitcoin and its consequences, it is thus imperative to understand what it is, what it is not, how it functions and what properties it exhibits compared to similar things.[3] This chapter describes the technical implementation of Bitcoin and its inherent financial characteristics. These become important in the later chapters when trying to understand why it has attracted the eye of some unconventional

1. Mike Brown, *Bitcoin's Present (And Future) Role in the American Economy*, Web Page, 2017, `https://lendedu.com/blog/bitcoins-role-in-the-american-economy/`.

2. Chiharu Mikimoto, *Bitcoin Recognized by Close to 90%–Who Actually Purchased It?*, Web Page, 2017, `https://news.mynavi.jp/article/20171107-a138/`.

3. Here the term "things" is used because the plethora of aspects constituting Bitcoin and bitcoins cannot be described aptly with one more specific term.

users and what its place could be in the years to follow.

1.2 Terminology

Due to Bitcoin's decentralized nature that will become apparent in the technical description following this section, there is no uniform style guide for correctly naming different aspects of the system. To avoid confusion, the author draws on the work of Karl Friedrich Lenz and adopt his terminology.[4] For terms not used by Lenz, the author's own standardized spelling and capitalization is used in as far as these match Lenz's template and general conventions in the broader Bitcoin community. The following are to be distinguished from one another:

Bitcoin—the system based on the Bitcoin blockchain, including the Bitcoin blockchain itself and the network of computers interacting with it. Note the capitalized spelling.
bitcoin/s—a unit of Bitcoin cryptocurrency on the Bitcoin blockchain. Note the lack of capitalization.
bitcoin—the collective term for all bitcoins.
BTC—the currency symbol corresponding to bitcoins.
Satoshi—the pseudonymous inventor of Bitcoin, Satoshi Nakamoto.
satoshi—one hundred-millionth of a bitcoin (10^{-8} or 0.00000001 BTC). The smallest presently divisible unit of a bitcoin.

1.3 Technical

Proponents of Bitcoin popularly describe the system as being to finance what the internet has been to communication systems. Although the purported revolutionary potential of Bitcoin is yet to be implemented, the description is somewhat apt in the way it relates to the way the Bitcoin network has been designed.

The system was first described in 2008 by its original developer Satoshi Nakamoto in a self-published article "Bitcoin: A Peer-To-Peer Electronic Cash System." Despite the popular perception that Bitcoin is something new in its entirety, it is only the case when the system is looked at from a holistic point of view. The cogs that keep the machinery itself running had already been used for decades prior.

Bitcoin—the network, from here on written with a capital B—is a transaction ledger. In its most rudimentary form, it is a little different from any other ledger used over the

4. Karl Friedrich Lenz, *Japanese Bitcoin Law* (Tokyo: Createspace Independent Pub, 2014), ISBN: 9781502353030.

past centuries for the purposes of keeping track of payments and deposits. Thus, just as in the days of yore, when a hypothetical Bob decides to send a payment to a hypothetical Alice, the payment amount is subtracted from Bob's account, added to Alice's account and the transaction is recorded into the ledger to reflect the new account balances of the participants. This tried-and-true system defines the entire Bitcoin system with all the following elements being merely the means of its implementation and individual choices as to how it should be implemented.

Bitcoin's ledger is entirely electronic. It is conceptually not much different from a traditional ledger implemented in a spreadsheet program such as Microsoft Excel or in any of the myriad of existing databases. In the words of Nakamoto himself, it is "a global distributed database".[5] Typically, the said electronic ledger would be the key component of a payment system, wherein a central authority would be tasked with maintaining the ledger and appending transactions to it as they occur. This is the crucial element wherein Bitcoin differs from preceding electronic payment systems.

Neither Alice nor Bob may be allowed to edit the ledger due to the inherent conflict of interest in maintaining it in a manner that would be just to both parties. Continuing with the two-party analogy, unrestricted access to the ledger would allow Bob to either corrupt the integrity of the ledger by changing his final balance and leading to funds appearing out of nowhere. This could be remedied by Alice a posteriori by recalculating the ledger until an inconsistency is found and amending it to reflect the correct balances. Alternatively, Bob could put more effort into his deception by going back a considerable period of time in the ledger, adding a transaction from Alice that had never occurred and recalculating the balances for all following transactions. Although Alice could notice that her balance had become smaller than it was following her previous transaction, determining at what exact point a fraudulent transaction had been added would require Alice to either be in possession of her own ledger that is the exact copy of the ledger used by her and Bob.

The aforementioned problem leads to the inherent problem of trust, which can be solved by two currently known means. The first is that of the aforementioned trusted intermediary that vouches for the integrity of the ledger. In other words, a bank or a bank-like institution. Should the bank be unable to meet the trust criteria of its clients, the existing clients are likely to withdraw their funds and new clients would avoid the firm. Alternatively, it is possible to build a trustless system where no such central intermediary is required to exists. Bitcoin is precisely this kind of system with electronic ledgers distributed to all participants of the network. Since there are considerably more

5. Satoshi Nakamoto, *Bitcoin Open Source Implementation of P2P Currency*, Web Page, February 2009, accessed 17 January 2019, `https://satoshi.nakamotoinstitute.org/posts/p2pfoundation/3/#selection-29.8-29.35`.

than two parties, the ability to keep accounts correctly and prevent irregularities hinges on the fact that each participant would not only be privy to the ledger containing his own transactions but a ledger that contains all transactions of all participants of the network. Because it is always possible for Bob to go further back in time and add a transaction that had never occurred or otherwise manipulate the ledger, all participants of the network must thus furthermore maintain a ledger dating back to the very inception of the network itself.

The implementation of the aforementioned system requires several key components that Nakamoto had successfully put together in 2008 and constitute a genuine invention of the author. It is necessary to verify that the transaction has indeed been executed by the account claiming to be executing it. Bob should not be able to make any transactions from Alice's account. It is also necessary to verify that the funds transferred from the account had not been transferred elsewhere already. Bob should not be able to pay two people a dollar despite having only a dollar to his name.

1.3.1 Transaction process

The first of these problems is solved through the use of public-key cryptography. The technique was developed in the 1970s and is based on the irreversibility of a one-way mathematical function. Such a function makes it possible to get an output value from an input value but makes it mathematically impossible to solve for the original input value from the output value. This results in the peculiar effect that the only way to reverse the function is to guess the correct input value and confirm that running it through the function would indeed result in the previous output value.

This makes one-way functions ideally suited for encryption. One can create a so-called *public key* that would be used to encrypt a set of data and a *private key* that allows one to decrypt the said data. Assuming that the interlocutors are again Bob and Alice, Alice can thus create the two keys and transmit her public key to Bob through an unsecured channel, be it through email, a postcard or even by uploading the entire key to her public blog or social network profile. Since the public key only allows one to encrypt, but not decrypt, Alice would not need to worry that any unwanted party could gain the key. Bob, on the other hand, could use the key to encrypt a message for Alice and again send it through any unsecured channel in a form now unreadable to anyone who does not know the corresponding private key. In other words, everyone can encrypt messages for Alice, but only Alice can read the said messages. Bob could also reciprocate by sending his public key to Alice and put both interlocutors in possession of the partner's public key. This allows them to encrypt messages, send them to each other and use their respective private keys to read the messages directed at them. Any single participant can store

as many public keys of their conversation partners and only needs one private key of their own. This technique lies at the heart of modern, widely-deployed email encryption systems such as PGP or S/MIME and remains a reliable tool for encrypting and verifying confidential communication.

Bitcoin uses this technique to the same effect as seen in the diagram provided by Nakamoto in his white paper:

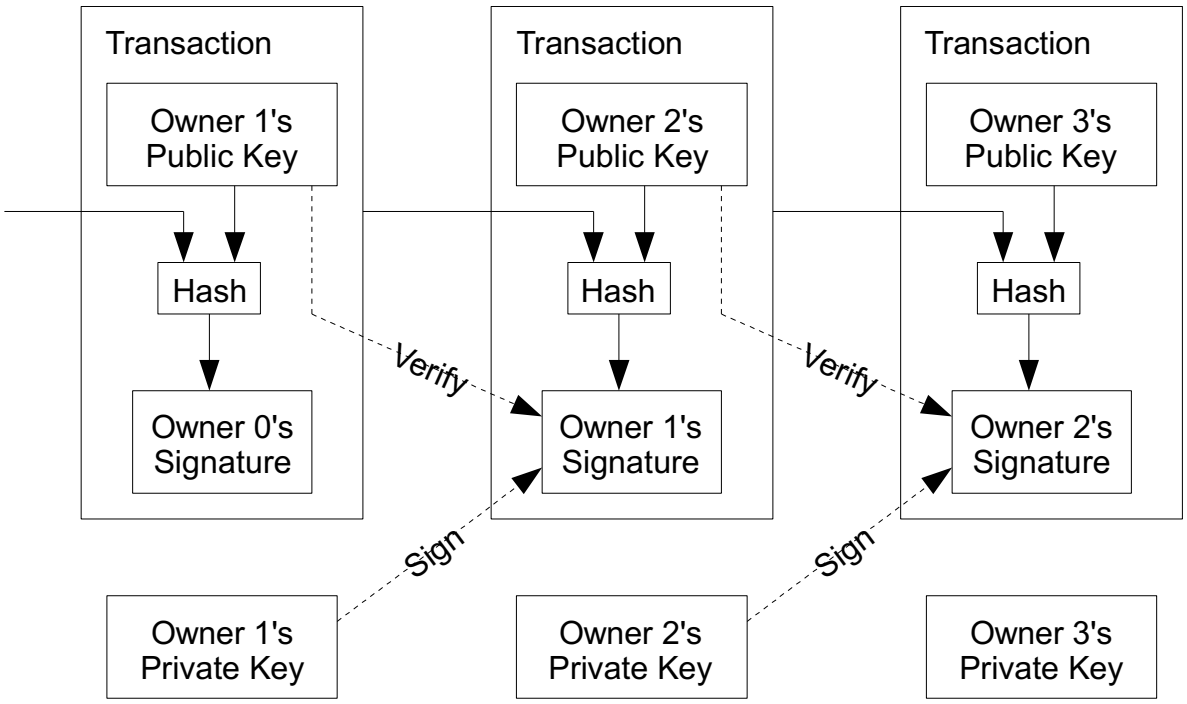

Figure 1.1 Diagram explaining how a transaction is executed from Nakamoto's original paper. Nakamoto, "Bitcoin: A Peer-To-Peer Electronic Cash System"

Although the original diagram may appear somewhat daunting, the technique proposed by Nakamoto is very easy to understand having made sense of public-key cryptography. The entire history of ownership of a "digital coin" is recorded in a chain of transactions. Whenever the coin is transferred to the next recipient, a new transaction is added at the end of the said history, much akin to the ledgers described above. When a new transaction is executed, the owner of the coin encrypts the data of the previous transactions with the public key of the next owner, just as they would when sending an encrypted email, and signs it with his private key, again just they would when cryptographically signing an email. The result is that the only individual who can continue this chain is the holder of the private key corresponding to the public key used by the previous owner. Assuming that no party had been compromised, the previous owner is the only party that had the ability to transfer the said coin. Upon transfer, the said original owner no longer has the ability to interact with the coin by the virtue of lacking

the new current owner's private key.

1.3.2 Double-spending

The aforementioned technique solves the issue of ownership, but results in another problem wherein there is no limitation on how many times an owner of a coin can spend it. Remembering that the owner merely requires his own private key and the recipient's public key, there is nothing stopping the owner from sending the same coin to an indefinite number of recipients. Assuming that it is Bob who sent a coin to Alice, he can no longer interact with the chain signed by Alice's public key, however, there is nothing to stop him from taking the chain in the state it was prior to the execution of the transaction and encrypting it with the public keys of Carol, David, Erin and any indefinite number of other recipients. As a result, Bob could digitally counterfeit money to his heart's content without anybody being the wiser. This problem has come to be known as *double-spending* and Nakamoto's solution to it is considered to be the pivotal achievement in the invention of Bitcoin.

Nakamoto notes in his paper that this issue had been solved previously by introducing a central authority that he refers to as "the mint". The said authority would be trusted by the members of the payment network and processes transactions based on their time of execution. Once a coin is spent, all future attempts to spend it are ignored and as such no double-spending can occur. However, Nakamoto notes that creating such an intermediary would result in the "fate of the entire money system depend[ing] on the company running the mint" and proposes a way of avoiding this single point of failure through implementation of a decentralized timestamp server.

Similar to a centralized timestamp server, the proposed solution would record transactions as they are executed and remove the possibility of multiplying the same coin indefinitely. In order to deploy this server on a peer-to-peer basis, Nakamoto introduces the concept of *proof-of-work (PoW)*, which consists of a member of the network being required to expend a certain quantity of computational power to record the executed transactions.

The concept of one-way functions has already been described in this section. A concept that builds upon it is the so-called *cryptographic hash*, which is a one-way function that allows a one-to-one mapping with extensive change in the output resulting from even the smallest change to the input. This means that for each value input there is only one possible output and for each output, there is only one possible input. Two or more similar inputs would result in outputs the form of which cannot lead one to believe that the inputs had been similar. One of the most popular of such hash functions and the one used in the Bitcoin system is the SHA–256. For illustrative purposes, the following are

the SHA–256 hashes of the inputs “Test”, “test” and “test1” respectively:

```
Test: 532eaabd9574880dbf76b9b8cc00832c20a6ec113d682299550d7a6e0f345e25
test: 9f86d081884c7d659a2feaa0c55ad015a3bf4f1b2b0b822cd15d6c15b0f00a08
test1: 1b4f0e9851971998e732078544c96b36c3d01cedf7caa332359d6f1d83567014
```

This unpredictability of the outcome is important in the implementation of Bitcoin’s peer-to-peer timestamp server. In essence, the system creates so-called *blocks* that contain sets of transactions that occurred at a specified time, the hash of the preceding block and a quasi-random or random variable known as a *nonce*.

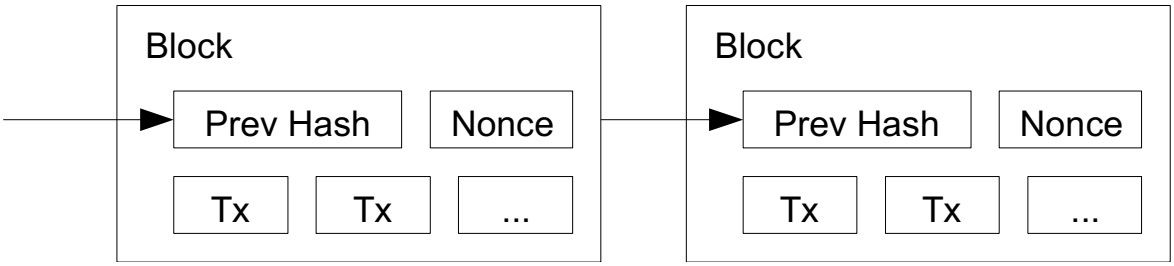

Figure 1.2 The chain of blocks containing Bitcoin transactions as displayed in Nakamoto’s paper. Nakamoto, “Bitcoin: A Peer-To-Peer Electronic Cash System.”

Each individual block thus contains a set of transactions that the creator of the block had been indiscriminately broadcast to from other network participants. This creator could be anyone on the network. However, in order for the block to be acknowledged by the network, the output of the block when hashed must meet certain requirements. In the case of the Bitcoin network, this requirement is that the hash of the block—the output—must begin with a number of zeroes specified by the network. As of the time of this writing, the three most recent hashes produced by the network were the following:

```
000000000000000001e9ee0657f848f92cece82a9c91b9b99439f1c82fe83b3
000000000000000001adae19a839416d0affc0e083fe8e628ec13bc2159b5fe
000000000000000001ed204ac941b866cccb52a6c2334e36a86d5a58a5936aa
```

Because the hash function is deterministic—a certain output always produces the same output—each want-to-be creator would produce the same hash based on the preceding block’s hash and the contents of the transactions received through the network. The element that leads to different hashes being produced is the presence of the nonce.

As it is mathematically impossible to reverse cryptographic hash, the only presently known method of finding the nonce that would produce a hash with a specific number of zeroes is trying as many different nonces as possible until a suitable hash is found. The

computer that finds the correct nonce broadcasts the block to the network. The block is added at the end of the chain, the computer that found a suitable nonce is rewarded with some coins to incentivize the participation in the block creation process, and the process begins anew.

This process of actively looking for the correct nonce has come to be known as *mining* due to its similarities with traditional mining wherein one expends effort to search for something that generates a return. The computers engaged in this search are conversely known as *miners*. Since the result of transacting on the network results in what can be best described as a chain of interlinked blocks, the technology as a whole has been baptized as the *blockchain*.

Proof-of-working mining thus securely time stamps transactions and avoids double-spending. Once a transaction has been recorded in a block, the network no longer accepts attempts to spend the now depleted funds by sending them to a different account. The only way to circumvent the system and rewrite the transactions from a specific point onwards is to rewrite the entirety of the blockchain anew. Due to the presence of mining, this would not merely require recalculating the new, fraudulent balances, but necessitates that the fraudster recalculates the hashes of all the previous transactions. Nakamoto notes that this is computationally unfeasible as long as the majority of network computing power is held by honest participants. In the case of Bitcoin, the network accepts the longest existing blockchain, which would be the real blockchain given the power expended to produce required *proof-of-work*.

By design, there is a limit as to how many bitcoins that can be mined, with the exact number being approximately 0.03 bitcoins short of 21 million. This number is derived from the halving of the number of bitcoins awarded to the miner each time a block is solved. The reward is halved every 210,000 blocks, with the first 210,000 blocks yielding 50 bitcoin. The following thus yield only 25 bitcoin, then 12.5 bitcoin and so forth. In its present implementation, bitcoins are divisible down to eight decimal places, the so-called 1 *satoshi* or 0.00000001 bitcoin. Calculating the total number of bitcoin than can be mined this way thus results in the aforementioned 21 million.

In an early email, Nakamoto describes that this process of block creation is the method by which bitcoins should be brought into circulation at a steady rate.[6] Due to the fact that the natural increase in computational power through faster computer chips or the number of members on the network—and thus the number of the computers looking for the hash—could and in fact did increase the speed at which blocks are mined, the network was designed to counteract the increase by raising the difficulty of the hash a miner must

6. Satoshi Nakamoto, *Bitcoin P2P E-Cash Paper*, Web Page, November 2008, accessed 17 January 2019, `https://satoshi.nakamotoinstitute.org/emails/cryptography/5/#selection-63.0-14.46`.

find in order to create a new block. As mentioned previously, the hashes of Bitcoin blocks must be preceded by a network determined number of zeros. Increasing the required number of zeroes by one makes the process of finding a new hash considerably harder. The following two hashes were solved in December 2010 and October 2018 respectively.

```
000000000003ba27aa200b1cecaad478d2b00432346c3f1f3986da1afd33e506
00000000000000000001e9ee0657f848f92cece82a9c91b9b99439f1c82fe83b3
```

The miner had to find a hash with mere eleven zeros when Bitcoin was still largely unknown in 2010. At this time, an average individual connecting from his home computer would have had a reasonable chance of drawing the right nonce. By contrast, in 2018 when Bitcoin was already known the vastest majority of this population, the difficulty had increased to eighteen preceding zeroes and massive computing centers all over the world were competing to find the right hash.

The network itself determines the difficulty of the required hash based on how long it took to solve the previous several hashes, expressed as a moving average. If the hashes are solved too quickly, the network increases the difficulty. If it takes too long, the difficulty is decreased. The result is that a new hash is solved and a new block is added approximately every ten minutes. In other words, Bitcoin follows a fixed schedule according to which the last fractions of a bitcoin will be mined in 2140.[7] From thereon, no new bitcoins will be added to the system and miners will be awarded fractions of each transaction as a reward for creating new blocks.

It is important to emphasize that the design of this system means that the mining process, and thus block creation, cannot be sped up past the brief window of time in which the system acknowledges that the transactions are being solved too quickly and slows the process down. The block creation continues at a fixed rate regardless of whether the mining base consists of a single computerized toaster attached to the network or by turning the entire planet into one massive supercomputer that does nothing but process Bitcoin transactions.

This also means that there is a physical limit to how many transactions can be executed per minute. In the case of Bitcoin, the maximum size of a single block is 1 megabyte. The typical transaction size is 495 bytes. The limit for the total number of transactions in a single block is thus 2020. Given that the network adjusts the difficulty of the hash to create a new block every ten minutes, a total of 3.37 transactions can be executed per second. This limit cannot be surpassed by technical means in Bitcoin's original implementation. This issue has been addressed by derivative networks such as Bitcoin Cash by increasing the maximum size of the block to 8 megabytes.

7. Rakesh Sharma, *Only 20 Percent of Total Bitcoins Remain to Be Mined*, Web Page, 2018, accessed 15 January 2018.

1.3.3 Usage

In order to interact with the network, the user required a client and a *Bitcoin wallet*.[8]

Clients

Since Bitcoin is an open platform, there is, in fact, no single definitive Bitcoin client, although one can arguably say that *Bitcoin Core* is a de facto main client due being the one that was originally developed by Nakamoto, remaining the reference implementation and being the oldest. The client allows users to generate wallets and execute transactions.

Originally, Bitcoin clients needed to download the entire blockchain up to the present moment before they could be used. In other words, the client would have to connect to the network and download every single transaction since Bitcoin had been launched. At the turn of 2019, this meant downloading and storing approximately 200 gigabytes of data that was largely useless to the overwhelming majority of participants the overwhelming majority of time.[9] For reference, the current lineup of Apple's MacBook Pro laptop computers is equipped with solid-state drives with capacities of 128 gigabytes, 256 gigabytes, and 512 gigabytes. In the standard, smaller monitor configurations, these cost $1,299, $1,499 and $1,799.[10] Consequently, if a participant decided to use the original implementation of Bitcoin clients and download a *full client*, it would be entirely impossible to do so on the lowest variant of what is a premium notebook computer; take up a prohibitively large amount of space on a medium-range variant that would make it difficult to perform other tasks requiring any sizable disk space commitment; and would take up nothing short of 40% of available disk space on the most expensive variant. While it is thus still feasible to store the blockchain on a desktop system, laptop users are largely excluded from full client implantations. This issue is even more prominent would one decide to deploy a full client on a tablet or a smartphone—a device arguably much more suited for executing payments than a desktop computer—whereby the vastest majority of phones available on the market simply would not have enough storage to download the

8. As stated previously, because there is no definitive authority that determines the terminology of Bitcoin, there is occasionally some overlap in the usage of terms referring to the network. "Wallet" is one such term, wherein it can mean both the client and the container with the encryption keys. This book will continue using the terminology laid out in this section, but the reader must be aware that it is usually not followed with great rigor and the term wallet is routinely used for Bitcoin clients on the quasi-official Bitcoin webpages.

9. Statista, *Size of the Bitcoin Blockchain From 2010 to 2019, by Quarter (In Megabytes)*, Web Page, 2018, accessed 17 January 2019, `https://www.statista.com/statistics/647523/worldwide-bitcoin-blockchain-size/`.

10. Apple's MacBook Pro series is used for illustrative purposes because, as of the time of this writing, they are the most well-known standardized notebooks available worldwide. Due to being premium products, one must account for the fact that they are by no means the cheapest computers offering the aforementioned storage capabilities.

blockchain.

For this reason, two alternatives appeared that alleviated the issue of the blockchain that outgrew portable storage capacities. The first was a series of *lightweight clients* that did not download the blockchain on the device itself but used it as an interface to the blockchain stored on the server of the provider of the client. The second alternative was simply entrusting one's Bitcoins to a custodian and executing transactions through the custodian's server as one would through an online bank. Although these solutions allowed the user the start using Bitcoin in minutes rather than hours or even days and only consumed a minimal amount of disk space, it must also be noted that they required the user to trust the service provider to a lesser or greater degree depending on the implementation, whilst creating an additional level of complexity that inevitably resulted in a greater number of vulnerabilities.

Wallets

Contrary to what the name may suggest, a *Bitcoin wallet* does not in actuality contain any bitcoins. Rather, it is more comparable to a prepaid debit card purchasable over the counter from a kiosk or a convenience store. It is a container that contains the keys to access the funds available on the Bitcoin network in the same way as having a debit card gives one the ability to access the funds stored at a bank. The contents of the wallet—the owner's private keys—can be secured through an additional layer of encryption by using a password determined by the user. Should the user lose the wallet or be unable to unlock it by forgetting the password, they would lose the ability to access their funds. The bitcoins will continue to remain on the network, but because there is nobody who can use them they forever remain dead in the proverbial void.

In the case of full clients and most lightweight clients, the wallets themselves are stored locally on the users' devices. Custodians and exchanges operated by third parties keep the keys in their own wallets and only let the user transact with the funds available to them and never let them a direct part of the network.

Since the wallet is just a set of keys, they can be transferred from one user to another. In the case of electronic wallets that are just files stored on a computer and accessed by the client, when need be the wallet can be transferred as any other file, be that via email, a thumb drive or an instant messenger. Provided the recipient knows the password, they would be able to access the funds in the wallet. This makes it possible to transfer bitcoins from one party to another without ever interacting with the network and leaving forensic evidence.

Using the same approach, it is also possible to make a physical wallet. This is most typically done by using a so-called *paper wallet*. As the name suggests, the user simply

writes down or prints the keys to the wallet on a piece of paper. The paper wallet can be then given to someone, stored in a safe box at a bank or used in any other way deemed necessary by its owner. A paper wallet is rather a method than a medium and can be reproduced with whichever material the author fancies. In recent years, a number of ways have been developed to facilitate this process, such as printing the wallet as a QR code that can then be scanned by a phone or creating a *seed phrase*. The latter is a way of encoding a difficult to read, write or memorize a string of alphanumeric characters into a specified number of English words that when processed by the client are converted back into the said alphanumeric string. An example of such a seed phrase can be seen below:

```
alien visual rude ladder hill someone
taste pool gallery timber initial sand
```

The phrase can then be memorized and, assuming the owner has a good memory, be used to store one's bitcoins without any tangible media whatsoever.

Lastly, there is a further concept of a *hardware wallet*, which is a specifically engineered, dedicated device that provides greater security than storing keys in a file on one's computer. The device typically resembles a thumb drive and is connected to the computer when a transaction needs to be executed, yet retains some physical controls that necessitate the user to operate the device itself. This is believed to significantly increase security and protect the users from malware specifically targeting wallets stored on their regular computers. The currently most popular hardware wallet families are the Ledger S and Trezor.

1.3.4 Post-Nakamoto additions

A large number of improvements followed after the original client had been released. These are known as *Bitcoin Improvement Proposals* or *BIPs*. The first such BIP was introduced by Amir Taaki on August 19, 2011.[11]

Due to Bitcoin not having a central authority governing it, its development process is somewhat peculiar. Developers and prospective developers communicate through a series of mailing lists and version control systems such as GitHub to propose, audit and commit changes to the network. As per BIP 0001 above, there are no specific requirements as to who can suggest changes. This is similar to other open-source projects and in general in line with the *free open-source software (FOSS)* ideas. Wherein Bitcoin differs is who determines what changes are accepted or not.

11. Amir Taaki, *BIP Purpose and Guidelines*, Web Page, 2011, accessed 17 January 2019, `https://github.com/bitcoin/bips/blob/master/bip-0001.mediawiki`.

Traditionally, a foundation or an individual leading the FOSS project would assume the authority over the said project. Should some of the developers disagree with the direction the project is going or want to create a slightly different project, they could create a *fork* and develop the exiting software in the way they see best fit. In some cases, such forks have outgrown their predecessor with a notable example being the forking of the office suite LibreOffice from OpenOffice after its primary sponsor Sun Microsystems had been acquired by the Oracle Corporation. Both suits exist to this day, but questions are being raised whether the development of the now less popular OpenOffice should continue.[12]

In the case of Bitcoin, there is strictly speaking no developer group that dictates whether a change is made. Because the network is designed in such a way that it always accepts the longest chain, whether changes are accepted or not is ultimately decided by the miners, who can either install the new updates or refuse to do so.

There is also a general distinction between the two types of forks: *hard forks* and *soft forks*. In their strictest definition, a hard fork is one where newly mined block that follows the new set of rules transmitted to the network is accepted by updated clients but rejected by old clients, and a soft fork is one where a newly mined block that follows the old rules is accepted by old clients but rejected by the updated ones.[13] This means that if the majority of the miners accept a soft fork, they will build a stronger chain than the not upgraded miners, who in return will accept the chain following the new rules due to it being stronger.

In simpler terms, this means that a hard fork will break backward compatibility with old clients and will thus result in two separate blockchains. While they will both be identical up to the moment the fork occurs, from there onwards one chain will be continued by miners that were updated and the other by miners that were not. The most prominent example of this is the creation of Bitcoin Cash that has become its separate cryptocurrency. By contrast, a soft fork does not result in two separate chains. There is furthermore a grace period wherein both new and old rules are accepted by updated miners until 75% or 95% of the total computing power of Bitcoin miners have signaled that they are ready to accept the new set of rules.

To further emphasize the distinction, whether a change to the Bitcoin network is accepted or not is determined not by the preference of the majority of users or developers working on the network, but by the owners of the majority of the computing power searching for nonces. It is thus a plutocratic rather than a democratic or meritocratic

12. Dennis E. Hamilton, *[DISCUSS] What Would OpenOffice Retirement Involve? (Long)*, Web Page, 2016, accessed 17 January 2019, `http://mail-archives.apache.org/mod_mbox/openoffice-dev/201609.mbox/%3C008d01d204a9%24bd37caa0%2437a75fe0%24%40apache.org%3E`.

13. Bitcoin.org, *Consensus Rule Changes*, Web Page, November 2018, accessed 17 January 2019.

governance system.

Other blockchains, supplementary and non-Bitcoin technologies

As Bitcoin gained momentum, the concept of a blockchain attracted a considerable amount of enthusiasts that developed their own blockchains, which in some but not all cases would advertise features unavailable on Bitcoin. These blockchains would thus be independent from the Bitcoin network, have their own miners and use their own coins. These coins are typically termed as *alternative coins* or *altcoins*. The entirety of all existing alternative coins and Bitcoin are typically found under the label of *cryptocurrencies*.

The most notable example of a non-Bitcoin blockchain is *Ethereum*, which akin to Bitcoin also allows one to send a receive the coins called *ether*, but expands the capabilities of the network to be able to execute computer programs within the network itself. In other words, while Bitcoin is a distributed payment network, Ethereum is a distributed computer. The most advertised feature of this computing capability is the option of deploying *smart contracts* that are enforced by the network with the consent of the participating parties. This means that a program is submitted to the network and is then executed when certain conditions are met—functionality which is not yet available in Bitcoin itself.

A further distinction must be drawn between the so-called *public blockchains* and *private blockchains.* Bitcoin and the aforementioned Bitcoin Cash and Ethereum are all examples of public blockchains. They receive this name because mining is open to all willing participants and relies upon mechanisms that allow them to function in such a manner.

By contrast, private blockchains are invitation-only networks, the transactions of which are subject regulation by a singular entity or a group of entities that are accepted as a trusted authority. Although they rely upon some aspects of blockchain technology such as cryptographic signatures, the centralized nature of the system allows private blockchains to abandon concepts such as proof-of-work. This results in systems that are considerably more efficient as no energy needs to be expended on searching for nonces, but also nothing like public blockchains and not necessarily very different from technologies existing prior to 2008. Most experimental projects of recent years marketed as "blockchain technology" by major firms fall into this category. This has resulted in some technology experts, among them the outspoken Bitcoin critic and University of California Berkeley network security researcher Nicholas Weaver, to dismiss these as "a 20-year-old technology that somehow causes idiots to throw money at it".[14]

14. Sean Illing, *Why Bitcoin Is Bullshit, Explained by an Expert*, Web Page, April 2018, `https://www.vox.com/conversations/2018/4/11/17206018/bitcoin-blockchain-cryptocurrency-weaver`.

1.4 Economical

1.4.1 Functions, money and intrinsic value

Having established the technical underpinnings of Bitcoin and other comparable cryptocurrencies, one can proceed to examine the role they play within the society. In isolation, Bitcoin is only a tool; it is what one makes of it that is important.

Throughout this book, the author proposes to differentiate between two archetypal uses of cryptocurrencies that all other uses are subordinated to: cryptocurrency as an electronic means of payment and cryptocurrency as an investment commodity.[15] This distinction is important because although Bitcoin is ultimately both of the above, the two functions are categorically separate. The core purpose of a means of payment is to transfer a specified amount of money from the sender to the recipient at the lowest possible cost. By contrast, an investment commodity is a fungible good purchased for investment purposes. It may or may not be held by some participants for non-investment purposes.[16] Before considering both separately, it is advantageous to address the elephant in the room and ask what money itself is and whether Bitcoin is money.

What is money?

In economic literature, *money* is typically defined as an asset that is a *medium of exchange*, a *unit of account* and a *store of value*. It is separate from other forms of wealth such as ownership of the physical or intellectual property due to the three aforementioned functions. Therefore, Bitcoin too would need to fulfill these functions to be money. For the purposes of brevity, the following definitions have been taken from Gregory Mankiw's *Principles of Economics*.[17]

Money as a medium of exchange is "an item that buyers give to sellers when they want to purchase goods and services". Imperative to this function is that the buyer can be confident that the seller will accept the medium of exchange. A hypothetical buyer going to a pharmacy in Japan is thus confident that the chemist will accept the Japanese yen in exchange for box of aspirin tablets, but he would have no such confidence were he to attempt to pay with his homemade cheese, a stock certificate, the promise to fix the chemist's computer or a non-Japanese national currency. Note that the medium of exchange must be conceptually differentiated from the means of payment. The medium of exchange determines with *what* one pays, whereas the means of payment determine

15. These are primary uses in the case of Bitcoin and similar blockchains, but not the only uses and not necessarily the primary uses of all blockchains, which will be discussed at a later point in this chapter.

16. J.C. Hull, *Options, Futures, and Other Derivatives* (Pearson Education, 2017), ISBN: 9780134631493.

17. N. Gregory Mankiw et al., *Principles of Economics* (Cengage Learning, 2011), ISBN: 0170191729. Pages 608–9.

how one pays.[18] The means of payment can and often are rejected in everyday situations. A store that is not connected to a specific payment processor may not accept credit cards, whereas an automated highway entry gate may have no mechanical component to accept banknote or coin payments. Nevertheless, both will accept the domestic currency of the country they are located in.

Money is also a unit of account and therefore "the yardstick people use to post prices and record debts". The prices of items sold in stores are denominated in this unit of account, which is in most cases the domestic currency of the store. In this function money thus serves as a way of determining the cost relationship between two goods or services. The situation becomes more difficult when the unit of account and means of payment are considered in tandem. Whereas most modern, domestic retail shoppers are accustomed to paying with the unit of account—in other words, an item with a price displayed in the Japanese yen is paid for with Japanese yen—this has not always been the case within the historical context or internationally. For example, in the case of medieval Europe, a debt could use the currency solidi as a unit of account and a horse as a medium of exchange.[19] More recently in the 1970s, Persian Gulf states used U.S. dollars as a unit of account but demanded British pound sterlings as a means of payment.[20]

The third function of money is in providing a store of value, defined as "an item that people can use to transfer purchasing power from the present to the future". This concept is closely related to the idea of wealth in general as money is only one of the many assets that allow one to preserve purchasing power over time.

Assets that are money can historically be divided into two categories: commodity money and fiat money. Commodity money can be distinguished from fiat money in that it has an underlying intrinsic value of the commodity used in its creation. The most well-known examples of gold and silver that have been used as commodity money in the past have such intrinsic value because they can in principle be smelted down and used for commercial or industrial non-monetary purposes, such as making conductors and jewelry. Mankiw suggests that under certain circumstances, such as at prison camps or in times of economic uncertainty, goods such as cigarettes acted as commodity money. By contrast, fiat money's value is not attached to the value of the commodity used in its creation and is largely intangible. It derives its value from several societal functions including the promise of the sovereign to accept fiat money for the purposes of taxation.

18. Bill Z. Yang, "What Is (Not) Money? Medium of Exchange ≠ Means of Payment," *The American Economist* 51, no. 2 (2007): 101–104, ISSN: 0569-4345.

19. Matthias Doepke and Martin Schneider, "Money as a Unit of Account," *Econometrica* 85, no. 5 (2017): 1537–1574, ISSN: 0012-9682.

20. Paul Krugman, "The International Role of the Dollar: Theory and Prospect," in *Exchange Rate Theory and Practice*, ed. John F. O. Bilson and Richard C. Marston (University of Chicago Press, 1984), ISBN: 0-226-05096-3.

Bitcoin as not money

Given the definition above, Bitcoin does not appear to be money to the vastest majority of its past and present holders.

Bitcoin and other cryptocurrencies are by and large not accepted as a medium of exchange and most merchants will not agree to exchange their goods and services for Bitcoin. This is a consequence of both the lack of adoption among the general populace and the practical barriers to accepting a volatile asset as a payment for a specific good or service. There had been some reports in 2017 of Bitcoin being used to an unspecified degree in Venezuela as it underwent a hyperinflation under the presidency of Nicolás Maduro[21]. Although there is no reliable data about its usage, it would appear that the cryptocurrency had assumed some of the role that the United States dollar—and as mentioned by Mankiw, cigarettes—play during periods of hyperinflation. This exceptional circumstance is further discussed in Bitcoin: A very brief social history.

Bitcoin also is not used as a unit of account. Although there are sufficient records of Bitcoin being used to pay for goods and services, be they pizzas or narcotics, the prices of these goods are determined based on the Bitcoin-United States dollar exchange pair. In other words, the seller defines an acceptable price in a national currency, then calculates how many Bitcoin can be bought with the said amount of money and then requests the said amount of Bitcoins. The United States dollar or a different national currency by proxy thus has to be the unit of account less the vendor wants to sell goods at uncompetitive fiat currency-denominated prices. Market logic dictates that doing so would quickly attract arbitragers that would buy from the vendor under the market dollar prices and sell at a viable markup, thus promptly leading to the vendor's exit from the market. It is possible that this is somewhat mitigated by the closed nature of the Venezuelan economy described above.

Bitcoin does fit the final function of money as a store of value. In stark contrast to live hogs or orange juice, it is a non-perishable commodity and can be retained by the owner over long periods to retain their purchasing power. Some Bitcoin proponents would even argue that it is a very good store of value because individuals who purchased their Bitcoin in the past had thus far historically been able to sell it a considerable markup in the future. This is furthermore in stark contrast to national currencies that more often than not tend to slowly lose their purchasing power over time due to inflation. A major problem with this line of reasoning is that it ignores the asset's volatility and market risk. Published research on Bitcoin's volatility already exists at this point and points

21. Billy Bambrough, *Bitcoin Believers Speak Out in Venezuela as Maduro Makes Historical Devaluation*, Web Page, August 2018, accessed 17 January 2019, `https://www.forbes.com/sites/billybambrough/2018/08/20/bitcoin-believers-speak-out-in-venezuela-as-maduro-makes-historical-devaluation/#f1ec2ab45ae5`.

towards it exhibiting risk greater even than that of individual exchange-listed stocks. As a result, while Bitcoin stores some value that value will differ greatly from one day to another making it less than ideal as an instrument used to settle reoccurring obligations in different units of account. There is also the issue of the asset's unpredictable future. It is unlikely that any of the major developed markets currencies will collapse in a manner akin to Venezuela in the foreseeable future, whereas it is not at all unlikely that interest in cryptocurrencies will vane for any number of reasons discussed later in this chapter and render them nearly worthless.

Bitcoin thus is not money of any kind, whether fiat or commodity. It is questionable whether Bitcoin could ever become fiat money, but—however unlikely—it could at one point become commodity money. This is because contrary to modern fiat currencies, each bitcoin exists in a sense that it is a proof of expended computation cycles required to mine it and an irreplaceable part of the Bitcoin blockchain. One can thus argue that, although it is not commodity money, it is a commodity and any commodity can in principle be made money.

This view is compatible with both orthodox macroeconomics and more recent approaches such as the Modern Money Theory (MMT) since a bitcoin is strictly speaking a real asset that is no one's liability. Within this framework, one can argue that were money be defined as debt—most commonly in the context of that of a sovereign government—bitcoins are in fact not money as no issuer of bitcoins is required to take them back or redeem bitcoins. Any purchases with bitcoins would thus constitute barter rather than money payments.[22]

Bitcoin as an investment commodity

Bitcoin can also be defined outside of being a medium used for the transfer of wealth that is then immediately converted into a sovereign currency. A popular tag line for Bitcoin is that it is de facto "digital gold". This nomenclature is not unreasonable, because bitcoin do in fact share many characteristics that lead to gold's present status.

Neither gold nor bitcoin is primarily held for their utility. It is a well-known fact that although gold is used among other things in jewelry and in some electrical components, the vastest majority of gold is held in vaults where it serves no utilitarian purpose whatsoever. As of the end of 2018, the United States' Treasury alone administered 260 million fine troy ounces of gold.[23] Given the average transaction volume on Bitcoin and the spectacular

22. L. Randall Wray, *Modern Money Theory: A Primer on MacRoeconomics for Sovereign Monetary Systems* (Springer, 2015), ISBN: 1137539925.

23. Bureau of the Fiscal State, *Status Report of U.S. Government Gold Reserve - Current Report*, Web Page, November 2018, accessed 17 January 2019, `https://www.fiscal.treasury.gov/reports-statements/gold-report/current.html`.

press coverage regarding the price of bitcoins that appeared in late 2017 rather than their usage possibilities, it appears unlikely that the network is used for payment purposes to any significant degree. This question is examined internationally and in the case of Japan later in the book. Furthermore and in contrast to bitcoin and gold, exchange-listed commodities such as lean hogs, soybeans, and orange juice are produced and used extensively for non-investment purposes.

A further similarity to gold is that there is a limited number of bitcoins that can ever be created, thus making the commodity scarce as described in section 1.3 "Technical". Despite the alchemists' best efforts, there is presently no economically feasible method of producing gold out of less valuable commodities. The present total supply is thus limited to what is generally believed to be a cube with the sides of approximately 20 meters each.[24] Any further increases in the supply of gold would thus require either a considerable advancement in particle accelerator technologies or extraterrestrial mining. In this regard, Bitcoin can be said to be superior to gold as there are no ways of increasing the number of bitcoins. Even forking or creating alternative cryptocurrencies would merely create alternative bitcoin, but never increase the number of the original bitcoins. If one were thus to argue that a commodity is an interchangeable good that can be produced by any number of manufacturers, bitcoin is such a commodity with its underlying value being the expended computational cycles during the creation of the blockchain. The intangibility of bitcoin appears largely irrelevant in this context.

Bitcoin must also be ultimately differentiated from other financial assets such as equity, fixed-income instruments and real estate due to constituting no claim on future cash flows and being non-productive. As mentioned earlier, bitcoin has no use relative to its market price and does not produce any outputs. Conversely, equity, fixed-income instruments, and real estate are in practice ownership or extension of credit to industrial production generating value. This difference had been famously described by investor Warren Buffett in his letter to shareholders published in February 2012 at the peak of the post-financial crisis gold rally:

> Today the world's gold stock is about 170,000 metric tons. … At $1,750 per ounce – gold's price as I write this – its value would be $9.6 trillion. Call this cube pile A.
>
> Let's now create a pile B costing an equal amount. For that, we could buy all U.S. cropland (400 million acres with output of about $200 billion annually), plus 16 Exxon Mobils (the world's most profitable company, one earning more than $40 billion annually). After these purchases, we would have about $1

24. Ed Prior, *How Much Gold Is There in the World?*, Web Page, April 2018, accessed 17 January 2019, `https://www.bbc.com/news/magazine-21969100`.

> trillion left over for walking-around money (no sense feeling strapped after this buying binge). Can you imagine an investor with $9.6 trillion selecting pile A over pile B? … A century from now the 400 million acres of farmland will have produced staggering amounts of corn, wheat, cotton, and other crops – and will continue to produce that valuable bounty, whatever the currency may be. Exxon Mobil will probably have delivered trillions of dollars in dividends to its owners and will also hold assets worth many more trillions (and, remember, you get 16 Exxons). The 170,000 tons of gold will be unchanged in size and still incapable of producing anything. You can fondle the cube, but it will not respond.[25]

A major difference between gold and bitcoin as an investment vehicle is that gold has historically offered a short-term hedge against equities in case of extreme market shocks.[26] The present history of Bitcoin and other cryptocurrencies is too short to determine how they perform relative to other assets. Turbulent developments of bitcoin's price action had been dramatic enough that any hedging effects would be rendered irrelevant vis-a-vis the asset volatility and price appreciation, suggesting that bitcoin as a commodity may not yet have reached their stable market price and remain an asset more useful for purposes of speculation.

Bitcoin as a means of payment

By its very nature, a means of payment is an intermediary for transferring money between two parties. These have taken various forms whether they be banknotes, credit cards or more recent solutions such as PayPal. Bitcoin undeniably qualifies as a further example of the means of payment as money can be converted into bitcoin, sent to anyone in the world and then again be converted into money. This results in several advantages and drawbacks some of which are discussed in greater detail in the following sections.

Due to the fact that Bitcoin can be used in such capacity and disregarding any advantages or disadvantages it offers over its contemporaries, it is reasonable to argue that the network has utilitarian value regardless of how high that value may be. Bitcoin is not money, but they are one of the means available to moving money.

Intrinsic value

When discussing or following the coverage of Bitcoin, one of the aspects raised most often is the price of individual bitcoins. A question that is often followed upon—usually from

25. Warren E. Buffett, *Letter to Shareholders*, Report (Berkshire Hathaway Inc., February 2012), `http://www.berkshirehathaway.com/letters/2011ltr.pdf`.

26. Doepke and Schneider, "Money as a Unit of Account."

Bitcoin's detractors—is that of the intrinsic value of Bitcoin. In many cases, experts in the financial industry and many of its leaders have asserted that Bitcoin's value is zero or that Bitcoin is a fraud. The list of prominent individuals and institutions making this statement would be too long to provide an exhaustive answer, but they include the head of global economics at Allianz Global Investors,[27] JP Morgan Chase CEO Jamie Diamond,[28] or the investor duo Warren Buffett and Charlie Munger.[29] The global chief economist and global head of Vanguard Investment Strategy Group, Joe Davis expressed the view that there is a "decent probability that [bitcoins'] price goes to zero".[30] The late founder of Vanguard itself and the titular name of one of the quintessential English language guides to personal finance *Bogleheads' Guide to Investing*, Jack Bogle offered the simple advice to "avoid Bitcoin like the plague".[31] The responses to these criticisms are equally numerous yet mostly confined to Bitcoin enthusiast-centric online outlets like the CoinTelegraph,[32] the Bitcoin News[33] and countless others.

Having looked at the two functions of both Bitcoin and bitcoin it is possible to address these criticisms with a greater degree of rigor than by merely looking at the price of individual coins. One must also ask what it is that one refers to as intrinsic value. Within the scope of this research, Benjamin Graham's definition from the 1934 book *Security Analysis* is used. It is a particularly appropriate given not only the book's quintessential status among the classics of financial literature but also the fact that Graham had published the work in the midst of the Great Depression and referred amply to the "excesses" in the stock markets leading up to the crash of 1929. Trading at 17% of its December 2017 peak, bitcoin's parallels to overvalued securities of the interwar era are by no means few or far apart. In Graham's definition intrinsic value is:

27. Stefan Hofrichter, *Beyond the Bitcoin Bubble, the Benefits of Blockchain*, Web Page, August 2018, accessed 17 January 2019, https://www.allianzgi.com/en/insights/investment-themes-and-strategy/beyond-the-bitcoin-bubble.

28. Robert Hackett, *No, JPMorgan Chase CEO Jamie Dimon Has Not Changed His Stance on Bitcoin*, Web Page, January 2018, accessed 17 January 2019, http://fortune.com/2018/01/09/bitcoin-price-chase-jamie-dimon/.

29. Krystal Hu, *Why Bitcoin Is 'Rat Poison' to Buffett, 'Turd' to Munger*, Web Page, May 2018, accessed 17 January 2019, https://finance.yahoo.com/news/bitcoin-rat-poison-buffett-turd-munger-211201721.html.

30. Joe Davis, *Vanguard: Bitcoin Presents a Quandary*, Web Page, May 2018, accessed 17 January 2019, https://www.etf.com/sections/etf-industry-perspective/vanguard-bitcoin-presents-quandary?EXCMPGN=EX:PC:FAS:Sustaining.

31. Nico Grant, *Vanguard Founder Jack Bogle Says 'Avoid Bitcoin Like the Plague'*, Web Page, November 2017, accessed 17 January 2019, https://www.bloomberg.com/news/articles/2017-11-28/vanguard-founder-jack-bogle-says-avoid-bitcoin-like-the-plague.

32. Darryn Pollock, *Mythbusting: Why Bitcoin Can Never Go to Zero*, Web Page, July 2018, accessed 17 January 2019, https://cointelegraph.com/news/mythbusting-why-bitcoin-can-never-go-to-zero.

33. Kai Sedgwick, *Predicting Bitcoin to Go to Zero Will Send Your Reputation to Zero - Bitcoin News*, Web Page, July 2018, https://news.bitcoin.com/predicting-bitcoin-to-go-to-zero-will-send-your-reputation-to-zero/.

> … value which is justified by the facts, e.g., the assets, earnings, dividends, definite prospects, as distinct, let us say, from market quotations established by artificial manipulation or distorted by psychological excesses.[34]

In other words, it is the same regardless of the assets' price. The value of an enterprise is the net present value the future cash flows it will generate or the strategic value of its assets; that of a fixed-income security is the net present value of the coupon payments and the principal; that of a real estate object is the net present value of the future rents and asset value appreciation. This leaves two other major non-derivative financial asset classes: currencies and commodities.

At first glance, the value of sovereign money would seem to be obvious, but the reasons behind it are more difficult. Within the economic school of chartalism, sovereigns money is argued to have value because it is used to pay taxes.[35] Nobel laureate Paul Krugman explains it in more immediate terms stating that "fiat currencies have underlying value because men with guns say they do. And this means that their value isn't a bubble that can collapse if people lose faith."[36] As discussed previously, these explanations do not apply to bitcoin.

This leaves only the commodities, which strictly speaking generate no cash flows by themselves and are not typically forced upon one by "men with guns". Although the term "commodity value" appears to have gained a sparse usage, commodities are generally discussed within the framework of the factors of production. For the purposes of simplicity, one may detach the value of a commodity from its price by arguing that it is constituted by the value an enterprise could generate by consuming the commodity.[37] This offers a theoretical basis to ascertain the value of either Bitcoin or bitcoin, although one may argue that this framework is even more imprecise than future cash flow analysis given the plethora of valuation possibilities for plausible uses.

As before, this value must be assessed in terms of the two aforementioned functions of Bitcoin: investment and payments.

In terms of bitcoin as an investment commodity, clearly, there is some value for the investor interested in preserving their capital without attaching any portion of it to any geographical location. The limited quantity of bitcoins that can ever exist make it fill a

34. Benjamin Graham and David Dodd, *Security Analysis: Foreword by Warren Buffett* (McGraw-Hill Professional, 2008). Page 64.

35. Wray, *Modern Money Theory: A Primer on MacRoeconomics for Sovereign Monetary Systems* Page 156.

36. Paul Krugman, *Transaction Costs and Tethers: Why I'm a Crypto Skeptic*, Newspaper Article, 2018, `https://www.nytimes.com/2018/07/31/opinion/transaction-costs-and-tethers-why-im-a-crypto-skeptic.html`.

37. Aswath Damodaran, *The Little Book of Valuation: How to Value a Company, Pick a Stock and Profit* (Wiley, 2011), ISBN: 9781118064146 Pages 192–193.

role similar to that of gold, despite having only existed for a decade and being considerably more likely to fall out of fashion. The hard-coded limit to the number of bitcoins means that there is no risk of the individual bitcoins being devalued by future advances such as extra-planetary mining,[38] but poses a risk that the system itself may be compromised by the eventual progress of quantum computing[39] or merely a yet unknown bug. Disregarding the present instability and the extraordinary appreciation of the past years which can only be attributed to bitcoin establishing its price range, one can conclude that despite its shortfalls bitcoin can add value to some investors under the certain circumstances by offering properties very similar to those of gold in a different form. These possibilities and their outcomes are explored later in this chapter and the following chapter.

In terms of Bitcoin as a means of payment, the analysis provided in the past sections illustrates why it is of questionable value given the solutions available today. One can only assume that the cost-benefit ratio will be further tipped against Bitcoin in its current state as the race-to-the-bottom for transaction costs continues through the introduction of new technological and organization advancements. While the network itself may adopt new technologies, it remains to be seen whether the rigid foundation of network will allow for sufficient flexibility to morph as its competitors proceed to innovate. This author contends that the uphill battle Bitcoin finds itself in will become only harder as years go by. From a historical point of view, means of payment appear to have rather been abandoned in favor of new better ways than adopted to the ever-changing modernity. No matter how many improvements one made to a physical tally stick it did not become a credit card. A similar process is currently occurring with traveler checks and the cash economy as a whole. From this point of view, one can only argue that individual bitcoins are worth only as much as the network is used as a means of payment relative to its competitors, which does not appear to make it particularly valuable even from its current perspective, although that estimate can vary somewhat depending on how much worth one attaches to its censorship resistance characteristics. This includes Bitcoin's extended functionality, such as being able to record non-monetary data within the blockchain.

It thus appears that Bitcoin does have value. This value difficult to impossible to attach a number to as none of the traditional methodologies seem to apply. Bitcoins generate no cash flows to discount and have no direct reliably-valued comparators. There is no book value because there is nothing underlying a single bitcoin. One cannot use the extraction cost as one could with a precious metal to establish any kind of baseline.

38. Martin Elvis, "Let's Mine Asteroids–For Science and Profit: The Commercial Dream of Trawling Space for Valuable Minerals Could Bring Enormous Benefits to a Wide Range of Sciences," *Nature* 485, no. 7400 (2012): 549–550, ISSN: 0028-0836.

39. Louis Tessler and Tim Byrnes, "Bitcoin and Quantum Computing," *arXiv preprint*, 2017, `https://arxiv.org/abs/1711.04235`.

At most one could calculate the costs of creating the present blockchain, but as it is no possible to revert these electricity and hardware costs in any way such valuation would not be meaningful. Furthermore, there is no real need to create new bitcoins to begin with as they are not consumed in any way and given minor changes to the protocol can be divided indefinitely.

Ultimately, as unsatisfying as the answer may seem, the value of Bitcoin as denominated in any of the fiat currencies appears to be dictated almost entirely by what the world decides it to be. This is especially true when considering the large number of other cryptocurrencies that can technically substitute all of Bitcoin's functions described above. They may not boast the energy expenditure contained within the Bitcoin blockchain, but there are no practical advantages to a blockchain that has ten years of transactions etched into it as opposed to a new identical blockchain that has no previous transactions. The only limitation that must be added to this conclusion is that the value of Bitcoin must be greater than zero should the network continue to operate even at the tiniest fraction of its current scale. As long as it is used to any degree that use generates a certain unspecified value to the user and necessitates ownership of bitcoins, thus creating a value of greater than nil. It is unlikely that the network will disappear entirely within any foreseeable future given that the cessation can only result in the event that every single computer with a full client is taken offline, thus almost certainly guaranteeing some value for the foreseeable future. Naturally, that value can be many orders of magnitude lower than the present price of bitcoin and is simply unknown at the moment. In Benjamin Graham's words:

> The stock market is a voting machine, not a weighing machine. Future prices fall outside the realm of sound prediction.[40]

1.4.2 Decentralization

If one were to imagine a hypothetical island nation with a total money supply of $10 million distributed between its inhabitants and stored at the island's only bank, a bug or a malicious cyberattack on the bank by one of its inhabitants could result in one of the accounts being erroneously or deliberately credited with an additional $10 million. This would raise the total money supply to $20 million. The $10 million were conjured from empty air and no single islander lost any money in nominal terms. However, due to the fact that the money supply doubled despite there having been no increase in productivity or overall wealth of the nation in real terms, every single existing unit of the island's currency can now buy only half as many goods as it did previously. Everyone,

40. Graham and Dodd, *Security Analysis: Foreword by Warren Buffett*. Page 408.

except the beneficiary of the aforementioned sum, now has only half as much money in their bank account in real terms. Being a major breach of confidence, the bank could have its engineers deploy a bug fix and retroactively adjust the account balance of the beneficiary to its previous state. While some damage would have been done already, it could nonetheless be mitigated to a large degree by the trusted custodian of the currency.

The same cannot be done quite as easily with a proof-of-work blockchain network. In fact, something very similar to the aforementioned attack indeed occurred with one of the more popular cryptocurrencies called *Verge (XVG)*. At its all-time-high in December 2017, Verge was the sixteenth most valued cryptocurrency.[41] In terms of the cumulative price of all Verge coins at their exchange rate to the U.S. dollar at the time, their market capitalization had been slightly over $3.7 billion.[42]

Between April 4 and April 6, 2018, an attacker had exploited a vulnerability in the code of the blockchain allowing them to mine the XVG cryptocurrency at a higher rate than permitted. This was made possible by fooling the network about the speed at which individual blocks were mined. By sending spoofed timestamps, the attacker convinced the network that the hash was too difficult and took too long to solve, to which the network reacted by radically reducing the difficulty of the hash by approximately six billion times. The issue was further aggravated by Verge's peculiar design, wherein a block can be created by using either one of five different hashes operating at different difficulties. This change has been introduced to democratize the mining process by making it possible to mine hashes unsupported by specialized mining hardware used by professional miners. The result of this democratization had been that the attacker could thus decrease the hash difficult for one hash while leaving other hashes at the previous difficulty. Targeting the now stupendously easy to solve hash, the attacker was able to create a large number of coins associated with their wallet at a rate corresponding to $80 per second or $1 million during the entirety of the attack.[43]

As a result of the attack, Verge de facto reversed the blockchain to the time before the attack by releasing an emergency patch and publicly directing the miners to use the new blockchain where the hack had not occurred. In the following weeks, Verge had suffered another attack and hard-forked again. Although the transactions were reversed, it is unclear whether any of the "counterfeited" coins were sold for a different cryptocurrency before the fork, thus effectively giving the attacker coins on a different blockchain

41. CoinMarketCap, *Historical Snapshot - December 24, 2017*, Web Page, 2017, accessed 17 January 2019, `https://coinmarketcap.com/historical/20171224/`.

42. CoinMarketCap, *Verge (XVG)*, Web Page, 2019, accessed 17 January 2019, `https://coinmarketcap.com/currencies/verge/`.

43. Daniel Goldman, *The Verge Hack, Explained - Time Warps, Mining Exploits, Denial of Service, and More!*, Web Page, May 2018, accessed 17 January 2019, `https://blog.theabacus.io/the-verge-hack-explained-7942f63a3017`.

unaffected by the Verge fork and leaving his unlucky exchange partner with nothing but hot air.

More importantly, this incident raises questions about how decentralized cryptocurrencies really are and what exactly this means for the entire premise of public blockchains if history can be reverted at will. As described earlier, the miners creating the blocks can decide whether or not they accept forks deployed by the development team. This puts the public blockchain's plutocratic modus operandi to the forefront. A professional mining operator with a mining farm attached to its own power plant in China would be considerably higher voting power than someone attempting to mine on their laptop computer.

The decentralization issue is however much worse. The high difficulty of hashes on popular blockchains makes it almost impossible for an average individual to calculate the right hash, which is why many smaller miners decide to join a mining pool in exchange for a lower, but steadier return. This gives the operator of the mining pool effective voting rights on the computing power of every contributor to the pool. The authority is only checked in as far as the contributors can withdraw their participation from the pool and join a different pool. As of October 2018, 54.5% of the hash rate is being controlled by four miners: BTC.com at 18%, AntPool at 14%, BTC.TOP and SlushPool at 11%.[44] In many ways, this is very similar to the transfer of authority from investors to asset management companies with regard to equity purchased with the investors' funds. While very few individuals would claim that enterprises operate in a decentralized manner, this belief is very strong among the proponents of blockchain.

A counter-argument is raised by authors such as Daniel Krawisz from the Sakamoto Institute, a group dedicated to propagating Bitcoin, arguing that the incentive structure of a cryptocurrency is such that the interest of its users are also that of the miners.[45] Should a fork take place that is disadvantageous for the users, the users would sell their coins in exchange for those more advantageous to them and thus decrease the dollar price of the former cryptocurrency. As the miners are rational agents motivated by profit and are compensated in the cryptocurrency they are mining, they would thus stop mining the coin that the holders have abandoned and begin mining the cryptocurrency that is now more en vogue. This argument has merits, but hinges largely on the premise that Bitcoin is rather used as a payment network than a commodity, and thus the price of its coins in some way corresponds to the value the user of the network derives from it rather than being a function of a momentum investing strategy in a rapidly appreciating

44. Blockchain.com, *Hashrate Distribution an Estimation of Hashrate Distribution Amongst the Largest Mining Pools*, Web Page, 2018, accessed 17 October 2018, `https://www.blockchain.com/en/pools`.

45. Daniel Krawisz, *Who Controls Bitcoin?*, Web Page, February 2015, accessed 17 January 2019, `https://nakamotoinstitute.org/mempool/who-controls-bitcoin/`.

asset. The argument does not necessarily stand the test of time either, as nearly four years after it had been made, Bitcoin's virtues of anonymity praised by the author have long been surpassed by competitor products including the aforementioned Verge network. Nonetheless, the said competitors never come anywhere close to displacing Bitcoin from its pedestal in terms of market capitalization. Bitcoin appears to remain the blockchain of choice not because of its technical capabilities, but merely because it was there first.

The decentralization aspect of Bitcoin and other public blockchains is thus somewhat dubious at best. Inarguably, there is no one singular central authority and the owners of bitcoin always have the option of attempting to sell their holdings in favor of a different cryptocurrency. However, if that is where the line is drawn not many things in the history of humanity are centralized. By this yardstick, a central bank is decentralized as both foreign and domestic owners of the currency can make a run on the currency, sometimes illegally. This has happened countless times during the periods of hyperinflation or other changes in monetary policy unfavorable to holders of the currency. The argument can be extended past the realm of monetary policy and well into the realm of absurdity to claim that an autocracy is not centralized, because the members of the underlying structure always have the possibility to revolt and thus force the autocrat to act in their best interests.

Bitcoin and other similar networks are decentralized in the technical sense. Much like the internet is decentralized, a failure of a single Bitcoin node does not result in the failure of the entire network. The system is peer-to-peer in nature, a distribution structure that had become most popular with the advance of high bandwidth internet in the early 2000s. Contrary to previous distribution methods, peer-to-peer networks do reply on a single server or a set of servers that would host content, but rather make every participant of the network both a content recipient and a content distributor. The system previously gained traction with average users, because it allowed for easy download of copyrighted content without having to purchase it from the copyright owner. Whereas the copyright owner could take down a single server hosting their motion pictures, music or video games, peer-to-peer networks made this effort essentially impossible as even a single remaining user on the network could again distribute the material to other willing users.

Bitcoin works on the same principles and, in theory, removes this single point of attack. This can be deemed beneficial for a payment network but is not necessarily something that has been a particular problem for commercial networks in the years past. A complete outage of a popular service has now become so rare that it is a newsworthy event, as was the case when a temporary outrage of YouTube[46] was reported by many outlets, including

46. Eli Meixler, *YouTube Went Down Around the World Today Prompting Outcry on Social Media*,

the Time magazine, or when Visa[47] was temporarily unable to process transactions. In the past decade, an entire industry of cloud computing providers has sprung up offering not only pre-packaged security solutions and defenses against most common attacks, but also the ability to keep once data replicated across multiple servers in different parts of the globe. Even in the case of a cataclysmic scenario ranging from a thermonuclear apocalypse to a mass extinction event through an asteroid impact, although humanity may not live to see another day, its cloud backups of holiday snapshots would still be in safe hands. Whether such a service vis-a-vis a peer-to-peer network can be described as centralized is questionable.

Conversely, one can not dismiss the fact that, as an asset, bitcoin production is a chiefly international affair. Gold can only be produced where gold can be found. Bitcoin can be produced anywhere with sufficiently cheap access to electric power, a basic internet connection and a variable investment into mining computers. Its production is thus truly global in theory, but not in practice. For example, in mid–2018 80% of the mining on the Bitcoin network cherished for its inherent censorship resistance was performed by the pools located on the People's Republic of China.[48] This means that a mere five mining pools, located in a single country with a strong central government and a prominent tendency for capital controls can effectively execute a 50% attack and rewrite the blockchain as they see fit. One must also note that the said mining pools were not subject to the same level of regulatory oversight as a typical financial institution. The only other major mining pool, SlushPool, that had not been located in China was in Croatia.

As such, the issue of Bitcoin's decentralization is a contentious one. It is "less centralized" than a bank, but also undeniably "more centralized" than a payment for services rendered in gold, Renoir paintings or any other physical barter good.

1.4.3 Scalability and efficiency

Perhaps one of the most glaring issues with Bitcoin is its inefficiency, both in terms of the speed of the network and its energy consumption. Neither seemed immediately apparent at the genesis of the network, yet both came to the forefront during the bitcoin rally in 2017.

Web Page, October 2018, accessed 17 January 2019, `http://amp.timeinc.net/time/5426712/youtube-temporary-outage`.

47. Andrew Griffin, *Visa Issues: Card Problems Across UK and Europe as Payment Systems Go Down*, Web Page, June 2018, accessed 17 January 2019, `https://www.independent.co.uk/life-style/gadgets-and-tech/news/visa-card-payment-down-mastercard-not-working-broken-payment-shop-a8379381.html`.

48. BTC.com, *Pool Stats - BTC.com*, Web Page, 2019, accessed 17 January 2019, `https://btc.com/stats/pool`.

Scalability

As described in section 1.3 "Technical", the Bitcoin network is set up to produce new coins at a specified rate that decreases by halving the rewards for a solved block every 210,000 blocks until some point in time in the year 2140. This results in a predictable timer for individual block creation that is set at approximately ten minutes. Assuming that the developers of the network want to keep the network backward-compatible, this means that the block size must remain at 1 megabyte. This limits the number of transactions per second to 3.37. After an increase in the block size to 2 megabytes as a result of the *Segregated Witness (SegWit, BIP141)* soft fork in July 2017, this limit increased to 7 transactions per second.

This has not been an issue from Bitcoin's first appearance and throughout the entirety of the first half of the 2010s. The network processed fewer than 100,000 transactions per day until 2015 and thus well below its 300,000 capacity. However, as interest in Bitcoin grew, so did the number of transactions on the chain, quickly reaching 200,000 transactions per second at the turn of 2017 and reaching peak capacity before Christmas. As a result and combined with the appreciation of Bitcoin throughout the year, the payer not only had to wait for over ten minutes for the network to confirm that the payment did indeed go through, but would also face considerable mining fees.[49] The network remained congested until the end of the rally.

This raises the question of how Bitcoin compares to other payment networks as a means of exchange. The brief answer is: poorly. Based on the company's test in 2010, Visa Inc.'s electronic payment network VisaNet processed as many as 150 million transactions per day, which is the equivalent of 1,736 transactions per second. Assuming that Bitcoin indeed could process 7 transactions per second—a matter of some uncertainty—this would mean that Visa's actual usage around the time Bitcoin first appeared had already been 248 times of Bitcoin peak capacity. In other words, all other things equal, if tomorrow morning humanity decided to boycott Visa in favor of Bitcoin and the only way of processing transactions would be to increase the block size, Bitcoin's blocks would need to become half a gigabyte in size. The said half a gigabyte would have to be stored on all full clients of the network, resulting in computer storage consumption of 26 terabytes per year for each computer on the network. While it may seem prohibitive from the storage point of view alone, one must note VisaNet's 1,736 transactions per second is actual usage rather than peek capacity, which according to Visa Inc. lies at 24,000 transactions per second,[50]

49. Kyle Croman et al., "On Scaling Decentralized Blockchains," in *International Conference on Financial Cryptography and Data Security* (Springer), 106–125.

50. Visa, *Visa Acceptance for Retailers*, Web Page, 2018, accessed 17 January 2019, `http://usa.visa.com/content/VISA/usa/englishlanguagemaster/en_US/home/run-your-business/small-business-tools/retail.html%3E`.

or 2 billion transactions per day, which is 3,400 times more than Bitcoin's capacity or an equivalent of 180 terabytes of storage added to Bitcoin's blockchain every year if the block size was expanded to meet the network capacity.

Clearly, Bitcoin in its current state cannot fill the role of just one popular payment network, to say nothing of becoming a "world currency" as fantasized by a portion of Bitcoin proponents, including the founder and CEO of Twitter, Jack Dorsey.[51] Neither does a path of expanding the 7 transactions per second limit by increasing the block size, as chosen by the developers of the Bitcoin hard fork Bitcoin Cash, appear to be a viable solution to replacing the existing transaction speed requirements of VisaNet.

The Lightning Network The current solution that is attempting to address the scalability issue is the so-called *Lightning Network (LN)*. While Bitcoin Cash's increase of the block size is akin to a simple painkiller that helps now without providing a sustainable solution, the Lightning Network is a full experimental therapy. It may very well fix the problem, but it may also result in a range of the yet unknown side effects.

What Lightning does is to dispense with the idea that all transactions occurring using bitcoins must indeed occur on Bitcoin. The transactions are taken off the chain and are not recorded in the ledger, but instead occur so so-called *channels* opened between two Bitcoin users. The opening of each channel is recorded on the Bitcoin blockchain, but all transactions that occur from thereon remain off-chain. To do so, both of the channel users credit the channel's Bitcoin address when the channel is created with an equal quantity of bitcoin. The transactions that occur from thereon are recorded between the two participants within the channel as quasi-deeds to bitcoins deposited to the address of the channel. Should one participant run out of bitcoins that he could promise to the other user, both can fund the channel address further on the Bitcoin blockchain.[52]

This is more easily explained with an example. Assume that Bob runs a cafe that Alice visits every morning before work. She pays 30,000 satoshi for a coffee and heads to the office. In the original implementation of Bitcoin, this would result in 250 on-chain transactions per year for Alice's morning coffee alone. Using the Lightning Network, Alice and Bob could open a channel with 7.5 million satoshis each, execute transactions through the new channel and close it at the end of the year. The result would be only two on-chain transactions. In theory, Alice and Bob could fund years and decades of morning

51. Jamie Powell, *Sorry Jack, Bitcoin Will Not Become the Global Currency*, Web Page, March 2018, accessed 17 January 2019, `http://ftalphaville.ft.com/2018/03/22/1521730045000/Sorry-Jack--Bitcoin-will-not-become-the-global-currency/`.

52. Aaron van Wirdum, *Understanding the Lightning Network, Part 1: Building a Bidirectional Bitcoin Payment Channel*, Web Page, May 2018, accessed 17 January 2019, `https://bitcoinmagazine.com/articles/understanding-the-lightning-network-part-building-a-bidirectional-payment-channel-1464710791/`.

coffees through the said two transactions, lowering both the Bitcoin congestion and their transaction fees dramatically. The only limitation is the amount of funds deposited in the channels.

The network can be further expanded by either Alice or Bob creating a new channel with a third party. Alice could open a channel with Carol. Now Carol could also purchase coffee at Bob's despite not having a separate channel open to him. She can simply promise to transfer 30,000 satoshis to Alice, who then transfers 30,000 to Bob and automatically receives a small fee for offering the service. The daisy chain of participants linked through such channels thus allows for transfers between any individuals as long as they have channels open with other participants that could in some way be used to create a connection between the payer and the payee. Given that the popular notion that every person is separated from any other person by mere six degrees of separation, such a network could conceptually solve Bitcoin's scalability problem once and for all.

There are considerable problems that could arise from this technology. The most obvious one would be the technical issues and potential vulnerabilities. The second-layer network would increase the complexity of Bitcoin dramatically and open new vectors of attack that previously have not been an issue. It may also be different enough from Bitcoin to lose the appeal of Bitcoin for some of its most staunch proponents.

The core issue is that people like Alice, who work as middlemen for other parties, may be considerably different in the eyes of the law than the current participants of the network. The previous sections have laid out why bitcoins are not money, but it does not mean that they may not fall under similar regulations once the legal situation is clarified across the board. Whereas at the moment the fees are received solely by miners, who merely packaged transactions and add them to the blockchain, Lightning would presuppose the existence of nodes, like Alice, who transfer funds between two parties.[53] Given this new role of some actors on the network, a serious question can be raised as to whether or not these parties could fall under the same provisions as third party settlement organizations[54] or banking regulations requiring licensing, know-your-customer and anti-money laundering regulations. Such provisions would considerably reduce the number of parties that could operate a Lightning node thus leading to the appearance of what would be for all intents and purposes banks on the Bitcoin network. At this point, questions can be raised whether there is much point in using Bitcoin to begin with. It is also presently unclear whether the proposed routing structure wherein there are multiple participants

53. Jonald Fyookball, *Lightning Network Centralization Leads to Economic Censorship*, Web Page, October 2017, `https://news.bitcoin.com/lightning-network-centralization-leads-economic-censorship/`.

54. Internal Revenue Service, *Third Party Network Transactions*, Web Page, 2018, accessed 17 January 2019, `https://www.irs.gov/payments/third-party-network-transactions-faqs`.

between Alice and Bob can work on a large scale as it presupposes sufficient liquidity of the routers. Even if the said routers were quasi-banks, it is unclear if the intentionally limited quantity of bitcoin would allow for such an institution to operate successfully at scale.

Even if one assumed that none of the above issues would occur, there would still remain the simple issue of why someone would want to use Bitcoin with Lightning over current payment methods even if they wanted to use Bitcoin by itself. That is because, for Lightning to be useful in reducing the load on the Bitcoin network, one would need to lock in at least three transactions worth of bitcoins in the channel. This is in stark contrast to the buy-now-pay-later credit card pattern popular today or even buy-now-pay-now debit card payments. While one can still picture Alice loading a few coffees worth of bitcoins into a channel, the proposition becomes more and more strenuous as the transaction size grows. Alice would need to lock in at least three rents, three tax payments, three insurance payments and so forth. For fixed payments, the effect for Alice would be the same as paying for everything at least three months upfront, whereas the effect for Bob would be receiving the first of these payments three months later. He would also need to lock in his own funds in the channel just to receive Alice's payments. As a result, Lightning makes no economic sense for fixed payments and the actors would be better off just transferring two or three payments at a time through regular on-chain transactions.[55] This again, however, would be impossible on a large scale, because even at three transactions at a time, the 7 transactions per second limit would cause the entire Bitcoin network to grind to halt should everyone in France decide to pay their taxes over the next three month period.

Stepping away from proposed solutions and looking at what exists now, perhaps the most realistic solution to Bitcoin's scalability is the one that already exists today in the plethora of other cryptocurrencies that have sprung from its rise to fame. It is entirely possible to just create not one single Bitcoin blockchain, but an entire host of blockchains being powered by the same technology. One would hold a certain amount of Bitcoin, a certain amount of Bitcoin II, some Bitcoin III and so forth. Any scalability issues can be easily overcome by just creating enough new Bitcoin blockchains that are all entirely independent from each other. Pragmatically speaking, however, one may just as well keep the current cryptocurrency ecosystem as it is today and use different coins during the times when the Bitcoin network itself becomes non-operational due to the high transaction load.

55. Note that due to the one-to-one nature of the network, receipt of other funds, such as a salary from her employer, would not benefit Alice's balance with Bob, because she would need to close the channel with her employer to receive the funds and credit her channel with Bob. This would result in more transactions on the Bitcoin blockchain rather than less.

Such a system, while much more plausible than any of the purer proposals, brings with it all the drawbacks of international monetary systems and escalates them by bringing them on national or even local levels. Since Bitcoin is different from the hypothetical Bitcoin II, Bitcoin III and all of its other variants, the exchange rate between the currencies would be governed by the laws of supply and demand or some kind of currency pegging system were Bitcoin II and Bitcoin III are issued by what would essentially become central banks in all but name. This, in turn, would expose the users of the coins to the exchange rate risk. One day, the backer may demand only 1 Bitcoin II for a loaf of bread if paid in Bitcoin III; the other day the exchange rate may shift and the same loaf of bread may become 10 Bitcoin II or 0.1 Bitcoin II. Any persistent reader of the economic press can undoubtedly remember an article that appeared in their newspaper of choice not too long ago about some company issuing new profitability forecasts due to a change in the exchange rates between the company's country of registration and one of their major markets. A multi-cryptocurrency world would put these kinds of problems not on an international level, but that between individual companies or perhaps even the departments within a single company. There would also be a large number of other issues, ranging from security of the individual blockchains to the fact that blockchains may still become overloaded and stop functioning, but in the greater scheme of things none of them matter as the entire premise of a multi-cryptocurrency world appears to be difficult from the sheer utilitarian point of view.

The scalability issue of Bitcoin thus remains unsolved.

Energy consumption

Bitcoin to this day does not seem to affect people who do not want to use the system in any shape or form. Nobody is forced to create a wallet and—opportunity costs aside–nobody loses by sticking to the world outside of the cryptocurrency sphere. One can make and lose a fortune by trading bitcoins, but it is also entirely possible to simply ignore their existence. Unfortunately, one of the aspects of Bitcoin does affect people who are mere bystanders. It does not appear to be one that its creator had considered greatly when developing the system, but one that received considerable press coverage after the boom of 2017.

Bitcoin is very close to being one of, if not the one, most wasteful endeavors humanity has embarked on to this day. As described previously, new bitcoins are created by miners that validate transactions. The total number of bitcoins that can be created in a single unit of time can fluctuate slightly but is fixed as an average. Whether the network consumers 1 watt to create a new bitcoin or 1 gigawatt does not change the operation of the network in the slightest.

Were Bitcoin to be controlled by a single entity, its steward could process all of the transactions of the network on a 1-watt computer connected to a network router and a sufficiently large hard drive disk. However, as anybody with a computer built in recent decades and an Internet connection can become a miner, the energy usage of the network becomes a simple function of bitcoins' price. Given a static price, one can determine that the fiat price of bitcoin should be near equal to but above the depreciation cost of the mining equipment, the cost of electricity used to run the equipment and other minor factors including labor and land required to operate the mining facility. This is self-evident as mining bitcoins at higher costs than the returns is economically unfeasible and mining considerably below the operating cost would attract other miners. In the latter case, the difficulty of solving the hash would increase and more electricity and capital expenditure would be needed to retain the same revenue at an ever decreasing net profit margin. The margin would inevitably continue to shrink until the price-cost equilibrium is reached and further expenditure becomes unprofitable.

The price of bitcoins in any national currency is nonetheless not at all stable. In 2017 alone, the price had increased from $964 to $12,789, which is equivalent to an appreciation of 1,227%. For comparison, Apple Inc., at the time the most expensive publicly traded company and a symbol for a "would have been a great investment" firm, finished the year at $152.50. Despite its rapid growth, one would have to have purchased Apple's stock at $11.49 to achieve similar returns. Such a price was last available in early 2009 after the stock had dropped 60% as the consequence of the financial crisis. Returns from buying bitcoins were in a year to what one of the biggest success stories of the early twenty-first century would have taken eight years and absolutely perfect market timing. Consequently, as the number of bitcoins produced remained stable the laws of supply and demand attracted an ever-growing commitment of energy to the cumulative process of bitcoin mining.

The website Digiconomist provides an assessment of how much energy has been expanded on mining bitcoins from early 2017 onwards.[56] The peak as of the end of 2018 was estimated at 73 terawatt-hours (TWh) per year or 60 terawatt-hours per year given more conservative inputs. This is not a trivial energy expenditure. For comparison, a nuclear reactor such as that in the R. E. Ginna Nuclear Power Plant in New York can produce only 5.1 terawatt-hours per year.[57] It would thus take 15 nuclear reactors to power Bitcoin at the end of 2018. The U.S. Energy Information Administration states

56. Digiconomist, *Bitcoin Energy Consumption Index*, Web Page, 2019, `https://digiconomist.net/bitcoin-energy-consumption`.

57. U.S. Energy Information Administration (EIA), *How Much Electricity Does a Nuclear Power Plant Generate?*, Web Page, 2019, accessed 17 January 2019, `https://www.eia.gov/tools/faqs/faq.php?id=104&t=3`.

that there were only 99 operating nuclear reactors in the United States as of that time.

To portray Bitcoins energy expenditure from a different angle, although Bitcoin only consumed 1.82% of all energy consumption in the U.S. and only 0.33% of the world, the network nonetheless consumed more than the entirety of Austria (population 8.7 million), Columbia (population 47 million) or Bangladesh (population 158 million).[58] In fact, were Bitcoin a country, its energy consumption would put it on the 39th place out of more than two hundred countries and could support 6.5 million U.S. homes. This makes a Bitcoin transaction 420,000 times more expensive than that of VisaNet[59] or 3,400 times more expensive than a non-cash transaction if one were to incorrectly assume that the entirety of the global banking system did nothing but process transactions[60]. Note that these consumption figures are only for Bitcoin as the biggest cryptocurrency. The distant second cryptocurrency Ethereum had consumed towards 21 TWh annually on its own.

The issue is further aggravated by the fact that Bitcoin was powered by the possibly worst kind of energy: coal-powered plants located in mainland China.[61] While stories of Icelandic hydroelectric and other renewable energy Bitcoin farms that used the excess energy and were cooled by Iceland's natural climate have ran rampant in its enthusiast community throughout 2017 and into 2018,[62] the networks notoriety for consuming copious amounts of Chinese coal led to its own spotlight in the venerated Nature magazine under the title "Bitcoin emissions alone could push global warming above 2°C".[63] In the paper, the researchers compared a large number of historical energy consumption increases in technologies as they gained mainstream use and concluded that should Bitcoin follow the pattern of other technologies, it alone would propel the climate change to the 2°C that the 176 ratifiers of the Paris Agreement of 2016 sought to avoid by reducing the entirety of human emissions.

The energy usage has continued to increase even after the end of the boom in late 2017 and remained steady from June to November 2018 despite a 70% depreciation in the price of bitcoin. This can most likely be attributed to the expectations of the miners that the price will rebound again and the costs associated with establishing and dismantling a mining operation. After the price had unexpectedly dropped again by a further 33% in

58. Estimates from the CIA World Factbook.

59. Digiconomist, *Bitcoin Energy Consumption Index*.

60. Digiconomist, *Renewable Energy Will Not Save Bitcoin*, Web Page, December 2017, `https://digiconomist.net/renewable-energy-will-not-save-bitcoin`.

61. Digiconomist, *Bitcoin Energy Consumption Index*.

62. Alex Hern, *How Iceland Became the Bitcoin Miners' Paradise*, Web Page, February 2018, accessed 17 January 2019, `http://www.theguardian.com/world/2018/feb/13/how-iceland-became-the-bitcoin-miners-paradise`.

63. Camilo Mora et al., "Bitcoin Emissions Alone Could Push Global Warming Above 2°C," *Nature Climate Change* 8, no. 11 (2018): 931, ISSN: 1758-67981758-6798, doi:`doi:10.1038/s41558-018-0321-8`, `https://www.nature.com/articles/s41558-018-0321-8`.

November 2018, the miner output had been scaled down 30–40%. It is almost certain that in the absence of a global regulatory intervention, this power consumption will resume should the price of bitcoins rise again.

What is perhaps the most unfortunate aspect of the aforementioned development is that unlike other sources of pollution Bitcoin does not in actuality generate much utility. In response to the popular criticism above, one of Bitcoin's major intellectual leaders Andreas M. Antonopoulos responded that "…Immutability is not a waste of energy. Christmas lights are…"[64] to the cheers of his close to five hundred thousand followers. This author begs to differ. Coal-heated homes keep their inhabitants warm in winter, the use of fossil fuel-powered cars or airliners moves passengers across the globe and cattle makes for delicious streaks that cannot yet be grown otherwise. As inefficient as some of those uses may be and as much as humanity may benefit from exercising restraint in their consumption, all of them add considerable benefits to the human quality of life while becoming more and more efficient with each passing year. This is especially true for modern, high-efficiency LED Christmas lights that add cheerfulness to a holiday not coincidentally celebrated on the darkest day of the year.

Conversely, rather than becoming more efficient, Bitcoin becomes less efficient the more expensive its digital assets become relative to national currencies. Whether moving digital tokens back and forth around the Internet is worth the above cost is hardly a question to be dismissed with a misplaced comparison to holiday illumination.

1.4.4 Irreversibility and costs

Since Bitcoin, as discussed in the section 1.4.2 "Decentralization", does not strictly have a central authority ensuring the correctness of the transactions executed within the system, the said transactions become irreversible under normal operating conditions. This is because once a block has been added to the chain, the following blocks build upon it, making the transaction final. Although this is not entirely true due to the fact that the miners can decide to return to a previous state of the blockchain and fork it, for the most part, once bitcoins have been sent to someone it is no longer possible to "unsend" them without the recipient executing a new transaction back to the sender. Irreversibility thus does not imply that a transaction cannot be de facto reversed by performing a counter-transaction for the same amount, resulting in the previous balances on the payer and payee accounts minus network transaction fees and the associated transaction costs.

The irreversibility issue can be examined from the perspectives of Bitcoin as a means

64. Andreas M. Antonopoulos, *Um No. Immutability Is Not a Waste of Energy. Christmas Lights Are a Waste of Energy*, Web Page, November 2017, accessed 17 January 2019, `https://twitter.com/aantonop/status/932223244605771777`.

of payment and that of the investment commodity separately.

Means of payment

The effects of the irreversibility of Bitcoin as a payment method are most easily and most commonly compared to those of other popular payment methods such as credit cards or banknotes. New and alternative means of payment also exist but for the purposes of this exercise they can be said to share the fundamental characteristics of either credit cards or banknotes, be they prepaid e-money cards like the Japanese Suica, travel checks or online platforms like PayPal.

Concerning credit cards, the two payment platforms differ fundamentally in that major credit card processors offer the ability to perform a chargeback whereas Bitcoin's transactions do not.

This leads to the question of why reversibility could be desirable or unwelcome, depending on whether one is the payer or the payee, with the foremost reason being fraud reversal followed by the increases in consumer confidence. Limiting oneself solely to fraud reversal, irreversibility is undesired by the payer and desirable by the payee. This is obvious in the case of the former as it is in the immediate interest of an account holder to be able to reverse a transaction upon discovery that the said holder did not initiate. In the case of a payee, especially one who has already delivered the counter-performance by delivering goods or providing a service, the opposite is true as a reversed transaction results in an immediate economic loss until and only if the reversal itself can be overturned either through the payment system itself or in a court of law.

In a paper published by the Tata Consultancy Services in 2003, Bhatla et al. note that the cost of chargebacks resulting from credit card fraud is born almost exclusively by the payees and banks and not the payers.[65] The authors argue that because most counties limit the liability of consumers and banks further provide extended protection to their customers, the costs to the typical payer are limited to monitoring their transactions and reporting fraudulent charges. Upon filing a report, the bank begins an investigation into the charge and the payer is refunded the amount due. Conversely, the payee has no such legislative or institutional protections and bears the responsibility of providing physical evidence of the transaction validity to begin the dispute process. An example of such evidence is the payers' signature upon the receipt of goods. Short of being able to do so, the payee who is typically a merchant incurs the costs of the goods that can no longer be recovered and the costs of shipping. Furthermore, the administrative

65. Tej Paul Bhatla, Vikram Prabhu, and Amit Dua, "Understanding Credit Card Frauds," *Cards Business Review*, 2003, `http://www.popcenter.org/problems/credit_card_fraud/PDFs/Bhatla.pdf`.

overhead is considerably higher on the side of the merchant, including the reprocessing of the transaction and the correspondence with the consumer and the bank. Lastly, the merchant has to pay both a banking charge for the chargeback and may be blacklisted by the credit card association, resulting in higher fees for future chargebacks or the termination of the contract in its entirety leading to the inability to accept credit cards in the future. A considerable cost is also born by the banking institutions themselves, which occasionally assume the costs of the fraud, but also suffer from administrative costs of processing chargebacks and must make ongoing large investments into computerized fraud prevention systems.

In the case of Bitcoin, no such reversal mechanisms exist meaning that the costs of fraud must be born entirely by the payer. This is very similar if not identical to payments performed through an exchange of banknotes with the notable difference being the added technological element and the lack of an exchange of physical objects taking place. Upon the receipt of payment, the funds are firmly in the hands of the payee and can only be returned either through a voluntary reverse transaction or by being mandated by a court order. Neither is likely to occur in the case of a successful fraud. Contrary to the credit card payment system, as there is no bank and thus no costs can be incurred by it.

The aforementioned advantages for the payers and payees by using a reversible or an irreversible means of payment are nonetheless illusionary at best and nonsensical at worse in the real economy. While no costs seem to exist to the consumer using a credit card, this is only true in the most reductionist sense.

First and foremost, credit card issuing institutions charge interchange fees (IFs) that are directly born by the merchants. These fees are the costs of using the payment system and are in the order of 1.8% as of 2016 in the United States with comparable cost structures throughout the developed markets.[66] Although credit card issuers have repeatedly come under regulatory scrutiny and were argued engage in anti-competitive business practices,[67] in the broader scheme of things some level of fees is bound to be necessary not only to cover the operating expenses but also to cover the issuer's capital expenditures resulting not the least from research and development of computerized fraud prevention mechanisms. These expenses are by no means a wasted effort and in the case of Visa have resulted in fraud reduction from 0.15% to 0.05% between the years 1990 and 2004.[68]

The merchant thus has to bear both the ongoing interchange fees and the one-off costs resulting from fraudulent chargebacks. These must be ultimately reflected in the price of goods and passed onto the consumer to maintain profit margins. The issue is

66. ValuePenguin, *Interchange Fees Explained*, Web Page, 2018, accessed 17 January 2019, `https://www.valuepenguin.com/credit-card-processing/interchange-fees`.

67. Zhu Wang, "Market Structure and Credit Card Pricing: What Drives the Interchange?," 2006,

68. Ibid.

further complicated by the fact these fees are not passed onto the consumers equally. For example, the interchange fees are much higher at above 3% in the case of American Express credit cards but are diffused among all customers because American Express cardholders typically spend more than their Visa and MasterCard counterparts and are thus attractive to the merchants.

Although these costs must be reflected in prices and are thus paid by consumers, it would be nonetheless incorrect to state that it is the consumers that bear the entirety of the costs of fraud, fraud prevention, and transaction processing. The price markup resulting from the aforementioned factors creates a de facto "fraud tax" that has an effect similar to regular taxation. In economic terms, any increase in the price of a good or service results in the upward shift of the supply curve, decreasing the quantity and reducing the surplus. Whether the reduction takes largely place in the consumer or producer surplus depends on the elasticities of supply and demand and therefore cannot be reduced to a single factor for all goods and services in the economy.[69] In other words, the costs associated with operating credit card networks providing chargeback mechanisms would appear to at first result in a deadweight loss larger than the costs of deploying and operating the mechanisms in the first place, and thus reducing the overall surplus in the economy.

This raises the question of whether Bitcoin can mitigate some of these issues.

When operating at low transaction volumes or supplemented with other cryptocurrency networks, Bitcoin at first appears to greatly reduce the costs of executing a transaction. As of the end of 2018, the mean cost of a transaction had been 0.003%[70]. This must nonetheless be considered with the caveat that transaction fees are static with regard to the size of a transaction and the above mentioned average transaction size had been approximately $14,000. In the case of smaller payments, main blockchain transactions become prohibitively expensive and economically unattractive for smaller purchases such as a morning coffee. This had been even more so the case in December 2017 at the peak of the Bitcoin rally, when a single transaction regardless of size bore a transaction fee of above $50. Assuming the eventual success of the Lightning Network described in section 1.4.3 "Scalability and efficiency" or a different solution, Bitcoin or one of its future iterations should in principle provide lower transaction fees.

Conversely, this line of reasoning entirely negates both the breadth services financed by the interchange fees and provided by credit card issuers as well as the additional costs

69. Mankiw et al., *Principles of Economics* Page 161 onwards.

70. Cost derived from average transaction amount over the U.S. dollar cost of bitcoins expended to execute the transaction. BitcoinCharts.com, *Bitcoin Avg. Transaction Value vs. Avg. Transaction Fee Historical Chart*, Web Page, November 2018, accessed 17 January 2019, `https://bitinfocharts.com/comparison/transactionvalue-transactionfees-btc.html#1y`

associated with handling Bitcoin. The most obvious one of these is the ability to perform chargebacks and receive support from the credit card issuers and banking institutions. This can be seen as a form of insurance spread among all cardholders. Should a fraudulent charge occur on a credit card, the cardholder can perform a chargeback and have their funds returned. Furthermore, the cardholder is typically not punished for a loss of funds that may occur as a result of their card or banking institution being hacked.

The opposite is true with Bitcoin wherein all transfers are final. Assuming that Bitcoin is used solely as a means of payment, there is a limited downside in that one can only lose as much as is needed to complete the transaction. This would make it appear as if Bitcoin may indeed be a good means of payment for smaller transactions where an incorrect transfer and the loss of corresponding funds are unpleasant but not critical. This benefit vis-a-vis a credit card increases with the transaction size is some elusive though not in the least because Bitcoin's fees are static with regard to the transaction size. As the size of the transaction increases, so does the sum that may be lost during the transfer, resulting in a conundrum concerning the ideal Bitcoin use case.

As with regular banking, nothing is hindering a sufficiently large group of users from socializing their losses through a form of a Bitcoin payments insurance. A trusted party could in practice agree to act as an insurer for Bitcoin transactions, collect insurance premiums from all insured users and cover the losses in case of fraudulent transactions. To the best knowledge of the author, no such organization exists in the present for direct Bitcoin payments. This is not surprising due to Bitcoin remaining largely unused as a regular means of payment and the administrative difficulties of operating such an organization. Given the current ease with which bitcoins can be laundered, it is unclear how such an organization would protect itself against insurance fraud and, even if it could, how high the insurance premiums would be in relation to the total transaction volume of individual users. In other words, even if one could make Bitcoin safer as a means of payment, the cost of the insurance and the administrative costs associated with operating the insurer could render the system prohibitively expensive even if performance bottlenecks were not an issue.

One of the issues that make cryptocurrencies difficult to use and thus easy to use incorrectly is the fact that the recipient has to be entered with particular care. A Bitcoin address would typically have the following form:

```
1BvBMSEYstWetqTFn5Au4m4GFg7xJaNVN2
```

The system is designed in such a manner that a mistake while typing in the address would almost certainly result in an error message from the client stating that the address is invalid. From a pure usability perspective, it is difficult to argue that cryptocurrency

addresses are either easy to enter or remember even in comparison to the already opaque banking institution numbers. This issue has been addressed by providing a number of auxiliary mechanisms that can make entering the address of the payee easier, among them the ability to scan a QR code, install an address book on one's computer or smart device and others. While helpful, all of these solutions also make it easier to defraud the sender by displaying the wrong QR code or editing the address book on the user's machine. The easiest solution for all of these issues appear to be entrusting once funds to a bank, which is a consequence that Bitcoin was explicitly designed to avoid.

In conclusion, the irreversibility of Bitcoin transactions poses considerable issues to its mainstream adoption vis-a-vis other means of payments. The decentralized nature of Bitcoin removes the oligopolistic resistance credit card issuers have exhibited to a run-to-the-bottom on transaction fees, which is a feature of the network that when all is said and done has to be given credit for. As there is strictly speaking no central authority, the network is incorruptible and cannot actively attempt to maximize fee collection from its users. Nonetheless, it would be equally incorrect to argue that credit card companies do not face fierce competition from newer FinTech entrants that appeared since the emergence of Bitcoin in 2008. While most of these payment systems presently interface with credit cards in one form or another, actions such as sending money within the network are performed entirely within the system and thereby exerting competitive pressures on the credit card issuers. Whether Bitcoin's and other cryptocurrencies' irreversible and fixed cost transactions can compete with these new technologies remains to be seen.

Investment commodity

The irreversibility of transactions for investment commodities poses a similar set of benefits and drawbacks as it does for currencies, but with some notable exceptions. As discussed in section 1.4.1 "Functions, money and intrinsic value", in the long-term, Bitcoin's properties suggest that—should the network persist—it should fill the same role as gold, but digitally. This gives rise to some interesting unique characteristics.

Due to the fact that each user of the Bitcoin network is "their own bank", any funds lost from the user's wallet are their own responsibility without there being a central authority that can take over the loss. This has to be considered as a particularly important issue should any user entertain keeping a considerable portion of his savings as bitcoin, because one simple mistake or even a lack thereof can result in a permanent loss of capital. There are a number of precautions described in section 1.3 "Technical" that the user may take to increase the safety of their funds, but, akin to buying a high quality safe to keep one's physical gold from being stolen by burglars, these measures are susceptible to failure like all others.

Alternatively, the users may decide to let someone else be their bank. This could be a cryptocurrency exchange or a dedicated custodian operated by a third party. Due to the digital and irreversible nature of cryptocurrencies, such firms are susceptible to the same dangers as individual users. While one would assume that economies of scale should apply, the general wisdom of the community revolving around cryptocurrencies is that presently one should not keep their coins at an exchange for any longer than necessary. While it is not possible to determine whether more coins are lost due to individual users' negligence or by being stolen from the exchanges, several large profile cyber attacks on major exchanges and the historical negligence of exchange operators have painted these services in an unfavorable light. This issue is addressed in greater detail in the next chapter Historical Overview. Understandably, such exchange also constitute interesting targets for any target-specific attacks and make it lucrative for the thieves to invest both time and resources into the attack.

The difference between gold and Bitcoin thus seems to be reduced to those of physical theft and electronic theft. Given the pace of technological progress, it is unsurprising that bank robberies have long given way to cybercrime.[71] At first, this would seem like a major drawback to keeping one's fortune in an electronic asset such as bitcoin and while it is currently the case for individuals living in stable nations under the rule of law and enforcement of property rights, a case can be made that it is specifically Bitcoin's irreversibility that makes it a superior asset in jurisdictions where expropriation of property is likely.

It is simply easier to keep bitcoins hidden from "men with guns" regardless of whether the said men wear uniforms or tracksuits. Expropriation of gold is as easy or as difficult as finding the gold and taking it away. This can be done by officers of the state—as has occurred in the United States under the Gold Reserve Act of 1934—or by robbers stripping their victims of all their belongings and checking for valuables. In this case, irreversibility may strike both ways depending on who is the expropriator. On the other hand, it is easy if not trivial to plausibly deny being in possession of bitcoin. The only thing the owner of the cryptocurrency needs to access it again at a later point is remembering twelve words in the correct order and a secure computer.

Notably, this advantage too can go both ways from multiple points of view. Funds can be hidden in such a manner by both refugees escaping peril and professional criminals stashing away their ill-gotten gains before going to jail. Similarly, the absence of knowledge of cryptocurrencies by robbers can, on the one hand, let a victim get off easy

71. Justin Jouvenal, *A Quintessentially American Crime Declines: Robbing Banks Doesn't Pay as It Used To.*, Web Page, October 2016, accessed 17 January 2019, `https://www.washingtonpost.com/local/public-safety/a-quintessentially-american-crime-on-the-decline--robbing-banks-doesnt-pay-as-it-used-to/2016/09/29/4f54a0a6-e7e9-437c-b484-151a337b0e0a_story.html`.

without losing their savings, or expose a victim who has no hidden cryptocurrency funds to further threats or acts of violence by the criminals believing that the victim may be lying. Ultimately, the only advantage that can remain uncontested for any particularly wealthy user of cryptocurrencies fleeing on foot is that a piece of paper with twelve words written on it is much lighter than a backpack full of gold and considerably less bulky than several duffel bags of $100 or even €500 bills.

One final advantage for the aforementioned groups that must be mentioned is that the practice of being "one's own bank" also means that one has absolute control over one's bank account and it thus cannot be frozen. This provides a degree of security to the holder of bitcoins from their prosecutor. Furthermore, the said bank is also connected to the Bitcoin payment network that acts independently of the local jurisdiction, which could allow unhindered outbound international transfers in circumstances where these would otherwise be impossible. This extends to both payments to and from countries under international sanctions when transactions through banking networks such as SWIFT are suspended—as is presently the case with Iran—and transfers of wealth abroad from countries exercising capital controls—such as the People's Republic of China.[72]

To conclude, bitcoins as an investment commodity pose considerable problems for investors operating within the bounds of law and in a stable political environment due to their relative ease of theft and the irreversibility of transactions. Conversely, they may under certain circumstances be a superior asset for individuals who found themselves outside of the law for one reason or another.

1.4.5 Permanence, transparency and unconditional propagation

Due to the very nature of the technology, all data on the Bitcoin network and other public blockchains are stored permanently and propagated across all full clients connected to the network. All blocks form a chain and no single one can be removed without reverting the chain to the previous state due to the system's cryptographic properties. When blocks are mined, new versions of the blockchain are uploaded to all full clients storing the entirety of the transaction history. With issues concerning costs and efficiency of applying such technology are have been addressed in previous sections, this section deals with the implications of this trait beyond the practicality of the system.

The direct consequence of this trait is that neither users merely transacting on the network nor the miner creating new blocks can decide what blocks they may or may not want to store on their computer systems. One cannot prevent others from storing specific transactions either. This gains importance once one differentiates between Bitcoin blocks

72. As of December 2018.

as sets of transactions and Bitcoin blocks as sets of machine-readable data.

Transactions

In 2015, the European Union Agency for Law Enforcement Cooperation (Europol) published a published an Internet Organized Crime Threat Assessment report noting that Bitcoin accounted for 40% of all known criminal-to-criminal online transactions.[73] Although this fact alone would make it seems that Bitcoin is a criminal payment system par excellence, the caveat is that careless use of Bitcoin is even more dangerous for a criminal enterprise than it is for the law-abiding citizenry. As with everything, where there is a demand there shall emerge a supplier and precisely this happened in the case of criminality centered around Bitcoin, with a number of legal enterprises offering to track down criminals on the network for any paying law enforcement agency.[74]

Although the advantages of Bitcoin described in section 1.4.4 "Irreversibility and costs" for performing financial transactions regardless of the directives of national and supranational bodies may paint it as a dream come true for any anarchist, dissident or drug trafficker, it is at the same time nothing short of being their worst Orwellian nightmare, wherein every and all payments made and received are forever etched into the public domain. The consequence thereof is that any small misstep can be proven to with a degree of certainty that a prosecutor could only dream of in the yesteryear. Once a real name has been attached to a transaction, the permanence of the money trail immediately results in possible incriminating evidence being read directly from the blockchain. The evidence of the exchange of funds cannot be hidden or erased whether through threats of violence, bribes or any other means. It is no exaggeration to say that such an exchange on bitcoin is even more permanent than if it had occurred during an anticipated sports event broadcast on national television.

The visibility of all transactions ultimately poses certain privacy risks and makes more transparent cryptocurrencies like Bitcoin less than ideal for individuals reluctant about being identified either due to a strong belief in pseudonymity or due to the possibility that the said individuals may be executing purchases of entirely legal goods that they would nonetheless rather not have broadcasted to the general public. One's purchases on the network are pseudonymized, yet also recorded until the end of time.

From the point of view of the sovereign, there are multiple benefits to having its

73. Europol, *The Internet Organised Crime Threat Assessment (IOCTA) 2015*, Report (Europol, 2015), `https://www.europol.europa.eu/activities-services/main-reports/internet-organised-crime-threat-assessment-iocta-2015`.

74. Will Yakowicz, *Startups Helping the FBI Catch Cryptocurrency Criminals*, Web Page, January 2018, `https://www.inc.com/will-yakowicz/startups-law-enforcement-agencies-catch-criminals-who-use-cryptocurrency.html`.

residents conduct business on a blockchain as this permanence and visibility of data provides considerable oversight over transactions that would otherwise occur in cash. A fully digital permanent ledger has the potential to make both taxation and auditing considerably easier due to the immediate availability of the data and the possibility to automate many traditionally manual processes. For example, given a society wherein cash is accepted as a payment method, it is not infeasible for a restaurant owner to profitably and illicitly employ waiters without work permits whilst violating work safety and wage laws. This is not the case for any payments made via Bitcoin. Should the patron refuse a receipt upon leaving the establishment, the transaction would be permanently recorded in the ledger making it impossible for the restaurant owner to skip the cash register and use the proceeds to pay off the illegally employed workforce. It is presently unclear whether the deployment of blockchain technology would in actuality produce any tangible benefits as opposed to a general prohibition of cash and restriction to other digital payment methods, but the concept has nonetheless attracted the attention of the cryptocurrency enthusiasts under the term of "sovereign cryptocurrency".

Data

As described in section 1.3 "Technical", Bitcoin's roots trace back to encryption for the purpose of sending data that would be secure from eavesdropping third parties. In the strictest terms, all the movements of bitcoins during transactions in the network are nothing more than a formulaic data being appended to the blockchain. However, the network does not mandate that all data on the chain must be strictly transaction data, and other less formulaic or formulaic non-transaction data can be written to the chain. This data can be absolutely anything with the only practical constraint being that the size of the data should not be too large or else it would result in excessive mining fees.

The easiest way to imagine this different data is again to think of a classic ledger. An accountant of yore adding transactions would typically follow a specific pattern to maintain clarity and would probably not also use the ledger to practice his poetry composition. Yet, technically, he could write a poem into his ledger. He could also sketch the candle in front of him or even use one of the pages to paint with oils. There is also nothing stopping the accountant from adding a few more lines and start writing music notes, a mathematical proof or a recipe for roasting turkey. All of this is also possible on blockchains, which opens up new possibilities for the technology beyond sending digital coins back and forth.

One of the possible uses of this technology has been pioneered by the Massachusetts Institute of Technology (MIT). It ran a pilot program in the summer of 2017, wherein the diplomas of 111 graduates had been recorded on a blockchain. The diploma could

then be accessed through a specially-designed smartphone application and shown to a prospective employer.[75] Because the information recorded to the blockchain is every bit as cryptographically sound as the transactions, the employer could easily determine that the diploma had indeed been issued to the individual presenting it, on the date the individual claims to have received it and with corresponding grades. Since all this can be determined instantaneously, there is a considerable advantage to such a crypto-diploma vis-a-vis a traditional one that can be fabricated and would require a minor investigation on the behalf of the Human Resources team to determine its veracity.

As is the case with many other uses of blockchain technology, one may pose a legitimate question whether one would really need to maintain a blockchain when a simple university or university group server could provide the graduate data without the need for distributed trust and, depending on whether the blockchain is private or public, considerable energy costs. This is a problem that has already been solved for many crucial industry classifications such as Certified Public Accountants (CPAs),[76] court sworn translators[77] and other groups by simply keeping a list on a website.

The contention of this author, however, is that this is indeed one of the uses of the technology that generates additional value in multiple ways. One such way is that it allows for differentiated access to the data through a single platform, which means that the owner of the data can choose to keep their data hidden from anyone without the key needed to decrypt it. Another advantage is that in this specific case the distributed nature of the data has a real tangible advantage to regular individuals. While it is unlikely that MIT will go out of business anytime within the lifetimes of the readers of this book, the same cannot be said about many other educational institutions or businesses. Although there are ways to determine whether the resume submitted by an alleged former employee is factually correct, not every Human Resources department has the capacity necessary to conduct what amounts to nothing short of a federal security clearance investigation. As a matter of fact, recent history shows that even high-ranking politicians have successfully falsified their resumes without anybody finding out about it for years. One such case is that of the German Social Democrat politician Petra Hinz, who had served as a member of parliament for eleven years before being unveiled as not only having fabricated her law degree but not even having a high school diploma.[78] Assuming that fabricating one's

75. Elizabeth Durant and Alison Trachy, *Digital Diploma Debuts at MIT*, Web Page, October 2017, accessed 17 January 2019, `http://news.mit.edu/2017/mit-debuts-secure-digital-diploma-using-bitcoin-blockchain-technology-1017`.

76. The Summit Express, *List of Passers: A-M October 2018 CPA Board Exam Result*, Web Page, October 2018, `https://www.thesummitexpress.com/2018/10/list-of-passers-a-m-october-2018-cpa-board-exam-result.html`.

77. Directory of Sworn Translators of France, *List of Sworn Translators*, Web Page, 2018, accessed 17 January 2019, `http://www.directory-sworn-translator.com/`.

78. Huffington Post Germany, *Kein Abitur, Kein Jura-Studium: SPD-Politikerin Gesteht, Lebenslauf*

past is a net cost to the enterprises and the society, an introduction of a distributed, cryptographically-secure database is a genuine improvement.

As with all things, a tool such as a blockchain containing verifiable data can be used to both help and harm. Since the data is stored permanently, it does not take a particularly vivid imagination to think of multiple ways in which one can publicize data that someone else wants to be kept private. This has already taken place on multiple occasions. Researchers from the universities of Aachen and Frankfurt am Main have conducted a thorough investigation of data of questionable character permanently etched into the Bitcoin blockchain.[79] The group had found that the available materials ranged from those of somewhat questionable character to illegal in most jurisdictions. Among the former, Bitcoin had been found to contain backups of the United States diplomatic cables, leaked by the WikiLeaks group in late 2010, and a 2014 BBC article about the Hong Kong National Day protests. The latter group contained an illegal prime used to break copy protection on DVDs, two "backups of link lists to child pornography, containing 274 links to websites" and an image containing "mild nudity of a young woman" of uncertain age. Given the current legal status of sexual content depicting minors, alone the possession of the data contained within the Bitcoin blockchain—something that is the case for every single user of a full client—would constitute of felony in a large number of jurisdictions. A similar case can be made for the possession of sensitive political or religious texts in less liberal jurisdictions.

Even were one to discard the extreme cases above, it is questionable whether a permanent data storage network would be socially desirable in the world of today. Modern data privacy laws, most notably the European Union's General Data Protection Regulation (GDPR),[80] specifically restrict how personal data can be used and under what circumstances the holder of the data may be obligated to delete it. While the battle between free speech and data privacy is far from over, public blockchains as a data register may very quickly come under considerable legal pressure should the latter be found victorious.

1.4.6 Inherent deflation and zero-sum games

One interesting characteristic of Bitcoin is the limited amount of bitcoins that can exist and their limited rate of supply. Although most aspects of cryptocurrencies described in

Gefälscht Zu Haben [No High School Degree, No Law School: SPD Politician Admits That She Fabricated Her Resume], Web Page, July 2016, accessed 17 January 2019, `http://www.huffingtonpost.de/2016/07/20/spd-politikerin-gesteht-lebenslauf-gefaelscht-zu-haben_n_11079326.html`.

79. Roman Matzutt et al., "A Quantitative Analysis of the Impact of Arbitrary Blockchain Content on Bitcoin," in *Proceedings of the 22nd International Conference on Financial Cryptography and Data Security (FC). Springer* (2018).

80. Intersoft Consulting, *General Data Protection Regulation (GDPR) - Right to Be Forgotten*, Web Page, 2018, accessed 17 January 2019, `https://gdpr-info.eu/issues/right-to-be-forgotten/`.

this chapter apply to Bitcoin as well as the majority of its younger siblings, this is not true across the board concerning the points described in this section, as some cryptocurrencies can be created indefinitely. The most notable example of these is Tether, which is pegged at a one-to-one ratio to the United States dollar and allegedly fully backed by dollar supplies of the issuing institution.

In Bitcoin's case, however, this automated and capped supply mechanism results in Bitcoin becoming a deflationary currency—were one to assume that it ever becomes money. Ignoring all technical limitations and practicality, this aspect alone makes Bitcoin a questionable candidate for what its proponents often hail as a possible universal currency of the future. Although deflations are generally considered to be bad for the economy, it is worth describing how this particular scenario plays out in the case of Bitcoin.

Typically, a deflation as that experienced during the Great Depression is characterized by the following pattern: Households and businesses expecting the price level to drop are incentivized to spend less because each unit of currency not spent today will be worth more in real terms tomorrow. The result of this reduced consumption leads to businesses reducing their prices to liquidate their inventories and attract demand. During this process, the workforce is reduced to meet the new lower aggregate demand, which in turn results in increased unemployment and fewer households being able to sustain the current demand. The cycle continues as the economy grinds to a halt.

To avoid this scenario, the central bank can launch a monetary intervention by lowering the interest rates, performing open market operations or changing the reserve requirements of commercial banks. By lowering the interest rates, the central bank reduces the costs of borrowing and incentivizes both the households and the businesses to spend more. This includes both consumer spending and investment into capital goods. In the case of open market operations, the government can expand the monetary base by buying its own securities or, should these run out, other securities available on the market. This, in turn, increases the quantity of money in the economy and pushes its price down. Lastly, by reducing the portion of the deposit a commercial bank must keep before extending the remainder of the deposit as a line of credit, the central bank can increase the multiplier at which commercial banks create money.

All of these approaches include money creation at some level of the national monetary apparatus. On the one hand, this is possible given the fiat currencies of today. On the other hand and contrary to the popular belief, it would also be possible was the world to return to the gold standard as the sovereign currencies were merely backed by gold reserves and were not the gold itself. This means that commercial banks could create new money by extending credit the same way they do today. It is not possible to do the same

if bitcoins were to be used as bitcoins. This is because bitcoins—within the bounds of this section's hypothetical Bitcoin future—are the currency itself and not the reserve asset. In other words, were one bank to lend a sum of bitcoins to another, this would reduce the quasi-physical amount of bitcoins in the bank's vault. Conversely, lending under a gold standard would result merely in the creation of a dollar asset for the lender and a dollar liability for the borrower, and no movement of the physical gold itself. This sort of money multiplication simply cannot occur as the bank cannot create any additional bitcoins and could at best issue a banknote with a claim on bitcoins in its reserves, thus defeating whatever little purpose the entire exercise had to begin with.

This problem extends across all banks, whether commercial or central. In the case of commercial banks, fractional reserve banking simply ceases to exist as no new money can be created. In the case of central banks, open market operations become impossible as the eponymous lender of the last resort could simply run out of bitcoin to lend. Setting the interest rates becomes equally problematic as the central bank may no longer be able to meet its obligations when setting the overnight interbank rate or its equivalent.

Further problems occur with regard to lending. Since money is becoming worth more as time passes, the relative wealth of those who are owed the deflationary currency grows, whereas that of those who owe decreases. The issue is further aggravated by the balance being tipped by the greater reduction in spending on the debtor side, resulting in a net decrease in overall spending.[81] Notwithstanding, the fact that merely holding money generates a return disincentivizes both spending and investment by creating a de facto natural interest rate in purchasing power terms, lending beneath which would result in a net loss of purchasing power to the lender.

Using the standard formula for determining the interest rate, one determine that:

> r = risk-free interest rate + inflation premium + default risk premium + liquidity premium + maturity premium[82]

However, due to the peculiar scenario proposed by the bitcoin monetary system, this formula would not include a contemporary risk-free rate as the aforementioned governmental interventions are no longer possible. Rather, the risk-free rate would constitute something akin to the minimum rate at which lending money is worthwhile. For the sake of simplicity, one can assume that the premiums for the risk of the debtor defaulting, the debt being less liquid than the currency and the length of the time until the debt matures

81. Irving Fisher, "The Debt-Deflation Theory of Great Depressions," *Econometrica: Journal of the Econometric Society*, 1933, 337–357, ISSN: 0012-9682. Paul Krugman, *Why Is Deflation Bad?*, Web Page, August 2010, accessed 17 January 2019, `https://krugman.blogs.nytimes.com/2010/08/02/why-is-deflation-bad/`

82. CFA Institute, *CFA Program Curriculum 2017 Level I* (Wiley, 2016), ISBN: 9781119315995.

remain more or less the same as they would for any single debtor and debt instrument today. Inflation, on the other hand, poses different problems.

The inflation premium is typically paid to cover the costs of inflation while the debt matures. If the money delivered after the debt matures has less purchasing power than when the credit was extended, the lender would compensate for the difference by demanding the difference. However, given that unlike modern-day inflation, there would be no instruments to ensure price stability short of adjusting production and thus by extension employment itself. Using the quantity theory of money, we can describe the inflation rate as:

> inflation rate = growth rate of Bitcoin's money supply - growth rate of the world GDP[83]

Or:

> inflation rate = (bitcoin creation rate - (bitcoin loss rate + bitcoin removal from circulation rate)) - growth rate of the world GDP

This identity holds as any increase in economic growth not followed by an increase in the money supply would result in the appreciation of the currency vis-a-vis real goods and services. Conversely, the creation of more currency relative to the quantity of goods and services being created devalues the currency. In the world of today, as it appeared following the dissolution of the Bretton Woods agreement under U.S. President Richard Nixon, there is no singular world currency with exchange rates floating or remaining pegged to a dominant currency, such as the U.S. dollar. As such, special circumstances excluded, inflation remains a currency area-dependent variable managed by the currency area's central bank. However, as mentioned previously, no such institution could exist in a hard bitcoin world. Given the deterministic nature of the network, one can thus determine an almost exact money creation rate for each year in advance. At the time of this writing, it is at 3.84% and will be halved to 1.8% by late May 2020.

One could subtract the rate at which bitcoins leave circulation from the money supply expansion rate to determine the Bitcoin's total active money supply. This figure is not fixed and consists of two separate rates, one at which bitcoins are taken out of circulation with the possibility of return at a later point and another of bitcoins forever lost in the network's abyss. The former may occur if an individual decides to hoard bitcoin for reasons of their choosing, the latter if the bitcoins are moved to an address that the

83. For the purposes of simplicity, velocity of money is assumed to be the same. Milton Friedman, *Studies in the Quantity Theory of Money* (University of Chicago Press, 1956); Business Reference Services, *History of the New York Stock Exchange*, Web Page, 2012, accessed 25 July 2019, `https://www.loc.gov/rr/business/hottopic/stock_market.html`.

Figure 1.3 Bitcoin block reward halving clock. BitcoinBlockHalf.com, *Bitcoin Block Reward Halving Countdown*

legitimate owner does not possess the private keys to. This can occur for any number of reasons, such as a malicious attack with an attempt to destroy a person's wealth, a mistake on behalf of the user sending bitcoins to an unoccupied address, or something as common as the user no longer being able to access their key by forgetting their password, being rendered physically incapable of entering it or dying without providing the next of kin with the private key. As both of these conditions are reflected in the network by bitcoins merely no longer being moved for extended periods of time, it is impossible to tell what percentage of coins are merely being hoarded as opposed to being lost indefinitely.[84]

Lastly, the movements in price levels are in a positive relationship with the size of the money supply and in a negative one with that of the output of goods and services in an economy when the velocity of money is constant. As such, in the long term, any growth of productivity in a closed global economy would act to counter the price increases taking place through the increase in the quantity of money. If the growth of the global

84. Typically the "hoarding" of money would be reflected in the quantity theory of money's velocity of money, but given that it is not possible to determine whether bitcoins are lost or merely unused this author has chosen to simplify it as part of the quantity of money.

economy is greater than that of the money supply, deflation would occur. This dynamic alone provides a basic idea of the issues that would arise from Bitcoin becoming money. Conclusively, given the aforementioned relationship between inflation, Bitcoin's money supply expansion rate and the rate of growth of the economy, one can conclude that, even were the rate of bitcoins take out of circulation equal to zero, the rate of growth must remain beneath the rate of growth of bitcoin supply in order to avoid a deflation. In other words, the current output growth of the world would have to be at under 4%, more than halving by 2020 and again halving every four years.

All that applies as said only in assuming that the previously stated general consensus that deflation is harmful holds true. This view has generally been shared by mainstream economists and has been the basis of the monetary policy upheld by the central banks for decades. A number of think tanks and similar institutions that can be generally placed under the umbrella of what is commonly referred to as economic libertarianism and to some degree Austrian economics have vehemently opposed this view. The two most prominent of these organizations are the American think tanks the Cato Institute[85] and the Ludwig von Mises Institute[86], both of which can be argued to derive considerable success in reaching the general public by explaining economics through "verbal logic, which provides a relief from the technical mumbo jumbo of mainstream economics"[87] and the opposition to the cause of any recent financial troubles.[88]

Within economic history, the idea that deflation does not necessarily mean economic collapse has also been raised by scholars such as Michael Bordo and Andrew Filardo.[89] Both specialists in monetary economics with experience at the Bank of International Settlements and some central banks, Bordo and Filardo argue that from a historical perspective the nineteenth and twentieth century offers several examples of deflation, some of which were bad, whereas others were good, and some "ugly". The scholars also point out—much akin to some economists at Cato and Mises Institutes—that it is perhaps our experience of the Great Depression and the deflation that accompanied it that may do a disfavor to the way deflation is being approached by mainstream economics.

85. John H. Cochrane, *Who's Afraid of a Little Deflation?*, Web Page, November 2014, accessed 17 January 2019, `https://www.cato.org/publications/commentary/whos-afraid-little-deflation`.

86. Christopher P. Casey, *Deflating the Deflation Myth*, Web Page, March 2014, accessed 17 January 2019, `https://mises.org/library/deflating-deflation-myth`.

87. Mary Hall, *The Austrian School of Economics*, Web Page, August 2018, accessed 17 January 2019, `https://www.investopedia.com/articles/economics/09/austrian-school-of-economics.asp`.

88. The author holds no strong convictions on the ideas presented by the two think tanks but notes that the often refined presentation by the members of Cato or Mises combined with easily understandable personal finance principles that can be somewhat at odds with the macroeconomic nature of monetary policy seem to be naturally more appealing to the general reader than the ideas of macroeconomic accounting required to understand positions represented by mainstream and MMT economists.

89. Michael D. Bordo and Andrew Filardo, "Deflation in a Historical Perspective," 2005, `https://www.bis.org/publ/work186.htm`.

Notably, there appears to be no dispute that particularly the nineteenth century had been ripe with an ongoing price instability resulting from short to medium term price fluctuations caused by the increases and decreases of the supply of monetary gold. One must conclude, that these would not likely exist were the monetary system based on bitcoin rather than gold, the quantity of which subject to deposit discoveries, which in themselves are a function of the price of gold. All that can and unequivocally must happen in the case of bitcoin is a long-term adjustment to the number of miners based on the relationship of prices of mining hardware, electricity and the purchasing power of bitcoins. Discoveries of bitcoin previously considered lost or out of circulation may happen, but they cannot be caused predictably through a larger investment in production factors as is the case with gold.

There also appears to be a hypothetical possibility that such a strictly pre-programmed rate of deflation given any single growth rate, the presence of deflation itself could result in adverse effects on economic growth. One can assume that a hypothetical mild deflationary bitcoin regime took place without noticeably adversely affecting economic growth. Given that bitcoins themselves directly correspond to purchasing power and assuming that any credit extended in bitcoins would be calculated as per interest rate formula laid about above, it naturally follows that a lender would expect to receive more bitcoins than he invested both in terms of purchasing power as determined by the appreciation of bitcoins due to ongoing deflation as well as in nominal terms, because even were all risk premiums reduced to zero it would make no economic sense to lend bitcoins if the repaid sum were not greater than what would result from keeping bitcoins in cold storage. This means that any investment would have to both provide a higher return in utilitarian terms than the rate of deflation and compensate the lender for any risks taken.

Conclusively, one can argue that the aforementioned effect could also act as a natural set of breaks on breakthrough innovations leading to overall rapid economic growth. In the present day, it is possible to benefit from the general growth of the economy by investing in a diversified equity portfolio. While not a perfect way of representing the world's economy, doing so allows the investor to benefit from the general economic growth at the cost of market risk. At the same time, the investor's funds are added to the secondary capital markets and create an ecosystem that allows the investors in primary capital markets to realize their book profits. This, in turn, allows for further investment in primary capital markets, which fund the expansion enterprises' operations.

None of this would be necessary in the case of a bitcoin world order, as merely hoarding bitcoins would result in an equal participation in the development of the economy. If the economy grows, any bitcoins held would purchase a greater quantity of goods and services.

If it shrinks, the opposite takes place. Notably, this means that it is no longer necessary to provide funds to capital markets and assume risk to reap their benefit of this growth. Furthermore, were one to again return to the idea of a technological or organizational breakthrough that would lead to a rapid expansion of the economy, one can genuinely pose the question whether the anticipation of such an advance and the imminent increased rate of deflation—as a function of there being more goods and services to the same quantity of money—would not cause the lenders to reduce their lending activity altogether. Increased purchasing power of existing funds and the higher required performance needed to survive for enterprises already holding debts on their books greatly reduce the incentives to extend credit. Similarly, the deteriorating credit environment would result in the enterprises in need of debt at the given point to face considerable difficulty meeting their obligations, resulting in anticipation of insolvencies and the subsequent sell-off of equity. As a result of the above, any anticipation of rapid economic growth would rather appear to result in a downturn of the real economy than an investment rally into the new markets. What follows instead are the typical ills mainstream economics links to deflation: unemployment and reduction of aggregate supply and demand.

Naturally, it is entirely possible to avoid all of the above problems by simply using bitcoins as a reserve currency and allowing banks to issue their bitcoin-based banknotes. This would greatly reduce the number of transactions that need to take place and allow for monetary policy to be implemented if one were to use an adjustable peg rather than a fixed one. The unfortunate truth is that adopting such a system would simply not make much sense as it would be a mere return to any one of the previously existing precious metal monetary orders. It also would not please any bitcoin advocates as they would be using bank-issued currency with all the aspects they do not like about it today. In simplest terms, going this path would be very much a case of a solution in need of a problem that had already been solved.

Tomorrow, today

While it does not appear likely that Bitcoin will become a world currency[90] in the above sense, both the deflationary aspects of the cryptocurrency and its zero-sum game investment properties had already surfaced in the very first years of its existence. Although there are Bitcoin ATMs and possibilities to pay with Bitcoins for some services, Bitcoin has become a little more than a zero-sum game of exchanging bitcoins for various national currencies.

90. The meaning of the term "world currency" is difficult to pinpoint itself, as it could mean almost anything from a one currency and no other currencies to a supranational currency akin to the Special Drawing Rights (SDR) of the International Monetary Fund to simply a currency that is accepted anywhere as a means of payment.

Although the price of bitcoin appears to be in no way correlated to the economic output of the planet, the vastest impact the network appears to have at the moment is in rearranging the wealth of the individuals participating in it. It is an example of the greater fool theory. Generating no income as described in section 1.4.1 "Functions, money and intrinsic value", the sum of the total profits from buying or creating bitcoins is always equal to the sum of the total losses. While Bitcoin does not necessarily appear to be a "scheme", there is a strong "Ponzi" element to it in that the individuals who purchased or otherwise acquired bitcoin early and then sold their bitcoin at a profit have ultimately derived gains from the unrealized losses of those who have not. In simpler terms, in a closed system—which the human civilization is one of—one can only get as much utility out of a box as one can put into a box, unless the box is productive, which Bitcoin is not. In this sense, buying bitcoin is in essence no different from trading currencies on the Forex market, but fundamentally different from stocks and bonds that over time produce tangible outputs. To be even more precise, Bitcoin and Forex are similar to the degree that they are in actuality negative-sum games due to utility continuously being seeped off by the exchange providers. In the case of both, this happens through transaction fees required to trade and the bid-ask spreads.

A cursory overview of any cryptocurrency topic in mainstream media immediately suggests that the general press and financial leaders are more interested in bitcoin's price swings than the ability to purchase goods and services with it. This topic is further discussed in the following chapter.

1.5 Vulnerabilities

Bitcoin has existed for approximately a decade. During this time, it has gained significant adoption and appreciated to the point that one can only examine its price chart for the past decade by setting the scale of the y-axis from linear to logarithmic. Nonetheless, several potential vulnerabilities can reduce the price of bitcoins to zero or near zero and lead to the de facto end of the network as it is known today. In this section, three classes of vulnerabilities are offered that could potentially lead to this result: technical, legal and societal.

1.5.1 Technical

Despite the furor around it, by its very nature Bitcoin is little more than software running on a network. To its great advantage, it is a very simple piece of software built with components that have already stood the test of time. This simplicity and the rigidity

of its parts means that it is easier to make sure that there are no critical bugs in the system, leading to a rather impressive consequence that, despite its once $200 billion market capitalization, Bitcoin has never been hacked. Nonetheless, there are some points worth mentioning regarding the future of this system.

One of the key elements of Bitcoin—if not the key element itself—and the reason why cryptocurrencies have "crypto" in their name is the SHA256 cryptographic hash function. This function is used for all encryption processes described in section 1.3 "Technical". The SHA256 is a very widely used function and Bitcoin is not unique in this regard. It is notably used in the Secure Socket Layer (SSL) that forms the basis for the overwhelming majority of encrypted Internet communications. When one accesses their online banking website, it is the SSL that is used to protect them.

SHA256 is published by the U.S. American National Institute of Standards and Technology (NIST). While this in itself may appear innocuous enough, the fact that it has been developed by none other than the National Security Agency (NSA) has attracted considerably more interest from the more technically curious Bitcoin aficionados. This effect has been further amplified by the famous leaks by an NSA contractor Edward Snowden that occurred during the same time Bitcoin appeared. Given that NSA's role is communications monitoring and security, the question of whether the entirety of Bitcoin is potentially standing on an intentionally porous foundation is not one that should be dismissed outright. Even though SHA256 has been believed to be secure when Bitcoin was released, NSA's track record shows that the agency has at times not been entirely transparent about the technologies it released for the wider public. For example, one of the popular email encryption standards still used to this day is the so-called Triple DES, which to no great surprise is built upon the Data Encryption Standard (DES). The DES, also developed by the NSA and published by NIST, had the curious characteristic that the random numbers used for the encryption were in fact not random, but instead picked out by the cryptographers at the NSA to make the encryption secure from an attack that only NSA appeared to know about. The agency had furthermore engineered the standard to have a short key length, which allowed its cryptographers to break the code by trying all possible combinations. SHA1, which is the predecessor of the SHA2 group that SHA256 belongs to, has also been found to be subject to a vulnerability that the NSA already knew about four years in advance.[91]

Although SHA256 appears to be secure, it is unclear whether it is, in fact, secure from the National Security Agency. The problem with this issue is not necessarily that the NSA could take down Bitcoin—the U.S. government has much more effective means of doing

91. Bruce Schneier, *The Legacy of DES*, Web Page, 2004, accessed 17 January 2019, `https://www.schneier.com/blog/archives/2004/10/the_legacy_of_d.html`.

so than going through the effort of breaking codes—but rather that should a third party discover this vulnerability, they too may use it to manipulate the blockchain in a way that benefits them. This problem with intentional back doors has long been known to security experts and has come to light for the general public when Apple Inc. publicly refused to create a way for the Federal Bureau of Investigations (FBI) to break the company's smartphone encryption systems for the purposes of investigating a perpetrator of a mass shooting.[92]

The issue of SHA256's security is further complicated by the fact that several commercial bodies such as Cisco[93] have released guidance to avoid using the function. The organizations base their conclusions on the following important and perhaps most critical vulnerability to Bitcoin and comparable blockchains in their present state resulting from the steady advancements in quantum computing.

Quantum computing has existed as a concept for now nearly forty years[94] and has mostly remained a nothing but a concept for the longest period of time. While an explanation of what a quantum computer lies far outside of the scope of this book, it suffices to say that as decades went by quantum computer prototypes have begun to slowly appear in research laboratories of companies such as IBM.[95] Although these still do not serve any practical purposes, the idea is that they will eventually allow one to perform certain computational operations at dramatically higher speeds than can be achieved today. To put it differently, quantum computers are not faster computers but different computers, and one task they are expected to be exceeding good at is breaking encryption. This is a problem for SHA256 and a problem for Bitcoin.

The only thing that is need for quantum computing to end the current state of cryptocurrencies is to execute the so-called Shor's algorithm.[96] The good news for Bitcoin is that as far as the general public is concerned, no quantum computer exists that is large enough to run the algorithm. As such a computer could still be decades away, Bitcoin and everyone's online banking can exist in a state of relative safety. However, once such

92. Aaron Pressman, *The Secret History of the FBI's Battle Against Apple Reveals the Bureau's Mistakes*, Web Page, 2018, accessed 17 January 2019, http://fortune.com/go/tech/fbi-apple-iphone-encryption-san-bernardino/.

93. Security Center, *Next Generation Encryption*, Web Page, 2015, https://www.cisco.com/c/en/us/about/security-center/next-generation-cryptography.html.

94. Paul Benioff, "The Computer as a Physical System: A Microscopic Quantum Mechanical Hamiltonian Model of Computers as Represented by Turing Machines," *Journal of Statistical Physics* 22, no. 5 (1980): 563–591, ISSN: 1572-9613, doi:10.1007/BF01011339, https://doi.org/10.1007/BF01011339.

95. Will Knight, *Serious Quantum Computers Are Finally Here. What Are We Going to Do With Them?*, Web Page, 2018, accessed 17 January 2019, https://www.technologyreview.com/s/610250/serious-quantum-computers-are-finally-here-what-are-we-going-to-do-with-them/.

96. Peter W. Shor, "Polynomial-Time Algorithms for Prime Factorization and Discrete Logarithms on a Quantum Computer," *SIAM Journal on Computing* 26, no. 5 (1997): 1484–1509, ISSN: 0097-5397, doi:10.1137/S0097539795293172, https://doi.org/10.1137/S0097539795293172.

a computer is built and were one hypothetically to attempt to turn it into a Bitcoin mining machine, the computer would be able to speedily crunch the hashes requested by the Bitcoin network regardless of the difficulty of the hash.

In other words, such a computer would remove the hard limit of a new block being mined every ten minutes and hastily work its way until the last bitcoin is mined, after which point it would proceed to process all transactions on the network while leaving all other miners in the dirt. If need be, the computer could rewrite parts of the blockchain by adding and removing transactions at will and recalculating the following hashes. What this means is that Bitcoin as a network would be completely controlled by a single computer, leaving the fate of the network in the hands of whoever operates the said computer. Needless to say, the effect of such an event would be an inevitable collapse in bitcoin value followed by the run on the exchanges to fiat currencies. Other cryptocurrencies vulnerable to this attack would collapse even without being targeted as their security would evaporate overnight.

There are ways in which cryptocurrencies can potentially avoid this fate in the future, but they do not apply to Bitcoin as it is today. The most obvious solution would be to use a so-called post-quantum encryption system, which will be resistant to quantum computer attacks in the same way that current systems are resistant to those of contemporary computers. Unfortunately, this is not something that can be done without triggering a hard fork, which is something that the owners of the main blockchain have been avoiding to this point to preserve backward compatibility with the previous versions. When such a change occurs, the main chain of Bitcoin will presumably die off and a new main branch will continue in its place. Whether this transition will occur smoothly or result in a fracturing of the main chain into multiple competing chains and a result weakening Bitcoin's position vis-a-vis alternative blockchains remains to be seen.

1.5.2 Legal

The second risk class that could greatly diminish Bitcoin's adoption is a concentrated effort through a body that possesses the authority to advance and enforce legislation or standards that are inscribed into an already existing legislation. Such a body may be a sovereign government or an international body such as the United Nations or the North Atlantic Treaty Organization (NATO).

It may be very difficult to eradicate the network itself. As long as one computer somewhere on the Internet still runs a Bitcoin node and mines its own blocks, the blockchain continues to exist and progresses along its normal path. This line of reasoning, however, omits the obvious caveat that something that barely anybody uses does not matter as much as something that becomes popular enough for bulge bracket investment banks to

begin opening trading desks. If the author of this book and its reader decide to turn Post-It notes into a currency that they would then use to determine whose turn it is to pay for coffee, this action will undoubtedly continue indefinitely without any legal consequences for either. If, on the other hand, one of the said parties decided to mint their own coins, claim to back them by some commodity and circulate them for general use, the said party may very quickly find themselves facing the possibility of a multi-decade prison sentence. The aforementioned scenario had occurred in the case of the self-issued currency called the Liberty Dollar, the issuer of which faced charges for everything from money laundering to conspiracy and was fortunate to get away with a figurative slap on the wrist.[97]

Fears of such intervention by a nation-state or an international organization with considerable clout have surrounding Bitcoin and other cryptocurrencies in one way or another since their inception. These were not entirely unfounded due to the fact that a number of prominent Bitcoin uses were less than puritan in nature: a large scale drug trading operation involving hitmen tying loose ends, extortion of individuals and legal persons through malware developers encrypting operation critical data, alleged large scale use of non-legal tender for payments in Venezuela, alleged capital flight from China and so forth. These events are described in greater detail in the following chapters, but it suffices to say that Bitcoin by its sheer existence has given the powers that be sufficient reason to take measures against it, even if it were something as trivial as the ecological damage caused by the system's highly wasteful block creation mechanism in an era where climate change had become is a major talking point in the international space.

The simple fact remains that Bitcoin, despite its peer-to-peer nature and the long-winded talks about its decentralization, is very easy to render useless were one to assume that it is either a means of payment or an investment commodity.

Starting with the means of payment, Lenz suggests that considerably limiting the usage of Bitcoin could be done as easily as by making it illegal to operate an exchange or take bitcoins as a means of payment in a business. Both of these are easily enforceable,[98] and would in practicality eradicate any interest a mainstream user would have in trying or continuing to use the system. In a world where Apple Pay and Google Pay fight toe-to-toe as well-staffed marketing departments continue adding new spins to electronic money cards to distinguish their take on loyalty points from those of other companies, an illegal payment system run by a group of renegade software developers is a hard sell. As Lenz notes, the ban could even be as easy as making it illegal to possess a copy of the

97. Federal Bureau of Investigations, Charlotte Division, *Defendant Convicted of Minting His Own Currency*, Web Page, 2011, accessed 17 January 2019, `https://www.fbi.gov/charlotte/press-releases/2011/defendant-convicted-of-minting-his-own-currency`.

98. Lenz, *Japanese Bitcoin Law*.

blockchain. This in itself can be easily justified by the fact that the Bitcoin blockchain does contain what appears to be child pornography, the possession of which is already illegal in most developed nations. The consequence of any such governmental action would essentially signal the end of mainstream Bitcoin use and make it as Lenz's keenly puts it "by definition, a network used only by criminals".[99]

Bitcoin as an investment commodity in a sense derives its value from the "greater fool" principle or the idea that someone will buy it later on for a higher price. Even if the idea was to sell it for the same price, any of the legislative actions above would greatly diminish the pool of "fools" interested in buying the asset and thus drastically reduce its price. In fact, there is evidence to believe that this is exactly what happened in late 2017 when the People's Republic of China restricted the exchange of bitcoin into the yuan. An outright ban of Bitcoin usage by a major jurisdiction would quite likely have an even more profound effect resulting in a major run on the exchanges.

This is not to say that the criminal world could not continue using it and thus maintain the value of the cryptocurrency at some difficult to specify level. By selling contraband, criminal groups can come into possession of sovereign currencies as they do today, which can then be used to purchase cryptocurrencies from other criminals. Given the mobility, plausible deniability and censorship resistance offered by Bitcoin and even more so by its more advanced brethren like Monero, the holder of the cryptocurrency could then withhold knowledge of their crypto-denominated wealth in the case of an arrest or use it for long-distance payments to other criminals. One cannot board a commercial airliner with a suitcase containing a million dollars without attracting attention, but one can easily board an aircraft with a thumb drive or a book containing a mnemonic phrase used to access the equivalent in bitcoins.

For those who want to use bitcoins for entirely legal purposes, whether it be buying coffees or saving for retirement, the above enterprises hardly pose a lucrative opportunity. Even more so, even if the cryptocurrency retained some of its value following the inevitable run on the exchanges, the said value would be considerably lower than whatever the cryptocurrency was purchased for or could have been sold in the general period prior to the ban. All in all, it would greatly reduce the appeal of Bitcoin, the degree of which depends on the punitive measures associated with its illicit use. In stark contrast to a peer-to-peer file-sharing networks like BitTorrent that are popularly used for downloading copyrighted materials such as music, films, and video games without paying for them, Bitcoin offers very few incentives to risk having one's door bashed in with a battering ram at four in morning by practically-dressed men with a search warrant.

99. Ibid.

1.5.3 Social

The third risk class is what can broadly be described as a sociocultural dependability. It is the most vague of the three classes and the one that is the easiest to imagine. Simply speaking, people can just stop caring about Bitcoin and move on. The two functions of Bitcoin are again be separated for the purposes of analysis.

Investment commodity

Risk is more obvious from the point of view of an investment commodity. Bitcoins derive their value from buyers believing that they will have value in the future. There are no "men with guns" enforcing the collection of taxes paid in bitcoins, no real uses for bitcoins outside of operating the payment and investment network known as Bitcoin and no cash flows generated by owning bitcoins. If gold were a chunk of metal devoid of its societal properties and industrial uses just sitting there and not doing anything, it could still be used as a paperweight; bitcoin cannot even be used in that capacity. This risk of outright abandonment cannot be neglected given the lack of gold's history as an investment commodity and some of its real-world uses.

More so than the other two classes of vulnerabilities, long-term apathy towards Bitcoin may result from a number of other factors within the previously described classes. Doubts about the legal status of cryptocurrencies or news about breakthroughs in quantum computing can very quickly affect the price of individual bitcoins, resulting in a rapid downward price pressure. This in itself would and, if 2018 is any evidence thereof, already has greatly reduced the speculations about bitcoin's potential worth by the mainstream media outlets that were quintessential for bringing the asset to the masses. One must not forget that Bitcoin was, by all means, the craze of the year in 2017. There have been other crazes before it and will certainly be more crazes to follow. Very few people are interested in Beanie Babies today and while the comparison is apples to oranges, history has shown us that humanity will continue finding new things that will be traded for speculative purposes.

Bitcoin's situation in this regard is not aided by the shallowness of its market. This means that the total volume of trades resulting in bitcoin's volatility is comparably small relative to other commodities to say nothing of Forex. Furthermore, typical commodities futures contracts are settled in the underlying commodity, that is, the holder of the long position has to either sell the contract before it matures or receive the actual commodity from the holder of the short position. This can at times results in humorous situations, wherein a new employee of a financial institution does not sell his long position in time and has to travel across the country to physically receive and somehow resell a

herd of live cattle on behalf of their firm.[100] This is not the case with bitcoin futures traded at the Chicago Mercantile Exchange (CME)[101] and the Chicago Board Options Exchange (CBOE)[102], both of which are settled in U.S. dollars. This has the effect that bitcoin futures contracts in fact become considerably more dangerous than comparable instruments due it becoming possible to manipulate the price of bitcoin themselves, in either direction, by funneling sufficient funds into Bitcoin exchanges while simultaneously holding leveraged bitcoin derivatives that will provide a considerably greater income at settlement than the funds spent on manipulating the price of the underlying asset. The opaque nature of the network combined with geographically distributed exchanges makes this kind of operation particularly easy. When asked, the founder of Microsoft turned philanthropist and investor Bill Gates has explicitly stated that bitcoins are a "kind of a pure 'greater fool theory' type of investment" and that he would "short it if there was an easy way to do it".[103] Bitcoins market structure does not make this kind of shorting possible for reasons listed above.

Although this distinction may appear overly technical, its implications for retail investors, who do not have the necessary financial assets and sophistication to trade regular futures, are very real and thus by extension very real for Bitcoin's prospects as an investment commodity. The listing of bitcoin futures on CBOE and CME has been seen by many of its proponents as a big step to becoming a real financial asset that big institutions can invest into and thus, despite the exact opposite having taken place, drive the prices much higher than the $20,000 range bitcoin was nearing when the futures were introduced. For a retail investor to buy bitcoin without having to deal with the burden associated with blockchain technology and uncertain tax legislation, a much more important development would be the introduction of a bitcoin Exchange Traded Fund (ETF). It is at this very point however that Bitcoin repeatedly stumbled to receive regulatory approval necessary to list the ETF and reach the retail investor. The Securities Exchange Commission (SEC), a body tasked with overseeing the trading of securities in the United States, rejected multiple proposals for an ETF, basing it stance on the fact that the "[e]xchange has not met its burden … to demonstrate that its proposal is consistent with the requirements of the Exchange Act Section 6(b)(5), in particular, the requirement that a national securities exchange's rules be designed to prevent fraudulent and

100. Hull, *Options, Futures, and Other Derivatives* Page 25.
101. Chicago Merchantile Exchange, *FAQ: CME Bitcoin Futures*, Web Page, 2019, accessed 17 January 2019, `https://www.cmegroup.com/content/cmegroup/en/education/bitcoin/cme-bitcoin-futures-frequently-asked-questions.html`.
102. Chicago Board Options Exchange, *XBT-Cboe Bitcoin Futures*, Web Page, 2019, accessed 17 January 2019.
103. Evelyn Cheng, *Bill Gates: I Would Short Bitcoin if I Could*, Web Page, May 2018, `https://www.cnbc.com/2018/05/07/bill-gates-i-would-short-bitcoin-if-i-could.html`.

manipulative acts and practices".[104] Given the SEC's previous position on the matter, it is unclear whether a bitcoin ETF will ever come into existence and even then whether other jurisdictions will share SEC's views on the matter.

As it stands, purchasing bitcoins is still very different from purchasing exchange-listed instruments such as equities and bonds. In consideration thereof, it remains to be seen whether Bitcoin can truly become the "digital gold" that some claim it to be.

Means of payment

From the point of view of a means of payment, Bitcoin's future looks considerably less optimistic than its chances at finding a permanent place on the Chicago Mercantile Exchange. Technology comes and goes and it is very unlikely that Bitcoin will be any different, especially in a market as competitive as electronic payments. It is the contention of this author that Bitcoin has already come and gone, not when the price began to collapse at the end of 2017, but rather when the cryptocurrency began appreciating to the levels that made it a nonsensical payment system. A means of payment is no more when shops cease accepting it citing volatility and fees that make up close to a half the price of the actual product.[105]

Were one even to agree that Bitcoin still has its place in the sun, the advantages it has as a commodity are often disadvantages to a means of payment. The system's theoretical decentralization and development by network consensus may all be useful traits for a commodity that should not be controlled by any one single entity. They are not necessarily useful traits when one is competing against the financial sector by offering a payment system. Despite its ardent following and a small handful of YouTube and Twitter-bound evangelists preaching the virtues of Bitcoin, the network itself does not have a marketing department. There is no collective group offering Christmas coupons for payments with Bitcoin, no loyalty points or cashback for using the network or even any kind of packaging designer. The only exception to the above statement are the advertisements paid for by Bitcoin exchanges themselves, but even in their case it is a question of whether the advertisement budget will remain unshaken following an initial push were the demand for bitcoin exchange services to dwindle or whether the firms would attempt a kind of uphill battle to promote a product declining in popularity at one's own expense. As Mankiw puts in his introductory work to undergraduate economists, advertising is a signal of product quality and it is its "existence and expense" that provides

104. United States' Securities Exchange Commission, "Release No. 34-83904; File No. SR-NYSEArca-2017-139," 2018,

105. Kutis, *Steam Is No Longer Supporting Bitcoin*, Web Page, 2017, `https://steamcommunity.com/games/593110/announcements/detail/1464096684955433613`.

a rational basis for the customer to value an advertised product to a greater degree.[106] Therefore, for exchanges to advertise Bitcoin in the times when the momentum is not in their favor, the exchanges have to not only to believe that it is the exchange services they are offering that are good enough cover the price of the advertisement, but that bitcoin itself is an investment vehicle attractive enough for buyers to continue using the exchange rather than liquidating their holdings and returning to speculating on the dollar-yen pair on Forex. Given the complete 2018 disappearance of exchange services television ads in Japan as opposed to their almost ubiquitous presence during the 2017 rally, it does not appear that the aforementioned belief in the customer value proposition is shared at the very least by the Japanese operators.

Even were one to disregard advertising and assume that Bitcoin could live of its technical merits alone, this conviction would be at the very least difficult to substantiate. Presently, the electronic payments, as well as the general financial technology market, are experiencing nothing short of a revolution. Whereas PayPal became the big sensation of the 2000s with the advent of online stores and marketplaces such as eBay, the mid–2010s have led to a considerable number of firms originating from the technology sector have begun offering their own payment solutions. These include but aren't limited to Amazon Pay, Apple Pay, Google Pay, Line Pay and the nearly ubiquitous Chinese WeChat Pay. Not only do all of the above have well-staffed marketing departments, but they are also arguably offering a better product for most users than does Bitcoin. This ranges from funds being less likely to be stolen through a wallet or exchange hack, considerably greater acceptance as a means of payment and quality of life improvements.

latter, any transition to an electronic payment system should in principle provide some kind of improvement to the customer vis-a-vis just carrying cash. For online payments, all of these systems are equally comfortable in that they require little more than a registration and a credit card to be provided by the customer. Wherein they presently differ is payments at brick-and-mortar stores with the largest differentiator being whether the customer uses a Quick Response Code (QR) or a Near-Field Communications (NFC) chip to authenticate the transaction. A QR payment is typically performed by the customer using their smartphone to scan a QR code displayed by the clerk at the register at which point information is exchanged between the two systems and the payment is authenticated. An NFC payment is performed through a secure chip being read by a compatible reader at the register. Both systems obscure credit card information and both can be further secured by requesting biometric data, such as a fingerprint or a facial scan, or a password before processing the payment. The two differ in that QR codes require Internet connectivity and a greater effort associated with aiming one's camera at

106. Mankiw et al., *Principles of Economics*.

the code as opposed to merely holding the device in the proximity of the reader. Furthermore, NFC payments allow for a cash balance to be stored on the device, whereas QR payments presently do not, making them particularly useful for situations when payments need to be processed instantly, such as when boarding a bus or passing through a railway gate during a rush hour. Currently, both major mobile manufacturers Google and Apple offer NFC payments through their respective platforms. In the case of Apple Pay, recent phones have been engineered to the point that some of the battery is reserved for payments even when the phone itself has run out of power, thus allowing the user to securely pay their fare even when the phone itself is no longer operational. This is too is not possible with QR.

Most modern Bitcoin wallets currently operate using QR codes, which can largely be attributed to the fact that the few actual payments that occur most likely do not occur at the point-of-sale where speed is of the essence. The Japan-based blogger Joel Breckinridge Bassett writing regularly about mobile payments notes that existing QR payments such as Line Pay require nothing short of "three steps and a minute of one's time" to buy a carbonated drink, whereas the same can be achieved by just swiping your device over the sensor when using NFC.[107] The speed issue is further aggravated by the fact that Bitcoin transactions are by no means instantaneous and require several confirmations by the network before they are finalized. The same blogger points towards inherent disadvantages of using full payment systems such as credit card NFC or QR payments for transit due to decreased reliability in comparison to stored-value electronic payment cards.[108] Although Bassett makes no mention of Bitcoin, there is little argument that given its architecture, this aspect of usability would place it far behind both stored value and credit card payment systems.

In conclusion, it appears difficult to argue for Bitcoin as a payment system that can compete with already existing electronic payment systems, to say nothing of those that will be developed within the following decade. In other words, if Bitcoin was just a way of paying someone, it is unlikely that anybody living within the bounds of law would be talking about it at this point. This leaves only Bitcoin as an investment commodity, which may persist or vanish into obscurity by losing its short-lived interest. Neither possibility is unlikely and only time will tell whether Bitcoin can sustain the broader public's interest.

107. Joel Breckinridge Bassett, *Tweet of the Day*, Web Page, November 2018, accessed 17 January 2019, `https://atadistance.net/2018/11/24/tweet-of-the-day/`.
108. Joel Breckinridge Bassett, "Traveling Abroad With Apple Pay NFC Switching Credit Cards," 2018, `https://atadistance.net/2018/10/29/traveling-abroad-with-apple-pay-nfc-switching-credit-cards/`.

1.6 Conclusion

This chapter laid out the technical and economic aspects of Bitcoin necessary to understanding the cryptocurrency and its surrounding landscape from a holistic point of view. Throughout the chapter, Bitcoin has been treated as serving two purposes: that of a means of payment and that of an investment commodity. Although a case can be made that Bitcoin is, in fact, many other things, the most notable case being the erroneous assertion that it is money, most of its other uses can be grouped into one of the two categories. A notable exception is that Bitcoin can be used to transfer information other than bitcoins themselves, be that text or encoded data, which nonetheless can be generally assigned to the category of means of payment[109] as it presently does not appear to be the major purpose of the system.

To tally the conclusions, it does not appear that Bitcoin is a particularly good value proposition to an individual seeking to solve either task unless very specific circumstances come into effect. In most cases to do so, the individual is likely to be targeted by entities that can exclude the individual from the banking system or exert violence upon the individual for expropriation. The most obvious example of such individuals are criminals, regardless of whether the crimes are conducted for the purposes of self-enrichment, such as drug trafficking, or ideological reasons, such as terrorism and anti-government activities; those living under systems without the rule of law, such as refugees fleeing the country or individuals being oppressed by militia gangs; and individuals that are excluded from necessary banking services after being ostracized by parts of the business community, such as the whistleblower website Wikileaks[110] and online personalities whose rhetoric has been deemed unacceptable by the payment providers.[111] Although such cases exist, the bitcoin's degree of appreciation leading up to the peak in December 2017 appears to be disproportionate to the size of the aforementioned user base. More so, the creation of financial instruments such as bitcoin futures and options on bitcoin do not appear to make much sense were it in the context of such a niche technology.

To an average individual living in a comparably stable society—that is, they are not under a permanent threat of a raid, expropriation or hyperinflation—bitcoin appears to be more a hassle than a boon from most rational points of view: it is difficult to store

109. One can also use other means of payment to transfer data. Writing a telephone number or drawing a picture on a banknote is an obvious example. Bank wire comment fields also allow transferring data between two parties and the intermediary. Neither is intended for the said purposes, but neither was Bitcoin.

110. Reuters, *PayPal Suspends WikiLeaks Donations Account*, Web Page, December 2010, accessed 17 January 2019, `https://www.reuters.com/article/wikileaks-paypal-idUSN0415723720101204`.

111. Nellie Bowles, *Patreon Bars Anti-Feminist for Racist Speech, Inciting Revolt*, Web Page, December 2018, accessed 17 January 2019, `https://www.nytimes.com/2018/12/24/technology/patreon-hate-speech-bans.html`.

and easy to lose; it is costly to transfer when its popularity grows; it exposes the owner to considerable market risks as seen by the cryptocurrency's high volatility; it exposes the owner to considerable political risk, in that a governmental intervention of any of a large number of principal actors can greatly reduce the market valuation of the asset; and others. With regard to the political risk, given Bitcoin's propensity to consume large volumes of electricity and hardware resources, it is not outside of the realm of possibility that the network has only escaped the regulatory hammer and an official condemnation by an influential international body, such as the United Nations, due to the simple fact that it had largely remained unnoticed and poorly understood by the powers that be. This author contends that such a condemnation followed by international action is almost inevitable if Bitcoin should regain prominence in the world news.

A point related to the aforementioned drawbacks but deserving a separate mention is once again the fact that cryptocurrencies offer no cash flows. It is a non-productive asset the only benefit of which is its sheer existence and the ability to transfer it to another. For any bitcoin investor, this means that they can only gain as much as others can cumulatively lose. There is little doubt that the cryptocurrency's biggest attraction has been exactly this ability to quickly gain wealth from its rapid appreciation relative to national currencies. It remains unclear what fraction of Bitcoin investors understood the negative-sum game nature of their trade or how many of these individuals understand it post-factum while sitting on an unrealized loss. The fact that bitcoins could be bought and sold through mobile apps on exchanges often located in other parts of the world as opposed to registering with an established broker undoubtedly aided the marginally educated decision-making process.

Ultimately, bitcoin's biggest draw appeared to be its upward trend. It is in itself not irrational to buy something that is trending up—in fact, it constitutes the basis of an entire investment strategy known as momentum investing—but doing so with a sizable portion of one's capital is unwise at best. Nonetheless and in stark contrast to the wonderful tales of Bitcoin multimillionaires, sufficient individuals did take such a position. On December 11, 2017—a mere week before the crash—CNBC interviewed the director of Alabama Securities Commission who reported that "mortgages [are] being taken out to buy bitcoin. … People do credit cards, equity lines".[112] Although it is unclear how many of the said individuals realized their gains and now many may still be waiting for their bitcoins to appreciate again, in the end, it appears that they were just less lucky than those who had taken out mortgages a year earlier.

There are two aspects of Bitcoin that do leave some hope for a brighter future. On

112. Michelle Fox, *People Are Taking Out Mortgages to Buy Bitcoin, Says Securities Regulator*, Web Page, accessed 15 January 2019, `https://www.cnbc.com/2017/12/11/people-are-taking-out-mortgages-to-buy-bitcoin-says-joseph-borg.html`.

the one hand, it is entirely possible that the drawbacks of the current implementation can be ironed out. Bitcoin appears to be a prototype that escaped the confines of its testing facility and has been unleashed on the unsuspecting world. It is not impossible to work around its major deficiencies and some solutions, such as "proof-of-stake" that bases mining off one's capital rather than computational power, may solve the imminent problems such as carbon emissions. Other problems appear to be more difficult to solve, the most crippling one of which is the transaction limit. This is less of a problem for lower volume applications like the MIT diploma verification or even Bitcoin itself before it gained popularity.

Conversely, it is imperative to recognize that cryptocurrencies can fail entirely and leave a positive legacy. There is a growing interest in private blockchains among financial institutions and certain government circles. Although "private blockchains" do not appear to offer any tangible advantages over the tried-and-true distributed databases with digital signatures, they come with the intangible advantage of being "the next big thing". What this means is that the sheer press coverage of the technology may very likely lead to organization progress in the areas that had previously been held back not by the lack of technology but by inertia. Putting in hours and funding into a "distributed database" hardly has the same appeal to a non-technologist than experimenting with "blockchain technology" even if the two perform essentially the same roles or are the same. All the good of modern technology can be injected into old processes without any of the bad that public blockchains bring with it, leaving the society better off in aggregate.

There is sufficient evidence that this process has begun already. In October 2018, the Japanese firm KPMG Consulting published an assessment of industrial blockchain deployment under the title "On the nature of and efforts behind blockchains". Its author argues that although the blockchain technology has been firmly embraced by the FinTech industry since 2016, there has not yet appeared a clear use case where the technology has seen wide levels of adoption. Some of the proposed uses are equally solvable by a regular database and the technology itself appears to have come before there was a use for it. Nonetheless, the publication notes that the global spending on blockchain technology is expected to increase from $1.5 billion in 2018 to 11.7 billion by 2022 or, respectively, from $45 million to $496 million in Japan alone. Despite both blockchain and artificial intelligence being the two popular innovations du jour, the former does not appear to have the same profound effects as the latter. The report's author argues the time is now and not later to find how the blockchain technology can be used effectively.[113]

113. Japanese Yen converted into United States Dollars at the present 109.45 USD/JPY conversion rate. The original figures are 4.9 billion Yen for 2018 and 54.5 billion Yen for 2022. From Suzumu Miyahara, *Burokkuchēn no honshitsu to tOrikumi-Kata Ni Tsuite* [On the Nature and Approach To blockchains], Web Page, October 2018, accessed 19 January 2019, `https://home.kpmg/jp/ja/home/insights/2018`

At the moment, this latter aspect has not taken any tangible form yet. Whether one of the prototypes being developed in the labs of banks and consulting firms around the world will indeed yield a real use case significant enough to live up to the current momentum behind blockchains remains to be seen. It is entirely possible that it is this and not the cryptocurrency itself that will become the long-term legacy of Bitcoin.

/10/blockchain-essence-approach.html.

Chapter 2

Historical overview

2.1 Ideological background

2.1.1 Cypherpunks

On December 2, 2015, a married couple in California opened fire on the unsuspecting employees of the San Bernardino County Department of Public Health, killing fourteen and wounding twenty-one. The assailants fled the scene but were promptly identified, discovered and killed in a shootout with the law enforcement officers not far from the crime scene. Questions followed, the killers were found to have "gone down the dark path of radicalization" and discussions of gun control once again resurged in American public discourse.[1]

As the inquiry progressed, the Federal Bureau of Investigations (FBI) had reached an impasse. The data on the mobile phone recovered from the male shooter could not be accessed. Issued to him by the county of San Bernardino, the Apple iPhone 5C ran one of the later versions of the operating system with its data cryptographically-protected from those not knowing the four-digit PIN code. At the time of the release, Apple advertised this functionality for corporate clients stating that it would provide the "IT [departments] with peace of mind that corporate data is secured without additional configuration" with "data protection enabled automatically, so information stored in App Store apps is protected with the user's passcode until they first unlock their device after each reboot."[2] The problem had become that the FBI could not access the data either. The Bureau made a top-level inquiry with the National Security Agency (NSA), who had

1. Gardiner Harris and Michael D. Shear, *Obama Says of Terrorist Threat: 'We Will Overcome It'*, Web Page, 2015, accessed 1 June 2019, `https://www.nytimes.com/2015/12/07/us/politics/president-obama-terrorism-threat-speech-oval-office.html`.

2. Apple Inc., *iOS 7 and Business [Retrieved From Archive.org]*, Web Page, 2013, accessed 1 June 2019, `https://web.archive.org/web/20130730153806/http://www.apple.com/ios/ios7/business`.

a long history of electronic counterespionage and was heavily involved in the creation process of major ciphers. The FBI asked the NSA to break into the phone, but the Agency's deputy director stated that they could offer no assistance as their targets did not use iPhones and they thus had no solution for breaking into the one available to them.[3] Typically breaking a four-digit password would not have posed major difficulties as there are only 10,000 possible combinations[4] that could also be tried out one-by-one. The problem arose in the possibility that the assailant activated a limit on the number of attempts an incorrect password could be entered. If the investigators had entered the wrong code ten times, the security system would delete the AES encryption key and, short of breaking the cipher itself, the data would become inaccessible.

Given a lack of options, the FBI contacted Apple and asked them to break into the phone they had themselves manufactured. Unlike the Bureau and the Agency, Apple could bypass the system by being the manufacturer of the device's operating system and having the digital keys required to create official versions of new operating system versions. The company could thus create a new version of Apple's iOS specifically for this occasion that could be installed on the device and disable its security systems. In a later assessment by Apple, it was estimated that the creation of such an operating system nicknamed GovtOS would "necessitate six to ten Apple engineers and employees dedicating a very substantial portion of their time for a minimum of two weeks, and likely as many as four weeks". Apple, however, refused the FBI's request, which given the magnitude of the act of violence committed in San Bernardino immediately attracted media attention. Although the Bureau's request had been specifically for the iPhone in question after which Apple was allowed to destroy the bypass system, the company argued that creating such a product in the first place would create a piece of software that would be the "equivalent of a master key, capable of opening hundreds of millions of locks" and unwind "the device security that Apple has worked so tirelessly to achieve … without so much as a congressional vote".[5] A long public and legal battle followed. The issue had even been raised multiple times by the presidential candidates of the raging electoral campaigns and had crossed the party lines with both Democrats and Republicans taking the sides of Apple, the Bureau or both. In a bizarre turn of events, everybody was suddenly interested in the questions of encryption.

3. Zack Whittaker, *NSA Finally Admits Why It Couldn't Hack San Bernardino Shooter's iPhone*, Web Page, 2016, accessed 1 June 2019, `https://www.zdnet.com/article/nsa-comes-clean-on-why-it-couldnt-hack-san-bernardino-shooters-iphone/`.

4. There are ten characters and for positions meaning that the number of combinations is just 10^4.

5. United States District Court Central District Of California Eastern Division, *Apple Inc's Motion to Vacate Order Compelling Apple Inc. To Assist Agents in Search, and Opposition to Government's Motion to Compel Assistance*, Web Page, 2016, accessed 1 June 2019, `https://cdn2.vox-cdn.com/uploads/chorus_asset/file/6106157/apple-motion-to-vacate.0.pdf`.

Although the entire affair ended up producing wonderful publicity for Apple, which thereafter doubled its emphasis the security advantages of its products, the company's reasoning had indeed been more than a mere marketing stunt in that a leakage of the aforementioned software would have indeed compromised the security of all their customers. The struggle concluded finally with the FBI stating that they had found a different way to access the device and could not disclose any specifics. Later reports suggest that an Israeli firm and a routine services provider for the United States government had managed to find a way into the system.[6]

Whilst this debate had become particularly heated in the early months of 2016, the key problem of public security versus privacy had by no means been a new one. The conflict is simple: any increase in privacy from the society makes it easier for the individuals who seek to harm the society to put their plans into action, whereas any decrease in privacy exposes more and more of the personal life of each individual member of the society whether they want it or not. It is fundamentally a question of what form the society should take with the extreme ends of the scale being a totalitarian police state and lawless anarchy. Although this question is as old as the civilization itself and this research is not a study of philosophy, the French existentialists Jean-Paul Sartre offers one of the better explanations in his work *Being and Nothingness: An Essay on Phenomenological Ontology*.[7]

Sartre describes the being as existing in a duality of states: the being-for-itself and being-for-others. The being-for-itself does not spend time considering itself as it observes the world around it. The world around it exists for the being as an object and the being itself is always the subject. It is only after the being encounters another being that it becomes a being-for-others and begins to reflect about itself, thus moving from the pre-reflective to the reflective state. This act of being observed turns the being from a pure subject into an object as it observes itself. It is this existence of the other that gives birth to feelings such as shame, which Sartre describes as "Hell is other people".[8]

To put it into more concrete terms, one can imagine being alone on an empty street of an abandoned city. One can observe the world around them, look at the buildings, the gardens and into the windows of the now vacant houses. One does not have to concern themselves with what one looks like as there is no one to look at one. One can perceive the world from whatever vantage point one likes. For all intents and purposes, one could

6. Thomas Brewster, *The Feds Can Now (Probably) Unlock Every iPhone Model in Existence – UPDATED*, Web Page, 2018, accessed 1 June 2019, `https://www.forbes.com/sites/thomasbrewster/2018/02/26/government-can-access-any-apple-iphone-cellebrite/#36b0697f667a`.

7. Jean-Paul Sartre, *Being and Nothingness : An Essay on Phenomenological Ontology* (New York: Philosophical Library, 1943).

8. Paul Meakin, Web Page, 2015, accessed 1 June 2019, `https://philosophypathways.com/essays/meakin3.html`.

be examining the said street from atop a trash can whilst looking entirely unbecoming, unkempt and with the remains of one's breakfast still sticking the one's face. In Daniel Defoe's *Robinson Crusoe*, the castaway famously remarked about how there was no one to look at him and, were it not for the scorching sun and the protagonist's good upbringing, he could just as well go about his duties naked. This state of affairs ends once someone else shows up on the street, the observer straightens up and attempts to quickly hide their imperfections. They are no longer alone and cannot observe the world with the same degree of liberty they had before.

The same process translates to one's digital life. Imagine one bore no ill will, but was interested in what involved building an improvised explosive device, producing a nerve agent or anything else of similar mass lethality. Although the consequences for looking for this knowledge alone are almost certain to be nil, would one enter "how to make a bomb" into the search engine with the same ease as one would enter "how to make cupcakes"? When communicating with a close friend over email or instant messaging would one really be as open about any and all matters to the same degree as one would in a spoken conversation in the privacy of one's own home? When expressing one's own opinion on a matter publicly in an Internet forum, would one express it with the same directness regardless of whether one is anonymous, pseudonymous or listed by name and with one's full address?

The answers to the questions above are not those to a hypothetical thought experiment but the result of a series of very specific historical developments of digital life that took place over the past decades. Presently, the search sector is dominated by the search engine Google that stores all search queries of its users for the purposes of advertising and improving its search capabilities. The interpersonal communications take place over email accounts operated from the servers of enterprises such as Google or proprietary instant messengers and are also typically monitored for advertising and product optimization purposes. Public-facing communications are dominated by Facebook, Twitter, and Google with many participants using their real names or pseudonyms linked to their email addresses, which themselves contain sufficient information to establish the user's identity. Facebook's platform, in particular, has grown to serve 2.4 billion monthly users or approximately a third of the world's population, each of which is required to identify themselves with their real name.[9] The data belonging to these users, from casual conversations about what to bring to the next barbecue party to discussions revealing the users'

9. The requirement can be circumvented by using a false name or one's initials, but this is not the way the system is intended to operate and it is unclear how many users attempt to conceal their names. Statista, *Number of Monthly Active Facebook Users Worldwide as of 1st Quarter 2019 (In Millions)*, Web Page, 2019, accessed 1 June 2019, `https://www.statista.com/statistics/264810/number-of-monthly-active-facebook-users-worldwide/`

medical history, is accessible by Facebook and processed in ways unknown to most.

Whilst 2.4 billion people using a platform suggests that a considerable portion of the human population does not have radical objections towards this kind of data processing by software programs known only to certain members of Facebook itself, this future had not been obvious when personal computing was just being defined from the 1970s onward. Some have argued that computer code should be *free*, as in the concept of freedom rather than being gratis. Perhaps the most notable advocate of this freedom of software has been Richard Matthew Stallman, or RMS as he is often referred to, who advocates this concept to this date. In its most basic form, Stallman and advocates like him argue that the people should not be prevented from using, modifying and sharing software in any way they see fit. Creating non-free, proprietary software is argued to be immoral because it prevents people from cooperating with each other. The movement and Stallman specifically have developed the concept of a *copyleft*, which is different from the lack of copyright in that it restricts the freedom of the programmers to make the underlying source code proprietary. This concept is put into practice in the GNU General Public License (GPL), which a software developer can apply to their software instead of copyrighting it. The license states in the most general terms that anyone can use the software as they see fit, modify and redistribute it, but only under the condition that the resulting software is also licensed under the GPL.[10] This means that just like with the copyright, a copyleft software passes on the "original sin" contained in the code it uses and cannot be unmade copyleft. This is in stark contrast to public domain licensing, which allows anyone to take the software, add the desired functionality to it and proceed to sell the newly created product under copyright to the interested parties. The very foundation of the license and the ideology behind the free software movement is in its self-perpetuating and to some degree voluntarily infectious form, wherein the use of any GPL software within a larger program also inadvertently turns the entirety of the host into a software licensed under the GPL. This viral nature has not restricted, or perhaps even aided, the GPL from being used in major software packages such as the content management system WordPress, the relational database management system MySQL and most importantly the Linux kernel that powers all Android smartphones, the majority of web servers and practically all supercomputers.[11] Notably, Bitcoin itself is not licensed under the GPL but rather the MIT license, which is a non-copyleft free license that allows anyone to do anything with the code as long as they attribute the original code to its developer.

10. Free Software Foundation, *GNU General Public License*, Web Page, 2007, accessed 2 June 2019, `https://www.gnu.org/licenses/gpl-3.0.en.html`.

11. W3Techs, *Comparison of the Usage of Linux vs. Windows for Websites*, Web Page, 2019, accessed 2 June 2019, `https://w3techs.com/technologies/comparison/os-linux,os-windows`.

In many ways the movement's fight for the freedom of software is reflective of an ideological battle occurring as the shape of modern computing was still uncertain. Stallman's formative years as a student and later a researcher had been at the academic institutions during the 1970s, first at Harvard then at the Massachusetts Institute of Technology (MIT), which allowed him the freedom to not only develop but also exercise his beliefs in a way that may have been difficult in the private sector and without major constraints on practicality or the lack thereof. There are many ways of framing any ideological movements, but the amalgamation of Stallman's beliefs can be described as those of a nonconformist. The series of events exemplifying this best, and often boasted about by Stallman himself, had occurred during his time at the MIT AI lab when the management of the laboratory introduced user passwords and a hierarchy of system administrators that could change the privileges of individual users. Disagreeing with the very premise, Stallman used a password of one of the administrators he knew and gave every user the ability to disable the security measures. After the system had been reinstated and the said administrator changed his password, who was later described as having "now changed his sympathies", Stallman proceeded to turn off the passwords through other means stating that "the aristocratic forces have been defeated" and signing his message with a pseudonym.[12] Although the copyleft is arguably the purest manifestation of Stallman's worldview and the environment in which he was exposed to computing, it must be stressed that it is but one of the manifestations of a much wider ideology expressed in a computer-centric manner.

As years passed, this anti-authoritarian attitude within computing circles had gained a different shade. A new group appeared calling themselves the cypherpunks. The chief concern of the community that formed with the spread of the Internet in the late–1980s and early 1990s had become not the removal of passwords and computer security, but enhancing them to allow for individual privacy.

The term itself appears to be a combination of the words cipher and cyberpunk, a genre of literature that cypherpunks have been eager to refer to in their discussions of how the future of networking should be constructed. The genre is often described as having its roots in Philip K. Dick's *Do Androids Dream of Electric Sheep?*, but has gained major prominence with the Ridley Scott's 1982 *Blade Runner* starring Harrison Ford and William Gibson's *Sprawl* trilogy that began with *Neuromancer* in 1984. The works in the genre are typically set in a dystopian near future, wherein transnational corporations form a ruling elite and exploit the general populace with an emphasis on the difference between the "haves" living in futuristic splendor and the "have-nots" trying to make ends

12. Richard Martin Stallman, *RMS Lecture at KTH (Sweden)*, Web Page, October 1986, accessed 3 June 2019, `https://www.gnu.org/philosophy/stallman-kth.en.html`.

meet and routinely engaging in various kinds of crime. Typically set in heavily-populated metropolises, the works often deal with subjects such as human cybernetic augmentation, artificial intelligence, and class struggle. As in Gibson's *Neuromancer*, the protagonist or a close member of their entourage are often hackers or elite mercenaries, who can bypass the security systems of the ruling elite either to further their own goals or on behalf of a rivaling elite. Notably, the genre has long made and continues to contain ample references to Japan and traditional Japanese culture, not in the least due to the fact that its origins were during the period when many Western observers believed Japan to be the next technological superpower. The novels and films would often feature characters of Japanese descent, the nation's infamous organized crime groups, major conglomerates with Japanese-styled names and paramilitary units routinely referred to as ninjas or the samurai, not uncommonly as cyborgs or laboratory-bred super-humans armed with some kind of futuristic bladed weapon akin to the traditional Japanese arms.

Whilst the above may appear like a leisurely tangent into this author's favorite genre, it is exactly these fictitious worlds that the cypherpunks looked into for inspiration and to derive influence from. Not unlike the works' protagonists, the cypherpunks in aggregate do not shy away from questioning authority and emphasize the importance of their liberty as free agents. This is first and foremost exhibited in the notion that the need for privacy trumps the need for public security and that the fight for the former should be continued in opposition to those aiming to subvert it. In more general political terms, the cypherpunks appear to generally align themselves with the ideas of contemporary American libertarianism, which typically advocates for a drastic reduction of taxation, elimination of many government agencies and the reduction of the government itself, dissolution of central banks and the cessation of all Keynesian policies, replacement of welfare and social security systems with voluntary charities as well as the removal of trade barriers and regulation on permissible market activities. Neither cypherpunks nor libertarians are a single cohesive group with a strictly unified agenda, but the above ideas are strongly represented in both and cypherpunks can to a large degree be argued to just be a subset of libertarians interested in technology and cryptography.

The two can arguably be distinguished as to what their principal focus and their principal antagonist. Both groups emphasize the importance of liberty from the government, however, it is the institutions that they take umbrage with that differ. In the case of libertarians, especially after the Global Financial Crisis, central banks, rent-seeking investment banks, government agencies and the government that is said to have enabled all of the above are the enemy. It is primarily a movement centered around the questions of political economy and the role of the markets. Cypherpunks, by contrast, oppose governments, corporations and "large, faceless organizations" seeking to impeach on the

cypherpunks' privacy.[13] Although the movement does not appear to discriminate between spaces in which privacy ought to be defended, the centerpiece of its discussions had been the privacy on the yet nascent Internet and how cryptography may be used to enhance it. Even in the article *Libertaria in Cyberspace: Cyberspace more hospitable to ideas of liberty and crypto anarchy* by one of the principal cypherpunks Timothy C. May, wherein the author discusses the possibilities of creating a truly libertarian social order, the argument immediately shifts from islands and oil rigs in the middle of the ocean to creating online communities that participants could exist in pseudonymously and switch between should they dislike the community's direction.[14] The text itself includes multiple references to cyberpunk novels by William Gibson, Neal Stephenson and Bruce Sterling. This choice of references is perhaps unsurprising, as the trio of the movement's most distinguished contributors, including May, Eric Hughes, and John Gilmore, have all emerged from engineering and programming backgrounds rather than from libertarian think tanks more prone to cite economists such as Murray Rothbard, Friedrich August von Hayek and Milton Friedman. Whilst more orthodox libertarians typically propose reduction or removal of taxation and withdrawal of the government from the economic life through social and legislative reforms, cypherpunks subtly propose anonymizing communication and interactions on the Internet, which will "alter completely the nature of government regulation, the ability to tax and control economic interactions".[15]

A key factor of such interactions is providing only as much information to the counterparty as is absolutely necessary and removing all middlemen. Eric Hughes explains in his *A Cypherpunk's Manifesto*:

> Since we desire privacy, we must ensure that each party to a transaction has knowledge only of that which is directly necessary for that transaction. Since any information can be spoken of, we must ensure that we reveal as little as possible. In most cases, personal identity is not salient. When I purchase a magazine at a store and hand cash to the clerk, there is no need to know who I am. When I ask my electronic mail provider to send and receive messages, my provider need not know to whom I am speaking or what I am saying or what others are saying to me; my provider only need know how to get the message there and how much I owe them in fees. When my identity is

13. Eric Hughes, "A Cypherpunk's Manifesto," *Activism.net*, 1993, `https://www.activism.net/cypherpunk/manifesto.html`.

14. Timothy C. May, *Libertaria in Cyberspace: Cyberspace More Hospitable to Ideas of Liberty and Crypto Anarchy*, Web Page, 1992, accessed 3 June 2019, `https://www.activism.net/cypherpunk/libertaria.html`.

15. Timothy C. May, *The Crypto Anarchist Manifesto*, Web Page, 1992, accessed 3 June 2019, `https://www.activism.net/cypherpunk/crypto-anarchy.html`.

> revealed by the underlying mechanism of the transaction, I have no privacy. I cannot here selectively reveal myself; I must always reveal myself.[16]

The combined efforts of cypherpunks as both software developers and activists led to some of the above transactions being possible to turn private shortly after the publication of the manifesto itself. Public key encryption for email allowed two parties to effectively communicate over the Internet without revealing the contents of the email to the email providers. Similar principles were later adapted to enable private instant messaging. Although both have found extensive use in the corporate world—with a major caveat that the information security department of a firm typically holds the keys to decrypt the communications in case of an internal investigation—it does not appear that the overwhelming majority of private users shared the cypherpunks' conviction in the necessity of privacy and continue to use unencrypted email communication to this day. In a 2018 article, the magazine Wired proudly announced that the "PGP [encryption system for email] is dead". Its total number of active users was around a total of only 50 thousand, not in the least because "it's a real pain [to use]".[17] The article proceeds to suggest that users should instead opt for an open-source encrypted messaging application called Signal, a more user-friendly alternative that nonetheless does not appear anywhere in the list of top messengers by user base. The Russian application Telegram as its closest alternative in terms of privacy ranks last at the eighth place.[18]

While private email already became possible by the mid–1990s, private online money took longer to implement successfully and had only been implemented successfully with the release of Bitcoin more than fifteen years after PGP. The key proposal was to create an alternative to cash, which while not entirely anonymous or pseudonymous due to the necessity of paying in person was still seen as least likely to be used for surveillance purposes. Notably, this is not a strictly cypherpunk phenomenon with three-quarters of Americans agreeing that they would rather "keep some of [their] purchases completely private by using cash" when asked explicitly.[19] The cypherpunks would write the code to enable this.

Precisely this kind of private payment method was offered by the cryptographer David Chaum and his startup DigiCash.[20] Chaum had been working on this concept since the

16. Hughes, "A Cypherpunk's Manifesto."

17. Amit Katwala, *We're Calling It: PGP Is Dead*, Web Page, 2018, accessed 3 June 2019, `https://www.wired.co.uk/article/efail-pgp-vulnerability-outlook-thunderbird-smime`.

18. Statista, *Most Popular Global Mobile Messenger Apps as of April 2019, Based on Number of Monthly Active Users (In Millions)*, Web Page, 2019, accessed 3 June 2019, `https://www.statista.com/statistics/258749/most-popular-global-mobile-messenger-apps/`.

19. Ibid.

20. Aaron van Wirdum's article for the Bitcoin Magazine offers a detailed chronology of the eCash, which the later descriptions are based on. Aaron van Wirdum, *The Genesis Files: How David Chaum's*

late 1970s at the University of California at Berkeley and was not a cypherpunk at that point as the very concept had not yet come to exist. Neither had its literary cyberpunk foundation, thus making it perhaps more elegant to describe him as the cypherpunks' spiritual father. In an interview with Wired in 1994, Chaum emphasized the importance of privacy and anonymity that lay at the heart of his project. Calling it eCash, the payment system was supposed to replicate the core characteristics of the world itself: it was meant to be electronic and it was meant to be usable as anonymously as cash.[21] The concept proposed and commercialized in the 1990s had shared a vast number of similarities to what would eventually become Bitcoin. eCash too used public-key cryptography to verify that the individual executing the transaction has the right to do so by verifying it with cryptographic signatures in the same way emails or PDF documents can be verified by attaching a digital signature to them. The transaction could be executed by anyone having the appropriate private key and, in contrast to bank transfers or credit card payments that should only be executed by the account holder, could thus be made entirely anonymously. The user would simply credit a payment card with a certain sum and use the amount as they saw fit.

Different from Bitcoin was that the money charged to the card would not be stored on a distributed ledger but at one of the participating banks. The system offered none of the independence from the base currency and what many Bitcoin proponents see as market manipulation by the central banks. No new electronic commodity had been created at any point in time with the account balance maintained in a national currency no different from a regular bank account. This dependence on banking institutions thus created considerable differences in practical applications of eCash vis-a-vis Bitcoin. It offered anonymity, but not censorship-resistance because a bank could still blacklist a recipient. It offered price stability, but there were no coins to speculate on or use as a hedge against inflation. It also offered little in terms of international transfers between continents that cryptocurrency proponents are quick to point out as one of the technology's strengths.

In many ways, it is not surprising that eCash did not offer any of those features. The Internet had still been young and only a few were connected; even those that did not have the bandwidth to maintain a distributed ledger or much less could afford it both in terms of connection costs and hard-drive space. The peer-to-peer technology that Bitcoin uses to distribute its ledger had also not yet reached mass adoption with Napster as its earliest major example launching only in 1999. It had simply been too soon for a public blockchain.

eCash Spawned a Cypherpunk Dream, Web Page, 2018, accessed 4 June 2019, `https://bitcoinmagazine.com/articles/genesis-files-how-david-chaums-ecash-spawned-cypherpunk-dream/`

21. Steven Levy, *E-Money (That's What I Want)*, Web Page, 1994, accessed 4 June 2019, `https://www.wired.com/1994/12/emoney/`.

DigiCash had nonetheless attracted considerable attention. Pilot projects were launched with major financials including the Deutsche Bank and Credit Suisse. Even Microsoft had allegedly been in negotiations with DigiCash to integrate eCash into its brand new Windows 95 operating system to facilitate one-click online transactions and had offered $100 million for licensing the technology. The negotiations are said to have failed after Chaum insisted on receiving two dollars for each version of Windows sold, which was not a condition Microsoft was willing to entertain at that point.

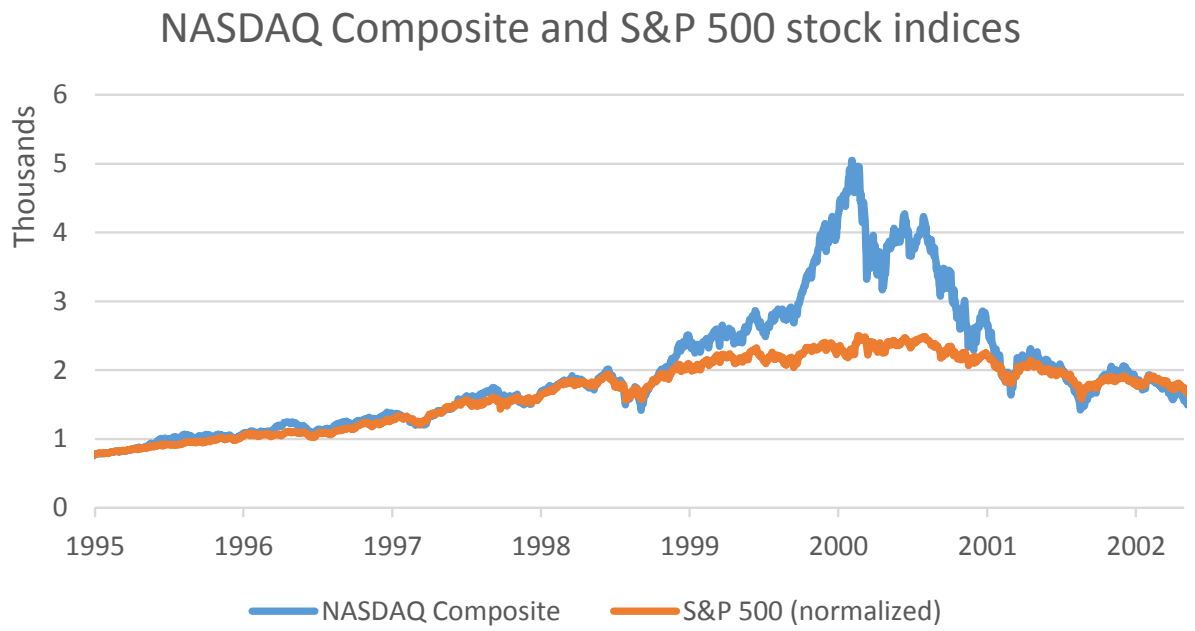

Figure 2.1 The information technology-focused NASDAQ Composite stock index and the general market S&P 500 stock index. The S&P 500 is normalized against the NASDAQ for January 1, 1995, to better demonstrate the effects of the Dot-Com Bubble's irrational exuberance as visible in the spread between the S&P 500 and NASDAQ. Data: Yahoo Finance.

The firm had ultimately closed its doors in 1999. As stated in a Forbes article of the time, "No one wanted it—not banks, not merchants and, most important, not consumers."[22] The digital cash company faced the same problems that cryptocurrencies face today: few consumers used the payment method, which led to few merchants accepting it, which again led to fewer consumers using it and the cycle continued. eCash was also by no means the only startup competing in the market of electronic payments. Aside from the behemoths VISA and MasterCard that already had a considerable market share, many other firms were attempting to offer similar services with CyberCash and First Virtual Holdings being the other few mentioned by Forbes. A more successful one of them was a company at the time called Confinity and later rebranded as PayPal. It was founded a

22. Julie Pitta, *Requiem for a Bright Idea*, Web Page, 1999, accessed 4 June 2019, `https://www.forbes.com/forbes/1999/1101/6411390a.html#6af20728715f`.

mere year earlier and was aimed to replace the "antique technology" of paper money.[23] When DigiCash filed for bankruptcy there had thus been no shortage of competitors even were one to ignore the issue of the lacking consumer interest. The Dot-Com Bubble was still expanding with the public capital markets and venture capital funds pouring vast quantities of money into just about anything related to the Internet, believing that these would usher in the New Economy wherein, as always, that time everything would be different. Some companies were naturally better funded than others. One of the major reasons why PayPal grew as fast as it did was precisely because of their access to sufficient venture capital funding. This allowed the firm to incentivize the consumers by offering $20 for anyone signing up for the service, later reducing it to $10 and finally $5. In a later interview, the co-founder Elon Musk reminisced that the company had spent $60–70 million dollars in a single month on the referral bonuses alone. The consequence had nonetheless been that PayPal managed to reach its first 100 thousand customers milestone a single month after launching its website.[24]

Perhaps the same incentive structure can also be attributed to the popularity of Bitcoin, which by now has far exceeded eCash. Although there have been no venture capital firms back it up, the funding effectively came from those seeking to participate in the cryptocurrency market later down the line and offering to purchase bitcoin at a greater price from the present bitcoin holders. If this proposition were to be entertained, it follows that Bitcoin's greatest strength had perhaps been not its censorship-resistance, its aspatial nature or any of the beliefs held dear by its activists, but the simple fact that, as with PayPal, new users simply saw it as a way to make money on the side.

2.1.2 Nakamoto emerges

The first known reference made to Bitcoin appears on August 18, 2008, when someone registered the domain name *bitcoin.com*.[25] The domain likely did not link anywhere at this point. The public was first directed to it at 14:10 Eastern Daylight Time on October 31 of the same year, when an author identifying himself as Satoshi Nakamoto submitted the *Bitcoin: A Peer-to-Peer Electronic Cash System* paper to a cryptography mailing list *cryptography@metzdowd.com*.[26] The email listed the basic properties of Bitcoin, an abstract of the paper and a link to the aforementioned website where it remains hosted to

23. K. Mookherji, *Digital Revolutionaries: Who Have Change the World* (Ocean Books (P) Limited, 2017), ISBN: 9788184305234.

24. KhanAcademy [mirrored], *Interview With Elon Musk*, Web Page, 2019, accessed 4 June 2019, `https://www.youtube.com/watch?v=fOPHUw4-XbQ`.

25. Who.is, *bitcoin.org - Whois Information*, Web Page, 2019, accessed 5 June 2019, `https://who.is/whois/bitcoin.org`.

26. Satoshi Nakamoto, *Bitcoin P2P E-Cash Paper [Email]*, Web Page, 2008, accessed 5 June 2019, `http://www.metzdowd.com/pipermail/cryptography/2008-October/014810.html`.

this day. The earliest incarnation of the website itself has been recorded by the Internet Archive's Wayback Machine on January 31, 2009, and contained the instructions on how to run the version 0.1.3 of the Bitcoin alpha-test software available only for Microsoft Windows at the time.[27] The author provided an email address he could be reached at, *satoshin@gmx.com*, as well as his public PGP key that could be used to contact Nakamoto privately or cryptographically verify whether any future communication attempts indeed came from Nakamoto.

Nakamoto famously never provided any personal information about his[28] identity. Admittedly, the general public knows as much about his real identity today as it did when he published his paper, which in all truthfulness amounts to knowing hardly anything at all. Satoshi Nakamoto could be a man or a woman of any nationality under the sun, one person or any number of people, or for that matter, Nakamoto could even be a creation of a highly advanced artificial intelligence or an alien race toying with humanity from the dark side of the moon. The creator's identity remains unknown and given that he ceased all communications in late 2010 it appears unlikely that it will ever be revealed. As far as public knowledge is concerned, he may even very well no longer be among the living.

This nonetheless has not hindered the blooming of a vast number of conspiracies about Nakamoto's identity and an equally large number of attempts to identify him. Multiple individuals of varying degrees of credibility have claimed to know who the author is never providing any sufficient evidence and often pointing at entirely different individuals. Among these Nakamoto suspects are first and foremost a number of cryptographers, including Hal Finney notable for having exchanged emails with Nakamoto and the previously mentioned cypherpunk Timothy C. May.[29] Both have passed away since the network came online. Another individual carried towards media attention by the *Newsweek* magazine had been a certain Dorian Nakamoto, described only as "an elderly Japanese-American whose hobbies include model trains and who has struggled to find work for the past decade, save for brief stints as a laborer, poll-taker, and substitute teach." Like many others Dorian denied that he had any involvement in Bitcoin and had not taken well to Newsweek's intrusion into his private life, stating that the whole ordeal had "been the source of a great deal of confusion and stress for myself, my 93-year old mother, my siblings, and their families."[30] More speculation followed with the

27. Internet Archive, *Bitcoin.org*, Web Page, 2009, accessed 5 June 2019, `https://web.archive.org/web/20090131115053/http://bitcoin.org/`.

28. From hereon referred to as male as per convention.

29. Jamie Redman, *A Look at Stylometry: Can We Uncover Satoshi Through Literary Quirks?*, Web Page, 2018, accessed 6 June 2019, `https://news.bitcoin.com/a-look-at-stylometry-can-we-uncover-satoshi-through-literary-quirks/`.

30. Kai Sedgwick, *How Dorian Nakamoto Became Satoshi Nakamoto*, Web Page, 2017, accessed 6 June 2019, `https://news.bitcoin.com/dorian-nakamoto-became-satoshi-nakamoto/`.

popular theory being that Nakamoto was actually an intelligence agency of a sovereign state—the fact that Nakamoto Satoshi can be translated as *Central Intelligence* undoubtedly aided the propagation theory—then followed by the unverifiable statements that an American intelligence agency had identified Nakamoto and claims that any number of popular Silicon Valley executives could be the creator of Bitcoin, including Elon Musk, who would have somehow found the time to write the software while actively managing a one company making cars and another building rockets.

Several techniques have been used to determine Nakamoto's identity. The most credible ones of these are linguistic, time and date, and program code analyses.

Whilst Nakamoto did not directly reveal details about himself, his texts can be quantified and analyzed through the application of linguistic and statistical methods. Perhaps the most rudimentary analysis of this had been conducted by those reading his communications as they were being posted and noticing his use of the expression "bloody hard" that would suggest a British upbringing. This belief would be further reinforced by Nakamoto's message forever recorded in the genesis block of Bitcoin citing the British daily: "*The Times* 03/Jan/2009 Chancellor on brink of second bailout for banks".[31] Conversely, Nakamoto's paper and his email correspondence with Hal Finney makes use of the American spelling of verbs such as "realize", "optimize" and "customize", which would be unusual for a British man.[32] The perfect command of English strongly suggested that even if Nakamoto was Japanese, he was either living abroad or had done so for a considerable length of time previously. More in-depth analysis followed attempting to determine which of the previously suspected cryptographers Nakamoto's writings were the most familiar to, albeit the usefulness of such analysis remains questionable given that there is no indication whatsoever that Nakamoto is among the list of the individuals his texts were being compared to.

Perhaps the strongest hints on Nakamoto's whereabouts could be gleaned from the timestamps of his texts. These are typically attached automatically to various files, forum posts, and emails and indicate when the said text had been saved or sent across the network. Collecting such time stamps and comparing them to the contents of his writings can give one an idea of which timezone the author resided in. Although there are some debates over where exactly Nakamoto had been writing from, evidence suggests that it was more likely to be the United States than the United Kingdom or Japan. Collecting all of Nakamoto's forum posts and upload dates of the Bitcoin source code

31. Italics by this author.

32. Hal Finney and Satoshi Nakamoto, *Emails Between Satoshi Nakamoto and Hal Finney*, Web Page, 2009, accessed 6 June 2019, `http://online.wsj.com/public/resources/documents/finneynakamotoemails.pdf`. Satoshi Nakamoto, "Bitcoin: A Peer-To-Peer Electronic Cash System," *Self-published*, 2008, `https://bitcoin.org/bitcoin.pdf`

can be used to create a frequency chart with the American timezones falling the closest to regular sleep times of someone often working into the late hours of the night.[33]

There have also been some inquiries into the programming style of Nakamoto. To touch only briefly on this as this author is not a C++ programmer, comments by the code contributor Jeff Garzik suggest that Nakamoto's coding style had been rather unorthodox and had "rarely followed standard engineering practices" strongly hinting at that the author may not have been any one of the aforementioned popular cryptographers. While praising Nakomoto as a "fantastic designer and architect", Garzik nonetheless added that it was "a jumble of source code" and that "several things had to be disabled almost immediately upon public release of Bitcoin because they were obviously exploitable."[34]

Ultimately, none of the above points towards a single person or even a nationality. At most, it appears that Nakamoto resided somewhere in the United States and was probably not a specialist in writing network code. It also remains unclear why Nakamoto chose to remain pseudonymous or indeed decided to select the pseudonym that he did. It is entirely possible that it was the influence of cyberpunk literature that had been at its source given the early blockchain community's strong ties to the cypherpunks of the 1990s. Unfortunately, it does not seem likely that anyone but Nakamoto and whoever he may confide in will ever know. As argued by The Economist, perhaps it has been in Bitcoin's interest for its author to remain unknown and vanish, creating a "powerful creation myth" and "generating ongoing publicity".[35] A legend is better than a man.

2.1.3 The Global Financial Crisis

Whilst the public does not know who Nakamoto is, it cannot be said that it knows nothing at all about the mysterious creator. Given the imperfections of Nakamoto's code, it appears unlikely that it was a coordinated effort by some nebulous group with significant resources. As has been discussed in Technical, Bitcoin is rather simple in how it effectively combines several already existing, well-developed tools. This is not to take away from Nakamoto's achievement, but his invention is trivial to replicate for anyone with basic programming experience once they know how it works. It is not something that would require a large group of skilled developers and, following Occam's razor, the code appears unlike to have been released as it had been if such a group was behind its

33. In Search Of Satoshi, *The Time Zones of Satoshi Nakamoto*, Web Page, 2018, accessed 6 June 2019, https://medium.com/%5C@insearchofsatoshi/the-time-zones-of-satoshi-nakamoto-aa40f035178f.

34. Danny Bradbury, *Bitcoin Developer Jeff Garzik on Satoshi Nakamoto and the Future of Bitcoin*, Web Page, 2013, accessed 6 June 2019, https://www.coindesk.com/bitcoin-developer-jeff-garzik-on-satoshi-nakamoto-and-the-future-of-bitcoin.

35. L. S., *Who Is Satoshi Nakamoto?*, Web Page, 2015, accessed 5 June 2019, https://www.economist.com/the-economist-explains/2015/11/02/who-is-satoshi-nakamoto.

creation.

If one were then to assume that Nakamoto had indeed been a single developer working not entirely within his area of expertise, the following step would be to look at what prompted the creation of Bitcoin in the first place.

It is often difficult to separate the idea from the man, but the timing of the release of Nakamoto's paper appears to be unlikely to have been coincidental. By August 18, 2008, when Nakamoto registered bitcoin.org, the financial crisis had already been in full swing. Fund redemptions were being closed throughout most of 2007 and already by August the Federal Reserve Board had begun to cut the federal funds rate.[36] When Nakamoto registered the domain in August of the next year, the rate had already dropped from 5.26% to 2% and Bear Sterns, an investment bank that survived the Great Depression, had been bought out by J.P. Morgan Chase. By the last day of October when Nakamoto sent his paper to the mailing list, Merrill Lynch had agreed to be bought out by the Bank of America and a mere day later the Lehman Brothers filed for bankruptcy after being unable to broker an acquisition deal. During this 74-day period of registering the domain and publishing the paper alone, the S&P 500 had dropped 20% and major financials were in considerable distress. Whenever Nakamoto came up with the idea for Bitcoin, he had plenty of time to publish his paper and develop a prototype as the financial crisis unfold.

While the rolling wave of what appeared to many as the impeding financial apocalypse undoubtedly played a role in Nakamoto's timing, a survey of his writing shows that he shared many of the anti-governmental convictions discussed in the preceding section. The most obvious example of this is in Nakamoto's post describing Bitcoin on the P2P Foundation forums in February 2019:

> … The root problem with conventional currency is all the trust that's required to make it work. The central bank must be trusted not to debase the currency, but the history of fiat currencies is full of breaches of that trust. Banks must be trusted to hold our money and transfer it electronically, but they lend it out in waves of credit bubbles with barely a fraction in reserve. We have to trust them with our privacy, trust them not to let identity thieves drain our accounts. Their massive overhead costs make micropayments impossible. …[37]

Shortly after publishing his paper on the cryptography mailing list, Nakamoto described his views on the importance of decentralization:

36. The Federal Reverse Bank of St. Loius, *Effective Federal Funds Rate (FEDFUNDS)*, Web Page, 2019, accessed 7 June 2019, `https://fred.stlouisfed.org/series/FEDFUNDS`.

37. Satoshi Nakamoto, *Bitcoin Open Source Implementation of P2P Currency*, Web Page, 2009, accessed 8 June 2019, `http://p2pfoundation.ning.com/forum/topics/bitcoin-open-source`.

> … Governments are good at cutting off the heads of a centrally controlled networks like Napster, but pure P2P networks like Gnutella and Tor seem to be holding their own. …[38]

There is little doubt that Nakamoto had at one point been a cypherpunk or strongly identified with their struggle. The first clue to that can already be gleaned from the title of his paper, wherein Nakamoto refers to Bitcoin as "electronic cash" rather than by any other name. Later in his writings on the P2P forums, Nakamoto also discusses how cryptography removed the necessity for trusted third-parties—a key cypherpunk concept—and how it is "time we had the same thing for money". Later again, Nakamoto states that the reason he believed other electronic cash systems to have failed was what he perceived as "the centrally controlled nature of those systems".[39] This level of engagement suggested particularly by the knowledge of various attempts at implementing electronic cash is far from average even for individuals generally interested in online privacy and cryptographically secure methods of communication, which largely excludes the possibility that Nakamoto just came up with an interesting technical concept in his spare time and had little interest in the political or ideological nature of the movement. While it can certainly be argued that electronic cash previously offered by for-profit businesses was indeed vulnerable because there was a business that could file for bankruptcy, it does not appear that this is the point Nakamoto is trying to make. Rather, the distributed nature of the Bitcoin network should work against coordinated forces that willingly seek to destroy it, as opposed to the consumers merely having little interest in clumsy payment systems with poor adoption by merchants.

Unsurprisingly, only fifteen days after publishing his paper, Nakamoto very quickly identified the target demographic for his project, writing that the system is "very attractive to the libertarian viewpoint if we can explain it properly"[40]. While Bitcoin-aficionados maintain multiple lists of their favorite truths laid out by the cryptocurrency's legendary founder, this is perhaps the one where Nakamoto had been the most spot-on. In an online survey conducted in early 2013, 44.3% percent identified as libertarians or anarcho-capitalists.[41] This should come as no surprise, as a very specific form of lib-

38. Satoshi Nakamoto, *Bitcoin P2P E-Cash Paper*, Web Page, 2008, accessed 8 June 2019, `https://www.metzdowd.com/pipermail/cryptography/2008-November/014823.html`.

39. Nakamoto, *Bitcoin Open Source Implementation of P2P Currency*.

40. Satoshi Nakamoto, *Re: Scalability and Transaction Rate*, Web Page, 2008, accessed 8 June 2019, `http://www.metzdowd.com/pipermail/cryptography/2008-November/014853.html`.

41. The possible categories were: Anarchist /Syndicalist /Anarcho-Collectivist, Centrist /Moderate /Swing Voter, Communist /Marxist, Conservative /Traditionalist /Right-of-Centre, Green / Environmentalist /Ecologist, Liberal /Progressive Democrat, Libertarian /Anarcho-Capitalist, Monarchist /Imperialist, Nationalist /Nativist, Socialist /Social Democrat /Left-of-Centre, Theocratic. From Lui Smyth, *The Demographics of Bitcoin (Part 1 Updated)*, Web Page, 2013, accessed 8 June 2019, `https://web.archive.org/web/20130629065001/http://simulacrum.cc/2013/03/04/the-demographi`

ertarianism has been there from the start in the blurring of the lines between money and wealth. Whilst libertarianism is a very broad movement that encompasses as many different ideas from liberalism, conservatism or progressivism, there is a specific type of very fervent libertarians that, in the worlds of The New York Times author Nate Cohn, "might scare everyone else out of the room with their views on a flat tax, the Civil Rights Act and a return to the gold standard."[42]

This particular tendency to be enamored with gold and its semi-independence from the governmental institutions and the monetary policymakers is precisely what makes Bitcoin so appealing to this specific demographic. In its very core, the preference for gold derives from the libertarian ideal of a near-maximally free market, which is believed to achieve the optimal outcome through the forces of supply and demand. This is one of the general core principles particularly promoted by the economist Milton Freedman's 1980s television series *Freedom to Choose* and is believed to be a cure for everything from road safety issues to monopolies to high unemployment rates of ethnic minorities, wherein the decisions of the government are seen as the cause of many of those ills. The preference for a gold standard is merely an extension of this same idea, stating that no authority should determine the size of the money supply or the level of the interest rates. The price of goods dropping relative to the price of money is seen as equally virtuous because it suggests that the goods can now be supplied in a greater quantity relative to the money supply. Conversely, the present practice of promoting an inflation rate of 2% is seen as a negative for the society, because it erodes the savings of those keeping their wealth in cash. Gold, the quantity of which is often erroneously believed to be fixed, is thus seen as a better kind of money. An irresponsible monetary authority or an irresponsible bank working under the fractional reserve system cannot simply create more gold.

This idea is naturally by no means shared by the mainstream economists to the point of being described as "macroeconomic illiteracy",[43] but as most people are not macroeconomists and, particularly at a time when banks are collapsing one-by-one with talks of a government bailout directed at rescuing those who caused the crisis, it is not difficult to see how the idea of commodity money may look appealing. Although there is a greater mythology to the idea described above, what it ultimately boils down to is the argument consisting of two parts: 1.) a unit of currency, for example $1, could buy something when the speaker was a child, but cannot buy anything close to it today, and 2.) a certain quantity of gold or silver could buy a certain item, such as a

cs-of-bitcoin-part-1-updated/

42. Nate Cohn, *Rand Paul's Challenge: Libertarians Are Still a Small Minority*, Web Page, 2015, accessed 8 June 2019, https://www.nytimes.com/2015/04/08/upshot/why-rand-paul-cant-win-as-a-libertarian.html.

43. IGM Forum, *Gold Standard*, Web Page, 2012, accessed 8 June 2019, http://www.igmchicago.org/surveys/gold-standard.

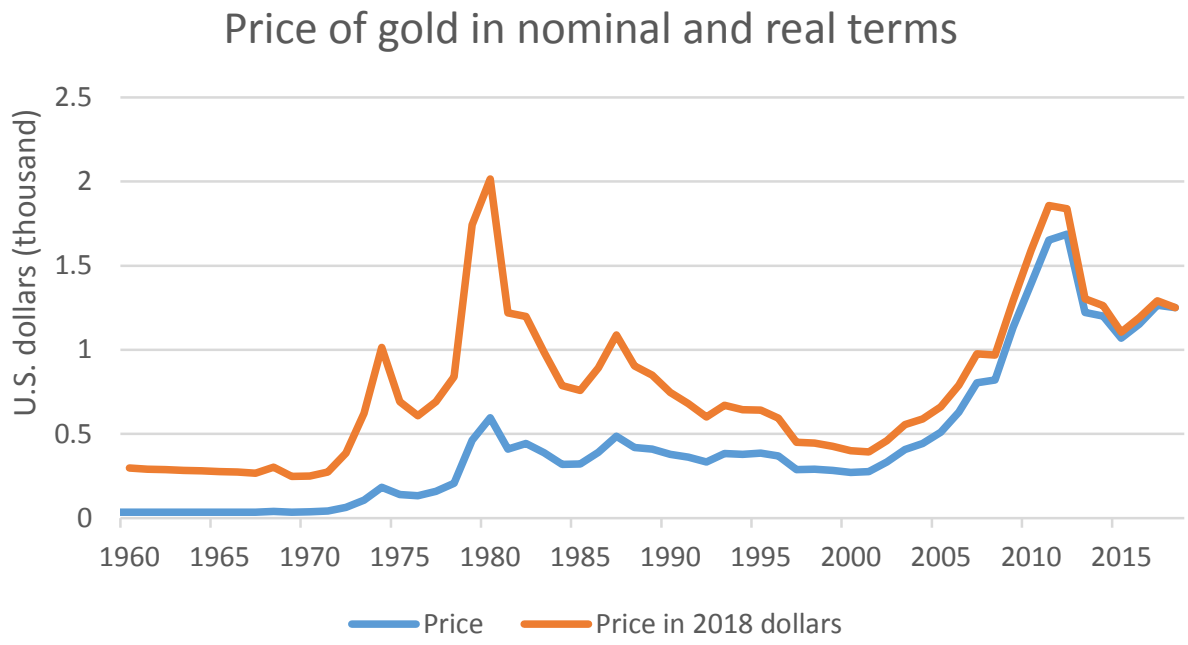

Figure 2.2 Nominal and inflation-adjusted price of gold. Computed with data from: The World Bank.

certain car model, back during the same childhood and it can buy one now. The first part is undoubtedly correct for the vastest majority of speakers, while the second one is demonstrably false and often not in the pleasant way where one can buy more than one car. More importantly, what this line of reasoning illustrates, often demonstrated by a specific group of libertarians both in the gold and the Bitcoin camps, is the blurring of the lines between money and wealth. Whereas the value of a unit of money can decline steadily over time, this in no way necessitates a decline in an individual's wealth that can be maintained with relative ease through the purchase of debt obligations. This point, however, is dismissed as the government issuing the debt is not seen as trustworthy. Furthermore, such ideation is by no means grounded in the lived reality of the wider society and the problems it faces.[44] As of 2001, only 6.4% of the assets of American households were kept in cash. Even among renter households that did not own a home, the said share did not exceed 13%. The real value of the remaining assets is not affected by the gradual loss of the purchasing power of the U.S. dollar, making it a non-issue for the vastest majority of people. This is particularly true for low-income individuals, as the household savings rates are inversely correlated to the household income.[45] Those earning the least either expend their incomes the fastest making inflation irrelevant to them or fall into debt at which point inflation acts in their very economic interests as it

44. John Benjamin, Peter Chinloy, and Donald Jud, "Why Do Households Concentrate Their Wealth in Housing?," *Journal of Real Estate Research* 26, no. 4 (2004): 329–344, ISSN: 0896-5803.

45. Federal Reserve Board, *Report on the Economic Well-Being of U.S. Households in 2015*, Web Page, 2016, accessed 9 June 2019, `https://www.federalreserve.gov/econresdata/2016-economic-well-being-of-us-households-in-2015-Income-and-Savings.htm`.

slowly erodes away their debt.

Nakamoto appears to fall squarely into this belief system and at no point draws a distinction between the usefulness of money as a means of exchange and its function as a store of value. The same appears to apply for a considerable number of libertarian cryptocurrency enthusiasts that Nakamoto has correctly predicted to be attracted to this kind of digital commodity. From an ideological point of view Bitcoin at its core had always been a project for a very specific community by a member of the said community.

The element of timing continued to remain on Bitcoin's side. Whereas the quick actions of the monetary authorities had put a quick end to the financial crisis that by all accounts could have been much worse than it turned out to be, its fallout remained. The trust in the banking sector remained shattered and the recovery proceeded only slowly,[46] with the unemployment rate not returning to its pre-crisis levels for eight years.[47] While protest movements such as Occupy Wall Street and the Tea Party had been gaining momentum in the United States, the European debt crisis had broken out in Europe now plunging the Old Continent into its own era of uncertainty. At the same time, a previously unremarkable group calling themselves WikiLeaks had become a major topic of discussion after its members first released the footage of an American helicopter shooting at civilians in Baghdad and then followed up with a release of a large volume of confidential diplomatic cables. Shortly thereafter, the payment system provider PayPal "permanently suspended" WikiLeak's account stating that the service cannot be used for "any activities that encourage, promote, facilitate or instruct others to engage in illegal activity".[48] In this instance Nakamoto had chosen to be a pragmatist rather than an idealist, writing:

No, don't "bring it on". \ The project needs to grow gradually so the software can be strengthened along the way. \ I make this appeal to WikiLeaks not to try to use Bitcoin. Bitcoin is a small beta community in its infancy. You would not stand to get more than pocket change, and the heat you would bring would likely destroy us at this stage.[49]

Nakamoto later stated that it would have been "nice to get this attention in any other context" and described WikiLeaks as having "kicked the hornet's nest, and the swarm is headed towards [the Bitcoin community]".[50] WikiLeaks would not remain the only source

46. Federal Reserve Bank of Atlanta, *The Financial Crisis and Recovery* [Why so Slow?], Web Page, 2011, accessed 9 June 2019, `https://www.frbatlanta.org/cenfis/publications/notesfromthevault/1110.aspx`.

47. The Federal Reserve Bank of St. Lous.

48. WikiLeaks, *PayPal Freezes WikiLeaks Donations: Digital McCarthism in the United States?*, Web Page, 2010, accessed 9 June 2019, `https://wikileaks.org/PayPal-freezes-WikiLeaks-donations.html`.

49. Satoshi Nakamoto, *Wikileaks Contact Info?*, Web Page, 2010, accessed 9 June 2019, `https://bitcointalk.org/index.php?topic=1735.msg26999#msg26999`.

50. Satoshi Nakamoto, *Dfg*, Web Page, 2010, accessed 9 June 2019, `https://bitcointalk.org/inde`

of public attention that Bitcoin received shortly thereafter.

2.2 Silk Road, crime and bitcoin as money

The most famous transaction in Bitcoin's early history occurred on May 18, 2010, and thus well before the PayPal incident and the WikiLeak's attention spilling over to the young cryptocurrency. A participant on Nakamoto's Bitcoin Talk forums known only as Laszlo from Jacksonville, Florida had grown peckish and asked if someone would send him "a couple of pizzas" if he paid them a modest sum of 10,000 bitcoins. Laszlo explained that he liked to have some pizzas left over to nibble on the following day and liked regular toppings like onions and peppers, but not "weird fish". At that point, 10,000 bitcoins were worth $41 dollars and considerably above the price of two pizzas, but Laszlo was adamant that he wanted to buy them so he would not have to prepare them himself. Three days later, nobody had yet ordered Laszlo's pizzas, which prompted him to ask if the bitcoin amount he was offering was "too low". The next day, Laszlo happily reported that he had received his pizzas, later adding that his offer was ongoing and that he would throw in a few more bitcoins if the next pizzas were "upgraded extra large" ones. The next post in the conversation appeared two months later in August, asking if Laszlo was still willing to buy two pizzas for 10,000 bitcoins that at this point were valued at $600. Laszlo replied that he was "kind of holding off on doing any more of these for now".[51]

Although Laszlo would return in 2018 to upload more photographs of pizzas he had ordered using the new second-layer Lightning Network, the above story is very indicative of Bitcoin's core problem both then and today: for a currency or electronic cash not many of its holders appear to be using it for buying and selling anything other than other currencies. Section 1.4.1 "Functions, money and intrinsic value" addressed the three functions of money and while one can argue that Bitcoin offers a store of value, no or barely any businesses denominate their prices in bitcoin and only a few smaller businesses accept it as a means of exchange. The first implies that bitcoin becomes the primary unit of account that the price is based on. While the number of retailers advertising themselves as accepting bitcoin has grown over the past several years, accepting bitcoin and designating prices in bitcoin are two separate concepts. As Laszlo quickly discovered, one cannot maintain a standing offer to purchase pizzas at a specified bitcoin price. Concerning the second function, although businesses that accept bitcoin undoubtedly exist, the total revenue of those businesses is undoubtedly magnitudes smaller than that

x.php?topic=2216.msg29280#msg29280.

51. Laszlo, *Pizza for Bitcoins?*, Web Page, 2010, accessed 9 June 2019, https://bitcointalk.org/index.php?topic=137.0.

of the businesses that only advertise as accepting bitcoin. One must distinguish between means and medium of exchange. Services such as BitPay allow retailers to advertise Bitcoin as a payment method without ever having to handle the cryptocurrency. This is achieved by providing the buyers with a time-limited quote of the price in bitcoin and an address to send the coins to after which BitPay credits the retailer's account with the original national currency value minus a 1% processing fee. Alternatively, the buyer can apply for a BitPay Visa and expose themselves to market risk even while living in their home country, which is the practical equivalent of keeping all of one's financial assets in risk-assets like stocks or gold. Unsurprisingly, similar services exist for individuals not interested in bitcoin but wishing to pay in other commodities such as gold or silver.[52]

Inevitably, Bitcoin offers very few advantages as a payment method for the consumers and it is unsurprising that even after becoming nothing short of a sensation in 2017 very few retailers integrate Bitcoin processors like BitPay despite the relative ease of doing so. There simply does not appear to be consumer demand for something that can be done with much greater ease with a regular credit card, especially when the said credit card offers cashback points and the processing fees are distributed equally among all consumers. Although six in ten Americans expressed disapproval of the decision to bail out the financial sector in 2008 once the dust had settled five years later,[53] when push comes to shove most people appear to be more interested in the convenience and cashback points over the opposition against the banking sector. For most non-speculator in the developed world cryptocurrencies in their current state simply do not offer a good value proposition. That is unless one is a criminal.

It is thus unsurprising that Laszlo's pizzas were not the only thing being paid for in bitcoin. The earliest and the most prominent examples of such activity had been an online narcotics marketplace known as *Silk Road*.

Under normal circumstances, one cannot launch a public website used for selling drugs and other contraband goods, and not expect a knock on their door. Such a page would inevitably be discovered by the corresponding authorities after which they could subpoena the hosting or the domain provider to take the site offline and surrender any identifiable information relating to the owner and participants of the website. The access itself can be cut off with relative ease at the Internet service provider level similarly to how some jurisdictions limit access to certain foreign websites. Payments themselves would be difficult as they could not be completed through bank wire or traditional payment processors, who would be able to further inform the authorities of the participating

52. See goldmoney.com for a comparable service for gold.

53. Allison Kopicki, *Five Years Later, Poll Finds Disapproval of Bailout*, Web Page, 2013, accessed 9 June 2019, `https://economix.blogs.nytimes.com/2013/09/26/five-years-later-poll-finds-disapproval-of-bailout/`.

parties and freeze the accounts. Although remittance providers have long been abused to defraud individuals into sending payments to countries with less stringent legal regimes, even this method would expose one to considerable risk when operating from a developed country.

Both of these issues were solved with some degree of success by Silk Road in February 2011, only shortly after Nakamoto lamented that WikiLeaks was not giving Bitcoin the kind of attention he had hoped for. The marketplace leveraged two technologies developed by online privacy advocates: the Tor network and Bitcoin.

The former is what is often referred to in the press as the ominous dark web. The technical inner workings of the network are beyond the scope of this research, but in its most basic terms it can be described as a network existing on the Internet that allows its participants to host or access the hosted materials anonymously. The websites on the network are not directly accessible through a regular web browser and require one to install a suite of Tor software to do so. One can also use the network to access pages on the regular Internet without exposing one's identifiable IP address to the website visited, although doing so offers little tangible value to most users at the cost of substantial delays and loading times. The usage of the network itself is not illegal and the registered non-profit maintaining the necessary software states that its goal is to "advance human rights and freedoms by creating and deploying free and open-source anonymity and privacy technologies".[54] A typical advertised use case is that of allowing political dissidents and journalists operating in states lacking in human rights and the freedom of press to express their ideas and communicate with each other. In the real world, recent research has shown that the vastest majority of dark web usage is unsurprisingly for strictly illegal purposes. Authors of a 2019 study have surveyed of these materials, finding large quantities of child pornography, gambling sites and offerings of contraband items such as forged identification documents, weapons, and drugs.[55] While merely distributing illicit files had not posed any technical challenges, their sale, as well as the sale of tangible goods, was considerably simplified with the arrival of Bitcoin.

The Silk Road utilized the pseudonymity of Bitcoin's transactions to create an online marketplace. Rather than selling its own goods, the platform allowed sellers to create listings of items priced in bitcoin that buyers could browse for by category. After finding an interesting item, the buyer would be presented with a Bitcoin address to deposit the funds to. Rather than providing the direct address of the seller, Silk Road generated its own address and kept the cryptocurrency in escrow to ensure that the buyer receives

54. Tor Project, *Homepage*, Web Page, 2019, accessed 10 June 2019, `https://www.torproject.org/`.

55. Al Nabki Mhd Wesam et al., "Classifying Illegal Activities on TOR Network Based on Web Textual Contents," in *Proceedings of the 15th Conference of the European Chapter of the Association for Computational Linguistics*, vol. 1 (2017), 35–43.

their purchase and to collect operating fees. The item would be processed, masking its smell if necessary, and mailed to the buyer through regular mail. The funds minus the fees would be released to the seller upon the receipt of the item. To create a reputation system akin to that of sellers on legitimate platforms like eBay or Amazon Marketplace, the buyer was prompted to leave feedback on the seller.[56]

Ross William Ulbricht who operated Silk Road is presently serving a life sentence without the possibility of parole. Silkroad had quickly come to the attention of the masses and the elected representatives after an at the time popular online outlet Gawker published an article titled *The Underground Website Where You Can Buy Any Drug Imaginable*.[57] It took over two years for the Federal Bureau of Investigations to take the site offline, but once they did so Ulbricht was in for more than merely operating a narcotics marketplace.

Strictly speaking, Silk Road always aimed to separate its narcotics activities from other contraband. In its rules, it specifically stated not to "list anything who's [sic] purpose is to harm or defraud", including weapons, stolen items, assassination offers and "anything related to pedophilia". The weapons segment had been outsourced to a short-lived sister site that was allegedly shut down after failing to attract enough customers.[58] Ulbricht himself had been an outspoken libertarian and his rhetoric combined with the focus on drugs attracted a significant number of sympathizers among cryptocurrency enthusiasts some of whom remain convinced of the injustice of Ulbricht's sentencing to this day.[59] Among other things, Ulbricht had been a staunch critic of the "War on Drugs" and shared a not entirely unpopular attitude that something should not be illegal if it does not harm others. Among the more plausible of these arguments is that the platform provided by Ulbricht allowed users to purchase narcotics without having to put themselves into danger of seeking out a local dealer in person as well as having access to user reviews and thus mitigating the danger of receiving a substance of lesser quality that in some cases could well prove lethal to the user. The fact that the largest illicit drug sold on the

56. Nicolas Christin, "Traveling the Silk Road: A Measurement Analysis of a Large Anonymous Online Marketplace," in *Proceedings of the 22nd International Conference on World Wide Web* (ACM), 213–224, ISBN: 145032035X, https://www.andrew.cmu.edu/user/nicolasc/publications/Christin-WWW13.pdf.

57. Adrian Chen, *The Underground Website Where You Can Buy Any Drug Imaginable*, Web Page, 2011, accessed 11 June 2019, https://gawker.com/the-underground-website-where-you-can-buy-any-drug-imag-30818160. Brett Wolf, *Senators Seek Crackdown on "Bitcoin" Currency*, Web Page, 2011, accessed 11 June 2019, https://www.reuters.com/article/us-financial-bitcoins/senators-seek-crackdown-on-bitcoin-currency-idUSTRE7573T320110608.

58. Christin, "Traveling the Silk Road: A Measurement Analysis of a Large Anonymous Online Marketplace."

59. Andy Greenberg, *Collected Quotations of the Dread Pirate Roberts, Founder of Underground Drug Site Silk Road and Radical Libertarian*, Web Page, 2013, accessed 11 June 2019, https://www.forbes.com/sites/andygreenberg/2013/04/29/collected-quotations-of-the-dread-pirate-roberts-founder-of-the-drug-site-silk-road-and-radical-libertarian/#7fb7a9911b0c.

platform had been marijuana—the legality of which is a hotly debated topic in its own right—had also resulted in some sympathy, although researchers examining the site point out that its preponderance is likely to be caused by there simply being greater demand for softer drugs than opioids. All of the above had led to Ulbricht reaching a certain degree of martyrdom. Nonetheless, the same research suggests that given a seller revenue of $1.2 million per month in early 2012, this martyrdom had also resulted in Ulbricht collecting $92 thousand in transaction fees as the operator of the market place thus hardly making it a not-for-profit endive.[60]

The developments also took a darker turn as the investigation proceeded and the federal agents arrested Ulbricht's partner in crime, who quickly gave in to the demands of the agents and withdrew bitcoins from Silk Road's accounts. Ulbricht hired an enforcer to torture his accomplice but eventually decided that a murder would be for the best. Fortunately for everyone involved, the hired help was Drug Enforcement Administration (DEA) agent already on the case and the entire assassination ended with photographs of the former accomplice "facedown on the floor, pallid, smeared with Campbell's Chicken & Stars soup" being sent to Ulbricht.[61] Further assassinations were attempted with Ulbricht paying a total of $650 thousand in bitcoin to tie any loose ends. The later court hearings concluded that neither of these had likely occurred. The particular severity of Ulbricht's sentence as a first-time offender was acknowledged by the court and justified by the attempts to murder accomplices and witnesses.[62] The court's decision and discussions of misconduct by agents involved in the case attracted considerable criticism by prominent anarchists and libertarians, among them notable figures such as Noam Chomsky and John Stossel, as well as a large online community gathered on the Free Ross Ulbricht website. The site itself links to an online petition for a presidential pardon, which presently states to have 173 thousand signatures, although verifying how many of these were made by unique users is difficult not in the least because there is nothing stopping someone from filling in the petition multiple times.[63]

While the story behind Silk Road is fascinating in its own right, more pertinent to Bitcoin is the fact that it had been an integral part of the system and used as both the medium of exchange and the unit of account. Prices on Silk Road largely followed the

60. Christin, "Traveling the Silk Road: A Measurement Analysis of a Large Anonymous Online Marketplace."

61. Joshuah Bearman, *The Untold Story of Silk Road, Part 1*, Web Page, 2015, accessed 11 June 2019, `https://www.wired.com/2015/04/silk-road-1/`.

62. United States Court of Appeals, Second Circuit, *UNITED STATES OF AMERICA, Appellee, v. ROSS WILLIAM ULBRICHT, A/k/a DREAD PIRATE ROBERTS, A/k/a SILK ROAD, A/k/a SEALED DEFENDANT 1, A/k/a DPR, Defendant-Appellant*, Web Page, 2017, accessed 11 June 2019, `https://caselaw.findlaw.com/us-2nd-circuit/1862572.html`.

63. Free Ross Ulbricht, *Homepage*, Web Page, 2019, accessed 11 June 2019, `https://freeross.org/`.

conversion of bitcoin to the U.S. dollar,[64] but the goods and services themselves were listed with bitcoin price tags rather than in national currencies that would be converted to a corresponding bitcoin value upon the receipt of a purchase request. This made Silk Road different from other online and brick-and-mortar retailers that merely advertise themselves as accepting bitcoin. Part of the reason why this could happen was because sellers priced narcotics at a markup to street prices, which buyers accepted given the benefits of transacting on Silk Road outlined above.[65] This and the general tendency of bitcoin to appreciate gave sellers a considerable margin of safety that did not require them to price their goods exactly as one typically would be given the competitiveness of online retailers. Criminal economics is after all markedly different from their main street equivalent. At the time of Silk Road's operation in early 2012, it was estimated that the marketplace alone accounted for 4.5% to 9% of all transactions occurring on Bitcoin exchanges,[66] the magnitude of which cannot be overstated given the fact that the said exchanges also include individuals buying and selling bitcoin as well as exchanging them for other cryptocurrencies.

Notably, Silk Road is far from the only criminal enterprise that made use of Bitcoin's functionality as money rather than merely an asset that one can hopefully sell to a greater fool at a considerable mark up later down the line. One of these other uses had been malware.

Pre-Bitcoin malware, commonly and often incorrectly referred to as "viruses",[67] typically involved installing web browser plugins that would bombard the user with links to pornographic websites, fraudulent antivirus sites and online pharmacies asking for payments through remittance providers. In other cases, the malware would quietly infect the user's system and connect it to the attackers' command-and-control server. A network of such compromised computers could then be used to launch Distributed Denial of Service (DDoS) attacks on target websites by forcing every infected computer to launch a series of attempts to connect to the target site, overwhelming the targets' servers and taking it offline. While annoying for the user on the one hand and promoting the development of anti-DDoS solutions for website operators, most of this malware could be removed either by using antivirus software from legitimate providers or by reinstalling the operating system itself.

A new kind of malware known as *Reveton* launched in 2012. This program would not message the user or use their computer to attack other sites, but instead leveraged

64. Christin, "Traveling the Silk Road: A Measurement Analysis of a Large Anonymous Online Marketplace."
65. Ibid.
66. Ibid.
67. Which are a specific type of malware.

the large library of cryptographic tools that cypherpunks fought so fervently to make available to the public to encrypt the personal data of the users on the target computer. Family photos, current work documents and any other invaluable data existing solely on the machine in question would suddenly become unavailable to its owner. The malware would then request that the user sent a certain sum, typically between $200 and $1000, through stored value cards to the attacker less the user wants the attacker to delete the decryption key and thus forever render the data inaccessible. This dynamic gave the malware its name *ransomware*.

Figure 2.3 Screenshot of famous Wannacry ransomware proudly flying the "bitcoin accepted here" banner.

While Reveton was the first, it was still limited by the inefficiency of stored value cards as an extortion method. Its successor, CryptoLocker, improved upon this by requesting bitcoin as a payment method. This offered several benefits to the groups distributing ransomware, such as the ability to integrate a greater degree of automation into the extortion process as well as better protect their identities by eliminating any central authorities in the process. The intangible nature of bitcoins and the preponderance of unregulated exchanges allowed for a greater ability to launder the funds than was

previously possible. Other systems were also integrated, such as time limits to pay the ransom as well as incentives to pay it quickly by increasing the ransom with the passage of time. At this point, it was not only the home users that were infected but also legal offices, police stations, hospitals, banks, and other organizations depending on critical data being handled in a timely manner. Many of these paid the ransom the lack of alternatives. CryptoWall, a successor to the CrytoLocker, had generated $320 million revenue for its authors turning ransomware into a major criminal industry.[68]

In contrast to Silk Road, ransomware authors quickly realized that it would be more efficient to demand a certain amount of United States dollars in bitcoin rather than bitcoin itself. Although this is not a topic most economists engage on a daily basis, the price elasticity of supply and demand exists every bit as much in the realm of demanding ransoms as they do elsewhere. Recalling introduction to economics, the demand elasticity is not the same for all goods: were one to live close to two supermarkets, one supermarket deciding to double all of its prices would result in most consumers simply going to the other supermarket and the demand can be said to be elastic; conversely, were the price of electricity to increase, individuals may buy more economic lights and use them for shorter periods, but they probably would not go back to using oil lamps and candles. Ransomware operates under similar principles. Whilst the demand elasticity of a hospital or a law office may have been low and thus being able to pay a considerably higher price, there is a certain point at which one would cut one's losses and come to the terms with the fact that one's holiday photos or a not entirely urgent business report are not worth several months of rent. Authors of CryptoLocker, as the first of the Bitcoin-powered ransomware programs, appear to have run into this very problem when the price of Bitcoin increased from $100–150 dollars in September 2013 to $700 by November of the same year. The original ransom of 2 bitcoins had now become considerably more expensive and presumably fewer victims were willing to pay $1,400 than $200–300. Despite being a monopolist with regards to the selling keys to the users' files, the authors were forced to do nothing other than slash their prices to only 0.5 bitcoins.[69] Thus even the malware using bitcoin as the unit of account seemed to ultimately peg their prices to the U.S. dollar and other major currencies. The authors of the next major ransomware program called CryptoWall improved upon their predecessors and offered ransoms denominated in U.S. dollars and only paid for in bitcoin at an on-the-fly converted rate.[70]

68. Juliana De Groot, *A History of Ransomware Attacks: The Biggest and Worst Ransomware Attacks of All Time*, Web Page, 2019, accessed 11 June 2019, `https://digitalguardian.com/blog/history-ransomware-attacks-biggest-and-worst-ransomware-attacks-all-time`.

69. Dan Goodin, *Soaring Price of Bitcoin Prompts CryptoLocker Ransomware Price Break*, Web Page, 2013, accessed 12 June 2019, `https://arstechnica.com/information-technology/2013/11/soaring-price-of-bitcoin-prompts-cryptolocker-ransomware-price-break/`.

70. Symatec, *Ransom.Cryptowall*, Web Page, 2014, accessed 12 June 2019, `https://www.symantec.c`

To any Bitcoin enthusiast excited about the future of the cryptocurrencies two of the above examples of its use may appear as though this author intentionally attempted to paint an unjustly critical picture of its potential capabilities and the benefits it can offer to the humanity as a whole. It is true that given sufficient fortunate developments and the overcoming of certain difficult bottlenecks, cryptocurrencies may indeed be very beneficial for entirely well-intentioned individuals in ways we cannot yet foresee. Nonetheless, this does not change the simple fact that its uses in the early days of its history were nothing short of criminal.

A small number of technology enthusiasts and entirely law-abiding individuals with a particular interest in privacy, decentralization and other ideological aspects of cryptocurrencies were indeed using Bitcoin on and off either for fun or to make a point. Laszlo is certainly one of such individuals. This is nevertheless hardly something that interested or presently interests the vastest majority of potential users who simply do not have the time, the energy or the curiosity to use something like Bitcoin. The few benefits it offers simply do not offset the costs associated with learning how to use it and will always be a hurdle no matter how straight forward the developers of various wallets and blockchains make it. There simply do not exist sufficient incentives to prompt its usage and there are more than enough reasons to not use it, ranging from the volatility of the real purchasing power to the lack of acceptance among merchants to it being quite easy to lose ones bitcoin either directly or through a proxy such as an exchange.

In fact, one can even argue that those who have gotten some basic understanding of the cryptocurrency and went out of their way to buy some units of it would be inclined not to use it. Laszlo's pizzas are regularly referred to as the first example of bitcoin being used as money, but at the same time every time they are mentioned, questions of the opportunity cost of buying those pizzas are raised, even if often in jest. While the argument in itself is entirely hollow as nobody could have known whether bitcoin would be worth more, less or even exist in any meaningful way seven years ago, there will likely always be a certain "what if" ambiance surrounding the two pizzas that, while undoubtedly delicious in mid–2010, cost Laszlo $200,000 at the height of the 2017 rally. Whilst the stories of being able to buy a certain number of liters of gasoline for $1 in 1950 certainly sound impressive, they will never match the fact that someone could have bought 10,000 bitcoins for $40 in 2010.

This expectation of price appreciation is more than an off-the-cuff hypothesis and is deeply ingrained into the culture of cryptocurrencies. These have quickly adopted two acronyms that described the attitudes towards the prospects of the cryptocurrencies and thus their price. One of these is the *Fear, Uncertainty, and Doubt* or *FUD*, which is used

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`om/security-center/writeup/2014-061923-2824-99`.

to justify keeping the position open when the price begins trending down or a series of negative news appear on the horizon. The other one is *Fear Of Missing Out* or *FOMO*, which is in many ways the opposite of *FUD* and refers to individuals recklessly opening positions because they do not want to miss out on the profits. Both of these terms are used regularly but are largely overshadowed by cryptocurrencies' own term *HODL*. Contrary to FUD and FOMO, HODL is not an acronym and is merely a misspelling of the word "hold" capitalized for effect. It first appeared in Nakamoto's Bitcoin Talk forums in 2013, when a user was describing why he still has not sold his bitcoins.[71] It was later associated with Warren Buffett's famous Buy-and-Hold strategy, which while a legitimate approach for productive assets does not apply for non-productive commodities, and eventually turned into a reverse acronym for "Hold On for Dear Life".

What is notable about all of these acronyms and pseudo-acronyms is that they relate to the price of the asset, which in all truthfulness appears to be more important than the actual technology even to those claiming that it is not so. Even if one were to generously give the cryptocurrencies communities the benefit of doubt and assume that the technology is equally important to them as the price of individual coins, a survey of any relevant forum that is not specifically about technology and has some form of moderation will quickly reveal how much of a focus is placed on the price of the asset through the sheer number of discussions about it. As stated previously, this is unsurprising as even the most staunch average income defender of privacy and liberty from the banking system undoubtedly benefits far more from the exponential growth of their cryptocurrency holdings than they do from achieving minor advances towards their goal.

The only exception to this rule is those individuals who operate outside of the law or the banking system. Just as with the dark web, a small number of these individuals would indeed be dissidents or journalists fighting for what they believe to be the right cause and, just as with the dark web, the very large remainder of the contents or uses would be those pertaining to criminal activities. Besides both being developed by cypherpunks directly or under their spiritual tradition, both dark web and Bitcoin share the remarkable similarity of offering anonymity or pseudonymity at the cost of usability. Consequently, both were not and are not used to a large degree by anyone but the small group, who are either very passionate about privacy or those who must remain private less they wish to be apprehended. For this latter group, both cryptocurrencies and the dark web were a blessing from above and have enabled new and more efficient ways of operating criminal enterprises. Whilst dark web remains a largely obscure network appearing in the public's eye only in an exaggerated form in popular police shows, Bitcoin had indeed surpassed its

71. GameKyuubi, *I AM HODLING*, Web Page, 2013, accessed 13 June 2019, `https://bitcointalk.org/index.php?topic=375643.0`.

criminal history through, not through its many uses, but the asset's appreciation against the national currencies. Whether it would have done so without the cannabis merchants on Silk Road will remain unknown.

2.3 Mt. Gox, crypto-pickpockets and crypto-bank robbers

The first chapter of this book laid out the technical basis of cryptocurrencies dividing them into two major types: those based on public blockchains and those based on private blockchains. Private blockchains have one or multiple authorities that act as blockchain administrators, which allows one to increase the transaction efficiency by removing the necessity to looking for hashes, engage in monetary policy by expanding or contracting the monetary supply as necessary, revert or nullify transactions and everything else that is done in traditional payment or monetary systems. Although the technology powering them differs slightly from distributed databases with cryptographic signatures, the functionality offered has existed since the mid–1990s and has only now been garnished in public prestige as Bitcoin made news. Conversely, Bitcoin itself and other public blockchains do not exhibit any of the above characteristics or exhibit them in a sufficiently difficult to attain form: transactions on the main chain are inefficient and require solutions that build on atop it, the money supply is pre-programmed and transactions cannot be reversed under normal circumstances. These characteristics offer certain advantages and allow for the creation of marketplaces like Silk Road and ransomware, which would be more difficult to utilize over a payment system where the supervising authorities can be subpoenaed or raided.

While the ideological core demographic of cryptocurrencies very much welcomes a number of the outcomes of this irreversibly, the effects of the said activities are not experienced directly by those in support of the technology. Most people do not get their wedding photos encrypted and held hostage by Russian malware, fewer still suffer primary or secondary effects of drug addiction and, when all is said and done, the entire range of effects of monetary policy and bank bailouts are understood by such a minuscule portion of the population that one may as well have any opinion under the sun and never have it affect one's life in a perceptible way. These effects of the operation of the Bitcoin network constitute economic externalities that users of the network itself do not pay the price of but distribute it sporadically among the population as a whole. This is particularly so the case with regard to the emissions generated by the mining process. Furthermore, these are either problems of another or issues macroeconomic enough to be handled only

on representatives' level, thus making the individual's opinion largely irrelevant. What is relevant to bitcoin holders is having them stolen and there being no recourse to get them back.

There are several mechanisms through which this can occur. The first is by stealing the coins directly from the wallet of their respective owner akin to breaking into one's home and taking anything of value. The second group collects coins by forcing unaware computer owners, who may not even know what bitcoins are, to mine them for the criminal. There is a third much less common group of cryptocurrency thieves that tap into the weaknesses of individual blockchains themselves and seep the coins out of the others' wallets or mint their own coins by exploiting the very system itself. The fourth one achieved is by having the individual willingly surrender their coins in expectation of greater returns, safekeeping or some other tangible benefit. A fifth group would consist of those criminals breaking into an institution keeping coins of multiple other owners and stealing them. Whilst all of the above criminals obtain cryptocurrencies from their rightful owners in different ways, the skill sets of most of the above individuals are largely identical and would fall under the umbrella of what is popularly known as hackers. In practice, this means knowledge of certain areas of programming and the ability to identify exploitable vulnerabilities in software systems. Depending on the technique, a smaller or larger degree of social engineering may be required.[72]

Crypto-burglars and crypto-slavers

Methods one and two in the above list typically consist of infecting the target's computer with malware. This malware can be distributed through any of the usual means, be it through emails or websites asking the user to execute a computer program that alleges to do something that the user wants. Once the program is executed by the user it begins working for its author.

The first of these appeared already in June 2011 and targeted Windows computers.[73] At this point, the selection of Bitcoin wallets was still mostly limited to the original Bitcoin Core wallet, which made it a particularly good target for attacks. Once the program was executed all it had to do was look for the wallet file, which was always stored in the same location within the user's personal directory. If the infected machine did not have the Bitcoin wallet installed on it, the malware would not do anything. If it did, the program attempted to email the wallet file to the attackers' email address and pretend not to exist. Ideally, the target should remain none the wiser about what had

72. Terms invented by the author and styled in the general spirit of cryptocurrency lingo.

73. Symatec, *Infostealer.Coinbit*, Web Page, 2011, accessed 15 June 2019, `https://www.symantec.com/security-center/writeup/2011-061615-3651-99?tabid=2`.

occurred until the attacker retrieves the freshly emailed in private keys for the target and transfers the entirety of the balance to their own account. The first time the target would become aware of the attack would be upon opening their wallet and seeing a transaction they did not execute. Unlike with banks and other centralized payment systems though, there would be no phone number to call for help.

Several solutions to better protect one's wallet have evolved as a result. The most basic one of these was encrypting the wallet with a password, which nonetheless could be intercepted by malware upon entry making the system less than ideally protected. A better solution was offered by keeping the wallet application on one's Apple iPhone, which unlike the desktop operating systems segregates data of one application from another and thus makes it much more difficult to access the private keys. Security limitations furthermore made keyboard recording neigh impossible. The most advanced form of protection came with the so-called hardware wallets. These are specialized hardware devices that store the private keys and require the user to press physical buttons on the device to perform a transaction.

The second type of attack is more egalitarian and affects both individuals who own cryptocurrency and those who do not. The malware does not attempt to retrieve the private keys but rather turns the infected system into a cryptocurrency miner. This does not lead to a large loss of funds if detected and addressed early, but nonetheless adversely affects the computer's performance by using up the available resources to mine cryptocurrencies. Running performance-intensive applications like video games and high definition video becomes unsustainable and even low-intensity programs such as web browsers and office suites begin to run considerably slower. The higher cycles of the central processing unit or the graphics processor also result in higher power consumption and thus electricity costs of operating the computer.

CoinHive as the most notable example of this quasi-malware had commendable roots and followed the road laid out with good intentions. Although the service has since ceased operations, it aimed to solve a number of persistent issues faced by operators of websites: monetization and spam.[74]

The former is a problem that the online publications have struggled with since the popularization of the Internet. On the one hand, one needs a source of revenue for the effort put into creating the web content and to cover the costs of operating the site. On the other hand, only a handful of well-established names can effectively demand a subscription fee for their online publications. While advertising is a solution, it distracts from the contents and is not liked by the readers. Since the popularization of browser

74. CoinHive, *A Crypto Miner for Your Website*, Web Page, 2017, accessed 15 June 2019, `https://web.archive.org/web/20190327011711/https://coinhive.com/`.

add-ons in the Firefox browser during the early 2000s, blocking advertisements has also become an option that left the hosts with no revenue to speak of. CoinHive offered a way out by forcing the browser to mine the cryptocurrency Monero while the reader had the website open.

At first, this may appear as a very fair way to pay for visiting the websites as the more time the user spends on the website the more revenue they generate, providing an incentive for the content authors to create appealing pages that users would visit often. The devil in the detail had been that the in-browser miner was highly inefficient and generated not only a fraction of the revenue of a non-intrusive advertisement, but also considerably less than the visitor paid in electricity costs to generate the hashes.[75] The rapidly accelerating cooling fans of the readers' computer also undoubtedly made for less than ideal reading experience.

The issue took on new proportions once enterprising individuals understood that one does not have to follow CoinHive authors' advice and can embed the mining code not only without informing the user but also without informing the operator of the website. Popular web pages such as Politifact and the American television provider CBS's Showtime were hacked and had CoinHive code inserted into them to mine Monero for the hacker.[76] An even better vector of attack became apparent once the hackers figured out that CoinHive's code can be inserted into nothing other than online advertisements that CoinHive was designed to replace. Popular websites such as YouTube had now served ads that took over the CPU cycles and mined Monero while the target watched the videos.[77]

Eventually, CoinHive became the target of the same parties as online advertisement. AdBlocker and antivirus providers began adding new rules to their databases to prevent any of the CoinHive's code from executing. CoinHive ceased operations in March 2019, citing that it could no longer effectively operate following a new fork of the Monero blockchain.[78] Its anti-spam Captcha filter variant, which required the user to solve a number of hashes before being able to post online died along with it as an unfortunate victim of the advertisement competitor's success.

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75. Maxence Cornet, *Coinhive Review: Embeddable JavaScript Crypto Miner - 3 Days In*, Web Page, 2017, accessed 15 June 2019, `https://medium.com/%5C@MaxenceCornet/coinhive-review-embeddable-javascript-crypto-miner-806f7024cde8`.

76. Iain Thomson, *Stealth Web Crypto-Cash Miner Coinhive Back to the Drawing Board as Blockers Move In*, Web Page, 2017, accessed 15 June 2019, `https://www.theregister.co.uk/2017/10/19/malwarebytes_blocking_coin_hive_browser_cryptocurrency_miner_after_user_revolt/`.

77. Dan Goodin, *Now Even YouTube Serves Ads With CPU-draining Cryptocurrency Miners*, Web Page, 2018, accessed 15 June 2019, `https://arstechnica.com/information-technology/2018/01/now-even-youtube-serves-ads-with-cpu-draining-cryptocurrency-miners/`.

78. Catalin Cimpanu, *Coinhive Cryptojacking Service to Shut Down in March 2019*, Web Page, 2019, accessed 15 June 2019, `https://www.zdnet.com/article/coinhive-cryptojacking-service-to-shut-down-in-march-2019/`.

Crypto-leeches

The third type of attack is perhaps the least interesting of all, but nonetheless a fundamental element of cryptocurrencies that cannot be ignored. Many cryptocurrency enthusiasts are quick to point out that they put more trust in mathematics than they do in the fallible individuals working in the banking sector. Another popular expression used to express the same idea is a phrase "code is law" coined by the academic and activist Lawrence Lessig, albeit it appears that the nuance of Lessing's argument has been lost in the popular understanding of the phrase.[79] This naturally, as the said enthusiasts will point out equally quickly, results in subtracting the undesirable human elements from money, be it corruption, error or the agent-principal problem. A computer program does merely what it has been written to do, like a perfect servant without questioning its authors' commands or pursuing its own agenda.

While this has certain advantages, it also comes with a major drawback. Writing computer code that does precisely what the author intended it to do is difficult. The more complex the code program becomes, the more likely it is that the human author himself had committed a human error and unintentionally given birth to a bug. Students of the classics will remember how the Greek king Midas asked the deity Dionysus to give him a magical touch that would turn everything to gold, only to find out that he could no longer enjoy a hearty meal or even sustain himself as even the food and drink he touched would turn to cold, unpalatable metal. Fortunately, when it comes to software development one can usually wish for more wishes and rectify the problem to no longer produce the unintended effects.

Bitcoin prides itself in that the blockchain itself had never been hacked. Nobody has yet found a way to simply add more bitcoins to their wallet out of thin air or delete others' bitcoins through some unforeseen error in the system's code. The same cannot be said about certain other projects.

One of the most famous examples of this, largely by the virtue of occurring early, had occurred in the previously mentioned Ethereum. The blockchain differentiated itself from Bitcoin and other cryptocurrency projects of the time by not being merely a distributed ledger for moving coins between wallets, but by offering additional distributed computing functionality on top of the blockchain. The participants cannot use the computers of other participants for computationally intensive tasks and reward them with cryptocurrencies, which has been proposed by some other projects, but rather the mining process itself can include very inefficient computing performed across the entire network. While this may at first appear of questionable benefit, this sort of process can be used for executing what

79. Lawrence Lessig, *Code Is Law: On Liberty in Cyberspace*, Web Page, 2000, `https://harvardmagazine.com/2000/01/code-is-law-html`.

Ethereum calls "smart contracts". These are in practice just computer programs that do something when specific conditions are met and cannot be interfered with.

Early in Ethereum's life, one such contract known as the Decentralized Autonomous Organization (DAO) had been launched to create a kind of Ethereum fund. Assets would be added to it and the shareholders of the fund could decide what the fund would invest in by voting through its smart contract. As very quickly became apparent, the DAO had a bug in it which allowed the attackers to seep the currency "ether" out of the fund over and over again. The attacker who exploited it managed to withdraw $60 million from the investors. The transactions could not be reverted and there was no routine way to return the funds to their proprietors. What happened is that the magnitude of the theft and its potential to drag the entire project down with it led a sufficient number of ether miners to decide to revert the blockchain to the state prior to the exploit. This effectively nullified all the transactions taking place following the hack, including not only the apparently illicit withdrawal itself but also everything else. If one had used Ethereum to buy stolen credit card numbers on some successor to Silk Road, those purchases had suddenly become gratis. Any ether bought following the hack on an exchange against payment in bitcoin or another unaffected cryptocurrency was also no longer part of the Ethereum blockchain. This defiance of the "code is law" mantra had nonetheless irked a number of more devout Ethereum miners, who concluded that they will continue to operate on the blockchain where the hack had occurred. It became a second Ethereum blockchain known as Ethereum Classic. The two blockchains are identical until the point of reversal and diverge shortly before the hack. The previous holders of ether now owned the same quantity two coins, ether (ETH) and ethereum classic (ETC).[80]

Although this is probably the most notable example of the code itself being hacked, the subject of the hack was a smart contract rather than the Ethereum blockchain itself. This is not to say that there had not been some attacks on the underlying blockchains themselves. In 2018, one such blockchain had been Verge, wherein the hacker succeeded in decreasing the difficulty of mining the cryptocurrency by approximately 6 billion times for some miners, but not for others, thus generating approximately $80 per second worth of coins for their own wallet.[81] Some other blockchains had been exploited in similar ways.[82] Even the thus far flawless Bitcoin blockchain was in danger of creating additional

80. David Siegel, *Understanding the DAO Attack*, Web Page, 2016, accessed 25 June 2019, `https://www.coindesk.com/understanding-dao-hack-journalists`.

81. Daniel Goldman, *The Verge Hack, Explained: Time Warps, Mining Exploits, Denial of Service, and More!*, Web Page, 2018, accessed 25 June 2019, `https://blog.theabacus.io/the-verge-hack-explained-7942f63a3017`.

82. Mike Orcutt, *Once Hailed as Unhackable, Blockchains Are Now Getting Hacked*, Web Page, 2019, accessed 25 June 2019, `https://www.technologyreview.com/s/612974/once-hailed-as-unhackable-blockchains-are-now-getting-hacked/`.

bitcoins when a bug in its reference implementation had been discovered. In this case, the bug was found by the developers themselves and patched before it could be exploited.[83]

To summarize, in the case of cryptocurrencies code does indeed appear to be law and human error within the fabric of the blockchain itself can lead to exploits through a third party. When push comes to shove and a sufficient number of otherwise ardent "code is law" proponents have their investments expropriated from them through the said law, the attitudes appear to change rather rapidly. In most cases, the systems' greatest strength also appears to be its major weakness. The vast sums locked in the cryptocurrencies also make them perfect targets for such hacking attempts. Whereas compromising a corporate web server only may be profitable, exploiting a blockchain is almost certainly guaranteed to be so. Even in the case of Ethereum, where transactions have been reverted, the continued existence of Ethereum Classic had more than compensated the exploiter.

Crypto-scammers

Method four is in principle not unique to cryptocurrencies and falls into the general category of Internet scams, phishing—an attempt to present the fraudsters' page as that of a legitimate organization—or Ponzi schemes. As with ransomware and narcotics, all of these activities were possible and prevalent before and were merely accelerated to the new level with the addition of Bitcoin and its younger siblings that allowed comparably quick and irreversible transactions.

While crypto-burglars wrote software that would steal the private keys, a group of crypto-scammers would do no such thing and instead set up a website that the owner would either submit their private key to voluntarily or send their coins directly to the displayed address. One of the ways one could do so would be to set up a fake wallet service or a fake exchange. For example, a popular service for managing one's Ethereum holdings is through a website called *MyEtherWallet (MEW)*, the correct address for which is *myetherwallet.com*. The user typically uploads one's wallet file followed by a password and then performs their Ethereum transactions directly on the site. A crypto-scammer could replicate the look of the page and set up multiple sites with similar addresses, such as my-etherwallet.com, mvetherwallet.com or myetherwallet.biz. All of the above are real phishing sites presently listed as active on a database cataloging nothing but Ethereum scams with 6775 entries and 713 active scams as of June 2019.[84] Once the site is set up, all the fraudsters have to do is direct the largest volume of relevant traffic possible to the

83. Alyssa Hertig, *The Latest Bitcoin Bug Was So Bad, Developers Kept Its Full Details a Secret*, Web Page, 2018, accessed 25 June 2019, `https://www.coindesk.com/the-latest-bitcoin-bug-was-so-bad-developers-kept-its-full-details-a-secret`.

84. Ether Scam DB, *Scams*, Web Page, 2019, accessed 17 June 2019, `https://etherscamdb.info/scams/1/subcategory/`.

site and collect the private keys of individuals who did not notice the scam. This type of phishing has been prevalent for a better part of the past two decades, but whereas access to one's online banking can often be reversed with limited damage, an empty Ethereum wallet is empty forever.

The second type of impersonation scam that had mostly been limited to the micro-blogging platform Twitter, wherein the users are identified by a unique handle following the *at* sign, for example @author. Whereas the handle is unique to each user, the platform furthermore allows one to set a display name and a profile picture that are not unique. What this allowed for is for scammers to set up accounts with the same name and picture, and only a slightly different handle than the target of their impersonation. The most popular targets appear to have been the developer of Ethereum Vitalik Buterin, SpaceX and Tesla CEO Elon Musk and the antivirus creator John McAfee. The notable similarity between the three is that they are all wealthy, famous in the cryptocurrency circles and use Twitter on a regular basis. After the real Buterin, Musk or McAfee would post something, a fake one would submit a message akin to the following:

> But if you send me 0.2 ETH, I will send 2 ETH back to your address, because I can. My address:
>
> 0xCDDd354cd8550c5E30eaB2d63cDC48156a344f0A
>
> Beware of fakes!#eth #ethereum #airdrop #donation pic.twitter.com/PiHzc3xUl4

This scam had been particularly prevalent in 2017, but has since subsided as Twitter began policing its platform more stringently.[85]

The above phishing attempts have a relatively-speaking low overhead and can be executed in large numbers quickly and often. A more elaborate scam that had spread like wildfire between 2016 and the end of 2018 was to create, promote and distribute one's own cryptocurrency. As has been described in the past sections, Nakamoto's Bitcoin had not been technically a very challenging proposition for anyone with software development experience. While it would take a long time to replicate complex systems such as Windows, Linux, Oracle's databases or a software suite like Microsoft Office or Adobe Creative Suite, once the cryptocurrency had been invented recreating it was akin to downloading the freely available Lego pieces and putting them together. This and the ease of creating specifically Ethereum-based cryptocurrencies had led to nothing short than a cryptocurrency Big Bang with thousands or tens of thousands of different coins existing during the given period.

85. Shannon Liao, *Twitter Says It Will Stop Cryptocurrency Scams by Removing Manipulative Accounts*, Web Page, 2018, accessed 17 June 2019, `https://www.theverge.com/2018/3/8/17096128/twitter-vitalik-buterin-elon-musk-cryptocurrency-scams`.

As with all things relating to cryptocurrencies, it is impossible to know how many of these coins have seen the light of day or how many of them have been honest attempts at creating something of value. The website CoinMarketCap that tracks prices and volumes of various cryptocurrencies presently lists 2238 different coins.[86] The list is, however, by no means extensive as many of the projects were not listed on cryptocurrency exchanges or have since ceased to exist.

A typical path for such a project would be to create a professional-looking website and publish a "white paper" akin to that uploaded by Nakamoto, wherein the creators would describe in detail what the blockchain seeks to achieve and what the utility of owning its cryptocurrency would be to the investors. Well before the Altcoin boom, the most famous example of this had been the release of Ethereum itself, which added functionality that Bitcoin did not have. More recent projects include the blogging platform SteemIt wherein authors can be rewarded with the steem cryptocurrency, the Basic Attention Token (BAT) used for advertising, and the distributed computing sharing platform Golem. As with Bitcoin, the idea had been that were one to invest in a successful cryptocurrency early, its price appreciation relative to bitcoin would allow one to multiply one's existing cryptocurrency holdings as denominated by more stable cryptocurrencies. To enable investment into one's coin, the authors would conduct an Initial Coin Offering (ICO)—the cryptocurrency world variant of the Initial Public Offering (IPO)—and sell their own coins in exchange for ether or bitcoin. The promise would then be to use the received major cryptocurrencies to fund the development of the project, which in return should increase the value of the coin relative to the said major cryptocurrencies and generate returns for the investors. Those buying the new coin would shop between different projects and act as what one would envision themselves as being a kind of a crypto-venture capitalist.

The problem arises exactly from this venture capitalist mentality. Whereas a typical investment into a venture would create a binding contract between the fund and the startup, preceded by a rigorous due diligence process of vetting the company's prospects and followed by regular revisions of the company's financial information, all of which the fund would report on to its shareholders, this sort of retail crypto-investor venture capital is based on little more than believing that the project's operators are acting in good faith and buying into the marketing. A project could easily claim to be in a partnership with reputable firms as well as having a star team as its originators and none of the crypto-investors would be any wiser as all investments would typically be made in cryptocurrencies themselves. This is not to say that all projects were thinly disguised

86. CoinMarketCap, *All Cryptocurrencies*, Web Page, 2019, accessed 17 June 2019, `https://coinmarketcap.com/all/views/all/`.

fraud, but a substantial number certainly had been. A website dedicated to the topic presently lists at the very least 602 submitted scams.[87] A different automated survey of 3,300 projects by the Wall Street Journal suggested that 513 of the aforementioned projects "showed signs of plagiarism, identity theft and promises of improbable returns".[88] It is unclear how many more unsubmitted scams there had been. It is also unclear how many projects were launched in full knowledge of having no real chance of success from the very beginning but had simply fizzled away rather than being exposed as a scam.

Perhaps the most iconic example of this irrational exuberance of the ICO boom had been the project *BitConnect*. Launching in late 2016, the project claimed to be "a community of like-minded, freedom-loving individuals who, like you, are seeking the possibility of income stability in a very unstable world", following on by stating that it is "not formed to be a company nor financial institution but to function as a collective". The value proposition of BitConnect had been that the users could participate in a "lending platform", which would pool the funds of the participants in order to operate a "trading Bot" and the project's "specialized bitcoin volatility software".[89] If one were to abstract the marketing buzzwords, what BitConnect's operators were alleged to be doing is using an algorithmic trading platform to buy and sell bitcoins given to them by their investors. Whereas algorithmic trading is indeed real, there is no evidence to believe that any such "trading Bot" existed in the case of BitConnect.

As with other projects running Initial Coin Offerings, BitConnect offered its investors to exchange bitcoins for the BitConnect coins (BCC). This in isolation had been no more or less harmful than any other project as the holders of BitConnect coins could buy and sell them at public exchanges at the current market price. The main issue lay in its lending platform and the mythical trading bot. To participate, the user first had to purchase bitcoins from a third party, then deposit them at BitConnect and receive BCCs, after which they could invest a certain dollar amount into the platform depending on the market value of their BCCs. From thereon, BitConnect would lockout the investor from having access to their funds for a specified period. The more the user invested, the shorter the lockout timer would be. Where matters become even more apparent is that BitConnect offered a "guaranteed interest rate" on the investments produced by its trading program, which would vary on the volatility of bitcoin. The investor could further increase their interest rates by either investing a larger sum and referring others to BitConnect.

87. Dead Coins, *Scam*, Web Page, 2019, accessed 17 June 2019, `https://deadcoins.com/?pagenum=1`.

88. Shane Shifflett and Coulter Jones, *A Flood of Questionable Cryptocurrency Offerings*, Web Page, 2019, accessed 18 June 2019, `https://www.wsj.com/graphics/whitepapers/?mod=article_inline`.

89. BitConnect, *Beta BitConnect: Connecting Bitcoiners Worldwide*, Web Page, 2016, accessed 18 June 2019, `https://web.archive.org/web/20161109043336/https://bitconnect.co/`.

Figure 2.4 BitConnect lending program rewards chart as of November 19, 2017. BitConnect, *Investing in BitConnect Lending*.

If any doubt persisted that the entire project had been a Ponzi scheme, none would remain after looking at the returns the platform had promised its investors. In the early days of the program, this rate fluctuated daily between 0.1% and 1% per day, occasionally reaching above 5%. As of November 9, 2016, the 30-day average had been 0.54% and 0.88%. These could be comfortably extended to stay above 1% sustainably by investing more than $10,010. In BitConnect's own words, "up to 40% Per Month" in returns could be generated from the platform, which equates to a 5669.39% compound annual growth rate. To put this into perspective, it would have taken someone in the lowest tier with a modest investment of $1,000, without referrals or daily bonuses, only 5 years, 2 months and 2 days to become the world's first trillionaire. While this may immediately seem absurd, this is a commonly promised interest rate range for successful Ponzi schemes, with the Bitcoin-powered Nigerian variant of MMM promising 30% per month during the same period[90] and Charles Ponzi himself offering 50% after ninety days before shortening the duration to forty-five days.[91]

The pyramid continued as new money was being invested into the scheme until it finally collapsed in January of 2018. The Texas regulators had filed an emergency cease-and-desist order and the operations did indeed cease.[92] By that point, BitConnect had become one of the top twenty coins by market capitalization and held its first and last annual ceremony. Held in Thailand, the proceeding allegedly hosted two thousand guests each of whom had pledged at least $20,000 by July to be able to attend. More verifiable is that the major promoters, that is individuals advertising the platform on Internet

90. Yomi Kazeem, *A Controversial Russian Ponzi Scheme Is Betting on Bitcoin to Relaunch in Nigeria*, Web Page, 2017, accessed 19 June 2019, `https://qz.com/africa/881054/a-controversial-russian-ponzi-scheme-is-betting-on-bitcoin-to-relaunch-in-nigeria/`.

91. Mary Darby, *In Ponzi We Trust*, Web Page, 1998, accessed 19 June 2019, `https://www.smithsonianmag.com/history/in-ponzi-we-trust-64016168/`.

92. Jean Eaglesham and Dave Michaels, *Crypto Craze Drew Them In; Fraud, in Many Cases, Emptied Their Pockets*, Web Page, 2018, accessed 19 June 2019, `https://www.wsj.com/articles/crypto-craze-drew-them-in-fraud-in-many-cases-emptied-their-pockets-11545820200`.

platforms such as YouTube and Reddit, had also been invited and were given a variety of expensive prizes including a Lamborghini sports car. BitConnect announced that it will release a payment card, rained "real money" on the audience and had the winner of *Thailand's Got Talent* do acrobatics on the stage.[93]

Before the Ponzi's end, BitConnect had reached a market capitalization of $2.8 billion.[94] This does not mean that that was the sum stolen from the investors as market capitalizations are largely meaningless in the case of cryptocurrencies as there is not necessarily anyone there to buy the assets. Absent underlying cash flows, there is no intrinsic value to a cryptocurrency and any owner of a private blockchain can increase the market capitalization of their coin simply by creating more coins. This had, in fact, occurred previously as a way of promoting one's cryptocurrency.[95] While this may be of some conciliation, a Wall Street Journal interview of investors who "maxed out their credit cards and invested more than $40,000 in a hot new digital currency [BitConnect coins]" continues to serve as a testament to a number of livelihoods ruined by this and other operations like it.[96]

As with narcotics marketplaces and holding the victims' data at ransom, BitConnect and other scams were neither new nor unique to Bitcoin and other cryptocurrencies. Fraudulent emails disguised as legitimate banking institution communication have been prevalent ever since the Internet and email had entered the mainstream. Various online scams intended to get the user to transfer a certain sum through a remittance provider to criminals living in nations where no recourse would be possible have been equally widespread. Even though spam filters have improved significantly over the past decades, it is unlikely that many readers will not have received an email from alleged Nigerian royalty with a recently deceased parent and in dire need of a trustworthy individual abroad to facilitate the transfer of millions of dollars. Similarly, Ponzi and Multi-Level Marketing (MLM) schemes of various kinds have existed and lured in victims for generations. One can rightly argue that it would be unfair to claim that cryptocurrencies were somehow solely responsible for the above.

Conversely, the existence of cryptocurrencies has made it much easier to commit fraud and escape without consequences. The world will likely never know how many of the ICOs were frauds and how many were merely unrealistic projects by individuals who did not

93. dennisen, *The First BitConnect Annual Ceremony – Thailand*, Web Page, 2017, accessed 19 June 2019, `https://steemit.com/bitconnect/%5C@dennisen/the-first-bitconnect-annual-ceremony-thailand`.

94. Eaglesham and Michaels, *Crypto Craze Drew Them In; Fraud, in Many Cases, Emptied Their Pockets*.

95. Justin Caldwell, *Why Cryptocurrency Market Cap Doesn't Matter*, Web Page, 2019, accessed 19 June 2019, `https://toshitimes.com/why-cryptocurrency-market-cap-doesnt-matter/`.

96. Eaglesham and Michaels, *Crypto Craze Drew Them In; Fraud, in Many Cases, Emptied Their Pockets*.

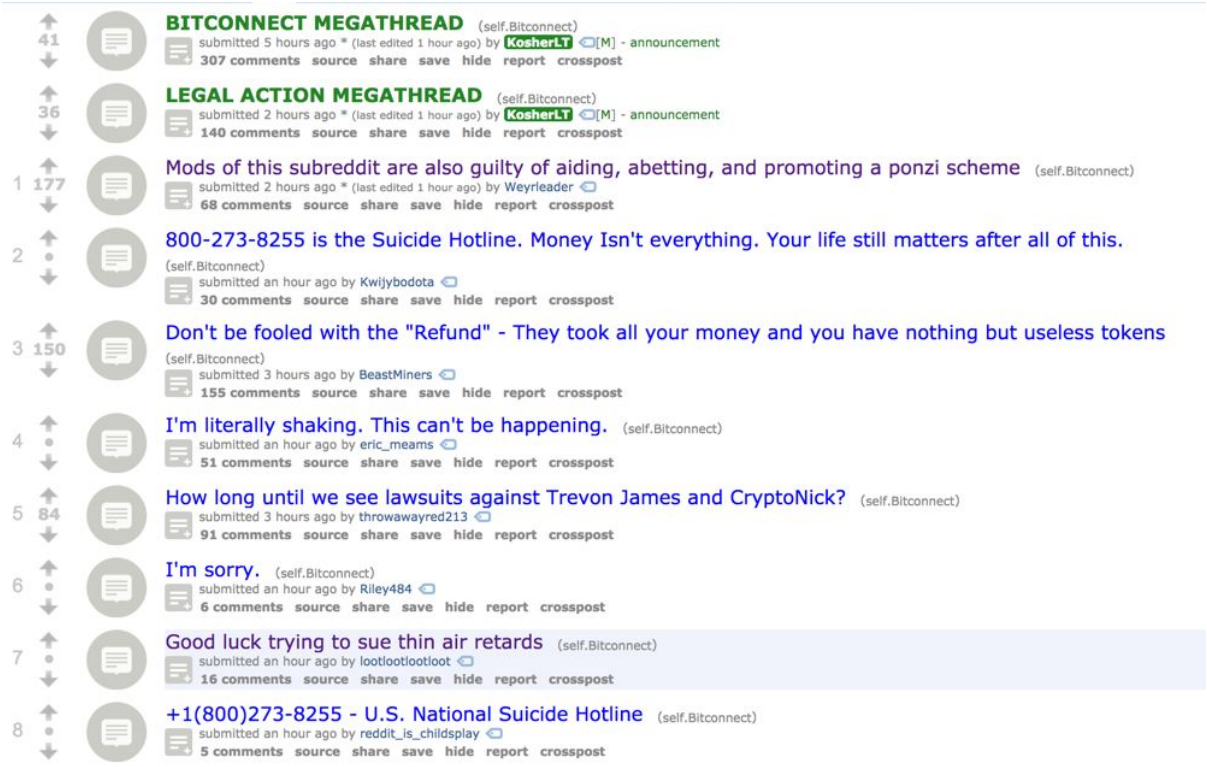

Figure 2.5 Screenshot of the front page of the online community following BitConnect on Reddit advising victims to contact suicide hotlines.

know what they were doing. Given the transnational nature of cryptocurrencies and the ability to successfully conceal one's identity, it is just as likely that it will never be clear how many of the projects even listed the real identities of their founders.

It is the intangible and aspatial nature of cryptocurrencies that have enabled the perpetrators of these schemes to escape unscathed. This would not have been as easy prior to the creation of Bitcoin and is not something the cypherpunks appear to have cared about. The originator of the idea Charles Ponzi had been arrested and incarcerated. Bernie Madoff, who caused $18 billion in losses for the investors in his scheme in the 1990s, is currently serving his prison sentence and will likely perish as an inmate. Even Sergei Mavrodi, the operator of the Ponzi scheme MMM, who had operated in the less-than-stable 1990s Russia had been arrested and served a prison sentence. Mavrodi had repeated the same Ponzi scheme in Russia and then a series of other developing and emerging economies but managed to avoid arrest by operating in different jurisdictions and later by the virtue of dying in 2018.

How many individuals responsible for BitConnect will be identified, to say nothing of arrested, remains to be seen. The alleged head of BitConnect India has been apprehended by the police,[97] but the extent of his involvement, as well as his exact role in

97. CoinTelegraph, "Police Arrest Alleged India Head of Now-Defunct Bitconnect Scam," 2018, `https`

the scheme, remains unknown. In stark contrast to the previous fraudsters, it is quite difficult to follow the money and even more difficult to confiscate the ill-gotten gains. The aforementioned individual may very well serve whatever sentence the Indian courts impose on him, leave the country and spend the rest of his days in luxury well beyond the reach of the authorities. It is not unlikely that his partners in crime are doing this very thing at this very moment. The same cannot be said about Charles Ponzi, who famously died in poverty, or Bernie Madoff, whose last meal will likely be sponsored by the American taxpayer and served with soft plastic cutlery. Sergei Marvrodi's case is less clear, who died as he lived, working hard scamming residents of emerging and developing nations and launching his own cryptocurrencies.

Crypto-bank robbers

Dispropriation naturally does not have to target individuals directly. While it is possible to steal little and make up for it in volume, one can also steal once if one steals a lot. The most iconic example of such single-run, high-return crimes is the bank robbery. These hold a particularly important place in the American culture, where successful robbers would be christened with nicknames and have them known many decades after their demise. This image is strongly present in the Westerns of the 1950s and 1960s and can be found in crime film to this day, not in the least including the popular Oceans Eleven series. What it makes up for in lore and shine, the modern bank robbery lacks in attractiveness. Criminologist Jerry Clark notes that bank robberies had gone from "low-risk, high-reward proposition to just the opposite". Suspects would be apprehended quickly, penalties for threatening violence with a firearm had become harsher and the stolen sums were less than could be made elsewhere. The largest heist had amounted to $52 million in 2014 dollars and as long ago as in 1831, whereas the contemporary average lay at mere $4,000 per heist;[98] a long call from the $320 million extorted by the authors of CryptoLocker.

Unsurprisingly, bank robbery had given way to cybercrime. It does not require one to show their face, is considerably less likely to result in one being shot and, given the lack of threats of violence, carries milder penalties. The Federal Bureau of Investigations estimated that $7.45 billion were lost to cybercrime between 2014 and 2018 with losses growing at an accelerating rate. Given that these crimes result over regular banking channels, the Bureau is able to not only counteract but also affect changes after the

://cointelegraph.com/news/police-arrest-alleged-india-head-of-now-defunct-bitconnect-scam.

98. Alan Farnham, *Bank Robbery a Fading Vocation in Internet Age: A Look Back at the Greats*, Web Page, 2014, accessed 20 June 2019, https://abcnews.go.com/Business/traditional-bank-robbery-decline-back-greats/story?id=23056521.

crime had occurred. The Bureau gives an example victim that wired $56 thousand to a scammer while trying to purchase a house, which resulted in a prompt account freeze and $54 thousand being returned to their rightful owner. In 2018, the Bureau had been able to recover $193 million of $257 million in domestic transfers or approximately three-quarters of the defrauded funds. Given this ability to return funds through the banking institutions, it is not surprising that the vastest majority of these crimes consisted of various types of social engineering and fraud rather than the silver screen equivalent of a bank robbery where hackers break into the server and empty the accounts.[99]

It is the cryptocurrencies that have made this very practice possible. As with the cybercrimes above, it is once again the ability to transfer the funds without the possibility of reversal that enables this practice. Whereas individuals are stolen from by web sites disguised as legitimate exchanges or malware that scans for wallets on their computers, exchanges themselves are robbed through focused attacks akin to the bank robberies of old. While the world will likely never know how much has been stolen on cryptocurrency through the above means from individual users, the publicly exposed nature of the exchanges themselves makes it easy to come up with a very close figure. To date, this tally is at $1.5 billion.

If one were to assume that cryptocurrencies are no longer in their infancy given the vast media attention and the general public awareness of their existence, during the days of the said infancy the belief had been that in the long run problems with crypto-bank robbers would be something that could be solved once the operators of the exchanges become more proficient at managing their clients assets. The problem is that this increase in proficiency does not appear to have had a significant effect on the magnitude of the exchange robberies and what once were losses of merely thousands of dollars are now typically in tens of millions. Outliers to these reach the range of hundreds of millions of dollars and one crypto-robbery that occurred in the not so distant 2018 and has been described "the biggest theft in the history of the world".[100]

Crypto-bank robberies too are only as effective as they are due to the irreversibly of public blockchain transactions. There are too many different methods of obtaining unauthorized access to a computer system to describe here, but in their entirety they can be described as exploiting a vulnerability in the software used by the target, manipulating one of the many employees of the target firm into doing something they should not or, in rarer cases, getting physical access to the computer system. The prevalence of these attacks has led to most larger enterprises conducting some sort of information security

99. Federal Bureau of Investigations, "2018 Internet Crime Report," 2019, `https://pdf.ic3.gov/2018_IC3Report.pdf`.

100. Ledger SAS, *A Timeline of Major Crypto-Exchange Hacks*, Web Page, 2019, accessed 21 June 2019, `https://discover.ledger.com/hackstimeline/`.

training to prevent their employees from opening unverified files, giving away information to unknown callers or opening doors to strangers. Just like with any prevention mechanism, it is only possible to reduce the number of occurrences rather than eliminate them as a whole and some degree of losses must be expected even despite best practices being put in place. The difference between a normal enterprise and a cryptocurrency exchange is that whereas the former may leak sensitive data that may cause financial loss, the latter can put the entire exchange out of business and result in substantial financial losses of their customers. Major losses at exchanges occur with such frequency that it would not make much sense for this author to list the latest one as by the next revision of this book the information would undoubtedly already be outdated.

The earliest of these well-known attacks had also occurred against the earliest of the exchanges. This exchange was known as Mt. Gox and its story is widely known even among those even marginally interested in cryptocurrencies. Contrary to what one may assume from the spelling alone, there were no mountains involved in the original idea behind the exchange. Predating both Bitcoin and the Global Financial Crisis, the website was originally set up by the American programmer Jed McCaleb in 2007 with the purpose of facilitating the exchange of cards used in the online game *Magic the Gathering Online (MtGO)*. Dating back to the early 1990s, Magic the Gathering in its original form has been played with physical collectible cards of varying rarity and different functions within the framework of the game. Still popular to this day, rarer cards can command seizable sums and are regularly bought, sold and traded by players and collectors. MtGO had been an online variant of the game with digital-only cards, but otherwise working on the same principles. McCaleb's idea had been to create an online exchange where cards could be traded by players, adding an X for the word *eXchange* to the game's abbreviated title. The project appeared not to see major developments until McCaleb had found out about the still-nascent Bitcoin and decided to re-purpose his website for trading a virtual currency in place of virtual cards. Eventually, McCaleb felt like he could not devote sufficient attention to the growing platform and sold it to the Tokyo-based French programmer Mark Karpelès.

As Bitcoin grew, so did Mt. Gox continue expanding at a rapid rate as the cryptocurrency's end-all and be-all exchange. The company promptly secured a three-floor office in Shibuya, had a CEO being interviewed by international agencies such as Reuters and even a Bitcoin Cafe that operated on a cash register that Karpelès had hacked himself. The only way seemed to be up, but the company, still branded as a collectible card game exchange, had not seen it a necessity to achieve sufficient standards of operational, legal or technical professionalism. Examples of this are ubiquitous.

Starting with the latter, developers that eventually joined the promising startup

quickly discovered that it had not followed the most rudimentary of the good practices: there had been no version control software to prevent files from being overwritten by other developers, no testing process with new software being released directly on the live system that held the customers' assets and only Karpelès himself could approve these updates, which led to resulting in security problems persisting weeks after they had been addressed by the development team.

On the legal side, Mt. Gox was for all intents and purposes operated in ways inconsistent with the requirements of the international lawmakers. Already by fall of 2013, United States' authorities had seized the company's American bank account for not registering as a money transmitter and a lawsuit from a former business partner had been pending.[101] In Japan where Mt. Gox was headquartered, legal scholar Lenz later argued that Mt. Gox did not have a banking license that it would have required to take the customers' deposits and was thus operating outside of the legal parameters, yet had somehow escaped the eye of the regulators until the very end. It is unclear why Karpelès had been given this degree of leeway when Japanese nationals and foreign residents had not only been persecuted by also received lengthy prison sentences for comparatively minor offenses. At one point, these issues with the United States and an uneasy peace in Japan had resulted in the curious circumstance when Mt. Gox no longer allowed the withdrawal of any currency from its platform except for the Japanese yen. The only way to remove one's funds from the exchange had been to buy bitcoins from Mt. Gox with one's dollar balance and transfer them to one's personal wallet. This led to an exploitable market inefficiency. Lenz documents how one would arbitrage bitcoin by buying it on a different exchange, selling them on Mt. Gox where the high demand for bitcoin as a way of cashing out had created upward price pressure, and finally withdrawing one's now considerably larger yen balance. Rinsed and repeated, this created a cycle similar to the infamous post-*sakoku* arbitrage of the shogunate-mandated gold-silver exchange rate that was differed from the nearby international markets in China. One such dollar-bitcoin-yen cycle resulted in a return rate of over 10%.[102]

On the operational end, the company appears to have been run like a side project rather than a financial firm. When the company was hacked for the first time in 2011 and its website had been taken down, major cryptocurrency figures Jesse Powell and Roger Ver rushed to aid Karpelès with restoring functionality. Whereas Ver had been in Tokyo already, Powell flew in from San Francisco on a moment's notice. Karpelès's response was said to be "nonchalant" and after a week of attempting to address the issues, Powell and Ver were shocked to find out that the CEO had decided to take the weekend

101. Robert McMillan, *The Inside Story of Mt. Gox, Bitcoin's $460 Million Disaster*, Web Page, 2014, accessed 22 June 2019, `https://www.wired.com/2014/03/bitcoin-exchange/`.
102. Lenz, *Japanese Bitcoin Law*.

off. Accounts by former employees suggest that Karpelès did not prioritize the issues the company was facing and instead escaped responsibility by tinkering with computer systems and launching a cafe. The then wealthy Karpelès rather seemed to enjoy his newly acquired fame and the prestige of being the big fish in the yet little pond, which had ultimately led to the demise of his fortune and his firm.[103]

The loss from the 2011 hack is estimated at $30 thousand. When Mt. Gox was hacked for one last time in 2013 the loss had amounted to $460 million or approximately 850 thousand bitcoins.[104] At the peak of 2017, the market value of the said bitcoins was nothing short of $17 billion. When Mt. Gox closed its doors, these 850 thousand bitcoins corresponded to approximately 7% of all bitcoins that had come into existence, including all those lost or presumed loss. If the bitcoin network plays out its course and does mine the final bitcoin at some point in the middle of the twenty-second century, this theft alone would still correspond to 4% of all the bitcoins that can ever possibly exist under the current parameters. Given the present greater distribution of bitcoin across exchanges, custodians and personal wallets, it is quite likely that this will remain the biggest theft of bitcoin in bitcoin-denominated terms as at the time no less than 70% of bitcoin transactions flowed through the platform.[105]

Lenz, a university professor in Japan at the time, describes the events in vivid detail. Mt. Gox suspended withdrawals of both bitcoin and national currencies, ignored all communication and moved out of their office. Heading to a Bitcoin enthusiast gathering, Lenz had come across an Australian man protesting with a sign in front of the Mt. Gox's office. He had flown in attempting to get an answer as to where his money went after being unable to get in touch with Mt. Gox. A week later, Lenz agreed to meet a second protester from London, whom he ended up taking a picture of standing in a snowstorm with a sign reading "MtGox where is our money". Lenz poses the question as to what the attitude of the Japanese Prime Minister would be had a regular Japanese bank suspended withdrawals, refused to communicate with either the depositors or the press, and then quietly closed "all of their branches to hide behind a post box virtual office address".[106] It is this quintessential episode of Bitcoin's history that would later lead to the necessary regulation that influenced much of the Bitcoin's future developments on the archipelago.

Whereas MtGox had finally filed for bankruptcy in 2014, later evidence suggests that the hackers had been slowly stealing bitcoins from Karpelès's wallets since as early as

103. McMillan, *The Inside Story of Mt. Gox, Bitcoin's $460 Million Disaster*.
104. Ledger SAS, *A Timeline of Major Crypto-Exchange Hacks*.
105. Ben Dooley, *Bitcoin Tycoon Who Oversaw Mt. Gox Implosion Gets Suspended Sentence*, Web Page, 2019, accessed 23 June 2019, `https://www.nytimes.com/2019/03/15/business/bitcoin-mt-gox-mark-karpeles-sentence.html`.
106. Lenz, *Japanese Bitcoin Law*.

2011.[107] The operator of the exchange had been arrested in August 2015 and remained in detention for approximately a year. Karpelès was found guilty of falsifying data in March 2019 and sentenced to two-and-a-half years in prison with a four-year suspension. Even to this day, Mt. Gox remains under the stewardship of a trustee. The company still has significant claims against it, but, given the rapid appreciation of bitcoin since the company's bankruptcy, also substantial assets that remained after the company had moved out of its Shibuya office to an undisclosed location.[108]

Although one would have hoped that such a major theft would result in the following exchanges being more prudent with their information security measures and undeniably many of the later participants set up much more professional operations than those conducted by Karpelès and his firm, in the end, the basic problem remained that public blockchain cryptocurrencies such a Bitcoin could be moved out of wallet with little to no recourse available to their rightful owners. Even among the much more mainstream Japanese exchanges that sprung up following regulatory changes and were advertised extensively to the general public, two out of four major players were hacked within the single year of 2018. The lesser of these attacks had been on Zaif, which lost $60 million. While not insignificant Zaif's loss still pales in comparison to the hack of the platform Coincheck that occurred earlier in the year and resulted in a loss of $535 million, thus beating Mt. Gox's record in dollar-denominated terms and resulting in the company being promptly acquired by the brokerage firm Monex.[109]

The only effective policy that customers appear to be able to rely on is insurance provided by a third-party against the loss of assets by the exchange. Given the apparent high risk of operating an exchange, such insurance products are likely to be expensive and lead to considerable costs being passed on to the account holders. While Bitcoin and other cryptocurrencies climb to new heights, the cost of such insurance products may appear entirely acceptable, however, were one to assume that cryptocurrencies at some point reach a level of relative stability, it is not entirely clear how the costs of such a policy should be sustained.

Two further incidents are not strictly crypto-bank robberies, but fall in the same category of crypto-depositors losing their deposits while they are at the bank or the said bank being forced to pay out a portion of their cash under duress.

The first of these occurred in 2017 when masked men kidnapped a Ukrainian exchange employee on the streets of Kyiv and demanded that the exchange pay $1 million in

107. Nathaniel Popper, *Mt. Gox Creditors Seek Trillions Where There Are Only Millions*, Web Page, 2016, accessed 23 June 2019, `https://www.nytimes.com/2016/05/26/business/dealbook/mt-gox-creditors-seek-trillions-where-there-are-only-millions.html`.

108. Dooley, *Bitcoin Tycoon Who Oversaw Mt. Gox Implosion Gets Suspended Sentence.*

109. Ledger SAS, *A Timeline of Major Crypto-Exchange Hacks.*

ransom from their bitcoin holdings. The ransom had been paid and the employee was released, but the obscurity of the cryptocurrency sector had raised some eyebrows as to whether the kidnapping had been real or whether it was an elaborate ruse to steal the depositors' funds.[110] Whatever the case may be, the incident has demonstrated that robbing a cryptocurrency exchange can be done without any extensive programming knowledge and that brute force criminality is not entirely passe.

The second case is perhaps the most bizarre one yet, even among the vibrant world of cryptocurrency crime and operational malaise, and one that may at first appear more akin to a prologue to an adventure film than a real-world event. The exchange in question was called Quadriga and had only filed for bankruptcy in the spring of 2019. Operating from Canada, it followed the similar one-man-on-top principle as Mt. Gox but to an extreme degree. Whereas Karpelès personally supervised every software update while his company was being leeched dry by hackers, Gerald Cotten of Quadriga appears to have wanted to keep his customers' funds particularly safe by not sharing the password to the cold storage wallets even with his colleagues. The plan appears to have backfired when Cotten decided to spend his honeymoon in India. Shortly after arrival, he was admitted to a hospital in the company of his wife with what appeared to be septic shock and died on December 9 of cardiac arrest. By January, the firm reported that it could not return the cryptocurrency it owned to its client as it could not access the wallets. Nobody knew the password to Cotten's laptop.

Unsurprisingly, if some seemed a little suspicious about kidnappings for bitcoin, the story of an exchange operator with no history of severe illnesses dying in a country where falsifying a death certificate is not quite as difficult as in Canada attracted a considerable number of skeptics, not in the least from the rows of individuals who were the customers Quadriga. It is difficult to make a generalized statement with any degree of demonstrable confidence, but surveying varying discussion boards focusing on cryptocurrencies as well as Quadriga's forum on Reddit has left this author with the impression that the overwhelming majority of the observers were no convinced by the story. The consultancy firm Ernst & Young was contracted to audit the firm as law enforcement agencies began their independent investigations. What seemed like a bizarre and somewhat questionable story was turning even more bizarre and questionable with each new piece of news.

Cotten had only been 30 years-old and thus quite young. Like many people his age, he did not have a will. That is until November 27 or less than two weeks before his unfortunate demise. He had given all his financial assets to his new wife, his sailboat to his parents and his Cessna 400 aircraft to his brother. Furthermore, the trip's objective

110. Pavel Polityuk, *Ukraine Kidnappers Free Bitcoin Analyst After $1 Mln Ransom Paid*, Web Page, 2017, accessed 23 June 2019, `https://www.reuters.com/article/us-ukraine-kidnapping/ukraine-kidnappers-free-bitcoin-analyst-after-1-mln-ransom-paid-idUSKBN1EN1QB`.

had not only been to celebrate the newly created bond between Cotten and his wife, but also to officially open an orphanage sponsored by the couple. The ceremony should have included teddy bears and was planned in advance. After his death, his wife emailed the administrator of the orphanage stating that Cotten had passed away and that the ceremony should proceed without him. Quadriga itself had not made a statement to the general public until January 14.[111]

As the investigations continued, even more peculiar facts began to resurface. Cotten's fellow co-founder, nee Omar Dhanani, had been found guilty of credit-and-bank card fraud, operating an online marketplace akin to Silk Road for stolen card numbers, burglary, grand larceny, and computer fraud. After serving his sentence, Dhanani traveled to British Columbia and had his name changed to Omar Patryn. Only five years later, he filed for a second name change from Omar Patryn to Michael Patryn. Changing his social media profile to "fintech advisor and portfolio manager", Dhanani had founded a firm named Fintech Ventures Group as a venture capital company for blockchain startups. Dhanani stated that despite being a co-founder, he had left the firm after a disagreement with Cotten three years prior to his death and no longer had any involvement with the firm.[112]

The story remains an ongoing plot to this day and the reader may want to find out how it ends from a separate source. The most recent development had been that Ernst & Young had succeeded in getting access to Cotten's computer and determined that the wallets with the firm's customer funds had already been empty by the time Cotten allegedly passed away. In the years leading up to his unfortunate demise, Cotten had executed 67 thousand individual transactions with the funds belonging to his customers, trading on the margin with substantial costs and resulting in substantial losses. Furthermore, Cotten had transferred funds to an "overseas exchange" and had been liquidating them over the course of the past years for the equivalent of $60 million.[113]

As mentioned at the beginning of this section, bank robberies have become a thing of the past. They are dangerous both from the point of view of persecution and one's own body. Until the very recent invention and popularization of cryptocurrencies, there had

111. Rohan Abraham, *A Crypto Millionaire, Loose Ends & a Dead End: A Consignment of Teddy Bears Before Gerald Cotten Died*, Web Page, accessed 23 June 2019, `https://economictimes.indiatimes.com/magazines/panache/a-crypto-millionaire-loose-ends-a-dead-end-a-consignment-of-teddy-bears-before-gerald-cotten-died/articleshow/68804401.cms`.

112. Doug Alexander and Matt Robinson, *Criminal Past Haunts Surviving Founder of Troubled Crypto Exchange*, Web Page, 2019, accessed 24 June 2019, `https://www.bloomberg.com/news/articles/2019-03-19/from-fraud-to-fintech-quadriga-co-founder-s-past-crimes-emerge?srnd=cryptocurrencies`.

113. Dough Alexander, *Quadriga Founder Transferred Clients' Cryptocurrency to His Own Personal Accounts, Ernst & Young Finds*, Web Page, 2019, `https://business.financialpost.com/technology/blockchain/quadriga-founder-transferred-clients-cryptocurrency-to-his-own-personal-accounts-ernst-young-finds`.

not been another as iconic a crime. Fortunately for the authors of the news publications and unfortunately for the society as a whole, it appears that this old tradition had again been reborn in a form more fit for the third millennium. With bigger stakes and more elaborate plots, one cannot help but remember the wisdom typically attributed to Mark Twain, whereby the history does not repeat itself but it often rhymes.

2.4 Degrees of moral ambiguity

As the readers of this chapter have undoubtedly noticed, this history of Bitcoin and the other cryptocurrencies emerging from it has been neither chronological nor flattering to its topic matter. The former is due to the fact that Bitcoin's history does not appear to have many developments that can be characterized as being novel to its nature. There has certainly been a significant effort expended on improving the code and the functionality of the networks over the years, but the same can be said of any actively maintained piece of software. It has gone from being an email sent to an obscure mailing list to become an asset the price action of which is reported in major financial publications. Yet despite all this, remarkably little has changed about what the project's means of being used. This makes topical rather than chronological writing of history more suitable, as most new or major events continue to repeat in perpetuity. After Silk Road there had been Silk Road 2, after Mt. Gox there had been Coincheck and undoubtedly after Cotten there will be some even more peculiar case of bitcoins being stolen or lost. If one were to agree that the history of Bitcoin is indeed this very bleak, why is it that the cryptocurrency continued attracting new participants.

The major focus of the financial press has been bitcoin's price and the major legitimate use of Bitcoin has thus been to not use it at all. The price of Laszlo's pizzas at the peak of 2017 had been approximately $200 thousand. No matter how one twists or turns this simple fact, in terms of the time value of money Laszlo would have been undoubtedly better off hoarding rather than consuming his bitcoins. This act of hoarding and to a lesser degree trading of bitcoin has undoubtedly constituted the one major, non-criminal use of the cryptocurrency. One must also emphasize that this process is distinctly different from what is typically described as "saving", wherein national currencies are deposited into a banking institution that reinvests the funds on behalf of the depositor and bears the investment risk. Bitcoin and any of its siblings can be deposited to exchanges to facilitate short selling for other customers, but the standard case is merely keeping the asset stashed away safely. Bitcoin owners are thus indeed very close to owners of physical gold. Given the appreciation rate of the asset in the past decade, it is not surprising that many participants have found this hoarding process to be a very lucrative proposition.

It is also arguably the major reason why the unending barrage of bad news has not detracted bitcoin holders from buying more bitcoins despite being aware of others losing their cryptocurrencies in all manners imaginable. Even if one were to lose bitcoin to the Mt. Gox hack, buying more bitcoin and waiting for the price to appreciate would promptly lead to a net profit. As more new customers invested in bitcoin and past customers added to their stockpiles, the price continued to rise and even more potential buyers were attracted to the cryptocurrency.

A legitimate question can be raised whether this cycle can continue and if so for how long. While not a very good metric, Bitcoin's market capitalization had reached $320 billion in 2017. That is approximately a third of the largest publicly traded enterprises in the world and a twentieth of gold. At some point one would expect this growth to cease as the pool of new participants begins to dry out and those already in the cryptocurrency have invested all their accumulated savings and can only contribute whatever they can save each month. Whilst this point still appears to be somewhat further away, one must wonder what happens once a major catastrophe strikes again and puts considerable selling pressure on the market. At present and in spite of the larger market capitalization, the bitcoin market appears to be shallow and quite fragile. Despite its $135 billion market capitalization in May 2019, a single large sell order of only $40 million had resulted in the price dropping by as much as 9% from $7,726 to $6,777. This had not been prompted by any bad news but appears to have merely been a large bitcoin holder liquidating a part of their position,[114] which raises the question as to how quickly the price would drop down to double or single digits were bitcoin holders indeed to begin liquidating their assets to any seizable degree. Conversely, this same shallow market mechanic can continue inflating the bubble and dramatically increasing the price even by modest quantities of bitcoin being traded at ask prices. As long as bitcoin exchanges continue to occur above the past exchange price, the price will continue rising and so will the unrealized gains of the bitcoin holders, incentivizing further buying. As long as these profits continue to remain largely unrealized, bitcoin's price need not concern itself with either the number of new entrants or the reduced purchases. Every participant can feel like they are getting a great return on their investment despite participating in a strictly zero-sum game.[115] To quote the hedge fund manager David Einhorn: "twice a silly price is not twice as silly; it's still just silly".

While the previous sections and speculation is what Bitcoin's history has been about for most of its holders, there have also been other less ambiguous applications of Bitcoin

114. Oscar Williams-Grut, *A 'Whale' Selling Bitcoin Crashed the Price By $1,000*, Web Page, 2019, accessed 27 June 2019, `https://uk.finance.yahoo.com/news/why-bitcoin-price-crashed-friday-may-17-bitstamp-whale-141622639.html`.

115. Excluding exchange fees.

in its first decade of existence.

One such use case has been the purchase of bitcoin as a hedge against hyperinflation and protection against expropriation in less developed markets. The most prominent example since the network's inception had been Venezuela following the reforms of President Nicolás Maduro and weak oil prices in the second half of the 2010s. Economic malaise and the inability to contain inflation had resulted in the purchasing power of the bolívar dropping by 80,000% per annum at the end of 2018 alone.[116] This corresponds to 1.85% inflation per day or the price of goods and services doubling every thirty-eight days. As with other examples of hyperinflation, this rapidly eroded whatever wealth Venezuelans may have kept in bolívar-denominated cash or bank deposits. At the same time, a large number of publications began publishing stories about bitcoin being used by Venezuelans to protect their savings against the bolívar, which in grim parallel to the German hyperinflation of the 1920s had now been used to decorate trees in public parks with the images of its banknote-printed national heroes.[117]

The problem with most of these reports is that they present a potential large scale use case for bitcoin rather than a practical one. There are two majors constraints. First, bitcoin in its present state has a very limited transaction volume and cannot be practically used by a nation the size of Venezuela even for larger transactions. With a population of 32 million and a theoretical monthly limit of under 20 million transactions on the main chain, it appears unlikely that this usage is very extensive. Even if one were to assume families of four being administered by a single head of the family, who first acquires the cryptocurrency at the end of the month and then use it once for a major transaction such as paying rent or buying a large quantity of food, these two transactions alone would already exhaust almost the entirety of Bitcoin's global network capacity. The assumption that bitcoin can play a significant role in daily life even of a medium-sized nation such as Venezuela is entirely absurd. This issue is further exacerbated by the fact that bitcoins must first be moved to the country in question. There are two mechanisms for doing so: mining and purchasing from current holders. Considering that Venezuela has been facing not only food shortages but also persistent blackouts, it appears unlikely that Venezuelans could bear the costs of and sustain the infrastructure necessary to generate

116. Steve Hanke, *Venezuela's Hyperinflation Hits 80,000% Per Year in 2018*, Web Page, 2019, accessed 27 June 2019, `https://www.forbes.com/sites/stevehanke/2019/01/01/venezuelas-hyperinflation-hits-80000-per-year-in-2018/#29003cad4572`.

117. Kamilia Lahrichi, *Growing Number of Venezuelans Trade Bolivars for Bitcoins to Buy Necessities*, Web Page, 2016, accessed 27 June 2019, `https://www.theguardian.com/technology/2016/dec/16/venezuela-bitcoin-economy-digital-currency-bolivars`. Allen Scott, *Venezuela Will Need a Bigger Chart for Its BTC Trading Volume*, Web Page, 2016, accessed 27 June 2019, `https://news.bitcoin.com/venezuela-chart-btc-trading-volume/`. Joseph Young, *Venezuelans Are Buying Bitcoin to Purchase Basic Goods, Treat Cancer*, Web Page, 2016, accessed 27 June 2019, `https://cointelegraph.com/news/venezuelans-are-buying-bitcoin-to-purchase-basic-goods-treat-cancer`.

bitcoin for domestic use.[118] Purchasing bitcoin from holders abroad appears to be equally difficult. A transaction always involves a buyer and a seller, which in the case of the bitcoin-bolívar pair would mean that somebody would want to exchange their bitcoin for the bolívar. This generates further problems as it means that not only would one need to find a willing buyer of bolívar, but one would also have to somehow evade Venezuelan currency controls and deliver the said bolívar to the bitcoin seller. The alternative to the above is that the Venezuelan purchasing power of bitcoin diverges dramatically from its global rate and creates opportunities for arbitrage. While such arbitrage may not occur during the crisis itself, it will without any doubt lead to significant purchasing power losses of Venezuelan bitcoin holders upon the eventual liberalization of the markets. At this point, one may as well ask if it would not be easier to smuggle the U.S. dollars into the country, which are both stabler than bitcoin and work when the power is out. It appears that just as with every hyperinflation of the recent decades, it is exactly this dollar-denominated black market economy that has been emerging in Venezuela.[119]

Nonetheless one must acknowledge that bitcoins' intangible nature has opened some opportunities to Venezuelans that were riskier in the past. In an opinion piece for the New York Times, economist Carlos Hernández describes how bitcoin has allowed for funds to be smuggled by Venezuelan economic refugees heading to Colombia and transferred back and forth between the refugee and his family members remaining in Venezuela. Dollars can be easily confiscated by the border patrols and presumably just as easily by any criminal gang, whereas whether the traveler in question holds any bitcoins only becomes known once they disclose the fact. Similarly and regardless of the exchange rate problems, the said bitcoins can be moved back and forth both faster and considerably safer between Colombia and Venezuela than dollars or any other banknotes.[120] What is risky in the developed nations is safe in those on their path there.

Another example of Bitcoin being used as a payment system had been in relation to the activist group WikiLeaks. The group's publication of classified cables and video material had resulted in it losing access to its PayPal account. Up until that point, PayPal had been the major source of financing for WikiLeaks and the freezing of funds had greatly affected the group's ability to operate. The situation did not get better from there with WikiLeaks coming under increased pressure from the corporates. Its

118. Mayela Armas and Juan Forero, *Venezuela Plans Electricity Outages to Save Energy*, Web Page, 2016, accessed 27 June 2019, `https://www.wsj.com/articles/venezuela-plans-electricity-outages-to-save-energy-1461276840`.

119. Eyanir Chinea and Maria Ramirez, *Venezuelans Scramble to Survive as Merchants Demand Dollars*, Web Page, 2017, accessed 27 June 2019, `https://www.reuters.com/article/us-venezuela-economy/venezuelans-scramble-to-survive-as-merchants-demand-dollars-idUSKBN1EK0XK`.

120. Carlos Hernández, *Bitcoin Has Saved My Family*, Web Page, 2019, accessed 27 June 2019, `https://www.nytimes.com/2019/02/23/opinion/sunday/venezuela-bitcoin-inflation-cryptocurrencies.html`.

visualization provider was petitioned by an American senator to cease their business relationship with WikiLeaks, the Swiss bank account of the group's figurehead Julian Assange had been frozen and payment providers MasterCard and Visa refused to process transactions.[121] Even its website had come under attack from an unknown source, its domain names were seized by registrars and police, and it could no longer be found in popular search engines.[122] WikiLeaks had been unwillingly exiled from the banking services and had no efficient ways of collecting donations from its supporters across the globe. Lacking a central authority to petition or serve a subpoena, WikiLeaks continued to be financed by through bitcoin donations that were the one lifeline that kept the lights on.[123]

Although WikiLeaks has been one of the earlier and more famous cases of this kind of corporate censorship, it was not the last. More recent examples of controversial websites and media outlets being denied services include several prominent neo-Nazi websites and the conspiracy theorist Alex Jones. Among others, the ethno-nationalist website Stormfront had lost its domain name after its internet registrar refused to provide services to them. Alex Jones had been banned from one of his major platforms on YouTube and Twitter. Both lost access to financial services,[124] and both have already embraced Bitcoin and other cryptocurrencies as a means of funding their operations.[125] Although one may argue that both Alex Jones and webpages such as Stormfront are not comparable with the more widely accepted WikiLeaks, it is this author's contention that there is no fundamental difference within the context of this research. The operation of the Silk Road

121. Roger Huang, *How Bitcoin and WikiLeaks Saved Each Other*, Web Page, 2019, accessed 27 June 2019, https://www.forbes.com/sites/rogerhuang/2019/04/26/how-bitcoin-and-wikileaks-saved-each-other/#3b5ae6e274a5.

122. Yochai Benkler, "WikiLeaks and the PROTECT-IP Act: A New Public-Private Threat to the Internet Commons," *Daedalus* 140, no. 4 (2011): 154–164, ISSN: 00115266, http://www.jstor.org/stable/23046920. WikiLeaks, *More Detail on WikiLeaks.de Suspension*, Web Page, 2009, accessed 27 June 2019, https://wikileaks.org/wiki/More_detail_on_WikiLeaks.de_suspension. WikiLeaks, *WIKILEAKS.INFO Censored by eNom and Demand Media*, Web Page, 2008, accessed 27 June 2019, https://wikileaks.org/wiki/WIKILEAKS.INFO_censored_by_eNom_and_Demand_Media. Danny Sullivan, *Why Wikileaks Will Never Be Closed or Blocked*, Web Page, 2010, accessed 27 June 2019, https://searchengineland.com/why-wikileaks-will-never-be-closed-58226.

123. Huang, *How Bitcoin and WikiLeaks Saved Each Other*.

124. Adi Robertson, *Two Months Ago, the Internet Tried to Banish Nazis. No One Knows if It Worked*, Web Page, 2017, accessed 27 June 2019, https://www.theverge.com/2017/10/9/16446920/internet-ban-nazis-white-supremacist-hosting-providers-charlottesville. Benkler, "WikiLeaks and the PROTECT-IP Act: A New Public-Private Threat to the Internet Commons." Marrian Zhou, *Alex Jones Sues PayPal After InfoWars Banned for 'Hate and Intolerance'*, Web Page, 2018, accessed 27 June 2019, https://www.cnet.com/news/alex-jones-sues-paypal-after-infowars-banned-for-hate-and-intolerance/.

125. Julia Ebner, *The Currency of the Far-Right: Why Neo-Nazis Love Bitcoin*, Web Page, 2018, accessed 27 June 2019, https://www.theguardian.com/commentisfree/2018/jan/24/bitcoin-currency-far-right-neo-nazis-cryptocurrencies. Billy Bambrough, *Alex Jones: The Preposterous Poster Boy for Bitcoin*, Web Page, 2019, accessed 27 June 2019, https://www.forbes.com/sites/billybambrough/2019/02/28/alex-jones-preposterous-poster-boy-for-bitcoin/#78586245281b.

marketplace had been a felony from the very beginning and its operator undoubtedly knew that it was so. Ulbricht was promptly arrested, trialed and imprisoned, and while his supporters continue to advocate that his platform was a net benefit for the society the law presently sees the situation differently. WikiLeaks, Stormfront, and Jones, on the other hand, are controversial enough to warrant being excluded by major corporate service providers, but not strictly illegal and protected by laws governing the freedom of expression. The simple fact of the matter is that over the past two decades the Internet as a whole and major social media platforms have become an indispensable media for propagating ones' ideas, no matter what these ideas are, yet in stark contrast to the public spaces in their traditional sense, it appears to be very easy to deny the said freedom of expression by preventing the controversial figures from accessing the public spaces of today, be they Facebook, YouTube or even one's website. Similarly, it is now more difficult for these controversial speakers to collect donations necessary for their ongoing operations as the audiences they are reaching may be hundreds if not thousands of kilometers away.

Surrendering any cost-benefit analyses and moral judgments to the reader, cryptocurrencies have begun to enable these figures to operate despite the aforementioned sanctions of the corporate world.

2.5 Conclusion

A brief overview of Bitcoin's history was given in this chapter. As mentioned earlier, this overview is a topical one rather than chronological and has largely aimed to underline the aspects of the cryptocurrency in their relation to society as a whole. Omitted were the numerous technological improvements added to Bitcoin throughout the years. While these are undoubtedly of interest to those interested in the technology itself, this author contends that no changes have occurred throughout the period that affected the essential properties of the project. Similarly, only a few mentions were made of alternative or competing public blockchains as these too do not largely affect the predominant motivations behind cryptocurrency participation for the overwhelming majority of users. Undoubtedly, were one to focus solely on the technical developments, the appreciation of cryptocurrencies relative to national currencies and their transition from a one-man project posted online this account could have been written differently. Such an account would however arguably either be distortionary to Bitcoin's history as it has unraveled for the general public or focus on what for all intents is purposes has been a mundane increase in the price of bitcoin. No lack of such literature containing such accounts exists.

Whereas Bitcoin only appeared in 2008, its origins date back to the earlier days of the

Internet and a group of ideologically-minded individuals, who rightly saw the Internet as a major new frontier. Inspired by science fiction literature of a particularly dystopian variety, these individuals envisioned the network as more than just a tool for sending emails but rather a new space of existence, the freedoms of which were not yet defined and would need to be protected. It was apparent to them that centralized authorities, be they states or enterprises, would encroach on these freedoms. They sought to utilize strong encryption to ensure guaranteed privacy rather than one merely granted by another. For better or for worse, these individuals could collectively be described as exhibiting little interest in issues such as national security or criminal prosecution, if it meant that these would come at cost of the said privacy.

Nakamoto integrated these principles and expanded this new immaterial space by allowing not only a private exchange of information but also property rights that were independent of any authority but the consensus of the majority of the network participants as expressed by their collective hashing power. This opened new possibilities within the space as one could now transact by exchanging an intangible asset of the Internet for other intangible assets or use it to pay for goods and services. It created an economy existing exclusively on the network itself and only connected to the non-cyberspace world in as far as its participants wished for it to be so. Nakamoto argued that previous attempts at creating such electronic cash had failed because they were centralized and rectified this problem by creating a ledger that everybody would always have the most recent copy of stored directly on their computer.[126]

As mentioned previously, this author does not believe that Nakamoto had been entirely correct in his assessment. It is true that Bitcoin's nature makes it immune to disappearing entirely as long as someone somewhere is interested in running a full wallet program. This is indeed dramatically different from previous electronic cash attempts that were operated by for-profit enterprises with employees that needed to be paid and shareholders to reported to. In this sense, Bitcoin is much more resilient than any company or any national or supranational governing body in existence today. As long as the Internet exists, Bitcoin or some variation thereof will likely exist with it. Nonetheless, if one was to assume that the goal of electronic cash is not merely to exist but to proliferate, it appears very unlikely that it is the privacy or the decentralization that has led an obscure project to become an international phenomenon. Rather, it is the limited number of bitcoins that can ever exist and their heavily-regimented creation process. Whereas previous electronic cash attempts were inconvenient ways of paying with U.S. dollars, Bitcoin was an inconvenient way of converting the same U.S. dollars into something that could be worth more tomorrow than it is today. While there is certainly a group of indi-

126. This was later changed as new methods of accessing the Bitcoin network were introduced.

viduals who are genuinely interested in the ideological aspects of Bitcoin—and perhaps a much larger group that merely uses the said ideology to justify speculative behaviors—it does not appear likely that this group was particularly important past the early stages of the project. One will find very few mainstream press articles that discuss the virtues of Bitcoin's pseudonymity or refer to Internet freedoms. Conversely, very many articles discussed its latest price developments. There is no specific year that can be attached to this change from ideology to speculation as it appears to have been a gradual transition as awareness of the cryptocurrency had increased.

For the vastest majority of the population, Bitcoin does not appear to have offered an attractive value proposition. This is unsurprising if one merely examines its basic characteristics and the problems that can result therefrom. To many Bitcoin enthusiasts, merely describing these inherent attributes as "problems" is in itself a sign of the speaker lacking some deeper level of understanding of these attributes' importance or their holistic value. In information technology and programmer parlance, this is often described by the comedic retort "it is not a bug, it is a feature", meaning that what the user perceives to be a mistake or a problem is an allegedly intended attribute of the program misunderstood by the user. In this sense, cryptocurrencies appear to be very feature-rich applications that have on multiple occasions resulted in nothing short of a dramatic loss of funds for their users. These range from anything as mundane as a piece of malware irreversibly transferring one's savings away to targeted attacks on de facto Bitcoin banking institutions to newer and more efficient ways of scamming unwary denizens of the Internet. The same issues that plagued centralized electronic cash attempts, with a lack of adoption being the most predominant one, continue to plague decentralized electronic cash. They are further exasperated by the cryptocurrencies' other factors such as poor usability, continuous reliance on Internet connectivity, slow transaction speeds, the volatility of purchasing power and putting the responsibility of securing one's coins on the owners themselves. None of these are attributes that are particularly attractive to most Americans, Europeans or Japanese if the only thing one receives in exchange is some higher degree of privacy. This is apparent not only by the lack of adoption of cryptocurrencies as a means or method of payment despite the high public awareness of their existence, but also by the fact that other projects that required users to put effort into achieving greater privacy, such public-key encryption in email, also lack any kind of notable adoption. The privacy-enhancing measures that have been added to popular and successful applications, be that end-to-end encryption on the messaging application WhatsApp or the proliferation of secure HTTP were included in the background presenting no or minimal inertia for the users themselves. Bitcoin is not one of such projects.

This is however not to say that there are no use cases. While Bitcoin as a payment

mechanism is nothing short of being an utter failure, its speculative market mechanism and the absence of regulation have been very attractive even in the face of the apparent inconvenience and risks. Stories of "Bitcoin millionaires" created a new gold rush that continues to this day and presents ample opportunities to sell shovels, be those cryptocurrency exchanges, hardware wallets, mining computers or even consultancy services.

The other side of cryptocurrencies is that they do in fact provide a decentralized payment mechanism for those who need it. A remittance provider is not as convenient or secure as a bank wire, but convenience and security is not a luxury one can afford when operating outside of the banking system or outside of law itself. Bitcoin falls squarely in the very category. It has undoubtedly been a great boon to those excluded by the financial system or in some shape or form persecuted by the government, be they whistleblowers or ethno-nationalists. Affording such an ability to transact is the original intention of the cypherpunk movement and undoubtedly another success to be added to their list of accomplishments. Nonetheless, as with other cypherpunk-inspired projects such as the dark web, for the periods when studies of network activity were conducted and given a qualitative analysis of news sources, it appears that these intended users were compensated for by a significantly larger number of inevitable users engaging in all manners of criminal enterprise. The project's first major use case was a narcotics bazaar selling everything from prescription drugs to methamphetamine to opioids. While there are still individuals who would argue about the net benefit of the above market place, fewer would argue in favor of ransomware programs that have accepted cryptocurrencies with open arms and arguably became a much more lucrative enterprise as a result thereof. Non-strategic cyberattacks conducted with strictly monetary goals have begun gaining momentum as online vaults housing cryptocurrencies continued their spread.

In conclusion, Bitcoin was a project with a history much longer and a school of thought older than the days of the Global Financial Crisis it emerged from. Compared to its predecessors, it has been an incredible success by allowing for easy speculation with unprecedented returns. These profits, often unrealized, have subsided between the peek of 2017 and the spring of 2019, but it is not the first time this has taken place and there is no reason that the speculative frenzy cannot continue for any number of cycles hereafter. Conversely, the project has thus far failed as a means or medium of payment not in the least because it was never well-designed to be one in the first place. Up until this point, it has largely been of interest to only a small segment of the overall population that are either operating outside the law or are socially stigmatized.

Chapter 3

Japanese securities landscape

3.1 Scope of research

This chapter examines the development and the present state of the Japanese securities landscape with a particular emphasis on the individual retail investor perspective. To specify the group in question that is the most pertinent to this research individual investors are to be distinguished from institutional investors. As the name suggests, an individual investor is an individual or a household, whereas an institutional investor is a firm. Typical examples of the latter include insurance firms, banks and investment funds of all flags and colors, be they mutual funds, hedge funds, pension funds or even sovereign wealth funds. Operated by professionals with both expertise and experience, dealing with by and large greater investment volumes and bound by contractual and legal regulations, institutional investors offer only limited comparability to an individual managing their household's finances. These firms lie outside of the scope of this research.

Investors can be further separated into two or more groups based on the size of their capital and their yearly income. There is no unified classification and research by the University of Nottingham shows that financial literature offers several different classifications with varying degrees of granularity. While the everyday distinction among "the rich" is that between millionaires, multimillionaires, and billionaires, the general trend among industry insiders appears to begin a separation around the $100,000 mark at which point an individual is considered to be "affluent". The individual's primary residence and any collectibles they may hold are not included to determine whether they qualify for this category as these do not constitute the so-called financial assets. Using the categorization of both PricewaterhouseCoopers' and Merrill Lynch Capgemini, an individual with a capital of $1 million or greater is distinguished from affluent individuals as a high-net-worth individual (HNWI). The next milestone is $30 to 50 million at which point the individual is considered to be an ultra-high-net-worth individual (UHNWI). Having

surpassed that threshold, typically no further distinctions are made. UHNWIs constituted approximately 1% of all HNWIs and this relation remained constant throughout the 2000s. The study notes that although globally the ultra-high-net-worth individuals "represented 0.9% of the population of HNWIs (78,000)", they "accounted for 35% of the total value of private wealth".[1]

Table 3.1 Example of wealth strata classification for 2017 as described by Nomura Research Institute. From Nomura Research Institute, *Nihon No Fuyūsō Wa 127 Man Setai, Jun Kin'yū Shisan Sōgaku Wa 299 Chō-En to Suikei.*

Group	Financial assets	Households	Group assets
Chōfuyūsō	>¥500 million	84 thousand	¥84 trillion
Fuyūsō	¥100-500 million	1,183 thousand	¥215 trillion
Junfuyūsō	¥50-100 million	3,222 thousand	¥247 trillion
Upper masusō	¥30-50 million	7,203 thousand	¥320 trillion
Masusō	<¥30 million	42,031 thousand	¥673 trillion

The distinction between the average retail investor and a high-net-worth individual is important on several levels. First, HNWIs constitute only a small portion of the population and despite owning a considerable portion of the existing private wealth are thus not representative of the average Japanese investor. For example, the Nomura Research Institute has found the children who have described their parents as wealthier than average demonstrated superior financial literacy and knowledge of the financial news and interest rates than the individuals whose parents were believed to be living beneath average. This finding remained consistent across the sexes.[2] Additionally, individuals with financial assets typically above ¥100 million qualify for financial services inaccessible to the average saver. Most importantly, these constitute asset management services such as private banking, funds with lower regulatory oversight and family offices at the extreme end. Lastly, individuals with particularly high wealth are affected by adverse trading conditions such a slippage, wherein purchasing or selling an asset—particularly one with a market as shallow as that of cryptocurrencies—could significantly shift the price of the asset through the act of trading it itself.

This study is exclusively about the relationship to Bitcoin and other cryptocurrencies of an average Japanese retail investor, a member of the *masusō*, rather than accredited investors such as institutions and the wealthy *fuyūsō*.

1. Jonathan V. Beaverstock, Sarah Hall, and Thomas Wainwright, "Scoping the Private Wealth Management of the High Net Worth and Mass Affluent Markets in the United Kingdom's Financial Services Industry," in *Final Report, May.* (2010), `http://www.nottingham.ac.uk/business/forum`.

2. Nomura Research Institute, *Nihon No Fuyūsō Wa 127 Man Setai, Jun Kin'yū Shisan Sōgaku Wa 299 Chō-En to Suikei* [Japan's Wealthy: 1.27 Million Households With Total Net Financial Assets Estimated at 299 Trillion Yen], Web Page, 2019, `http://www.nri.com/jp/news/newsrelease/lst/2018/cc/1218_1`.

3.2 A brief history

3.2.1 Tokugawa to recent times

Historical literature classifies Japan as a late industrializer. Its transition into modernity, whatever its meaning may be, is traditionally argued to have begun following the arrival of Commodore Perry's black ships in 1853, the resulting conclusion of two hundred years of the *sakoku* period of seclusion and the eventual 1868 Meiji Restoration. Japan's military government had come to a close with the emperor as its new leader reorganizing the nation according to the Western ideas not in the least to hasten its withdrawal from the unequal treaties that established extraterritorial zones within its borders and considerably limited the nation's tariff autonomy. Within five years of seizing the rule, the imperial government had reformed Japan's education system, its military, switched from the Chinese lunisolar calendar to the Gregorian and built the nation's first railway from Shimbashi to Yokohama. Later developments followed equally rapidly, including the introduction of the new civil code based on the German draft and the nation's first constitution.

Pre-Meiji

Japan first modern stock market had been opened in Tokyo in May 1878 with trading beginning on June 1 of the same year.[3] This may appear to be considerably late compared to its Euro-American counterparts, such as the exchanges in Frankfurt and New York founded in 1585 and 1792 respectively,[4] but while a late to industrialize Japan had by no means been late to finance and was one of the first major markets to develop futures trading.

At the end of the Warring States period, the *daimyō* Toyotomi Hideyoshi initiated two important economic processes: a nationwide census and a land survey.[5] The later clarified the property rights to land and established a new *kokudaka* system, whereby plots were classified based on their agricultural yield.[6] This established a formalized basis for taxation with a portion of harvested rice constituting the tax payment to the local feudal lord. Some of the rice would then be passed on from the daimyō to his warriors as wages. After whatever rice had been consumed, the remainder would be sent to the

3. Junichi Ujiie, *Japanese Financial Markets* (Elsevier Science, 2002), ISBN: 9781855738751.

4. Deutsche Börse Group, *History of the Frankfurt Stock Exchange*, Web Page, 2019, accessed 25 July 2019, `https://www.deutsche-boerse.com/dbg-en/our-company/frankfurt-stock-exchange/history-of-the-frankfurt-stock-exchange`. Business Reference Services, *History of the New York Stock Exchange*.

5. Daimyō—Japanese feudal lord.

6. Dirk G. Baur and Brian M. Lucey, "Is Gold a Hedge or a Safe Haven? An Analysis of Stocks, Bonds and Gold," *Financial Review* 45, no. 2 (2010): 217–229, ISSN: 0732-8516.

daimyō's warehouse in Osaka to be sold. A similar process occurred within the farming class whereby rice was sold directly a local market.[7]

This centralization of rice trade at Osaka's market promptly resulted in more complex financial relationships than that of direct exchange between a rice buyer and a rice seller. In her investigation of the Osaka rice market, Ulrike Schaede notes that the daimyō promptly began working with the city's money changers who began providing credit in exchange for future deliveries of rice. Although rice did not constitute money by its modern definition, not in the least due to its perishable nature, its homogeneous nature allowed for the establishment of a commodity market at Dōjima.

A system of property bills developed for rice stored in the daimyō's warehouses. Traded obligations were originally for short-term delivery of goods with one bill corresponding to approximately 1.5 tons of rice[8], but already by 1700 maturities were extended up to 18 months. As time went on, standardization of contracts advanced, clearinghouses appeared as separate institutions and a secondary market for rice bills began to develop. The bills were divided into several types, such as "delivery bills" that were backed with rice to be sold immediately at delivery and "monk bills" that were not backed by rice in stock. Interest paying bills recording credit extended to the warehouse also appeared, as did the ability to trade on a margin by paying between 5 and 30 percent of the price in advance. A smaller market was developed in Edo[9] catering to the geographically distant daimyō that were exporting rice from their provinces in northern parts of Japan, but never reached the size or the complexity of the Osaka market. Schaede notes that the Osaka rice market displayed the necessary characteristics to qualify under the modern definition of a futures market,[10] thus constituting the precursor to the later financial markets. Even after the centralization of power in Tokyo, the Osaka Securities Exchange remained the largest futures exchange in Japan throughout the twentieth century until a merger with Tokyo Stock Exchange in 2012.

Meiji to Postwar

The rice trade in Osaka and the practices associated with it played no small in the westernization process of the Japanese markets. Describing the development of the securities law in Japan, Mark Happe notes that already eight years following the assumption of

7. Ulrike Schaede, "Forwards and Futures in Tokugawa-Period Japan:A New Perspective on the Dōjima Rice Market," *Journal of Bankings & Finance* 13, no. 4 (1989): 487–513, ISSN: 0378-4266, doi:https://doi.org/10.1016/0378-4266(89)90028-9, http://www.sciencedirect.com/science/article/pii/0378426689900289.

8. 10 koku.

9. Tokyo.

10. Schaede, "Forwards and Futures in Tokugawa-Period Japan:A New Perspective on the Dōjima Rice Market."

power, the Meiji government introduced the London Stock Exchange Rules translated into Japanese as the 1874 Stock Transfer Ordinance. One of the goals of the said legislature was the reduction of speculative behavior that characterized the arbitrage transactions in the Dōjima market. Although the text was largely aimed at equities, the bulk of the Japanese financial transactions at this point were still speculation on the price of rice. Four years later in 1878, the Meiji government put in effect the Stock Exchange Ordinance that superseded the previous ordinance and lead to the establishment of the exchanges first in Tokyo and two months later Osaka. In 1893, the exchanges themselves became a publicly traded companies following the adoption of the Exchange Law.[11]

The trading at the Tokyo exchange is said to have continued largely uninterrupted until August 1945.[12] Nonetheless, the exchange building itself had burnt down along with the rest of the newly-established business center in the Kabuto-chō district as a consequence of the devastating Great Kanto Earthquake of 1923. The problems appeared to be not only cataclysmic in nature though. Even though the stock exchange was one of the many reforms to drive the modernization of Japan, capital markets financing played only a subordinate role to the conglomerate-internal financing of the *zaibatsu* corporations that dominated large swathes of the Japanese economy. The participation of individual investors remained limited.[13] In June 1943, eleven of the Japanese stock exchanges were merged into a semi-governmental joint-stock company under the new Securities Exchange Act to stabilize the price of securities.[14]

Trading had been suspended for the first time on a prologued basis following the defeat of Japan at the end of the Second World War. On September 25, 1945, the Office of the Supreme Commander of the Allied Powers issued a short memorandum to the imperial government reading merely "You will not permit the opening or reopening of any Stock Exchange, Commodity Exchange or similar institution without prior submission to and approval by the Supreme Commander of the plan of operation of such institution".[15] The Tokyo Stock Exchange building was then declared the General Headquarters of the Allied forces in Japan. No permission to reopen trading had been granted before May 11, 1949, when a new memorandum rescinded the previous order and specified that the exchanges in Tokyo, Osaka, and Nagoya may be reopened on May 14, 1949.[16] Being a Saturday,

11. Mark J. Happe, "Inside the Japanese Stock Market: An Assessment," 5 (1989): 87. Pages 99–105.

12. Nikko Research Center, *Nihon Keizai to Shihonshijo: Kigyō to Tōshi-Ka No Gabanansu Ga Motarasu Henka* [Japanese Economy and the Capital Markets: Changes in Corporate and Investor Governance] (Tōyō Keizai Shinpōsha, 2016), ISBN: 9784492654767. Page 17.

13. Happe, "Inside the Japanese Stock Market: An Assessment" Pages 99–105.

14. Japan Exchange Group, "History," 2019, `https://www.jpx.co.jp/english/corporate/about-jpx/history/01-03.html`. Happe, "Inside the Japanese Stock Market: An Assessment" Pages 99–105.

15. Office of the Supreme Commander for the Allied Powers, *SCAPIN-59: SECURITIES EXCHANGES 1945/09/25*, Government Document, September 1945.

16. Office of the Supreme Commander for the Allied Powers, *SCAPIN-2004: SECURITIES EX-*

the trading resumed two days later on May 16, 1949.[17] Notably, the suspension of the exchange operations had not extended to over-the-counter (OTC) trading of financial instruments that resumed shortly after the end of the war in the same Kabuto-chō district that housed the exchange itself.[18]

1949–1955

Once the stock exchanges had been reopened, they remained operational until the present day. A total of fifteen business cycles had concluded from that point onward. The latest one to date had begun in 2012 and constitutes the sixteenth. Until recently, the Izanagi was the fourteenth and the longest of these cycles. It began with the post-Dot-Com recovery in 2002 and ended with the subprime crisis in 2009. It has since been surpassed in length by the current Abenomics boom, which in itself is not surprising as the present post-Global Financial Crisis recovery has been both long and slow not only in Japan but also in the United States and other major markets. Monetary historian Michael Bordo argues that this is not uncommon specifically in the case of financial crises as opposed to run-of-the-mill recessions due to depth of the contraction caused by such an event.[19]

Returning to 1949, immediately after the exchanges had been reopened, the bulk of Japanese equities had found a new home in a place they would not return to again: the hands of the households. This is less so due to some postwar change of heart of the said investors, but rather because the equities were acquired from no one other than the General Headquarters. In his work on the Allied Occupation of Japan, historian John Dower describes the influence the New Deal reforms of the Roosevelt administration had on the American reformers of the new Japan, noting that "the bedrock principles of democratization espoused by the New Dealers contained a strong component of economic democracy, which in practical terms meant the active encouragement of organized labor, opposition to excessive concentrations of economic power, and policies aimed at ensuring a more equitable distribution of wealth".[20] One of the more prominent aspects of this economic democratization had been the much-discussed land reform that reduced the size of plots landlords were permitted to own, forcing them to indirectly sell the land to their tenants through a mandatory governmental purchase and resale program. The other aspect had been the partial dissolution of the zaibatsu conglomerates that, while imperfect, lead to a de-concentration of economic power in Japan.

CHANGES 1949/05/11, Government Document, May 1949.

17. Nikko Research Center, *Nihon Keizai to Shihonshijo*.

18. Japan Exchange Group, "History."

19. M. C. K., *Is the Slow Recovery Unusual?*, Web Page, 2012, accessed 11 February 2019, `https://www.economist.com/free-exchange/2012/10/15/is-the-slow-recovery-unusual`.

20. John W. Dower, *Embracing Defeat: Japan in the Wake of World War II* (WW Norton & Company, 2000), ISBN: 0393345246.

The Occupation authorities saw the family-owned conglomerates as incompatible with the new vision for Japan due to their ideological tilt as well as due to, so argues economic historian Takafusa Nakamura, the feudal image of Japan that had been perpetuated by E. Herbert Norman's book *Japan's Emergence as a Modern State*. Prior to their dissolution, the holding companies of the four major zaibatsu[21] alone had controlled as much as close to a quarter of all authorized stock in Japan.[22] As a result, a process led by the GHQ's Securities Coordinating Liquidating Committee[23] had turned workers into shareholders by awarding them shares of the companies they had worked in, just as the land reform had turned tenants farmers into landowners of the fields they labored in. By 1949, individual investors held as much as 70% of the Japanese corporate equity.[24]

This state of affairs had not persisted very long. Despite the fact that financial institutions as the core of the former zaibatsu conglomerates were now burdened with antitrust legislation that limited the number of shares they were permitted to hold, the reopening of the exchanges had quickly led to an outflow of shareholder equity from the individual investors towards financials and corporates. This had been in no small part due to the harsh conditions of the postwar manifesting themselves in shortages of food, the consequent appearance of black markets, unemployment, and inflation, that Dower referred to as "enduring the unendurable" from the Emperor's capitulation speech.[25]

Another perspective worth raising is that the first year of Japanese equity ownership can be described as the polar opposite of that experienced by American retail investors in the stock market rally leading up to the crash of 1929. While the latter notoriously attracted large swathes of buyers lacking any meaningful financial literacy—the prominent example being a shoeshine boy discussing stocks—the former would have had the same effect on the newly-minted sellers. In 1949, the Tokyo Stock Exchange opened with 681 listings and the Nikkei at ¥176.21. As a result of the Dodge Line counter-inflationary measures, which consisted chiefly of balancing the fiscal budget, eliminating subsidies to domestic firms and monetary tightening through a prohibition of new loans issued by the Reconstruction Finance Bank, that valuation had been reduced to ¥85.25 by July 1950.[26] Both the Occupation and the Japanese government were facing a serious risk of companies starved of funds failing one after another.[27] Given the already difficult living conditions of the immediate postwar, this had led to an unsurprising sell-off on behalf of

21. Mitsui, Mitsubishi, Sumitomo, and Yatsuda.
22. Takafusa Nakamura, *Lectures on Modern Japanese Economic History: 1926-1994* (LTCB International Library Foundation, 1994), ISBN: 9784924971004. Page 137.
23. Originally: 証券処理調整協議.
24. Nikko Research Center, *Nihon Keizai to Shihonshijo*. Pages 55–57.
25. Dower, *Embracing Defeat: Japan in the Wake of World War II*. Pages 97–104.
26. Nikko Research Center, *Nihon Keizai to Shihonshijo*. Page 19.
27. Nakamura, *Lectures on Modern Japanese Economic History: 1926-1994*. Pages 160–164.

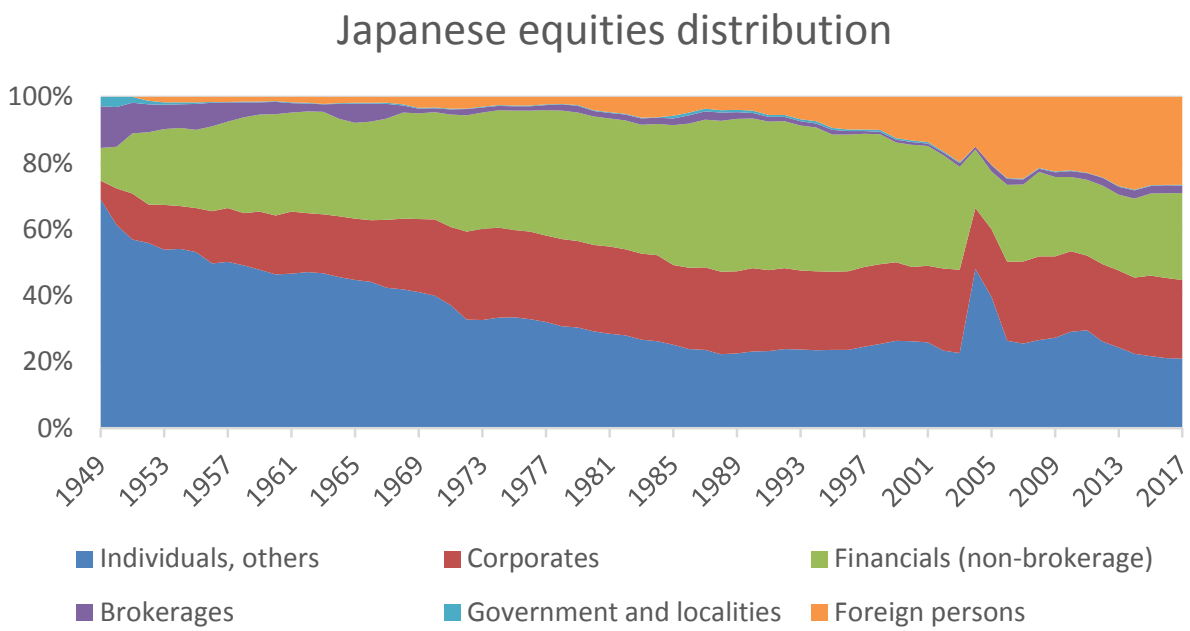

Figure 3.1 Japanese equity distribution. The spike in the early 2000s is distortion caused by the LiveDoor scandal. Data: The Japan Institute for Labour Policy and Training. The Japan Institute for Labour Policy and Training, *Distribution of Japanese Equities*.

the retail investors that, while subdued, persisted through the following decades.

Even before the stock market hit its first postwar bottom, the outbreak of the Korean War on June 25, 1950 had already paved the way for the postwar recovery. The "Gifts from the Gods" consisted of two major categories that substituted for the contemporaneous lack of Japanese exports and an abundance of imports from the United States. These were the spending of the United States military personnel stationed in Japan and the so-called Special Procurement Orders of the Department of Defense. For the total five year period, these corresponded to $974,607 and $644,129 respectively.[28] The importance of these personnel spendings and military procurements are best characterized by the 1954 Japanese annual of the Institute of World Economy:

It is here that the unstable character of Japan's international balance of payments becomes apparent. Assuming for a moment that these temporary receipts were to disappear, the present dollar reserves amounting to 700 million dollars will in all probability be spent within one year at the most, in consequence of which foreign trade, industrial production and the standard of national consumption, indeed the economic circulation as a whole, will undergo a serious contraction and may seal the very fate of the country's economy.[29]

Dower vividly describes the immediate postwar transformation of the Japanese economy, wherein "sword makers began producing kitchen cutlery. Steel helmets were con-

28. Nakamura, *Lectures on Modern Japanese Economic History: 1926-1994*. Page 166.
29. Institute of World Economy, "The Japan Annual," *The Japan Annual*, 1954, Page 184–188.

verted into cooking pots. A former manufacturer of machine guns redesigned its plant to turn out sewing machines."[30] By 1952, the Occupation authorities partially lifted the ban on the production of military goods in potential anticipation of a full-scale war with the Soviet Union. By 1953, trucks, automotive parts and various kinds of textiles that dominated the Special Procurement Orders by value were instantly superseded by the expediently resuscitated armaments industry.[31]

By February 1953, the Nikkei reached ¥473.43. The rally, however, came to an abrupt at when on March 4 the news of Stalin's grave condition had reached the international markets. The ensuing sell-off of munition stocks dragged the index down 10% in a single day and constituted the fourth largest sell-off in the postwar history.[32]

Already as of June 1951, the Act on Investment Trusts and Investment Corporations had been ratified, allowing for the establishment and operation of the [33] eponymous companies. The new law aimed to create an easily accessible vehicle for investment into the Japanese enterprises that would allow domestic retail investors to transfer a portion of their savings towards much-needed productivity growth. Although one may have assumed that the Occupation era legislation would have borrowed heavily from the American Investment Company Act of 1940, the Japanese law allowed only for a peculiar fund structure known as the "unit-type investment fund"[34]. Under this structure, the fund would sell its shares at a specified price for an investment period of one month after which no further shares would be sold. The fund would then keep the capital as assets under management for the ensuing and comparatively short period of two years.

In 1954 and later in 1956, the length of these funds operation had been extended to three and five years respectively. In 1952, it also became possible to establish funds that allowed for the investment of additional capital into an existing fund past its initial offering period known as "additional investment funds"[35]. Despite this, the unit-type investment fund remained the most widely sold investment fund until the burst of the asset price bubble in the 1990s.[36]

1956–1972

In the years of 1955 to 1956, Japan had reached several important milestones. It joined the United Nations, normalized its relations with the Soviet Union, surpassed the pre-

30. Dower, *Embracing Defeat: Japan in the Wake of World War II*. Page 168.
31. Nakamura, *Lectures on Modern Japanese Economic History: 1926-1994*. Pages 167–169.
32. Nikko Research Center, *Nihon Keizai to Shihonshijo*. Page 20.
33. ibid. Page 20. *Shōken tōshishintaku hō*. Japanese: 証券投資信託法.
34. *Tan'igata kabushiki tōshi fando*. Japanese: 単位型株式投資ファンド.
35. *Tsuikagata fando*. Japanese: 追加型ファンド.
36. Kouji Sugita, "Hossoku Kara Man 60 Nen O Mukaeru Nihon No Tōshi Shintaku" [Japan's Investment Trusts Are 60 Years Old], 2011, Page 6.

Occupation industrial production peak[37] and saw the spread of the catchphrase "it is not postwar anymore" (*mohaya sengo dewa nai*).[38] Introduction of new technology played a crucial role in a sway from exporting labor-intensive goods to those requiring high levels of capital expenditure. This aspect of the post-Occupation era is particularly visible in the Japanese export structure, wherein the share of the foodstuffs continued its decline. The previously important textile industry followed a similar path after a brief peak in 1954.[39] In the period of 1956 to 1972, Japanese firms had signed no fewer than 176,000 foreign licensing agreements centered around the fields of electrical machinery and chemical industry, including pharmaceuticals and synthetic fibers. These technologies were chiefly imported from the United States.[40]

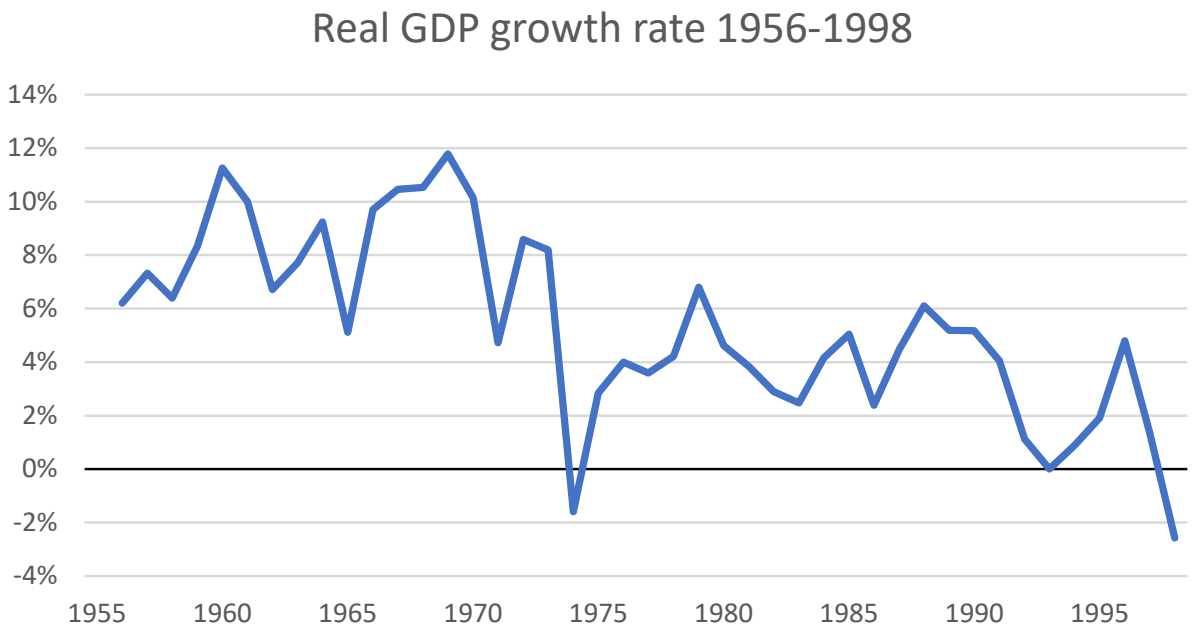

Figure 3.2 Real gross domestic product growth rate for Japan, 1956–1998. Data: Bureau of Statistics, *3-5 Gross Domestic Product and Factor Income Classified by Economic Activities.*

The steady growth of Japanese equities from 1954 onward that had already been named after the mythical emperor Jinmu came to a brief pause with the eruption of the Second Arab-Israeli War in October 1956. This increased the prices on foreign goods and once again sent the Japanese current account into a deficit. The growth had however promptly resumed following what can be best described as a virtuous circle of capital investment into heavy and chemical industries (HCI) that fueled further capital invest-

37. Nakamura, *Lectures on Modern Japanese Economic History: 1926-1994*. Pages 176.
38. Nikko Research Center, *Nihon Keizai to Shihonshijo*. Page 20. Japanese: もはや戦後ではない.
39. Hirohisa Kohama, *Industrial Development in Postwar Japan* (London; New York: Routledge, 2007), ISBN: 9780415437073 0415437075 9780203939420 0203939425. Page 12.
40. Ian Inkster, *Japanese Industrial Economy : Late Development and Cultural Causation* (London: Taylor / Francis, 2012), ISBN: 9780203472040 0203472047. Page 66.

ment in other industries. Japan had begun its transition from coal to oil aided by the establishment of oil fields in the Middle East and the increase in the size of oil tankers, but also by the nation's new insatiable appetite for industrial machinery. The said capital goods, in turn, had to be built somewhere leading to further growth of the machinery industry itself. In his book, Takafusa [41]Nakamura tells an anecdote of a small lathe factory emblematic of this era that in mere two to three years grew to the point where it employed three thousand people with "young people and housewives being bused in from nearby farms". "The factory went bankrupt at the first sign of recession in 1962", writes Nakamura, "but its brief success is emblematic of the boom".

This growth had been so rapid that the nation's annual gross domestic product growth promptly entered the double digits and peaked at around 12%. The growth and the expectations of future growth had also been priced into the domestic stock market accordingly, if, perhaps not uncommonly, also exceedingly optimistically. The new Iwato Boom, named after the cave that Sun Goddess Amaterasu had locked herself within after being upset by her brother Susanoo, sent the Nikkei from ¥584.42 at the end of June 1958 to as much as ¥1829.74 later in mid-July 1961. The market rallied nothing short of 45% on an annualized basis or over three times for the entire period of little more than three years.

The ownership share of Japanese equity by the individual investor continued its decline during this period. Nonetheless, the rate of decline had decreased considerably especially in comparison to the first three years after the reopening of the exchanges. In other words, although individual investors' relative ownership share of the Japanese equity continued to decline, the was somewhat subdued. Using a three-year simple moving average, this decline in the reduction of ownership rate had manifested itself in 1954, from whence onward the rate of decline would fluctuate 1.5% and 2.5% percent as opposed to the 6.8% for the three-year period after 1949 and 4.23% for that after 1950. Using this metric or a rolling three-year difference, one can even observe a brief growth in equity ownership in 1963; something that did not reoccur until a similarly brief period in 1975 to 1976.[42]

In the same period of high capital investment that resulted in the stock market rally, the previously described investment fund system began to pick up steam. The portion of total personal financial assets allocated to investment funds had been close to 1% percent in 1955 and 1956, almost half of what it had been in 1953. However, already by 1958, it had again reached 2%. By 1961 it had peaked at 6.3% and began its rapid decline back to the under 2% range where it remained until 1978 from which point onward in

41. Nakamura, *Lectures on Modern Japanese Economic History: 1926-1994*. Pages 206–211.

42. The Japan Institute for Labour Policy and Training, *Omona Shoyūsha Betsu Mochikabu Hiritsu (Tangen-Sū Bēsu)* [Ownership Ratio by Main Owner (Based on Unit Price)], Web Page, 2017, `https://www.jil.go.jp/kokunai/statistics/timeseries/html/g0706.html`.

proceeded to fluctuate between 2% and 4%.[43]

The rally ended abruptly with the increase of Bank of Japan's interest rate in July 1961. The growth resumed in late 1962 in anticipation of increased public spending following the announcement that the 1964 Olympic Games will be held in Tokyo, however, it was destined to be only a short-lived cycle of thirty-six months—the second shortest in the Japanese postwar history. It ended abruptly with the so-called Kennedy Shocks. Although the term appears to be strictly Japanese, the shocks consisted of two events. The latter, occurring on November 22, 1963, is the assassination of President Kennedy in Dallas that resulted in a brief but sudden sell-off in the American markets. The arguably financially more important shock, however, had been the introduction of the Interest Equalization Tax by the Kennedy cabinet in July of the same year.[44]

This latter exogenous cause requires a brief explanation as it is a problem indicative of the time. In 1960, the United States had found itself in a recession. To address the issue, the newly-elected President John F. Kennedy proposed a number of conventional measures to reinvigorate the economy, such as reducing taxes across the board and asking the monetary authorities to increase the availability of loans.[45] However, this latter aspect of financing had a different problem associated with it. At the beginning of 1960, the discount rate—the rate at which banks can borrow from the Federal Reserve—was at 4%; by the end of the year it had decreased to 3% where it remained until July 1963.[46] By contrast, the discount rate for Japan had fluctuated between 3.5% and 4% for the same period.[47] As a result, some of the foreign fixed-income securities, those issued in Japan among them, had become considerably more attractive than their domestic counterparts, which made financing difficult and adversely affected the United States' economy. Furthermore, as capital outflows are part of the national balance of payments, their outward movement had put the United States into a deficit.

In a current day floating exchange regime, this would not necessarily pose any problems for either nation as the exchange rate can shift with the change. This can increase or reduce the value of securities issued in a specific currency and adds currency risk to the valuation process. A domestic bond of equal credit quality would thus be always safer than a foreign bond because the holder of the bond can always wait for the bond to mature to receive the interest and principal in their home currency. A foreign bond,

43. Sugita, "Hossoku Kara Man 60 Nen O Mukaeru Nihon No Tōshi Shintaku." Page 3.

44. Nikko Research Center, *Nihon Keizai to Shihonshijo*. Page 20.

45. John F. Kennedy, *News Conference 2*, Interview, February 1961, `https://www.jfklibrary.org/archives/other-resources/john-f-kennedy-press-conferences/news-conference-2`.

46. The Federal Reverse Bank of St. Loius, *Interest Rates, Discount Rate for United States (INTDSRUSM193N)*, Web Page, 2019, accessed 2 April 2019, `https://fred.stlouisfed.org/series/INTDSRUSM193N`.

47. Masato Shizume, "A History of the Bank of Japan, 1882–2016," *Sveriges Riksbank and the History of Central Banking* 328 (2018). Page 21.

on the other hand, would still return the interest and principal in its home currency, but the shift in the exchange rate could negatively affect the returns of the bondholder once the foreign currency is exchanged for the domestic one. However, this was not a problem during the height of the Bretton Woods system in the 1960s, when one dollar was always 360 yen and an investment-grade bond in Japan was just as good as one offered by a domestic company.

In response to this problem, the Kennedy administration implemented the "Interest Rate Equalization Act of 1963".[48] The new law imposed a tax on the purchase of foreign securities, encompassing both equities and fixed-income securities. As a result thereof, the attractiveness of Japanese securities had been drastically reduced and led to a major slump in the Nikkei until the beginning of the Izanagi Boom in October 1965. Although the Olympics Games of 1964 and the launch of the *shinkansen* bullet train system had by all accounts made it a year of quintessential importance in the Japanese postwar history, the same cannot be said about the nation's market indices.

Japan received its final World Bank loan in 1966 concluding the thirteen-year period it had been a borrower.[49] From then on, the Japanese equity markets grew with lesser bumps along the road. One of these had been the outbreak of the Third Arab-Israeli War in June 1967. Another was the devaluation of the pound sterling from $2.80 to $2.40 in the November of the same year.[50] Later, in 1969, the Japanese monetary authorities tightened the credit in an attempt to prevent inflation.[51]

In 1971, President Nixon dissolved the link between the U.S. dollar and gold, signaling the beginning of the end of the Bretton Woods system. Michael Bordo argues that one of the key reasons why the system had begun its collapse was the need for confidence that no longer could be offered by the United States. The growth of the Japanese economy and those in Europe had resulted in there simply not being sufficient growth of gold reserves to match the quickly growing economic output of the world. Since 1960, the United States accordingly attempted to prevent the conversion of dollars into gold that formed the very foundation that the system had rested upon. Bordo argues that "the defense of sterling was a first line of defense for the dollar", and thus following the British devaluation and global inflation, which led to demands for conversion of dollars into

48. United States. Congress. Joint Committee on Internal Revenue Taxation, United States. Dept. of the Treasury, and United States. Congress. Senate. Committee on Finance, *"The Interest Equalization Tax Act of 1963" (H.R. 8000) : Outline of Provisions of H.R. 8000, as Passed by the U.S. House of Representatives, and Amendments Recommended by the Treasury Department* (1964), `https://archive.org/details/theinterestequal1064unit`.

49. The World Bank, *Japan*, Web Page, 2019.

50. S. Newton, "The Sterling Devaluation of 1967, the International Economy and Post-War Social Democracy," *The English Historical Review* CXXV, no. 515 (2010): 912–945, ISSN: 0013-8266, doi:`10.1093/ehr/ceq164`, `https://dx.doi.org/10.1093/ehr/ceq164`.

51. Nakamura, *Lectures on Modern Japanese Economic History: 1926-1994*. Pages 244–245.

gold by the United Kingdom and France had ultimately led to the suspension of gold convertibility.[52] Although an argument can be made that the system continued to exist in a way in a sense of the new interwoven global economy it had created,[53] by 1973 the Bretton Woods system as a monetary order had come to an end and the present era of floating exchange rates sprung up into existence. Although it is a transition to this new system that would later enable the Plaza Accord, which some would argue to have led to the biggest and longest economic crisis in Japan's postwar history, the closing of the gold window itself did not have a profound effect on the views of the Japanese investors and Nikkei proceeded to grow at a rapid pace.

1973–1987

One year earlier, a prediction of a geologist named M. King Hubbert dating back fourteen years and reiterated again in 1968 had materialized itself as the oil production output of the United States had reached its peak.[54] In 1973, as a result of the Fourth Arab-Israeli War, and the depreciation of the dollar caused by the closing of the gold window and resulting in a reduction in oil-producing nations' profits, Colonel Gaddafi, who came in power after a successful coup in 1969, enacted an embargo on Libyan exports of oil towards a number of nations perceived to in support of Israel. The move was promptly followed by other Arab member states of the Organization of Petroleum Exporting Countries (OPEC).

The shock came unexpectedly. Writing in 1973, the United States Ambassador to Saudi Arabia James Elmer Akins remarked pointedly that "oil experts, economists, and government officials who have attempted in recent years to predict future demand and prices for oil have had only marginally better success than those who foretell the advent of earthquakes or the second coming of the Messiah." Atkin's argued that the misplaced attention towards whether there was sufficient oil to drive the world's economy had overshadowed the real issue that the United States' was no longer in the position where it had "large spare oil production capacity" and small imports from the overseas.[55]

As one of the countries on Gaddafi's list, Japan had entered a recession and its stock

52. Michael D. Bordo, "The Bretton Woods International Monetary System: A Historical Overview," in *A Retrospective on the Bretton Woods System: Lessons for International Monetary Reform* (University of Chicago Press, 1993), 3–108.

53. Michael D. Bordo and Barry Eichengreen, *A Retrospective on the Bretton Woods System: Lessons for International Monetary Reform* (University of Chicago Press, 2007), ISBN: 0226066908.

54. Charles A. S. Hall and John W. Day, "Revisiting the Limits to Growth After Peak Oil: In the 1970s a Rising World Population and the Finite Resources Available to Support It Were Hot Topics. Interest Faded—but It's Time to Take Another Look," *American scientist* 97, no. 3 (2009): 230–237, ISSN: 0003-0996.

55. James E. Akins, "The Oil Crisis: This Time the Wolf Is Here," *Foreign Affairs* 51, no. 3 (1973): 462–490, ISSN: 0015-7120.

market reacted accordingly. Its nominal value would not recover until the end of August 1977. Between 1960 and 1972, the rate of inflation had fluctuated between 3.6% and 7.7% with steep annual drops and followed by equally steep increases. In 1972, the prices had increased by 4.84%; in 1973, already rampant inflation combined with the oil embargo raised the prices by 11.62% and in 1974 by as much as 23.18%. Nakamura describes the chaos following the announcement of the embargo, stating that even the prices "of things that didn't have much to do with oil, started to take off" with sellers withholding goods and buyers stockpiling. One of the curious phenomena of this panic had been that people began stockpiling toilet paper after a rumor had spread that it too would soon run out, which inadvertently also led to its decreased demand in the following months.[56] The inflation of the oil crisis and the following years had taken a considerable toll on the purchasing power not only of savers but also of those who may have been invested in the stock market. It would have taken four and a half years to recover one's investment into the Nikkei, but the money recovered by that point would only have had half the purchasing power than it did when it was invested. Just to recover the same purchasing power, the investor would have had to wait no less than twelve years until early 1985.[57]

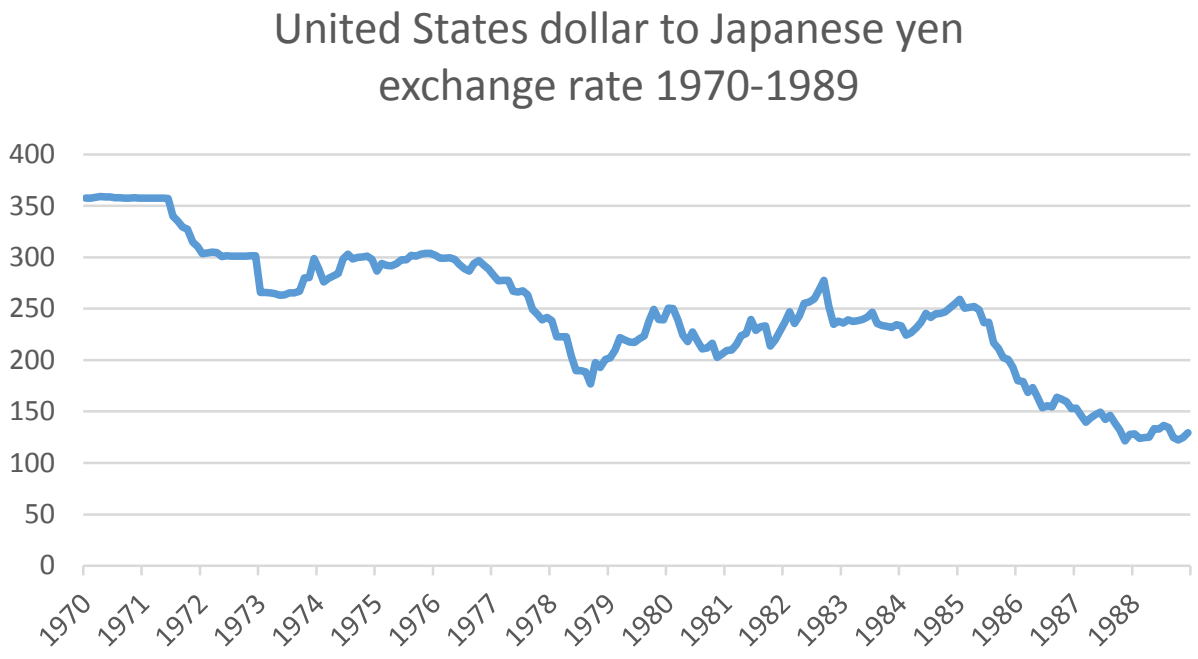

Figure 3.3 United States dollar–Japanese yen exchange rate. Data: The World Bank.

56. Nakamura, *Lectures on Modern Japanese Economic History: 1926-1994*. Pages 250–251.

57. The peak in March 1973 is used as the starting point. Using inflation data from the World Bank, the value is increased by the inflation that occurred each year until the nominal Nikkei 225 value as given in the index exceeds the increasing inflated purchasing price of 1973. This value is 12677 and is the closing price for March 1985. Notably, dividends not accounted for in this calculation and only monthly values are checked against.

In 1973, the Japanese gross domestic product had grown by 8%.[58] Although this had already been lower than the growth of any year in the 1960s with the exception of 1965, it would also be the last time the Japanese grew this fast. By 1975, the Japanese government concerned with increasing its fiscal deficit decided against further expansionary spending. Once the growth of the domestic demand stopped, the Japanese businesses began to increase their exports abroad.[59] From July 1974, the dollar-yen pair remained at a relative steady exchange rate of 1:300. However, already by 1977 the floating exchange rate regime had begun swaying against the Japanese exports with the yen appreciating to 1:240 and then to 1:193 only a year later.[60] 1977 also saw a historical record in corporate bankruptcies with 18.5 thousand cases, 18.1% higher than in 1976, most of which occurred among small-medium companies suffering from the long recession and the inability to adjust to the rationalization measures carried out by large enterprises.[61] Already by 1978, the Japanese government introduced a stimulus package.

The issue of Japanese government bonds (JGBs) increased rapidly during the second half of the 1970s when the recession caused by the oil crisis greatly diminished the quantity of corporate taxes collected. No new bonds were issued until 1964 due to the Japanese government's concern that they may cause runaway inflation similar to that of the immediate postwar. The rapid growth of the economy had also led to sufficient tax revenue. The main fixed-income product until that point had been the Nippon Telegraph and Telephone Corporation's (NTT) 10-year bond.[62] This changed in 1965 when Japan faced an unexpected drop in tax revenue and began issuing debt in order to stimulate public infrastructure projects through the so-called construction bonds.[63] The bonds issued from 1976 onward, however, were no longer used for infrastructure expansion, which was the only kind of government bond that could be issued according to the Finance Act of 1947. Rather, the new bonds were used to balance the governmental deficit. Whereas as recently as in 1973 as much as 85% of government's revenue had been collected through taxation, by 1977 this figure had dropped to just above 60%. The Japanese government bond (JGB) was slowly establishing its foothold on the archipelago.

An important aspect of the 1980s is a considerable degree of financial deregulation and the effects it had on the corporate finance landscape in Japan. These included a deregulation of foreign exchange markets from only explicitly permitted transactions to restricting only those explicitly prohibited, a rewriting of the Bank Law allowing broker-

58. The World Bank.
59. Nakamura, *Lectures on Modern Japanese Economic History: 1926-1994*. Pages 258–259.
60. Nikko Research Center, *Nihon Keizai to Shihonshijo*. Page 23.
61. *OECD Economic Surveys: Japan 1978* (OECD Publishing, 1978), ISBN: 9789264151970. Page 21–22.
62. Ujiie, *Japanese Financial Markets*. Pages 9–13.
63. *Kensetsu kokusai*. Japanese: 建設国債.

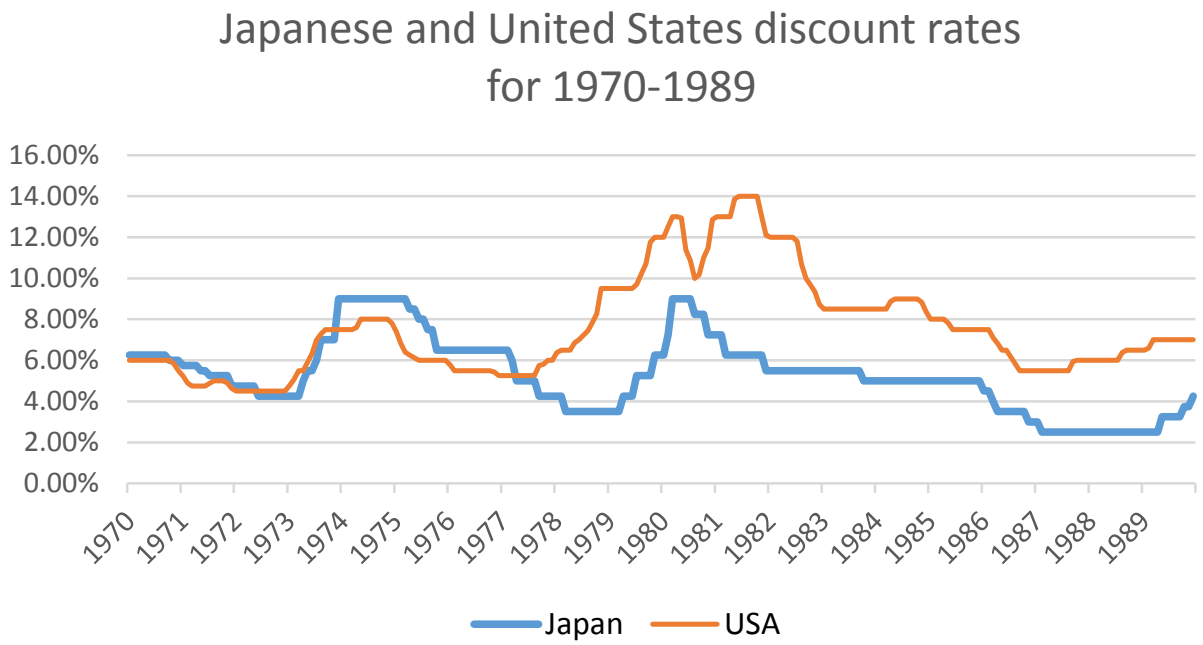

Figure 3.4 The Japanese government drops the discount rates to stimulate the economy following the oil-crisis recession. Data: The World Bank; Federal Reserve Bank of St. Louis.

ages and banks to compete in each other's arena, a permission for foreign firms to become listed on the Tokyo Stock Exchange, an introduction of money market certificates and Samurai bonds and others.[64] Furthermore, a shift in the financing of Japanese corporations had begun. Whereas prior to the 1980s only a small portion of financing occurred through the debt markets and the principal source of credit were loans offered by the Japanese banks, the new decade saw a gradual expansion of both straight bonds that paid coupon on an ongoing basis as well as convertibles that, given a positive development of the stock price of the underlying enterprise, allowed the bondholder to exchange the bond for a specified number of common shares of the said enterprise. The regulations on bond issuance had been relaxed, but not abolished entirely, which resulted in some enterprises being less constrained than others. In a 1999 analysis, C. W. Anderson and A. K. Makhija separated the firms into three categories "unconstrained", "partially constrained" and "constrained firms" in terms of their access to bond markets. The least constrained category had increased its ratio of bonds to total debt from less than 5% in 1980 to over 20% in 1990, whereas the most constrained firms had only gone from 2.5% to 7%.

At the same time the trade surplus with the United States, best visualized through the preponderance of Japanese automobiles, and consistently 3–4% lower interest rates in Japan had resulted in a capital outflow into the American Treasury securities. The trade tensions between the United States on the one side and Japan and Germany on the

64. Nakamura, *Lectures on Modern Japanese Economic History: 1926-1994*. Pages 285–289.

other had led to self-imposed restraints on the number of exported automobiles, but also to an increase of Japanese steel prices and a liberalization of imports of American beef and oranges.

NTT during the Bubble

By the late 1980s when the Japanese asset price bubble began to gather momentum the share of the Japanese equities owned by individual investors had already reached its perpetual range of 20–25%. There is little point in describing the bubble in greater detail as this has already been done in most economic history books dealing with the period, but it is important to again reinforce the point that even now, some three decades after the bubble, the overall Japanese market has not recovered from the exuberant valuations of the late 1980s and early 1990s. One particular example is worth bringing to the attention when discussing the experiences Japanese retail investors, in particular, have had with the Bubble itself.

The NTT 10-year bond has been mentioned as the principal Japanese fixed-income instrument before the issuance of the first Japanese government bonds in 1964. The company itself was founded twelve years prior as a governmental corporation and was responsible for the reconstruction of the telephone network in postwar Japan. By 1985, the company previously known as *Denden Kōsha* had been privatized as NTT to allow for a more competitive telecommunications market. This had been viewed as an important step, as before that point NTT had effectively been a governmental monopoly that controlled the entirety of the Japanese phone communications. The move had also been very much en vogue during the ongoing privatization of the British industry by Margarette Thatcher not in the least under the influence of Reaganomics in the United States. NTT was not the only Japanese governmental company to be privatized, as only two years later the Japan National Railway had been split into seven different Japan Rails and privatized.[65]

The initial public offering (IPO) of NTT occurred in October 1986. It was followed by three consecutive offerings in 1987, 1988 and one scheduled for 1989 but delayed until 1998. The first two offers were a major success and attracted particularly a large number of retail investors. However, already by the third offering, the enterprise began running out of steam. In stark contrast to the Japan National Railway, much was still ambiguous about what the government owning the majority of the firm's shares had in mind with regards to the NTTs corporate structure.[66] Furthermore, as a result of the liberalization

65. Tsuruhiko Nambu et al., "International Comparison of Privatization and Deregulation: The Case in JAPAN," 1995, `http://www.esri.go.jp/jp/archive/dis/dis062/dis062a.pdf`.
66. Ibid.

of the telecommunications market, it quickly became apparent that the value proposition offered by NTT had no longer been the same as it was before 1985. Consumers desired lower telephone charges and a series of "New Denden" companies emerged to fill the gap, cutting into the former monopolist's earnings. In the case of the British Telecom, 50.2% of whose shares were sold to the public in 1984, additional 10% up to 400 shares were offered to the shareholders after three years; this had not occurred in the case of NTT and neither did a dividend raise, reducing the publicly perceived attractiveness of the stock.[67] After an early peak in April 1987, the share price began its rapid decline. By 1992, the stock that had been previously described with the phrase "[i]t is impossible to lose money on a stock sold by the government!"[68] had dropped to 15% of its 1987 price. Whereas the British Telecom had been sold off entirely by 1997, recent regulatory filings suggest that a third of the NTT shares continues to belong to the Japanese government.[69]

Perhaps the most unfortunate aspect of the NTT's IPO and rapid decline is that it disproportionately affected the credulous retail investors. Writing in 1992, Andrew Pollack of the New York Times reported that as the bubble continued to inflate at a rapid pace through 1987, "the stock attracted many first-time investors who were eager to get in on the rising market and who believed that because the stock was being sold to them by their Government, it had to be safe." Quoting Alan Bell of Baring Securities, "It was the stock that gave legitimacy to owning shares to individuals … It was sold to a lot of unsophisticated investors as their first-time purchase and they've lost a lot of money."[70] Indeed, on the thirtieth anniversary of the NTTs IPO, the *Nihon Keizai Shimbun* newspaper reported that as many as 1.6 million individual investors held shares of the company at the peak of the bubble. While the "impossible to lose money" NTT stock will undoubtedly remain a sore spot for its investors, one must also remark that not only had it performed considerably better than the overall market, but as of 2017 it had even produced nominal earnings for its shareholders if one accounts for the past thirty years of dividend distributions.[71] The same cannot be said about the German telephone

67. Hiromi Tamamura, "The Actual State and Effect of Privatization in Japan," 1999, https://www.jftc.go.jp/eacpf/03/privatization.pdf.

68. *Seifu ga uridasu kabu de son o suru hazu ga nai.* Japanese: 政府が売り出す株で損をするはずがない. From Nihon Keizai Shinbun, "NTT Jōjō 30-Nen: Haitōkomi Kabuka Ga Purasu Tenkan" [NTT Listed for Thirty Years: Positive Returns When Including the Dividends], 2019, https://www.nikkei.com/article/DGXLZO12747500Z00C17A2DTB000/.

69. United States' Securities Exchange Commission, *XML 113 R8.htm IDEA: XBRL DOCUMENT*, Web Page, 2013, accessed 21 April 2019, https://www.sec.gov/Archives/edgar/data/769594/000119312513275605/R8.htm.

70. Andrew Pollack, *World Markets; The Sad Saga of Nippon Telegraph*, Web Page, 1992, accessed 21 April 2019, https://www.nytimes.com/1992/08/16/business/world-markets-the-sad-saga-of-nippon-telegraph.html.

71. Nihon Keizai Shinbun, "NTT Jōjō 30-Nen: Haitōkomi Kabuka Ga Purasu Tenkan."

company that would be privatized, offered to the public a decade after NTT and crash with equal ferocity with the Dot-Com Bubble it appeared in.

The Financial Big Bang

The Bubble had burst and the Japanese economy remained in a recession with the financial sector being in particularly dire straits following the emergence of a large number of "zombie banks". The name derives from the fact that these continued to operate largely through the grace of the government and had no real chance of recovery. By 1997, the financial sector had officially accumulated ¥28 trillion of non-performing loans, with the unofficial estimate being at ¥85 trillion or approximately 90% of all commercial and industrial loans issued in the United States.[72] To make things worse, the extensive stimulus program by the government started already in 1992 had succeeded in leading to a slight economic recovery, when in January of 1995 the Great Hanshin Earthquake devastated central Honshu killing 6.4 thousand people and devastating large portions of heavily urbanized central Japan. Just two and a half years later, the Asian Financial Crisis hit leading to the bankruptcy of several prominent Japanese banks and brokerage houses.[73]

Between 1996 and 2000 the Japanese government consequently again greatly liberalized the financial industry. The most fundamental change had been the general liberalization financial sector putting a greater emphasis on competition between the participants rather than the guidance of the Ministry of Finance. Previously, the Japanese financial markets were described as operating under the so-called *gosō sendan hōshiki* or "convoy system" (*gosōsendan hōshiki*).[74] The name is derived from the naval practice of military vessels moving in-formation led by a central flagship, where every ship has their designated role and no ship is left behind. If a ship is slow, the entire formation of the ships around reduces their speed. In the case of the financial system, this central flagship had been the old Ministry of Finance *Ōkurashō*. It called every shot and no financial would step out of its designated place. As with the postwar economy in general, the financial industry had very much been subject to planning by the central bureaucracy.

Although the Ōkurashō would not be restructured and rebranded until 2001, already by 1998 major changes had begun to occur. The foreign exchange transactions had been liberalized and allowed Japanese investors, who just a year later would be facing zero interest rates, to invest in foreign fixed-income securities that exposed them to both higher coupon payments in their home currencies but also the currency risk. Corporate access

72. Edward J. Lincoln and Robert E. Litan, "The "Big Bang"? An Ambivalent Japan Deregulates Its Financial Markets," 1998, `https://www.brookings.edu/articles/the-big-bang-an-ambivalent-japan-deregulates-its-financial-markets/`.

73. Nikko Research Center, *Nihon Keizai to Shihonshijo*. Page 24.

74. Japanese: 護送船団方式.

to the financial markets had been drastically simplified by transitioning from a license to a registration system for exchange-listed enterprises. This meant that by and large the companies no longer needed to be authorized specifically and were merely required to meet certain disclosure standards to receive public equity financing. Brokerage commission were also liberalized, which turned out to be a particularly timely change coinciding with the rise of the Internet and allowing for the appearance of first online brokers offering transactions at substantially lower fees at the cost of not having physical offices the customer could walk into.[75] Perhaps more than anything, the years between 1998 and 2001 had brought the Japanese financial markets closer to their American and European counterparts of the same period with a strong focus on inter-financial competition rather than guidance from above.

3.2.2 Performance during the Heisei Era

The purpose of this section is to provide an assessment of the recent historical performance of instruments traded on Japanese markets that an individual investor could reasonably invest in. The aim is to establish a foundation as to what the lived experience of participating in the market would have been like in Japan and how the results of this participation differed from other markets. This is done under the assumption that the lived experience of recent years directly affects the individuals' perception of opportunities and risks associated with an activity through word-of-mouth perpetuation or personal experiences. When considering an individual investor, this research assumes a modal resident of a nation without any particular degree of training or enthusiasm for personal finance, the markets or investing in general.

The section lays out the performance of the Japanese markets in the past three decades. This period closely corresponds to the Heisei Era, excluding the first half of 2019. The markets examined herein are limited to equities, the fixed-income and real estate investment trusts (REITs). While this excludes the real estate as residential properties owned by the retail investors themselves, it is the contention of this author that these are best omitted at this point due not typically being considered under the general label of financial assets as well as due to the multifaceted nature of buying or owning residential real estate, which may be either used as a primary residence of the proprietor and thus non-investment related, or a quasi-variable annuity providing a reliable source of income. This raises the question as to whether such properties are viewed as first and foremost as investments or spending by the proprietors themselves. Furthermore, were

75. Ujiie, *Japanese Financial Markets*. Toyama University, *Kin'yū bigguban to kongo no keizai* [Financial Big Bang and Future Economy], Web Page, 1998, accessed 1 May 2019, `http://www3.u-toyama.ac.jp/furuta/bigbang.html`.

these only seen as investments, any analysis of residential real estate performance is difficult not only due to the illiquid nature of the market but also due to the obscure returns calculation that would have to include ongoing and one-off costs, work hours on behalf of the landlord and asset depreciation. Assuming that an average property owner would indeed correctly know what their returns were on a property they owned over several decades is in the opinion of this author gratuitously optimistic. Nonetheless, the matter will be briefly addressed in the later chapters within a different context.

As with the other parts of this research, the United States is used as the main comparator due to its position as the largest market and its dominance of the financial sector.

Equities

Although the bubble famously burst in 1992 when land and real estate prices began to drop, the stock market had reached its highest valuation already by December 29, 1989, when the Nikkei 225 peaked at ¥38,915.87. This valuation has not been reached to this day almost thirty years later. Not only had the valuation not been surpassed, it has not even come close. As of the first trading day of the year, 4 January, 2019, the index opened at ¥19,655.31 or just barely above half of its peak price. Conversely, the United States' S&P 500 returned approximately six times and the German DAX roughly five times the performance. This raises certain questions as to how far the same investment principles that may have been fostered in the American and German retail investors could have taken root in Japan.

Typically the performance of an index or any other publicly traded instrument is displayed as a chart above. A more neutral representation method will be given later on in this section. In nominal terms, the Nikkei has severely underperformed the three other comparator indices used in this section.

The aforementioned stale performance of the Japanese market and the precipitous drop from the bubble should be of no surprise to anyone even remotely interested in Japanese economic history. However, one may argue that it is worth not only looking at the performance from some selectively picked point but rather examine what the investment experience would have been like for someone investing in the past thirty years. Assuming that the age at which one would begin having a disposable income and thus may be interested in investing a part of it is around mid-twenties, one can simulate the possible investment outcomes for a presently mid-fifties retail investor curious in participating in the stock market. This particular age group is important not only because they were the generation that entered the workforce at the peak of the asset price bubble, but also because they are presently at the peak of their earning capacity and are likely to

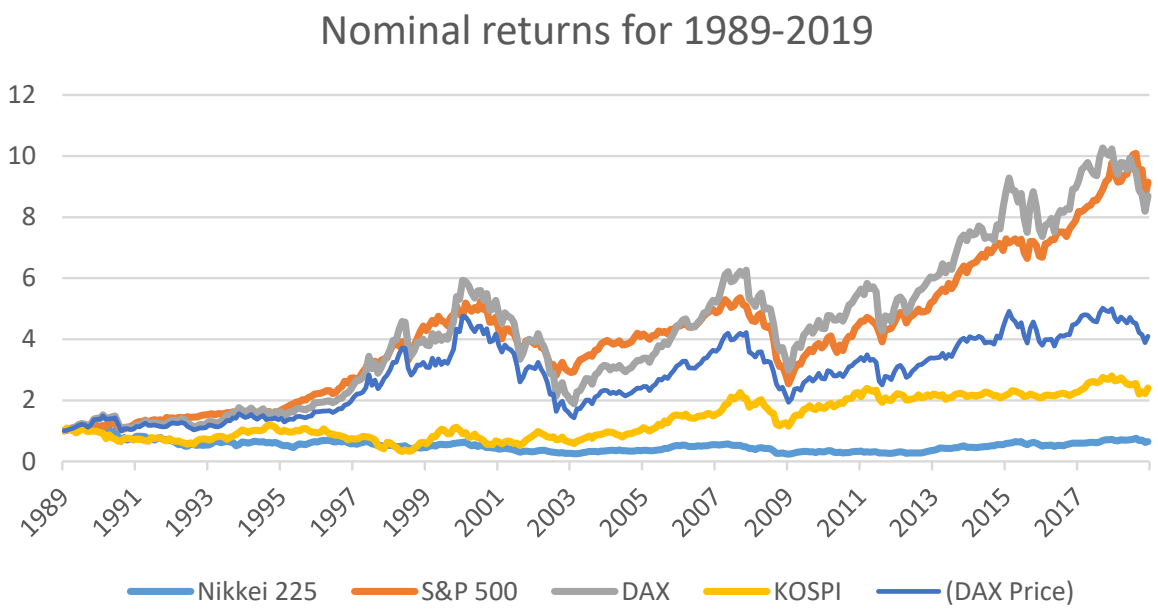

Figure 3.5 Note that DAX is a total return index that accounts for dividends being reinvested rather than distributed to the investors. Its direct companion is the comparatively rarely discussed variant called the *DAX Price index*[76], which does not account for dividend reinvestment and thus bears a closer resemblance to the other three indices. It is displayed in this chart for clarity, but will be omitted henceforth as it is not the default go-to national index that the vastest majority of unsophisticated retail investors—the group investigated in this research—would be looking at.
Data: Bloomberg, DAX Price Index: Deutsche Bundesbank. Resolution: One month.

have children entering or at early stages of employment.[77] In other words, rather than picking a specific date at which an investment was made and another date at which it was subsequently liquidated, one can provide a more neutral analysis by assuming both a random entry and a random exit. While this does not in practice reflect the retail investor behavior because it eliminates the behavioral patterns of the market as a whole, it provides the most systematic way of looking at actual market performance for a given time frame. To do so, one can calculate all possible trades within a given time frame. While this does not remove the bias of the data set being temporally, it removes the selection bias. Thus, on the one hand, taking a dataset from 1989 to 2019 will still show the market as performing worse than by taking a dataset from 1993 to 2019 or even better from 2009 to 2019. On the other hand, the resulting performance is still more evened out than if one merely selected 1992 as a starting year, 2019 as the ending year and ignored all the losses the investors would have incurred by buying and selling between those two points.

The S&P 500 for the said period provides a look at a well-performing market when examined through this lens and thus constitutes a good entry point. The index performs

77. Garon, *Molding Japanese Minds*.

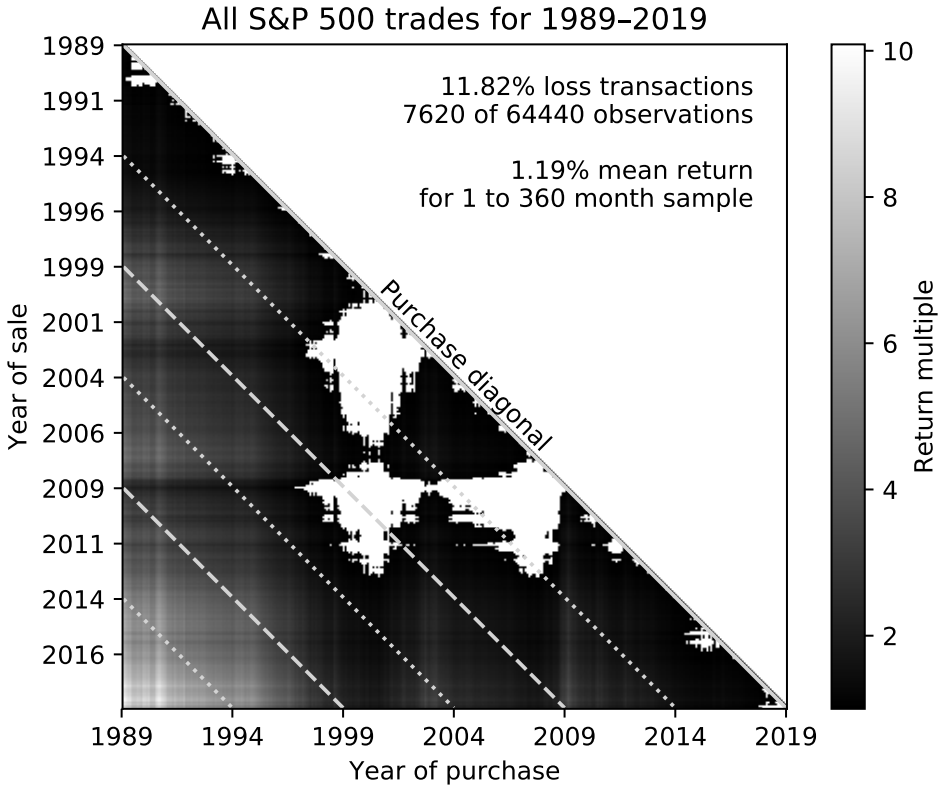

Figure 3.6 The triangular area displays all possible returns within a given period. To see a performance of a single trade, one selects the year when hypothetical security mirroring the market is purchased on the x-axis and the year it is sold on the y-axis. The blank white areas signify that the trade is made at a loss and no further distinction is made for the purposes of readability. The black to gray to white gradient areas signify that the trade would have been profitable. The brighter the gray, the higher the returns. The right-hand scale provides a legend for the return multiple.

The chart more easily understood when examining from the perspective of the "purchase diagonal". When a security is purchased at any point on the diagonal, it can be sold at any point directly beneath it. The earlier the security has been purchased, the more points there are at which the security can be sold until the end of the sample time frame, thus resulting in the diagonal reducing the number of sell opportunities by one unit for every one unit moved further in time when buying.

Gray diagonal lines beneath the purchase diagonal mark the points at which five years have passed since the purchase. Each following line suggests another five years. The dotted lines thus correspond to 5, 15 and 25 years since purchase; the dashed lines correspond to 10 and 20 years since purchase. The data ends at 30 years and no line is plotted at this point.

Finally, the figures in the top-right corner of the chart indicate which percentage of all possible transactions would have lead to a loss regardless of the severity of the loss. The number beneath indicates the mean return for the sample. This and all following charts of this nature are calculated based on a 1-month resolution and a 360 month period equivalent to 30 years. This means that a trade can only be entered into or exited from at the closing price at the end of a month and no trades could be executed on either daily, intraday resolution or otherwise.

Note that this specific chart does not account for inflation, tracking errors of investible index funds or any of the associated expenses (12b-1 fees, management fees and so forth). Furthermore, note that every second tick of the y-axis is half of a five-year period and thus refers to the June of the corresponding year. These are the years 1991, 1996, 2001, 2006, 2011 and 2016. The tick method applies to all subsequent graphs. Data: Bloomberg. Resolution: One month.

much like one would expect of an index that lends itself to the popular buy-and-hold investment style that serves as a basis of many defined contribution retirement funds. The chart is a nearly uniform gradient of black to light gray except for three large "holes" in the middle. These are the Dot-Com bubble of the late 1990s and the 2007 United States housing bubble, the implosion of both of which has lead to a temporary decline in equity prices. The closer to the peak of the bubble the security is purchased, the longer does it take until the first black dots appear signifying a positive return. Purchasing the security during these months would have lead to the worst outcome both in the short and long term.

Furthermore, the chart demonstrates—again reinforcing the validity of the buy-and-hold strategy—that, outside of the two bubbles, the only times one would be in the red is by selling the securities close to the purchase diagonal. This hacksaw-like pattern is caused by the normal short-term fluctuations of equity prices, which significantly increases the chances of incurring a loss by selling the security too early. This is further emphasized by the gradient of the chart, the gray becoming brighter and brighter as one moves further away from the purchase diagonal with a bright gray nexus in the bottom left quarter of the chart. At this point, one is the furthest away from the diagonal and has been holding the investment for the longest period. Occasional brighter vertical line-like patterns suggest that the valuations have been particularly low during those months of purchase, leading to higher returns for the fortunate buyer. Conversely, the dark horizontal line-like pattern suggests the periods immediately after which the prices had dropped rapidly.

Given this data, it is possible to compute the likelihood of a random position being closed at a profit or a loss as well as calculate the mean return of a transaction. Only 11.82% of the S&P 500 index transactions had led to a loss. Furthermore, when considering both trades at a loss and trades at a profit, the mean return for random trade entry and random trade exit was a positive 1.19%. Note that this number is merely a mean of all possible transactions and is thus not annualized.

Importantly, these results would look considerably different were one to separate trades by the length of the trade duration. Shorter trades would result in a considerably lower ratio of wins to losses as well as lower mean returns. Trades held for 15 or more years would lead to no losses whatsoever again reinforcing the validity of the buy-and-hold strategy. Not even the Dot-Com Bubble or the Global Financial Crisis would have led to a nominal loss for investors.

An important theoretical limitation to this approach that must be emphasized is that the loss ratio and mean returns are susceptible to the length of the examined data. All else equal, a ten-year sample would have a greater ratio of losses and lower meaner returns than a fifty-year sample. In other words, the excellent performance of the long-term

trades compensates for the bad performance of the short-term trades. Conclusively, the calculated values in isolation in no way reflect the performance of the S&P 500 itself and are only useful as comparators to other indices or the same index with the sample taken from a different period. As the focus of this research is on current investor behavior, only the measures of the performance of the most recent period are provided.

Before examining the Nikkei itself, it is important to emphasize that the United States chart pattern is not usual for a healthy or even a moderately healthy economy. Below are the charts for the German DAX and the South Korean KOSPI general market indices for the same period. Note that both countries have undergone considerable turbulences such as the German Reunification in 1990 and the South Korean exposure to the Asian Financial Crisis in 1997, whereby latter lead to a large number of insolvencies and consolidations in the financial sector as well as a $58.4 billion bailout package from the International Monetary Fund (IMF).[78]

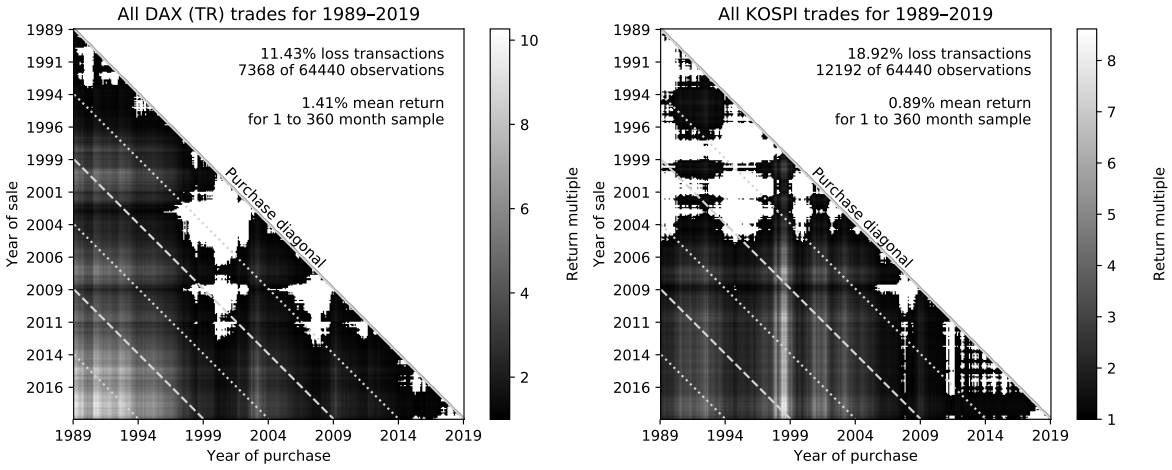

Figure 3.7 Data: Bloomberg. Note that the DAX is a total return index as explained further below.

Whereas Germany has closely followed the pattern of the United States, Korea exhibited a similar pattern, albeit with a greater number of loss periods largely attributable to the turbulence of the 1990s. The Global Financial Crisis has had a visibly lower impact on the South Korean valuations than it did on the Euro-American equities. The bright gray vertical line indicates that a market timer would have outperformed the earliest buyers by entering into a trade at the 1998 bottom of the Asian Financial Crisis, but one can nonetheless see that an investor holding a KOSPI tracking product for more than fifteen years would not likely have suffered a loss. The same cannot be said for Japan.

As has been noted previously, the Nikkei 225 index of 2019 still has not reached its

78. Kim Kihwan, "The 1997-98 Korean Financial Crisis: Causes, Policy Response, and Lessons," in *IMF Seminar on Crisis Prevention in Emerging Markets* ().

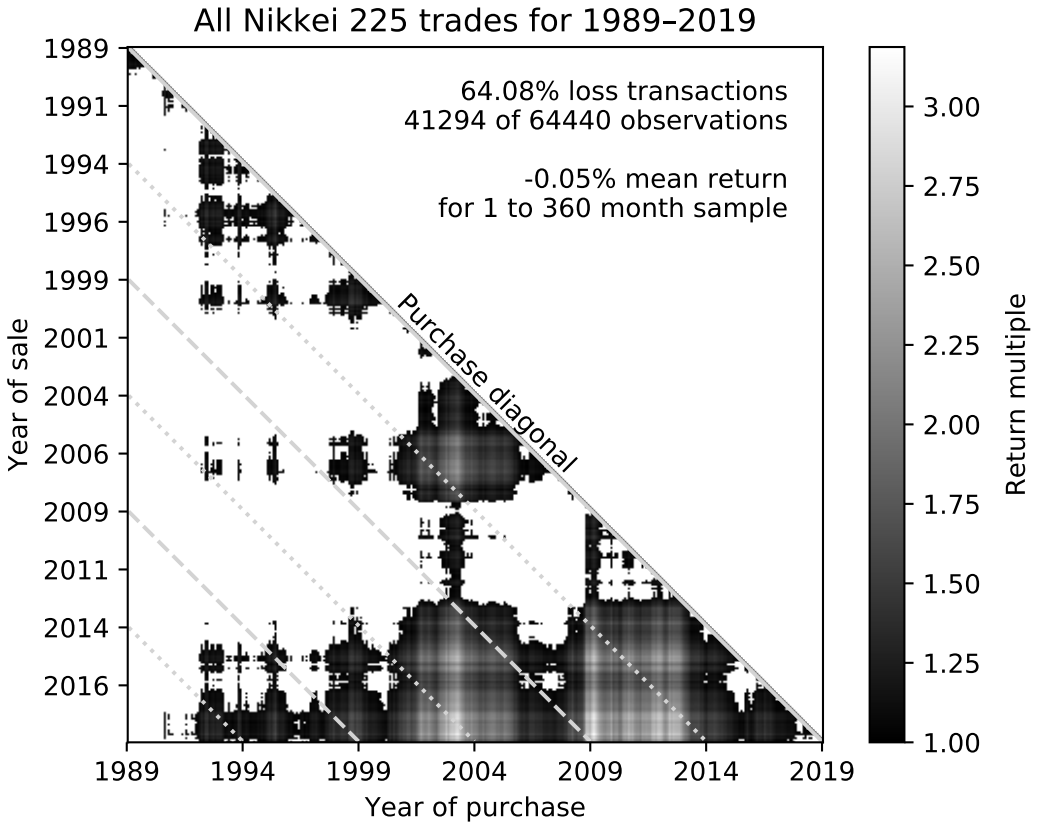

Figure 3.8 Data: Bloomberg.

previous peak nearly thirty years later. However, this is not merely the case of an unlucky investor entering the market at the very peak of the bubble as is popularly vocalized in the cautionary tale of the Japanese markets, but rather a persistent state that only began a turnaround following the enactment of Prime Minister Shinzo Abe's Abenomics reforms. Signs of recovery can be seen in the early 2000s time frame, but are immediately cut short by the burst of the U.S. American subprime bubble. Also notable is the fact that the Lost Decade indeed appears to be offering a bare minimum of nominal returns on the profitable trades, which are few and far apart.

Contrary to the previous three markets, one must also note that the nominal loss rate for random entry and exit transactions is excruciatingly high. Whereas the S&P 500's loss rate lay at below 12%, the DAX below 12%—although this had been largely due to how the index is constructed rather than the real performance the of the market—and the KOSPI at under 19%, the odds of entering into a losing trade in the case of Japan remained above 64%. Furthermore, not only did the index expose any prospective investors to a greater degree of risk, it is the only of the four examined indices that had a negative nominal mean return.

Risk It nonetheless needs to be stated that despite the poor performance, the Japanese equities did not exhibit a high degree of risk as expressed by 30-day volatility.

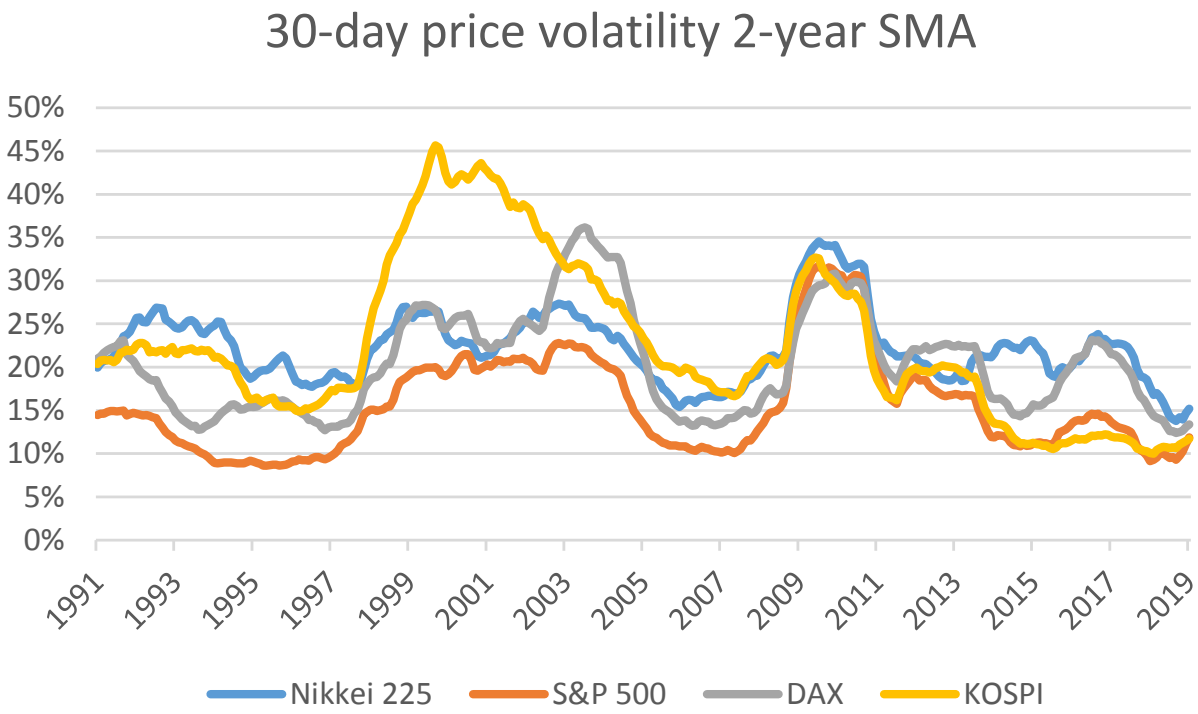

Figure 3.9 The chart displays the Japanese two-year trailing average of the 30-day volatility for the corresponding indices. The time frame corresponds to the same 1989 to 2019 period as previously with each point corresponding to the mean 30-day volatility of the previous two years. The two-year moving average is used to visualize otherwise unreadable data.
Data: Bloomberg.

The Nikko Research Center research points out that Japanese equities have performed poorer than those in the United States while being associated with greater risk.[79] This is correct, but perhaps more so a statement about the volatility of equities in the United States than those of Japan. As seen in the graph above, although the United States indeed had lower volatility than Japan, it also had a considerably lower volatility than both Germany and South Korea.

All three countries excluding the United States were undergoing considerable transformations during the said period. Korea, which is still typically included in the "emerging markets" indices rather than the "developed markets" ones that the other three countries belong to, had just barely entered its Sixth Republic era of democratization and dismantling of authoritarianism. Not even a decade later, it had fallen as one of the main victims of the Asian financial crisis. Germany had found itself in the process of reunification and reintegration of a former socialist republic into the capitalist system. From 2009 onward, the country remained involved in the European sovereign debt crisis and

79. Nikko Research Center, *Nihon Keizai to Shihonshijo*.

the subsequent intra-European transformations. Japan had seen the burst of the asset price bubble, followed by the Lost Decade and eventually the introduction of Abenomics. By contrast, the United States did not go through any particular process that had not also been transferred to a significant degree to the other three countries, whether it be the run towards the technology stocks bubble in the late 1990s, the outbreak of the wars in the Middle East following the attacks on the Twin Towers or the subprime crisis and the effects of quantitative easing. In this context, the volatility levels of the Japanese stock market are very close to those of Germany and Korea at a mean of 21.8% for the Nikkei, 20.1% for the DAX and 22.1% for the KOSPI. Conversely, the volatility of the S&P 500 had been at a considerably lower at 15.4% despite superior performance to all of the comparator countries.

The average degree of volatility in the Japanese markets nonetheless did not compensate for the lack of return within the given period. A comparison of the markets on a risk-adjusted basis can be achieved by calculating one of several risk ratios. The following table provides the risk-adjusted returns by employing the Sharpe ratio and adjusting it for inflation.[80]

Table 3.2 Risk-adjusted returns for 1989–2019

		Nikkei	**S&P 500**	**DAX**	**KOSPI**
Non-discounted	Annualized total return	-0.39%	9.97%	7.48%	2.96%
	Standard deviation	6.05%	4.09%	5.94%	7.84%
	Risk-return ratio	-0.06	2.44	1.26	0.38
Discounted	Annualized total return	-1.38%	6.59%	3.46%	-0.13%
	Standard deviation	6.05%	4.09%	5.94%	7.84%
	Sharpe ratio	-0.23	1.61	0.58	-0.02
CPI-adjusted discounted	Annualized total return	-1.89%	3.93%	1.55%	-3.71%
	Standard deviation	6.13%	4.12%	6.03%	7.66%
	CPI-adjusted Sharpe ratio	-0.31	0.95	0.26	-0.48

The annualized total return is computed by calculating the geometric mean of the monthly total return and annualizing it. The risk-return ratio is then computed by dividing the geometric mean of the total return by the standard deviation of the monthly returns. To account for the risk-free rates available in each market, the discounted risk-return ratio known as the Sharpe ratio is computed. In this case, the returns are discounted on a monthly basis by subtracting the monthly discount rate of the corresponding central banks. In the case of Germany, data for the Deutsche Bundesbank is used until the end of 1998 after which the European Central Bank rate is used. The discounted returns

80. The author acknowledges that a similar risk analysis is provided for the period following 2005 and a different set of comparator nations in the research provided by Nikko. The calculation and the data sets used are different leading to results different from those published by Nikko.

are then divided by the standard deviation of the non-discounted returns to compute the Sharpe ratio for individual indices. Finally, a CPI-adjusted Sharpe ratio is calculated to account for the purchasing power parity within the individual markets. Total returns are adjusted for inflation, which influences the standard deviation of the market returns. The geometric mean of the CPI-adjusted returns is then divided by the standard deviation of CPI-adjusted returns to compute the CPI-adjusted Sharpe ratio. Data: Bloomberg for index returns and CPI; Federal Reserve Bank of St. Louis for discount rates.

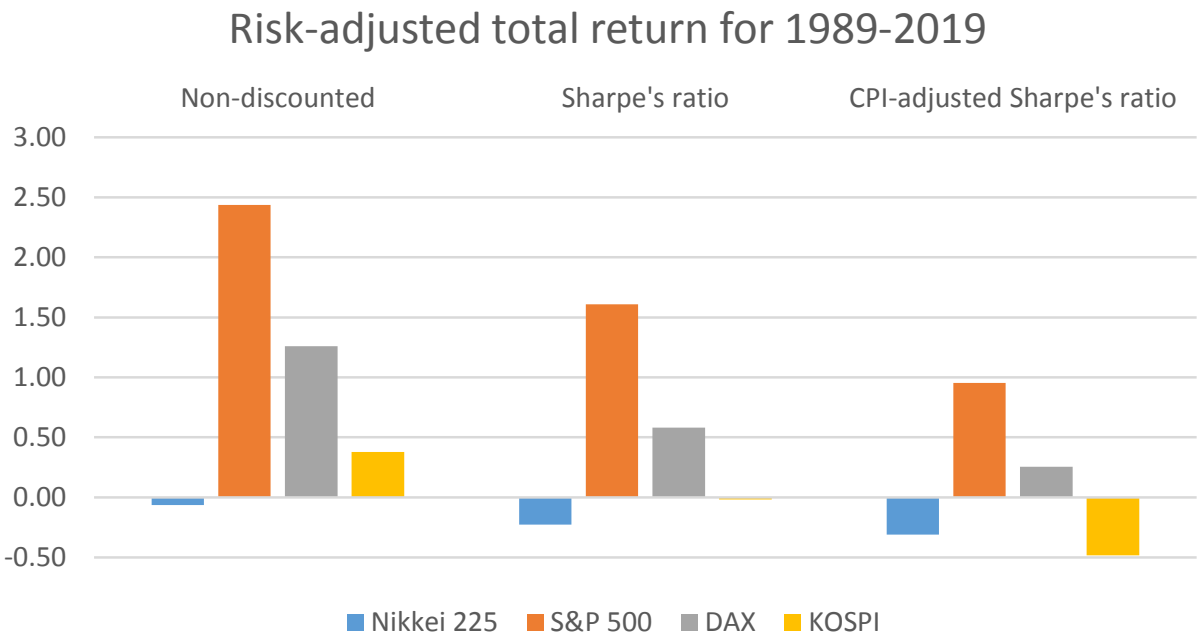

Figure 3.10 Data: Bloomberg for index returns and CPI; Federal Reserve Bank of St. Louis for discount rates.

The Sharpe ratio is typically used to compare mutual fund performance on a risk-adjusted basis. It provides a useful metric that accounts for both the return provided by the fund, but also the degree of volatility that the fund would have exposed the investor to on an ex-post basis. This is useful for evaluative purposes due to the fact that some funds may attempt to limit volatility at the cost of long-term performance to cater to the investment goals of their investors. For example, a fund aiming to provide high returns by investing exclusively into small-cap businesses and emerging markets may provide a higher return associated with higher volatility, whereas a systematic risk parity fund with a large allocation to bonds, precious metals and commodities would likely provide a lower return whilst minimizing volatility. The performance of each fund can then be computed as a Sharpe ratio by accounting for the funds' excess returns above the risk-free rate.

As can be seen, when accounting for dividends, Japan is the only market with the negative nominal returns at –0.39 basis points per annum. By contrast, the United States, followed by Germany and Korea, provide a return of close to 10%, 7.5%, and 3%

respectively. This difference persists when the returns are adjusted for by subtracting the discount rate of the respective central banks at which point the Japanese equity returns fall even further to –1.38% with a corresponding Sharpe ratio of –0.23. This can be explained by the fact that not only were Japanese returns negative for the period, but they were also unsurprisingly below the risk-free rate. However, when accounting for the risk-free rate we also observe that the South Korean KOSPI had also underperformed the risk-free rate, making its Share ratio negative too. Lastly, since the purpose of this research is to look at the effects market participation would have had on an individual investor, the Sharpe ratio rate needs to be adjusted for the inflation within the respective markets. This furthermore reduces the Sharpe ratio in Japan because, while inflation had been low it occurred nonetheless, but put the overall risk-adjusted performance of the Nikkei 225 above that of the KOSPI. In consideration of the close cultural ties between Japan and Korea, this degree of poor risk-adjusted performance exhibited by both the domestic market and its neighbor can be argued to be influential on the risk readiness of the domestic Japanese retail investor.

Dividends Whilst the total return of indices with dividend reinvestment will be discussed at a later point, assuming that the investor in question had invested into distributing funds that pass dividends along to the investors or purchased shares of individual enterprises outright, what would the Japanese experience have been in the past decades?

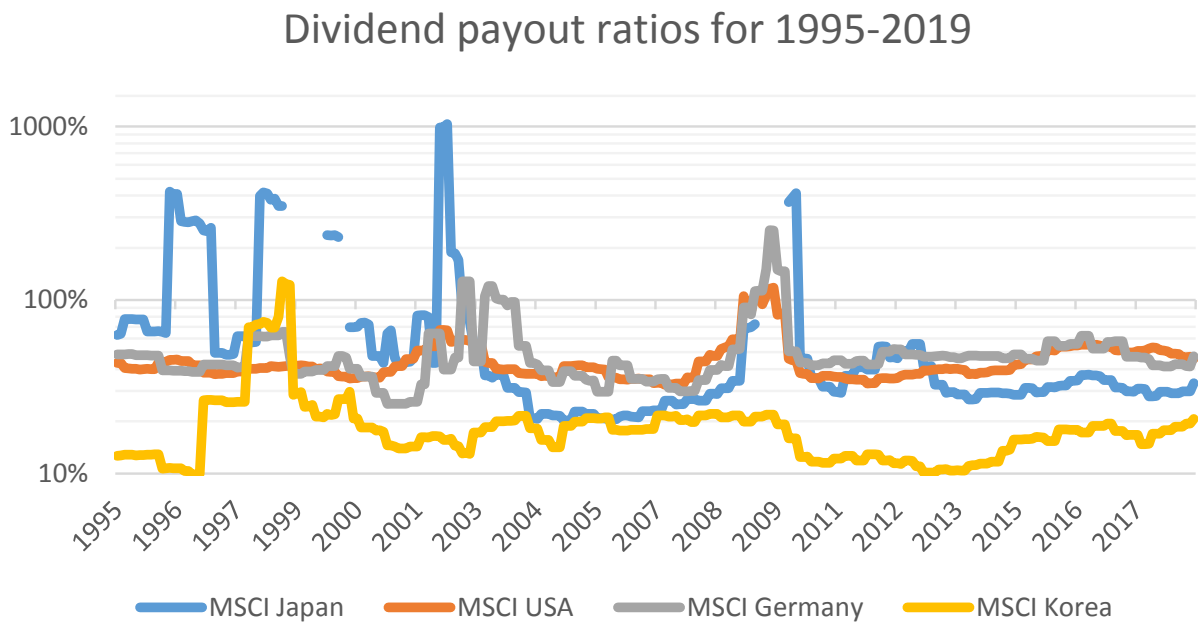

Figure 3.11 Note the use of the logarithmic scale. Data: Bloomberg

If one were to look at the dividend payout ratio, which is the percentage of the enterprise's net income paid out to shareholders in dividends, the Japanese ratio is much

less stable than that of the other three comparator countries. This is the most evident when compared with the United States. Curiously enough, this instability is, in fact, a sign of stability of the dividends themselves and deeply embedded in the Japanese corporate practices. In its study of the corporate governance practices in Japan, the Nikko Research Center notes that Japanese firms typically prefer to pay out steady, ongoing dividends that are largely unaffected by the earnings of the firm in any given year. In fact, the dividend profile of Japanese equities appears to act more akin to fixed-income instruments rather than common stock. Throughout the bubble period of 1985 to 1989 when the earnings of the Japanese exchange-listed enterprises had gone up by approximately 80%, the dividends had only increased by a half. Conversely, once the bubble burst and corporate profits begun their equally rapid plunge into the Lost Decade and became corporate losses towards its end, the dividends remained essentially the same and persisted to rise at a very slow pace until earnings increased drastically in 2003. In a dramatic change from the previous practice, the dividends doubled over the period of the next five years after which they were reduced only slightly when earnings again became negative in 2008. Another reduction occurred in the following year, after which the dividends began to rise along with the earnings.[81]

Table 3.3 Arithmetic means and standard deviations of dividend payout ratios for 1995–2019

	MSCI Japan		**MSCI USA**		**MSCI Germany**		**MSCI Korea**	
	Mean	**Stdev**	**Mean**	**Stdev**	**Mean**	**Stdev**	**Mean**	**Stdev**
1995–2019	73.82%	1.303	44.86%	0.135	50.82%	0.272	19.89%	0.152
1995–2000	132.91%	1.358	40.00%	0.027	44.67%	0.089	30.23%	0.273
2001–2010	69.80%	1.628	48.35%	0.192	56.43%	0.406	17.99%	0.032
2011–2019	34.52%	0.077	44.14%	0.073	48.42%	0.052	14.50%	0.031
2014–2019	31.04%	0.027	48.62%	0.056	49.41%	0.060	16.41%	0.024

This change of policy towards dividend payments can be observed in the drastic drop in the standard deviations throughout the observed period. Whereas the dividend payout ratios fluctuate at 1.4 and 1.6 standard deviations in the 1990s and 2000s respectively, they fall in line with those of the United States in the 2010s and even considerably lower for the final five years of the Heisei period. The consequence of this combined with the poor earnings in the 1990s and the first half of the 2000s resulted in the Japanese investors having received considerably higher dividend distributions than if a similar economic malaise were to strike Europe, the United States or South Korea.

While the Japanese dividends payments were steady, they were also low compared to other states, lending more credence to the previous proposition that they share a certain resemblance to the fixed-income market. BlackRock Investment Institute notes that for

81. Nikko Research Center, *Nihon Keizai to Shihonshijo* Page 60.

the period of 1970 to 2011, the dividend yield for Japan had been the lowest of seven nations[82] at approximately 1.5%, nearly three times as low as the United Kingdom and Australia, and almost twice as low as the second-lowest place occupied by Germany.[83]

In a 2010 paper, Pawel Mlodkowski suggests this adherence to continued dividend payouts despite decreased earnings had two effects. On the one hand, the continuous income from dividends led to consumer spending being largely unaffected by the burst of the bubble. Christel Rendu and Ramana Ramaswamy argue that one of the reason for the Japanese consumer's ambivalence to the deteriorating condition of the market had been none other than the fact that Japanese households did not and still do not participate in the equities market to any large degree.[84] On the other hand, argues Mlodkowski, the decision to continue paying higher dividends in terms of dividend yield had, in fact, worsened the situation during the Lost Decade. Although households may not own equities directly, the pension funds that the aging society had depends upon as an income source do. This results in what the author calls a "clientele effect", wherein the corporations follow the wishes of the pension funds and continue paying out dividends despite a lack of the corresponding earnings. A smaller fraction of the equities owned by foreign investors do not object to this practice either, because they see Japan as a safe harbor that does not generate book returns but pays a steady income. Prior to the asset price bubble, Japanese enterprises were able to finance their operations through credit generated by the domestic savings encouraged by the postwar governmental policies, such the creation of organizations such as the Central Council of Savings Promotion in charge of dissemination of pro-savings literature, personal finance education and appointing of individual citizens as "savings promotion leaders".[85] During the 1990s a credit crunch occurred and Japanese enterprises could no longer get credit as easily, all while being burdened by the ongoing dividend payments, thus hamstringing source of funds for investment and ultimately reducing their international competitiveness.[86]

Real performance Although the above figures appear to be particularly bleak for the Japanese case, this is not necessarily the case or not as extremely the case as the

82. The comparator countries were the United Kingdom, the United States, France, Germany, Australia, and Canada.

83. Quintin Price et al., "Means, Ends and Dividends: Dividend Investing in a New World of Lower Yields and Longer Lives," *BlackRock Investment Institute*, 2012, https://www.blackrock.com/us/individual/literature/whitepaper/means-ends-and-dividends-us-version.pdf.

84. Christel Rendu and Ramana Ramaswamy, "Japan's Stagnant Nineties," *Japan's Stagnant Nineties: A Vector Autoregression Retrospective* 99, no. 45 (1999): 1–22, ISSN: 1018-5941.

85. Charles Yuji Horioka, "Why Is Japan's Household Saving Rate So High? A Literature Survey," *Journal of the Japanese and International Economies* 4, no. 1 (1990): 49–92, ISSN: 0889-1583.

86. Pawel Mlodkowski, *Dividend Policy in Crisis. Case of Japan 1991–2008*, vol. 5 (2010), 49–74, doi:10.1007/BF03405727.

nominal Nikkei 225 prices would suggest. While it would be a stretch to assume that any of the following would greatly affect retail investors given the low degrees of financial literacy and popular media focusing exclusively on nominal performance, it is nonetheless important to acknowledge some weaknesses of the aforementioned approach that may be eradicated through educational means even in presence of an extreme form of home bias limiting the hypothetical investor solely to the Nikkei index.

None of the aforementioned indices except for the DAX accounted for the reinvestment of dividends. Should the investors have selected a mutual fund or later an exchange-traded fund (ETF) that accumulated and reinvested dividends into the same basket of stocks, as opposed to paying them out to the investors, this would over time resulted in a superior performance than that of simply holding the equities and savings or consuming the distributed dividends. Given that premise, one can reconstruct the previous indices in their Total Return variants, as was already the case with the DAX. Doing so further decreases the loss ratio and increases the mean return due to long-term investors' positions becoming more valuable and thus not necessarily dropping beneath the purchase price in the case of a market downturn. In the case of the United States, this increases the mean return from 1.19% to 1.92% (61% change) and decreases the loss rate from 11.82% to 7.99% (–32% change). In the case of South Korea, the loss is reduced from 18.92% to 16.33% (–14%) and the mean return increases from 0.89% to 1.28% (44%).

Even by accounting for dividend reinvestment, the Japanese market does not receive a boost of the same magnitude as its comparators. The losses decrease from 64.08% to 55.65% (–13%), while the mean returns turn from a negative –0.05% to the positive 0.07%.

A further adjustment that must be made is that for the loss of purchasing power. Once the retail investor decides to liquidate their assets, for instance for the purposes of financing their retirement as part of a defined contributions plan, the price level of goods becomes an immediate concern. To account for this loss of purchasing power, one can recalculate the value of each position relative to the consumer price index (CPI) of the starting year. In theory, one can assume that this will further give the Japanese index a leg up against other indices due to the long low inflationary or even deflationary periods characterizing the post-Bubble economy. The assets traded in the markets may not have appreciated as much, but neither have the prices increased greatly. It was only by 2019 when the Financial Times reported that Coca Cola Japan raised its prices for the first time since 1992.[87]

While this final adjustment in no way makes the Nikkei 225 index a great investment of the past thirty years, it nonetheless considerably reduces the gap between the Japanese

87. 2019–03–14 Recent price rises fail to boost Japan inflation.

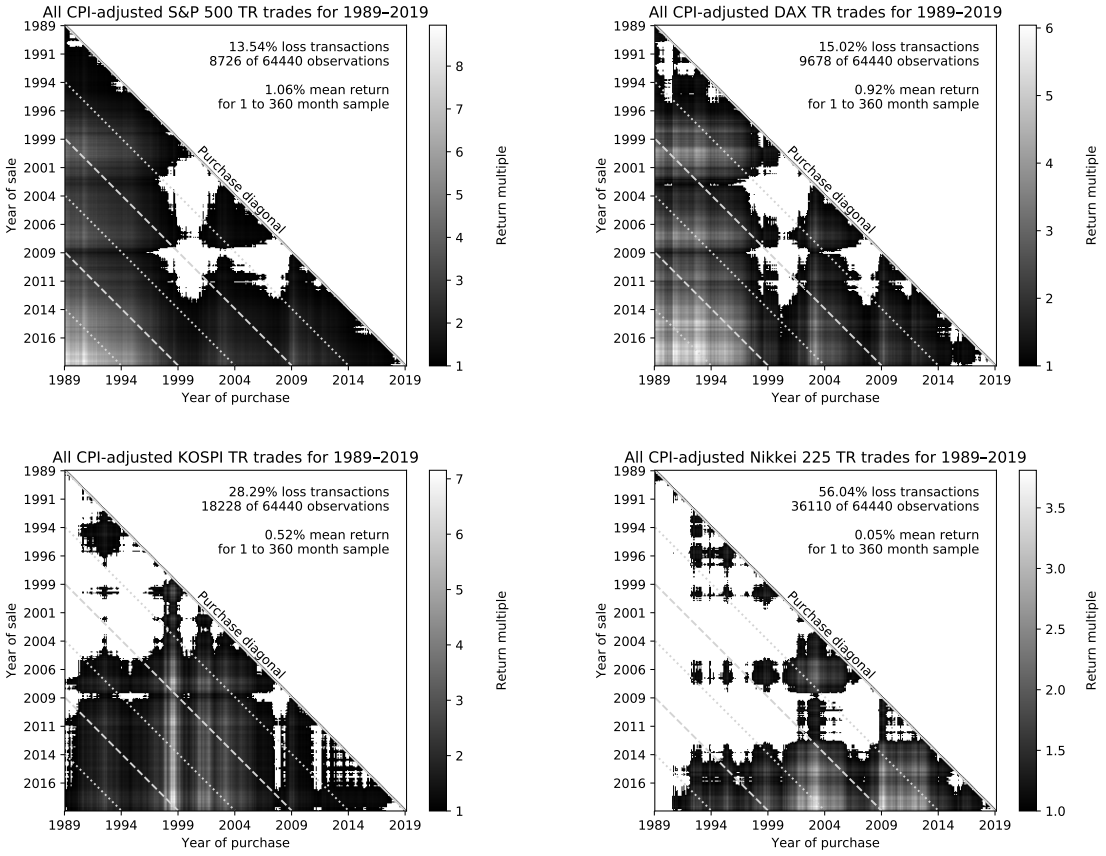

Figure 3.12 Data: Bloomberg.

market and those of the other three nations. The loss rate increased slightly from 55.65% to 56.04% (1%), in stark contrast to an increase of 7.99% to 13.54% (69%) for the United States, 11.43% to 15.02% (31%) for Germany and as much as 16.33% to 28.29% (73%) for South Korea. Similarly, the mean returns for Japan decreased from 0.07% to 0.05% (–29%), as opposed to 1.92% to 1.06% (–45%) for the United States, 1.41% to 0.92% (–35%) for Germany and 1.28% to 0.52% (–59%) for South Korea.

This suggests that the lack of much-desired inflation in the Japan economy had at least somewhat mitigated the opportunity costs of investing in the home market. Ultimately, these findings are most likely of little relevance to the behavior of the Japanese retail investors and, while presenting a case for the performance of the Japanese market not being as bad as it would seem in relative terms from the nominal chart of the Nikkei 225 alone, there is no way to interpret the performance of the past thirty years as anything worth aspiring to. The best thing the Japanese mutual fund managers can hope for is collective amnesia eradicating all memories of the market prior to 2012.

Fundamental conditions of the market

Earnings To conclude the discussion of the stock market performance of the past thirty years, it is worth throwing a brief glance at the underlying fundamentals of the market itself. These are unlikely to be considered by anyone but a very small minority of retail investors, but they nonetheless give a more complete picture of the underlying conditions than the prices themselves. The metrics examined in this section are the price-earnings, price-book and the debt-equity ratios for the respective indices.

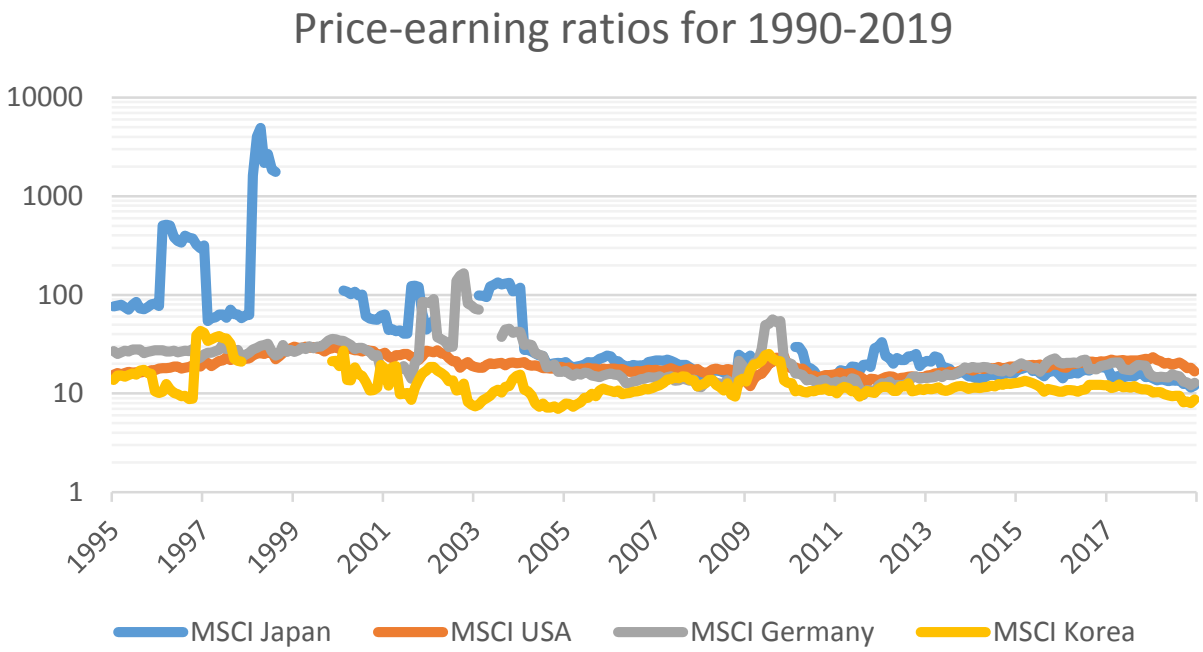

Figure 3.13 Note that a logarithmic scale is used. MSCI indices are used to harmonize the index composition criteria and due to the greater availability of older fundamentals data for all indices except the S&P 500.

Data: Bloomberg.

The price-earnings (PE) ratio is perhaps the most popular fundamental metric used in stock or market valuation. It is computed by dividing the total market capitalization of an enterprise by the company's earnings after subtracting the dividends paid to preferred stockholders. In the case of an index such as the MSCI Japan, the price-earnings ratio corresponds to the weighted average of the price-earnings ratios of the index's constituents. The ratio is thus a subject to change either through the movement of the price or a change in earnings, whereby increased earnings at the same valuation result in a lower price-earnings ratio and an increased price would result in a higher price-earnings ratio.

Although the Japanese equities remained well beneath their Bubble era peek, the market had not been cheap in terms of earnings. In the late nineties the earnings of

Japanese companies, plagued by structural issues within the Japanese economy, such as low investment, poor corporate governance and zombie banks, had been significantly lower relative to their market price when compared to their foreign counterparts.

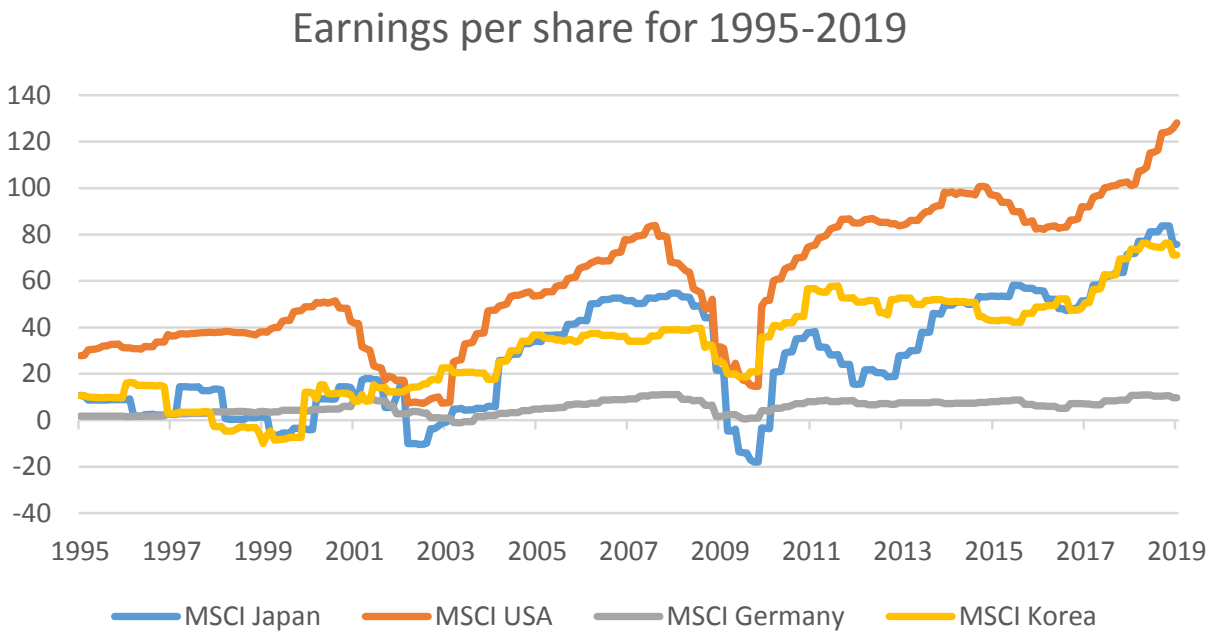

Figure 3.14 Data: Bloomberg.

Furthermore, in contrast to the United States and Germany, the said price-earnings ratio for Japan showed a significantly greater degree of variability. In May 1998, it rapidly rose to a little shy of 5,000 or 200 times higher than that of the MSCI USA. Since earnings can drop beneath zero—and division by zero is not possible—periods during which the reported earnings are negative do not have a price-earnings ratio and such gaps, wherein earnings could not be computed, had indeed occurred in the case of all countries except the United States. Examples thereof are the periods of the East Asian Financial Crisis for Japan and Korea, the 2003 bottom of the early–2000s recession that led Germany to miss the deficit ceiling of the European Union's stability pact[88] as well as in 2009 when the effects of the Global Financial Crisis had led to a 51% contraction in demand for Japanese automobiles that at the time made up for approximately a sixth of all Japanese exports.[89]

Lastly, we can observe a considerable decrease in the cost of the Japanese market throughout the observed period. Over the entire period, the market had been more than 6 times as expensive as the American market, but this was in no small part due to drops

88. BBC News, *German Economy Shrank During 2003*, Web Page, 2004, accessed 11 April 2019, `http://news.bbc.co.uk/2/hi/business/3398989.stm`.

89. Jun Saito, *Why Was Japan Struck So Hard by the 2008 Crisis?*, Web Page, 2018, `https://www.jcer.or.jp/english/why-was-japan-struck-so-hard-by-the-2008-crisis`.

Table 3.4 Arithmetic means and standard deviations of the price-earning ratios for 1995–2019

	MSCI Japan		MSCI USA		MSCI Germany		MSCI Korea	
	Mean	**Stdev**	**Mean**	**Stdev**	**Mean**	**Stdev**	**Mean**	**Stdev**
1995–2019	127.73	491.32	19.66	3.95	24.07	18.66	13.18	5.89
1995–2000	479.76	971.55	22.97	4.70	27.84	3.11	19.43	10.08
2001–2010	38.24	35.77	18.88	3.14	28.12	27.78	12.23	3.84
2011–2019	17.40	3.80	18.14	2.63	16.40	3.14	11.17	1.07

in earnings in the 1990s. During the 2000s, it had already been only twice as expensive as the American market. In no small part due to the market rally started by the Abenomics program, the Japanese equities established the same general level of price-earnings as the United States. In October of 2018 before a brief drop in the American equities market, each dollar of earnings generated by the Japanese equities had a cost of $12 or 40% less than each dollar generated by their American counterparts. To give a scope of the mania of the late 1980s, the same one dollar of earnings sold at more than 60 dollars.[90]

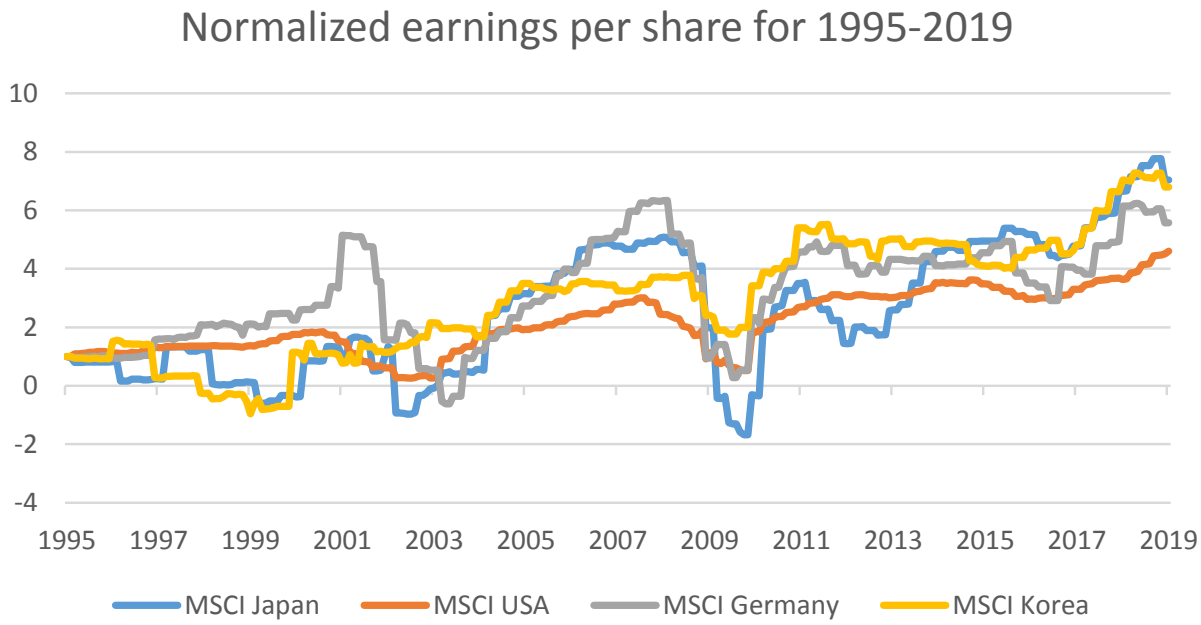

Figure 3.15 Normalized by January 1995. Data: Bloomberg.

In terms of the growth of earnings independent of the stock price, most of the current earnings appear to have come into existence as many other features of the Japanese stock market as a result of the Abenomics program. There had been a considerable recovery from the slump of the Lost Decade in the early years of the new millennium, but that growth had been cut loose by the impact of the Global Financial Crisis on the Japanese export markets. As a result thereof, the Japanese case is a particularly turbulent one

90. Burton G. Malkiel, "Bubbles in Asset Prices," in *The Oxford Handbook of Capitalism* (2010).

with a standard deviation of normalized earnings at 2.28 as opposed to 2.03 for Korea, 1.7 for Germany and only 1.04 for the United States.

Book value Another popular metric for evaluating equities is the price-book ratio. Whereas the price-earnings ratio looks at how much it would cost to buy a dollar of an enterprise's earnings on the stock market, the price-book ratio looks at how much it would cost to buy the enterprise's based on its value on the balance sheet minus the liabilities and intangible assets, and the market capitalization of the enterprise. In other words, it represents the price paid for what remains of an enterprise in terms of tangible assets in case of liquidation after paying off the debt. Example of the said tangible assets are factories, land, capital goods such as machinery as well as manufactured products and manufacturing inputs held in the enterprise's inventory. As the value of the tangible assets in an enterprise is much more stable than its earnings and is less affected by a sudden drop in demand for the enterprise's goods and services, the price-book ratio shows a lower degree of variance than the price-earnings ratio. A price-book ratio lower than 1 suggests that the company is trading for less than it is worth.

Like the price-earnings ratio, the price-book ratio typically varies between industries. This applies to both industries within a nation and the composition of indices on an international basis. For example, an Internet software and services company would have very few tangible assets on its books, such as office space and some computer equipment, because its biggest assets are intangible, such as its patents and the number of users on its platform. On the other hand, a utilities company owning a large water purification plant and a network of pipes, or an automotive manufacturer owning factories and large inventories of goods would have a much larger percentage of tangibles on its books. All else equal, the Internet software services company would have a high price-book ratio whereas a utility company would have a low price-book ratio. As of January 2019, an American Internet software company had a mean price-book ratio of 14 while a utility company had that of one of 1.96.[91]

From the early 2000s onward Japan remained middle-of-the-road in terms of its price-book value. The market had been slightly more expensive than Germany and Korea before the financial crisis, less expensive immediately thereafter and precisely in the middle following the Abenomics reforms. By January 2019, the price-price ratio for Japanese equities had been at 1.2 in contrast to that of 3 for the United States.

As with individual companies, this difference in price-book ratio is in no small part due to the nature of the companies underlying the indices. If one were to examine the

91. Aswath Damodaran, *Price and Value to Book Ratio by Sector (US)*, Web Page, 2019, `http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/pbvdata.html`.

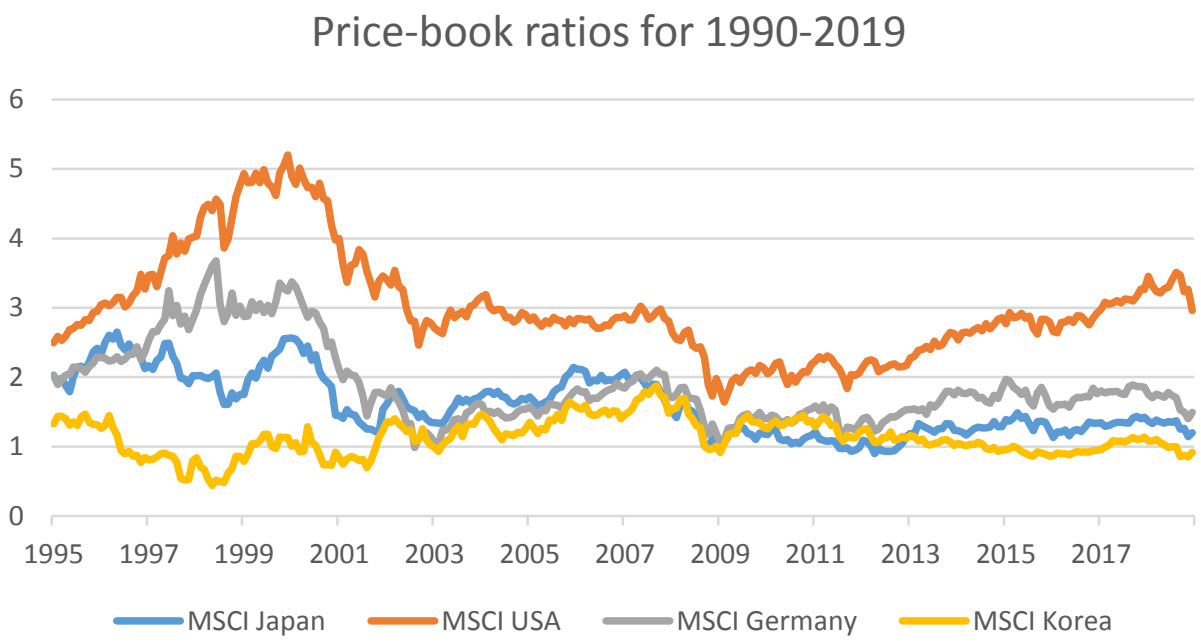

Figure 3.16 Data: Bloomberg.

Table 3.5 Arithmetic means and standard deviations of the price-book ratios for 1995–2019

	MSCI Japan		MSCI USA		MSCI Germany		MSCI Korea	
	Mean	**Stdev**	**Mean**	**Stdev**	**Mean**	**Stdev**	**Mean**	**Stdev**
1995–2019	1.60	0.44	3.01	0.77	1.88	0.57	1.13	0.27
1995–2000	2.16	0.27	3.91	0.82	2.72	0.45	0.97	0.28
2001–2010	1.55	0.32	2.73	0.49	1.58	0.27	1.30	0.25
2011–2019	1.23	0.15	2.69	0.41	1.63	0.18	1.04	0.12

manufacturing output of the four nations in 2015, the United States was second after China with a little under $2 trillion and making up for 18% of global manufacturing. It is then followed by Japan with $1 trillion, Germany with $700 billion and Korea with $372 billion. However, relative to the national output the United States' manufacturing makes up for only 12% as opposed to 19% in Japan, 23% in Germany and 29% in Korea.[92]

The combination of the Lost Decade in Japan and the East Asian Financial Crisis in Korea coinciding with the stock rally during the Dot-com Bubble has resulted in the two East Asian equity indices not appreciating as much as their Euro-American counterparts. When considering price-book, the said ratio for Japanese equities during the Bubble had risen to nearly 5,[93] approximately coinciding with that of the U.S. American index during the peak of the Dot-com Bubble.[94]

92. Darrell M. West Lansang and Christian, "Global Manufacturing Scorecard: How the US Compares to 18 Other Nations," 2018, `https://www.brookings.edu/research/global-manufacturing-scorecard-how-the-us-compares-to-18-other-nations/`.
93. Malkiel, "Bubbles in Asset Prices."
94. Ibid.

Bonds

The second major asset class that Japanese individual investors could effectively participate in through their brokerages are the fixed-income instruments. These consist primarily of the money market, bonds and fixed-income instruments created through securitization, such as mortgage-backed securities (MBS).

In the previous section, equity indexes such as the Nikkei 225 and the S&P 500 were used to measure the performance of the Japanese equity market relative to itself and the comparator nations. As previously mentioned, these indexes are effectively rule-based baskets of individual equities that are typically argued to present the national market. A similar process can be undertaken to create an index of fixed-income securities for the aforementioned national market.

Two indices are used to represent the performance of the Japanese and the American bond market: the Nomura Bond Performance Index (BPI) and the Bloomberg Barclays U.S. Aggregate Bond Index. Both indices are total return indices, which means that coupon payments and principal are reinvested continuously rather than being paid out to the investor.

The Nomura BPI is the leading fixed-income performance index for the Japanese market and has been compiled by Nomura since 1986. It includes Japanese government bonds (JGBs), municipal bonds, government-guaranteed bonds, investment-grade corporate bonds, bank debentures, yen-denominated foreign bonds (Samurai), mortgage-backed securities (MBS) and asset-backed securities (ABS). The instruments must be at least A-rated and traded on the public markets. As of a 2016 publication, the index consisted of approximately 81% Japanese government bonds followed by 7% municipal bonds, 6% corporate bonds, 3.5% government-guaranteed bonds, 1.3% mortgage-backed securities and the others instruments at under 1%. The percentage of Japanese government bonds has been increasing rapidly since the 1990s when they constituted only half of the index. Similarly, municipal bonds have grown in weight since the turn of the millennium.[95] Unsurprisingly, between 2000 and 2019, the index has performed very close to the performance of its Japanese government-bond only counterpart, the Nomura BPI JGB,[96] by growing at 1.86% annualized and 1.92% annualized respectively.

The Bloomberg Barclays U.S. Aggregate Bond Index is Nomura BPI's direct comparator. It constitutes a basket of investment-grade fixed-income securities denominated in U.S. dollars and includes United States' federal government-issued bonds (Treasuries), government agency bonds, corporate bonds, Eurodollar bonds, mortgage-backed securi-

95. Mayumi Onozawa, Hiroe Fukasawa, and Koji Masaoka, *Japan Bond Indices Handbook*, Report (Nomura, 2016).

96. Bloomberg data.

ties, and asset-backed securities. In contrast to the Nomura BPI, as of February 2019, it contains only 42% government-issued bonds. The Treasuries are followed by 28% of mortgage-backed securities, 25% corporate bonds of which 15% were financials, 2% commercial mortgage-backed securities, and 1.5% government agency bond.[97] If compared to its Treasury-only counterpart between the years of 2000 and 2019, the Bloomberg Barclays U.S. Aggregate Bond Index had grown at 4.89% annualized compared to 4.5% annualized.[98]

In contrast to the equity indices, both bond indices include foreign securities that are issued in the home currency of the index—that is the Japanese yen for the Nomura index and the U.S. dollar for the Bloomberg Barclays index. There is an argument to be made for the importance of the said bonds from the perspective of investments' function as a vehicle for financing domestic enterprises, but as this research revolves around the retail investors only the attractiveness of the returns generated by the bond markets is of interest.

The following is a basic perspective on how the indices have developed over in the new millennium.[99]

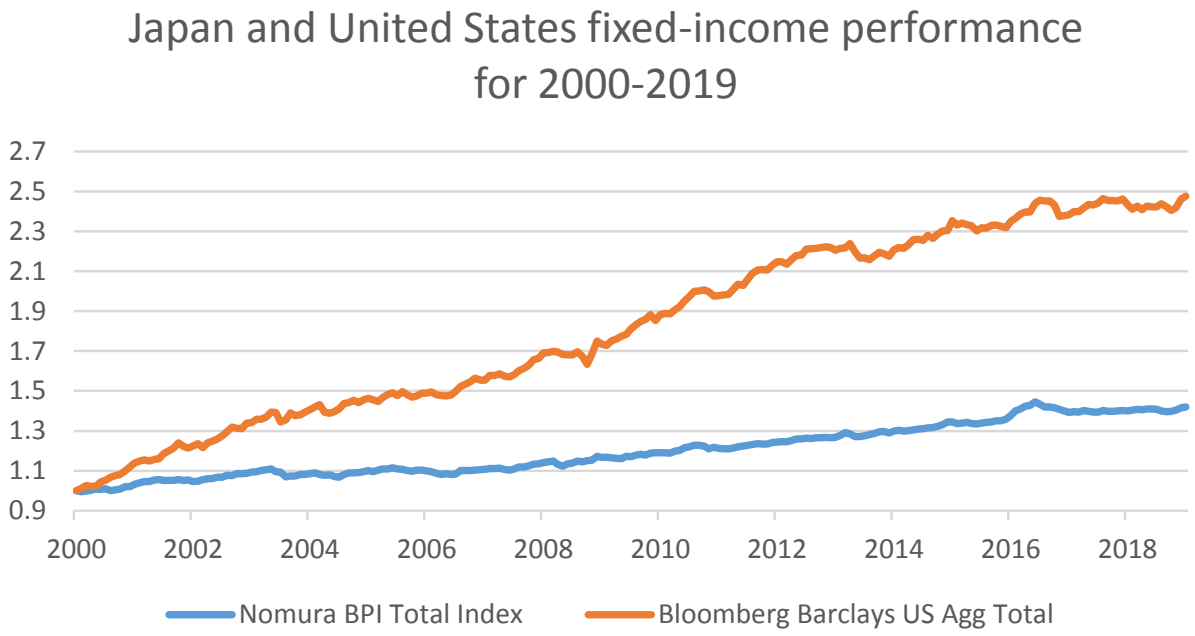

Figure 3.17 Data: Bloomberg.

Although the Japanese bonds underperformed the compared to the American bonds, they did not suffer the same fate as the Japanese equities and returned a positive nomi-

97. Bloomberg Barclays Indices, *Bloomberg Barclays Index Methodology*, Web Page, 2017, accessed 6 April 2019.
98. Bloomberg data.
99. Pre–2000 data for Nomura BPI could not be acquired.

nal performance over the observed period. Even more importantly, the Japanese bonds at 1.86% annualized returns have vastly outperformed the Japanese equities that only returned 0.28% annualized during the same period. Furthermore, although the American bonds greatly outperformed the Japanese in terms of nominal performance, they were also riskier investments throughout most of the observed period as shown by the 30-day volatility.

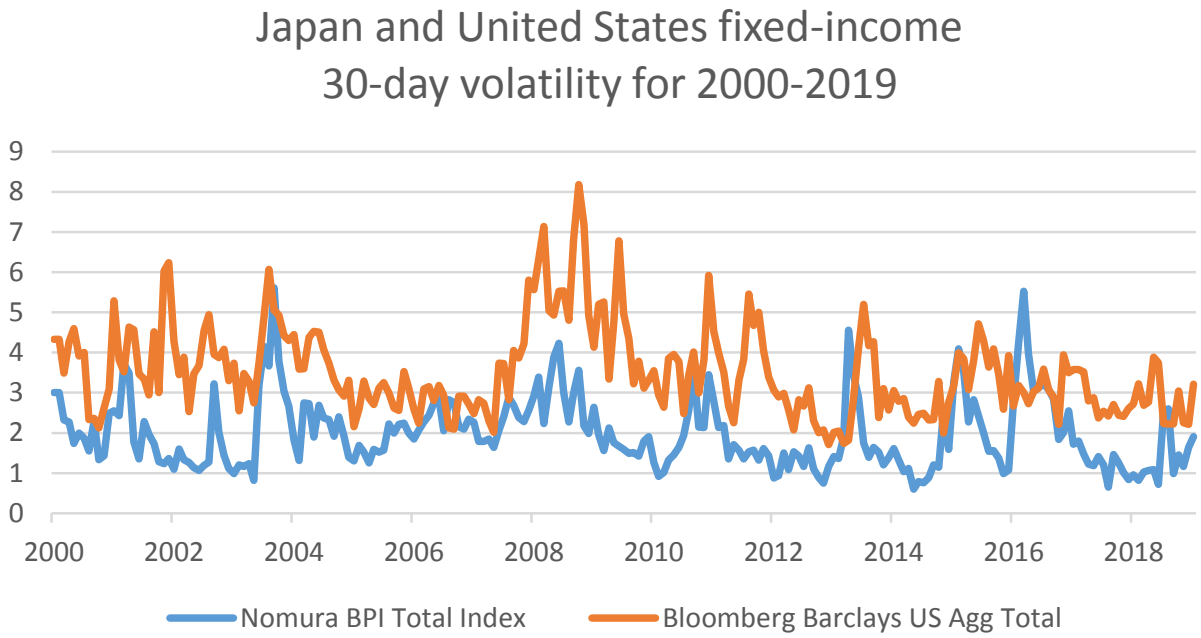

Figure 3.18 Data: Bloomberg.

As with the equity indices, it is possible to generate a heat map to ensure that one is not merely picking an unfortunate starting point. This is arguably not as necessary as it is with equities since bond indices have considerably lower volatility and are less likely to trade at a loss for long.

The Japanese bond performance bears a much higher resemblance to the American bonds than Japanese equities do to their American counterparts. Both charts display a healthy gradient towards the bottom left corner that suggests the validity of the long-term buy-and-hold strategy, which individual investors saving for retirement or other long-term goals are likely to pursue. Similarly, both charts hint towards losses at the far right end of the diagonal. These are linked to the present policy of quantitative tightening executed by the United State's Federal Reserve Board and the possibility of monetary tightening by the European Central Bank (ECB) and the Bank of Japan (BOJ).

Although this is a clear case of hindsight always being twenty-twenty and past performance not being indicative of future returns, one can argue that were the Japanese retail investors better exposed to the existence of bond indices that, unlike the Nikkei

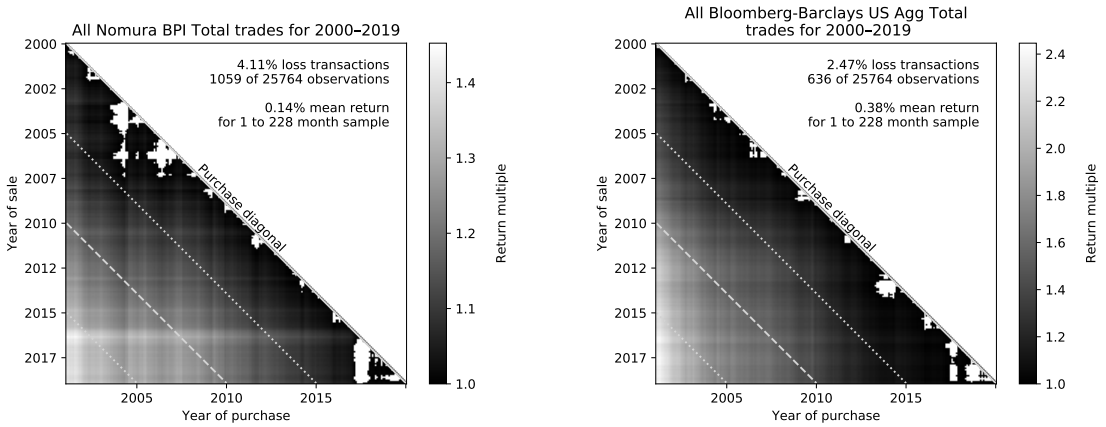

Figure 3.19 Data: Bloomberg.

225 and the Dollar-Yen spot rate, do not take the prominent spot during the evening news, they may be more inclined to purchase them based on their positive track record. Remarkably, the said track record is not limited to the new millennium but has shown an annualized return of 6.28% during the 1990s when Japanese equities remained in an ongoing state of flux. From 1965 to 2000, the index yielded an annual return of 7.55% decreasing in nominal terms through the entire period.[100]

One may assume that the Japanese retail investors would thus prefer bonds when given an opportunity to select a portfolio, but as will be shown later based on asset allocations in Japanese defined contribution plans, this is not the case.

Real performance As with the stock market, the Japanese bonds performed better relative to the American bond market when accounting for inflation. This is even more so the case for a period following the start of the new millennium.

Whereas the United States' dollar depreciated by approximately a third of its value in the past nineteen years, the prolonged period of deflation leading up to the premiership of Shinzo Abe has greatly reduced the spread between the Japanese and American investors' returns in the bond market. This condition has been further reinforced by the fact that the deflationary period occurred in the first half of the observed period, thus aiding the compound interest effect. These effects are the most visible when observed on the corresponding heat maps.

When compared side-by-side, the Nomura BPI performance for nominal and real values looks very similar. On a monthly resolution, the random entry and exit return difference is a mere basis point as opposed to 20 basis points for the Bloomberg Barclays index. When considered in real terms and assuming no commissions, fees or tracking

100. Ujiie, *Japanese Financial Markets*. Page 27–28.

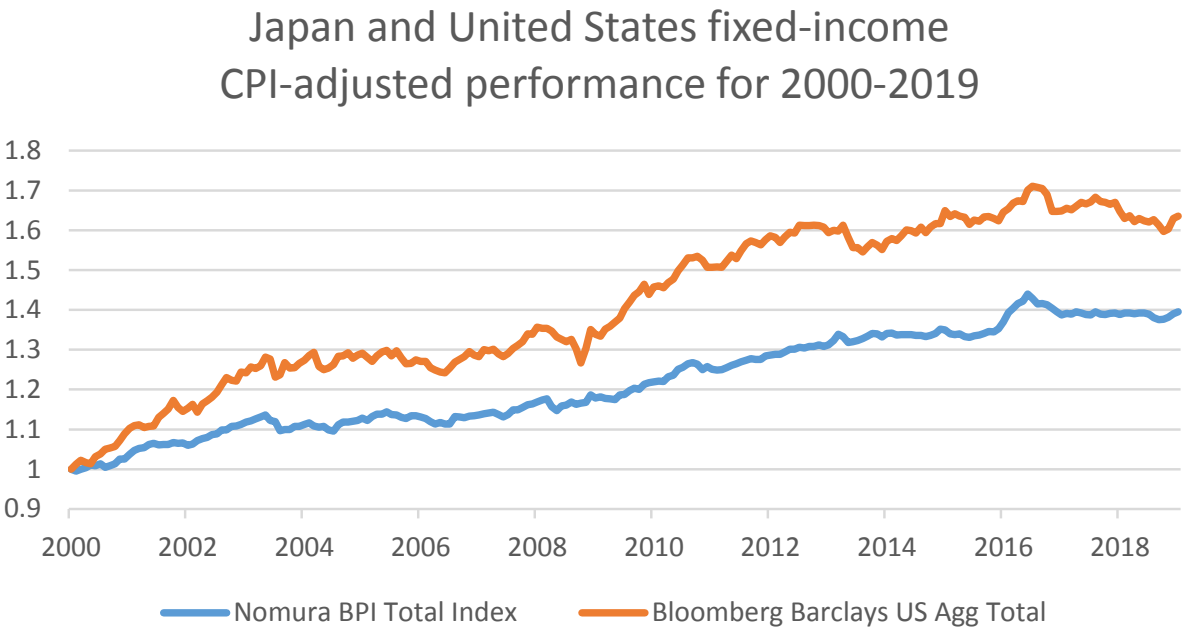

Figure 3.20 Data: Bloomberg.

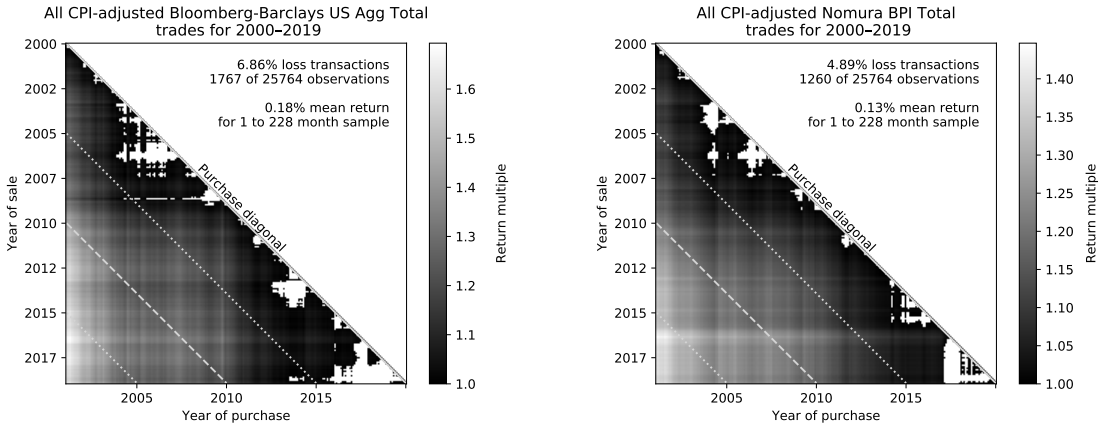

Figure 3.21 Data: Bloomberg.

errors, participating in the Japanese bond market randomly would have had a lesser probability of incurring a loss compared to the U.S. American bond market.

Real estate

The last sector examined in this section is the real estate managed by professionals and owned by investors through the purchase of shares of real estate funds.

The two indices chosen are the Tokyo Stock Exchange (TSE) REIT Index and the Morgan Stanley Composite Index United States (MSCI US) REIT index. Both indices track a portfolio of real estate investment trusts in their respective markets. Although REITs existed in one form or another in the United States since the 1960s, they were

introduced in Japan only following the amendment of the Investment Trust Act in November 2000. The first two REITs were listed in September 2001. The TSE REIT index itself was introduced in March 2003. Conversely, the MSCI US REIT is one of a large series of MSCI indices that specifically tracks the United States' REITs. Due to the recent nature of these instruments, the data set only begins in June 2005.

For brevity, only total return data is shown for the REITs sector. This is important to understand due to the high dividend nature of the REIT instruments, which can be reasonably assumed to be immediately obvious to a retail investor venturing into this asset class. Whereas Japanese stocks have historically paid out a modest but very stable dividend, a significant portion growth of both Japanese and to a lesser degree American REITs comes from the said dividends. For example, whereas a hypothetical redistributing TSE REIT index fund with zero costs and no tracking error would have produced a return of only 13% over the past 13.5 years, an accumulating fund would have yielded as much as 108% during the same period.

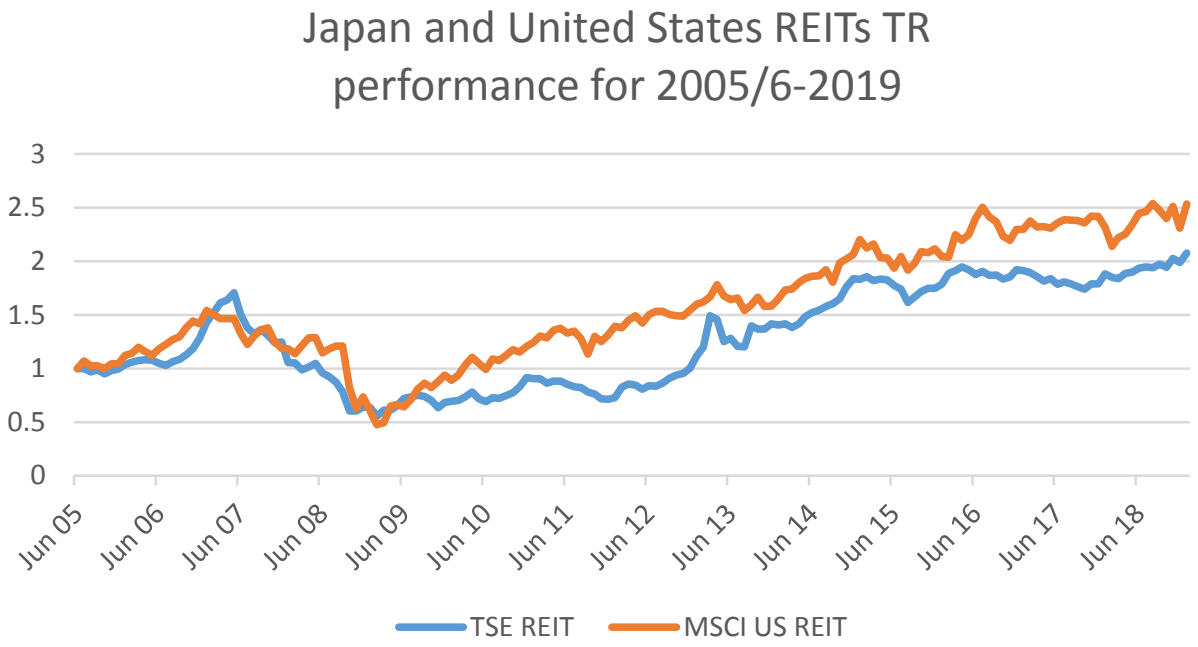

Figure 3.22 Data: Bloomberg. Note that tick marks are always at June rather than start of the year.

In stark contrast to the Japanese equities and even the bond markets, the nominal performance of the Japanese REITs is very close to that of its American counterparts. As can be expected, both indices were adversely affected by the subprime crisis but have since recovered from it. The said recovery appears to be both delayed and slower in the case of Japan. A considerable increase in valuations is also visible following the beginning of Abenomics that persisted until the United States Federal Reserve Board rate hikes in 2016 under the chairmanship of Janet Yellen. During the given period, the TSE REIT

and the MSCI US REIT had grown at a compound annual rates of 5.5% and 7.12% respectively, resulting in a total appreciation of 107% and 153% respectively.

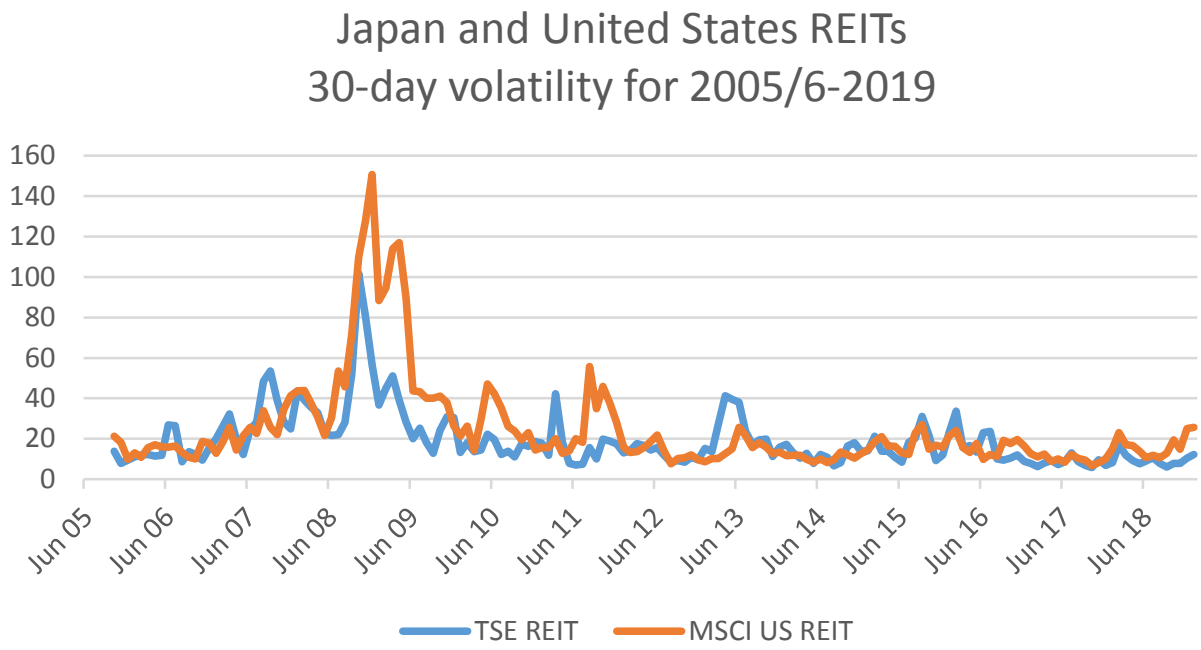

Figure 3.23 Data: Bloomberg. Note that tick marks are always at June rather than start of the year.

In terms of risk, both indices show comparable 30-day volatility with the United States real estate volatility being overall higher than for Japan largely due to the subprime crisis. When compared to the stocks and the bonds, the two markets are remarkably similar in terms of risk with a minor exception of the 2008 to 2009 time frame.

Real performance After adjusting for inflation, the Japanese real estate market outperforms the U.S. market by a very thin margin. As with bonds, this is in no small part due to the deflationary period in the first half of the observed period. The final difference is insignificant with only 6% between the two indices over a period of fourteen years, but it nonetheless suggests that Japanese investors that had chosen to participate in domestic-only assets had a chance to perform as well or even a little better than their American counterparts. This stands in contrast to the factually uninspiring performance of the domestic stock market and the somewhat questionable perception that the Japanese bond market may not have been worth participating in since the burst of the bubble.

One may argue that the performance of REITs in the given time frame may be similarly applicable to Japanese housing that could be purchased by retail investors for the purposes of renting out or personal use. Unfortunately and in spite of the recent personal housing rally, this is unlikely to be the case. First, one must acknowledge the elephant

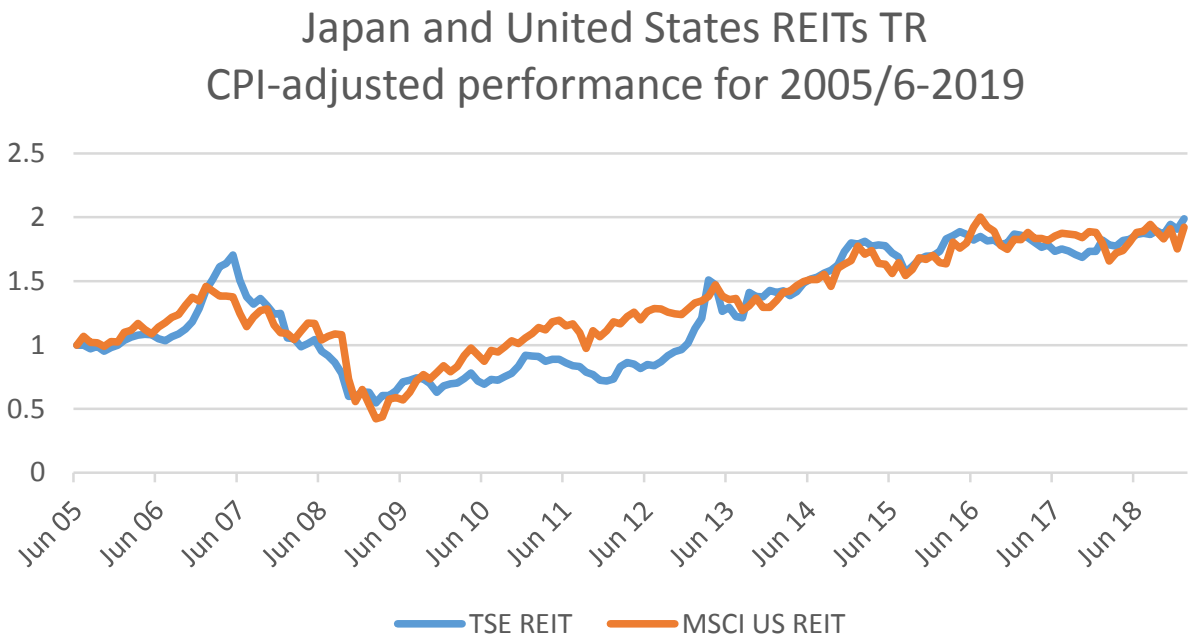

Figure 3.24 Data: Bloomberg. Note that tick marks are always at June rather than start of the year.

in the room which is that REITs did not appear until the early 2000s and thus do not include the effects of the Bubble that were accounted for in the case of equities. Anyone having bought a residential, commercial or industrial property in Tokyo would still be underwater. This is particularly the case for commercial sites that on average reached the price of ¥7 million per square meter during the peak of the real estate bubble in 1990.[101]

Furthermore, from a nation-wide perspective, the largest appreciation in property prices of the decade following the Global Financial Crisis does not appear to be in the assets a retail investor would typically purchase on their own. The largest drivers of this appreciation had been the price of the condominiums that had increased by 35% since 2010, followed by commercial real estate. The biggest drivers of the latter were retail real estate at 33%, offices at 22% and warehouses at 14%. The figures fluctuate somewhat depending on the location, with office spaces having appreciated more than commercial retail real estate in Tokyo but significantly less so in Osaka and Aichi.

What remains a constant across all surveyed prefectures, whether it be Tokyo, Shikoku or Hokkaido, is that prices of detached housing have not been keeping up with other real estate classes. The national average appreciation since 2010 had been under 2% and thus well below the level of purchasing power loss through inflation. Even then, the said positive gains appear to be well within the volatility range of the asset class. In some

101. Ministry of Internal Affairs and Communications, *Chapter 15 Real Estate and Land*, Web Page, 2019, accessed 8 April 2019.

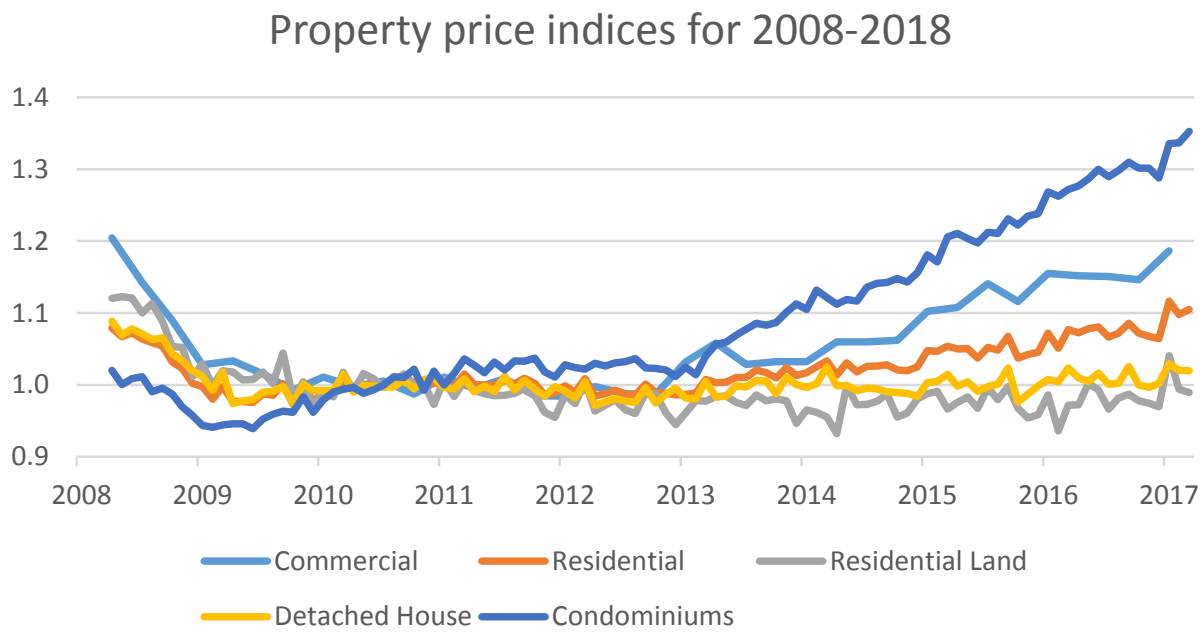

Figure 3.25 Data: Ministry of Land, Infrastructure, Transport and Tourism, *Japan Property Price Index*.

cases, such as Chubu, Shikoku, and Osaka, detached houses had even depreciated in nominal terms.[102]

Given that personal residential housing is far and wide the most common real estate asset a retail investor would purchase in its entirety combined with the emphasis on homeownership in Japanese media, it does not seem likely that the success of the REITs in the past fifteen years would translate well to homeownership. One can nonetheless argue that this performance is by and large irrelevant to the public perception of the asset class, as homeownership is much more than—or perhaps, not even an—investment in the eyes of the public at large.

3.2.3 Concluding remarks

As has been demonstrated in this section, the past decades of Japanese capital markets have not necessarily been encouraging to the individual investor seeking long-term capital appreciation. The stock market crashed following the asset price bubble and, even despite the valiant efforts to reinvigorate the Japanese economy under the banner of Abenomics, the market remains only at half of its previous peek. Structural issues, lack of business confidence, adverse demographic conditions and aging corporate governance practices that are changing only at a slow pace continue to haunt the valuations of Japanese

102. Ministry of Land, Infrastructure, Transport and Tourism, *Japan Property Price Index*, Web Page, 2019, accessed 8 April 2019, `http://www.mlit.go.jp/en/report/press/totikensangyo05_hh_000011.html`.

equities. The low-interest-rate policy of the Bank of Japan that came into effect following the Bubble and remained at below 1% since the late 1990s has also rendered the Japanese fixed-income securities less attractive than they may have been otherwise. This is not necessarily an entirely objective assessment, as the previous sections have shown that the Japanese bonds markets have produced a very respectable yield, especially when considered from the price-purchase parity perspective. The REITs have performed even better for those who were not invested into share ownership of commercial real estate during the Bubble period. The condominium market, in particular, has continued to experience a boom across all surveyed prefectures. Detached residential homes, on the other hand, have shown little or even negative appreciation with the number of *akiya* abandoned homes expected to surpass 20% by 2033 and already having made up for as much as 11% even in the nation's capital itself.[103]

At this point, one can only assume what the effect of such developments would have been on someone curious but not yet knowledgeable in the investment side of personal finance. This is not a question that is likely to be answered with definitive precision in the near future due to the long-term macroeconomic nature of the experiment required to analyze it. The Japan markets, and especially their equity side, have long remained the bogeyman for investors worldwide. No matter how well the buy-and-hold strategy may have held in the past and how long an investment horizon a prospective pensioner sets, the shadow of "another Japan" occurring is never far behind. For the Japanese retail investors themselves, the said shadow has long been cast and perhaps may have already left its long-lasting mark.

3.3 Behavioral finance biases

As this research focuses on the question of investor's behavior, it appears prudent to review the major insights from a field that studies this specific topic being behavioral finance. This section will give a brief overview of the main biases identified by the field and, while it is by no means comprehensive, establish the terminology and concepts used in the future sections. The overview is largely based on Baker and Nofsinger's edited *Behavioral Finance: Investors, Corporations, and Markets* and articles by Markku Kaustia, Morris Altman, Markus Glaser, Martin Weber, and Hisham Foad.

103. Yen Nee Lee, *Want a Free Country House in Japan? They're Giving Them Away*, Web Page, 2018, accessed 8 April 2019, `https://www.cnbc.com/2018/11/22/japan-free-homes-empty-houses-given-away-and-sold-cheap.html`.

3.3.1 Disposition effect and its causes

The disposition effect branches off into an entire tree of biases that result in its occurrence. First identified by Shefrin and Statman, the disposition effect is the tendency of the investors to keep their losing positions and selling their winning positions.[104] The rationalization on the behalf of the investors themselves behind this behavior is that a loss is only realized once the position has been liquidated and thus does not represent a loss if one does not sell. While this is true in principle, it ignores the basic principles behind the evaluation of investments as laid out in Benjamin Graham's *Security Analysis*[105] and similar literature. Rather than regarding a share as a part-ownership of a business that has underlying value which the share's price should correspond to either by being cheaper than the business's current value, known as value investing, or higher in anticipation that the business's future value will supersede the shares' current price, known as growth investment, an individual affected by the disposition effect uses the price at which they purchased the shares as an anchor in their investment strategy. Excluding tax optimization purposes, such behavior is irrational as the purchase price of a single investor is in no way a measure of the future performance of a financial instrument. Furthermore, this goes against the old adage of cutting one's loses and keeping one's winners, which as Markku Kaustia notes had been the advice of 19 different personal finance advice books published in 2008 alone and made up for two-thirds of the golden investment rules of the economist and broker David Ricardo.[106]

Shefrin and Statman suggest the disposition effect has four causes. The first is the prospect theory developed by Tversky and Kahneman.[107] The theory suggests that individuals are affected more by a loss than a gain of an equivalent amount, affected by how a proposition is framed and think in terms of short-term gains and losses rather than one's long-term situation. Kaustia summarizes its effects as "an investor with preferences given by prospect theory … becom[ing] more risk-averse after experiencing gains and more risk-seeking after experiencing losses".

Secondly, investors perform mental accounting, which means treating money differently depending on some arbitrary circumstance. Examples of this treating money differently depending on whether it is earned with one's labor, received as an inheritance, as a gift, as dividends or coupon payments on a bond, saved by not making a certain purchase, found on the street, won in a raffle and so forth. From a rational point of

104. Hersh Shefrin and Meir Statman, "The Disposition to Sell Winners Too Early and Ride Losers Too Long: Theory and Evidence," *The Journal of finance* 40, no. 3 (1985): 777–790, ISSN: 0022-1082.
105. Graham and Dodd, *Security Analysis: Foreword by Warren Buffett*.
106. H. Kent Baker and John R. Nofsinger, *Behavioral Finance: Investors, Corporations, and Markets*, vol. 6 (John Wiley & Sons, 2010), ISBN: 0470499117. Page 182.
107. Amos Tversky and Daniel Kahneman, "Judgment Under Uncertainty: Heuristics and Biases," *science* 185, no. 4157 (1974): 1124–1131, ISSN: 0036-8075.

view, there is no good reason to treat any one yen or dollar as more or less valuable than another, yet this is a practice that one inadvertently suffers from. Concerning the disposition effect, Kaustia notes that investors separate stocks into different mental accounts and treat them on an individual basis relative to the purchasing price.[108] As such, selling stock at a loss is perceived as a loss even if the entire portfolio is performing well precisely as a result of its intelligent composition that the stock was an integral part of.

Third is regret aversion. Selling an asset at a loss causes mental pain to the investor having to admit to themselves that they have made a mistake. Keeping asset an that is currently an unrealized loss leaves some hope that it will still recover at some point in the future and outperform its benchmark, whereas selling an asset and thus realizing the loss is perceived as final, even though the liquidity recovered from its sale may ultimately be invested into a very well-performing asset.

Kaustia refers to multiple studies noting that there is a negative relationship between the disposition effect and the sophistication level of the investors. In other words, investors who trade more, trade professionally on institutional accounts or start with more than one stock exhibit the bias to a lesser degree than those who do not fall into the above categories. This is not to say that the effect is eliminated entirely and even after a decade of trading experience, investors are still nearly twice as likely to sell at a gain than at a loss. Conversely, some investors do not appear to be affected by the effect and some are affected by an inverse effect.

3.3.2 Familiarity and home biases

Two major biases that are strongly related to each other are the familiarity and home bias. In a sense, the latter is an extension of the former.

The presence of a familiarity bias suggests that the investor is likely to invest more into things they feel familiar with than would otherwise be rational. In principle, investing in companies one knows more about does not seem like a bad idea. Perhaps one of the most popular quotes by Warren Buffett, as one of the most prominent investors of the current time, is to "never invest in a business you cannot understand". As most retail investors have jobs, lives, and families to take care of, the so-called "circle of competence" can only be so large and would typically revolve around the investors' profession and a handful of hobbies.

The issue arising from following this strategy is in an inherent lack of diversification of the assets owned by the investor. While the optimal degree of diversification is up to a debate, the Investment Company Act of 1940 offers a good yardstick known as the 75–5–

108. Baker and Nofsinger, *Behavioral Finance: Investors, Corporations, and Markets.* Page 182.

10 rule, stating that an investment company can only be called diversified, if "at least 75 per centum of the value of its total assets is represented by … [assets] limited in respect of any one issuer to an amount not greater in value than 5 per centum of the value of the total assets of such management company and to not more than 10 per centum of the outstanding voting securities of such issuer."[109] The hedge fund manager Ray Dalio in his book *Principles*, suggests a similar allocation for the purposes of risk reduction stating that "with fifteen to twenty good, uncorrelated return streams, [he] could dramatically reduce [his] risks without reducing [his] expected returns".[110] The ability to find such a "fifteen to twenty" good, uncorrelated investment appears to be difficult in the case of a retail investor. An example of a particularly devastating case where the lack of diversification and familiarity came to public attention was the Enron bankruptcy of 2001, wherein more than 60% of the assets in the 401(k) retirement accounts of its employees were Enron's stock.[111] At one fell swoop, the employees of the company they perceived themselves to be familiar with lost not only their jobs but also a considerable portion of their life's savings.

The home bias is an extension of the familiarity bias which pertains to the fact that investors tend to overemphasize the instruments pertaining to their own countries of residence or nationality. As such, American investors buy more American equities than reason would suggest, Japanese investors buy more Japanese equities and Germans buy more German ones.

Strictly speaking, there is a pragmatic case to be made for a certain degree of home bias. As described later in section 3.4.2 "Pricing", certain discount brokers appealing to individuals with smaller portfolios offer lower fees on purchases of domestic equities while some do not offer foreign equities at all. The other issue is that domestic assets may offer tax advantages that foreign assets do not and be associated with a lower bureaucratic burden. Due to the lack of a language barrier, they are also considerably easier to research. Particularly in the case of largely domestically operating businesses and above all fixed-income instruments, domestic assets are not—or to a lesser degree[112]—exposed to exchange rate risk, which particularly in the case of low-risk low-return government bonds can have drastic effects both on the returns and their reliability.

109. Senate and House of Representatives of the United States of America, "Investment Company Act of 1940," 2018, `https://legcounsel.house.gov/Comps/Investment%20Company%20Act%20Of%201940.pdf`.

110. Ray Dalio, *Principles* (Simon & Schuster, 2018), ISBN: 9781982112387.

111. Baker and Nofsinger, *Behavioral Finance: Investors, Corporations, and Markets*. Page 277.

112. An argument can be made that outside of governmental fixed-income instruments, all equities and bonds are exposed to a degree of exchange rate risk based on the premise that the world's supply chains now stretch across markets and continents and no enterprise, especially not one operating close to the export sector, is exempt from exchange rate changes. If an enterprise is exposed to exchange rate risk, so are its equity and liabilities.

Examining the data it quickly becomes apparent that this bias is expressed across markets to a very high degree. For example, the International Monetary Fund's data suggests that 87% of equities held by an average American investor are those of American enterprises. The situation is similar in the case of Germany and Japan, wherein the countries' portfolios consist of 72% and 90% of their own equity respectively. Although this effect appears lower in the case of institutional investors, research by Strong and Xu suggests that portfolio managers from the United States, continental Europe, and Japan all showed the highest degrees of optimism towards their home market,[113] which Hisham Foad keenly points out cannot possibly be a good prediction for all of them at the same time.[114]

It is perhaps the home bias that had been particularly detrimental to Japanese investors of the past thirty years. While there was no way for a Japanese investor to diversify away the recession of the Lost Decade, merely not limiting oneself to the domestic market or assigning only the percentage of portfolio to the domestic market that corresponds to that of the market capitalization of the domestic market relative to the world would have led to considerably better performance than buying equities of companies headquartered in one's own nation.

Lastly, there remains a group of biases that can generally be grouped under the term inertia. The first of these pertinent to this research is conservatism, which leads to new information being underweighted relative to the established facts. This results in new information being acted upon only slowly by the entirety of the market participants, who only gradually adjust to the new status quo. The second is the status quo bias, which results in an existing strategy being preferred to adopting a new one. This is particularly relevant with regard to pension plans and personal financial strategies and is especially noticeable with regard to the pension plan participation rates with opt-in vis-a-vis opt-out enrollment.[115]

3.4 Investment environment

This section looks at the availability of the regulatory and institutional infrastructure required for investing that the Japanese retail investors would be confronted with. In section 3.3 "Behavioral finance biases", a detailed list of biases identified by behavioral finance research has been provided. Among these was the status quo that leads investors to prefer to maintain their current situation rather than embark on a new path even if

113. Norman Strong and Xinzhong Xu, "Understanding the Equity Home Bias: Evidence From Survey Data," *Review of Economics and Statistics* 85, no. 2 (2003): 307–312, ISSN: 0034-6535.
114. Baker and Nofsinger, *Behavioral Finance: Investors, Corporations, and Markets.* Page 289.
115. ibid. Page 314–317.

logic and reason would dictate that doing so would bear fruit in the long run. There is little doubt that a certain degree of intellectual inertia and a lack of decisiveness leads to suboptimal outcomes in many areas of life, but it is perhaps the area of personal finance where these features of human nature are exhibited particularly clearly. This inertia is also entirely understandable because unlike many other areas of life the stakes in managing one's wealth are particularly high. Whereas trying a new sport or a diet merely requires a minor temporal and financial commitment, putting years' worth of salaried income or an inheritance that a deceased loved one had spent their entire life amassing into a group of financial instruments is a daunting prospect. Returning to a previously mentioned survey by the Nomura Research Institute, nearly two out of five individuals who reported that they are interested but have no experience in investing described it as the process as "high risk", over a third said that it is for "individuals who have an excess money" and a quarter described it as being both "gambling" and "scary".[116] It is apparent that crossing this Rubicon poses a considerable challenge for large segments of the population, with the herd behavior only adding to its difficulty.

One can argue with some confidence that this difficulty can be amplified or reduced by the regulatory and institutional environment of the investor. These include but are not limited to laws protecting the investors by requiring disclosure of publicly traded enterprises, penalizing securities fraud and ensuring that brokerages and investment companies maintain a fiduciary responsibility towards their clients and shareholders. The availability of brokerages and trading conditions are equally important, particularly for low-income individuals such as students and recent graduates undergoing on-job training. Of equal importance is whether the domestic stock markets offer investment vehicles that render purchasing exchange-listed instruments lucrative enough to entice retail investors to participate. The degree of necessity to invest and the governmental systems funneling or promoting investment such as pension plans and tax-advantaged accounts must also be considered. Lastly, there remains a question of taxation outside of qualified accounts and the bureaucratic hurdles put in the way of stock market participation.

3.4.1 Structure of household financial assets

Readers of contemporary financial press may be familiar with the seasonal lamentations of its authors about the unfortunate low lack of participation of the general populace in the financial markets or the general lack of savings. Titles such as "Stocks are high,

116. Original terms used are リスクが高い, お金に余裕がある人向け, ギャンブル賭博 and 怖い. From Nomura Research Institute, "Jakunensō O Chūshin to Shita Kojin Ni Yoru Tōshi No Genjō to NISA No Riyō Sokushin Ni Muketa Kadai Ni Kansuru Chōsa" [Survey on the Current Status of Investment by Young People and Issues for Promoting the Use of NISA], 2015, https://www.fsa.go.jp/common/about/research/20151001-1/02.pdf

but investor numbers are low" followed by summaries such as "The investment class in the United States is small … Only 54 percent of American households own stocks …",[117] "Why are Germans afraid of equities?"[118] or "Are French savers too cautious?"[119]. It appears that regardless of where one resides the local news publications will point out both eagerly and repeatedly how bad the situation is with regards to savings and personal finance in one way or another. A brief survey of the structure of the financial assets of the Japanese households ought to give American and European commentators some much-needed respite.

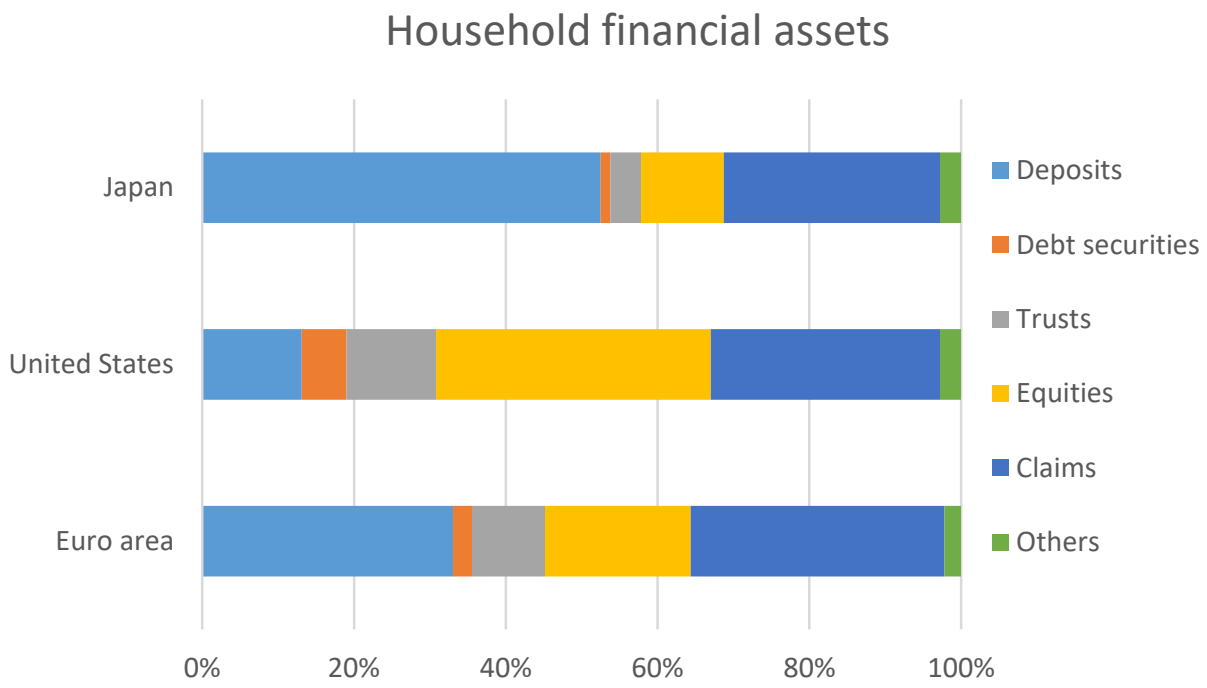

Figure 3.26 Deposits refer to currency and various bank deposits, trusts are investment trust beneficiary certificates which includes both equities and fixed-income products and claims are claims to insurances, annuities and pension entitlements.

Recreated from Bank of Japan, *Flow of Funds - Overview of Japan, the United States, and the Euro Area.*

Even though the percentage of equities and investment funds is considerably lower in the case of the Euro area than in the United States, it is nonetheless no match for the Japanese ratio of funds kept as cash, bank deposits or other money instruments. Section 3.2.1 "Tokugawa to recent times" laid out that this large allocation of funds

117. Bob Pisani, "Stocks Are High, but Investor Numbers Are Low," 2017, `https://www.cnbc.com/2017/11/02/stocks-are-high-but-investor-numbers-are-low.html`.
118. Anke Rezmer, "Anlegerverhalten: Warum Die Deutschen Angst Vor Aktien Haben," 2019, `https://www.handelsblatt.com/finanzen/anlagestrategie/trends/anlegerverhalten-warum-die-deutschen-angst-vor-aktien-haben/23918372.html`.
119. Hugo Baudino, "Les Épargnants Français Sont-Ils Trop Prudents?," 2019, `https://www.latribune.fr/vos-finances/epargne/les-epargnants-francais-sont-ils-trop-prudents-759086.html`.

towards cash is a consequence of the government programs to promote savings. Once the deposits arrived in the customers' banks, indirect financing allowed for the much needed capital expenditure of the postwar years and the rapid growth that followed. As of 2019, this large cash position that now yields next to nothing for the depositors and proceeds to burn a hole in the banks' balance sheets, remains a well-grounded element of the Japanese financial landscape. The portion of savings allocated to equities, various kinds of investment funds and, remarkably, bonds remains at a mere 16%. Writing in 2001, the Institute for International Monetary Affairs noted that "[t]he rate of return on household savings is the lowest among the G7 countries, reflecting the low return in Japan's financial system as a whole. The most serious economic issue Japan now faces, is how to manage savings in a more effective manner to produce higher returns."[120]

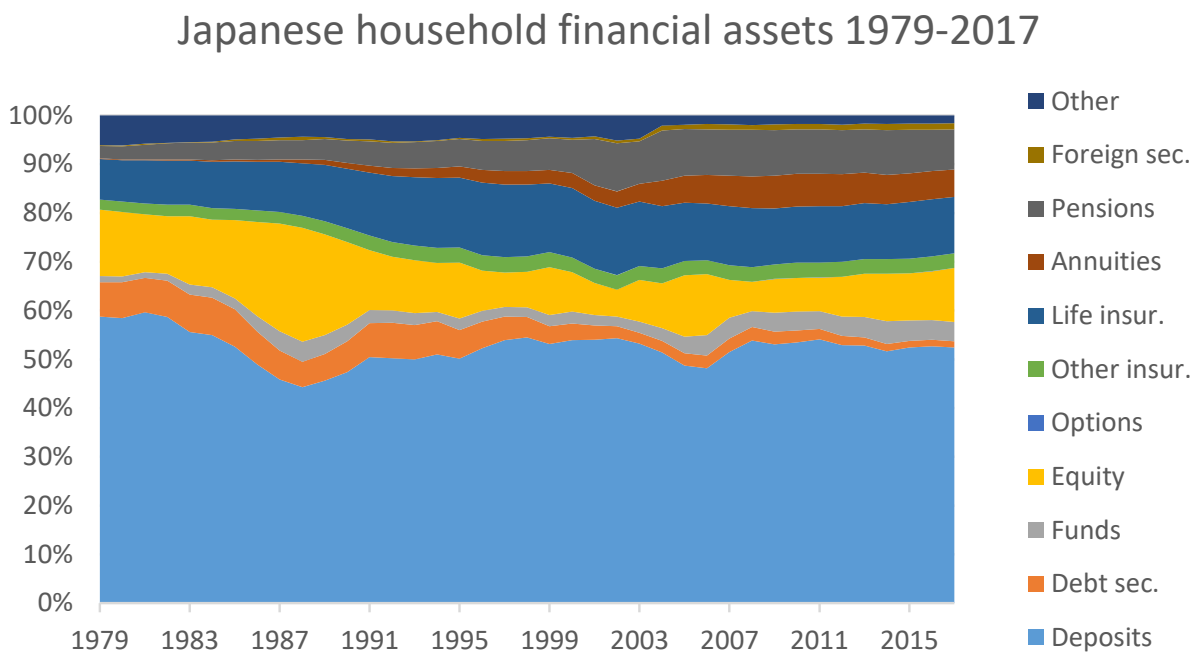

Figure 3.27 Data: Bank of Japan. Flow of funds.

The large portion of savings allocated to cash instruments has not changed considerably over the past forty years. In 1979, these constituted 58.7%, dropping to the still very high low of 44.28% during the Bubble rally in 1988 and eventually stabilizing at around 52% for the remainder of the period. Where the changes did occur is in the other asset classes. Debt securities' share had moved from 7% in 1979 to 1.3% today, investment fund participation rose from 1.3% to nearly 4%, equities remained on the same general level but have expanded and contracted considerably during the period,

120. Tadahiro Asami and Junichi Mori, "Regional Cooperation in Developing Bond Markets: Harmonization and Standardization of the Region's Bond Markets," *Institute for International Monetary Affairs*, 2001, `https://www.iima.or.jp/docs/report/2001/Research_Report2_paper.pdf`.

and claims on products such as insurances, annuities, and pensions plans have expanded considerably. This large scale view, however, does offer much insight into the changes within the individual classes themselves.

Cash instruments

A major shift occurs is the shift from the time and savings deposits towards transferable deposits and currency. The latter is quite simply Yen-denominated banknotes and coins issued by the Bank of Japan. While an increase in cash itself may seem peculiar in an age where electronic payments become more and more prominent, it is indicative of a greater shift towards liquidity following the Bubble economy as seen by the shift between the two deposit classes.

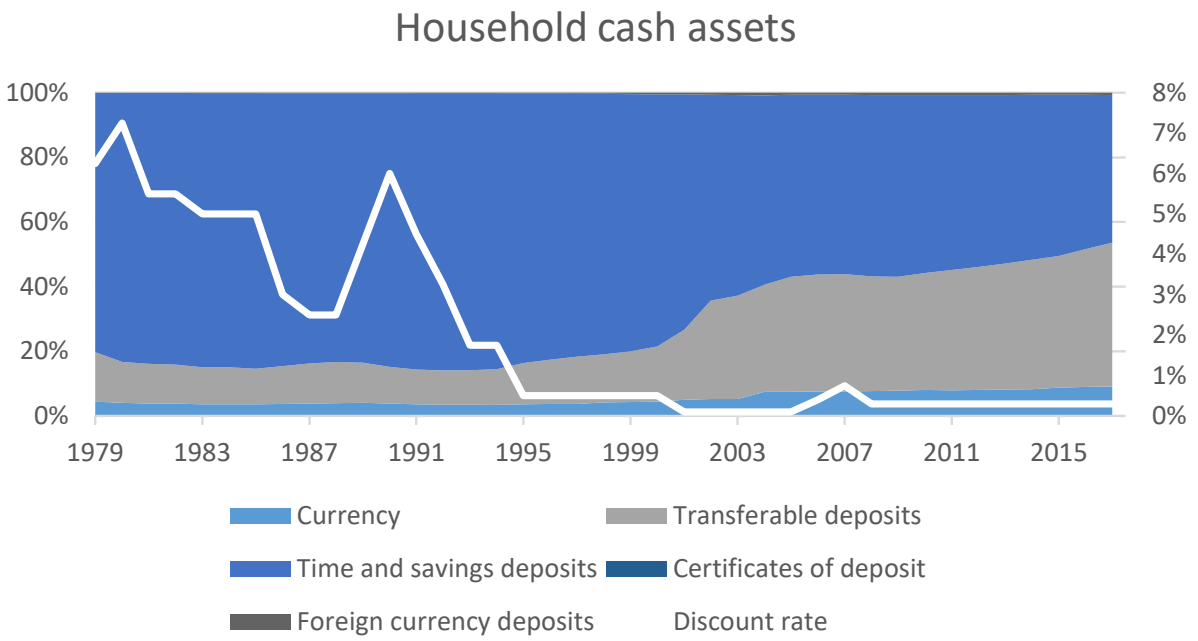

Figure 3.28 The percentages of assets invested into individual cash instruments correspond to the left-hand scale, the discount rate corresponds to the right-hand scale. Data: Bank of Japan. Flow of funds.

Bank of Japan defines transferable deposits as "deposits with indefinite deposit term and which are used primarily for settlements". These are current or quasi-current accounts that funds can be withdrawn from almost immediately. Conversely, time and savings deposits are "deposits from which withdrawals can be made with certain restrictions, and which are used primarily for savings."[121] These are also deposits protected to the same degree as transferable deposits, but locked-in for a specified period of time and as a result offer a higher rate of return. Around 1990 to 1991, these term deposits offered returns

121. Bank of Japan, *Guide to Japan's Flow of Funds Accounts*, Web Page, 2017, accessed 24 April 2019, `https://www.boj.or.jp/en/statistics/outline/exp/data/exsj01.pdf`.

between 5.5% and 6% per annum, whereas current accounts only offered 2%. When the Bubble burst, the Bank of Japan began its long journey on the path of low-interest rates and by 2000 the term deposit returns current accounts only paid 0.1% and term deposits with 1–2-year maturities only returned 0.256%.[122]

As older deposits with higher interest rates began to mature and the liquidity spread had been reduced to near meaninglessness from the retail investor's point of view, Japanese savers began withdrawing their money. This is a perfectly rational behavior as having one's financial assets locked away in term deposits posit certain liquidity and reinvestment risks on the savers that current accounts do not. These range from personal issues such as the increased need for funds due to a sudden illness, death or damage to the primary residence, but also opportunity costs. Were better opportunities to present themselves, money locked away in term deposits cannot be utilized for these new investments until deposits mature, whereas current accounts can be emptied as quickly as the bank can execute the transfer. Writing in 2006, the Mitsui Sumitomo Trust Bank argues that this latter cause is what motivates Japanese savers, who had by then already shifted "from savings to investment" and towards "an age managing one's personal capital" with a greater risk appetite.[123]

As of January 2019, the aforementioned 1–2-year maturity deposits offer only 0.028% and current accounts return 0.001% (0.1 basis points).[124] Certificate of deposit popular in the United States and foreign currency deposits both remain very low throughout the entire period.

Claims and entitlements

Strictly speaking, insurances and pension entitlements are not financial assets in the same way as equities, bonds or cash instruments. This is because both insurances and certain types of pensions cannot be marked-to-the-market from the perspective of the beneficiary the same way other instruments can. As the name suggests, these are claims and entitlements that are paid out when certain conditions are met, be that a minor automotive accident or reaching the pension age. These are typically not paid out in full but rather corresponding to the criteria of the claim and often in installments. Therefore, the Bank of Japan computes these based on the aggregate claims of the beneficiaries to the assets of the trusts themselves.

122. Bank of Japan, "Market Interest Rates," 2019, `http://www.boj.or.jp/statistics/pub/sk/data/sk2.pdf`.
123. Sumitomo Mitsui Shintaku Ginkō, "Zero Kinri Jidai No Kojin Kin'yū Shisan Dōkō O Furikaeru" [Re-examining personal financial asset trends during the zero interest rate period], *Chōsa geppō*, 2006, `http://dl.ndl.go.jp/view/download/digidepo_9381473_po_664_1.pdf`.
124. Bank of Japan, "Market Interest Rates."

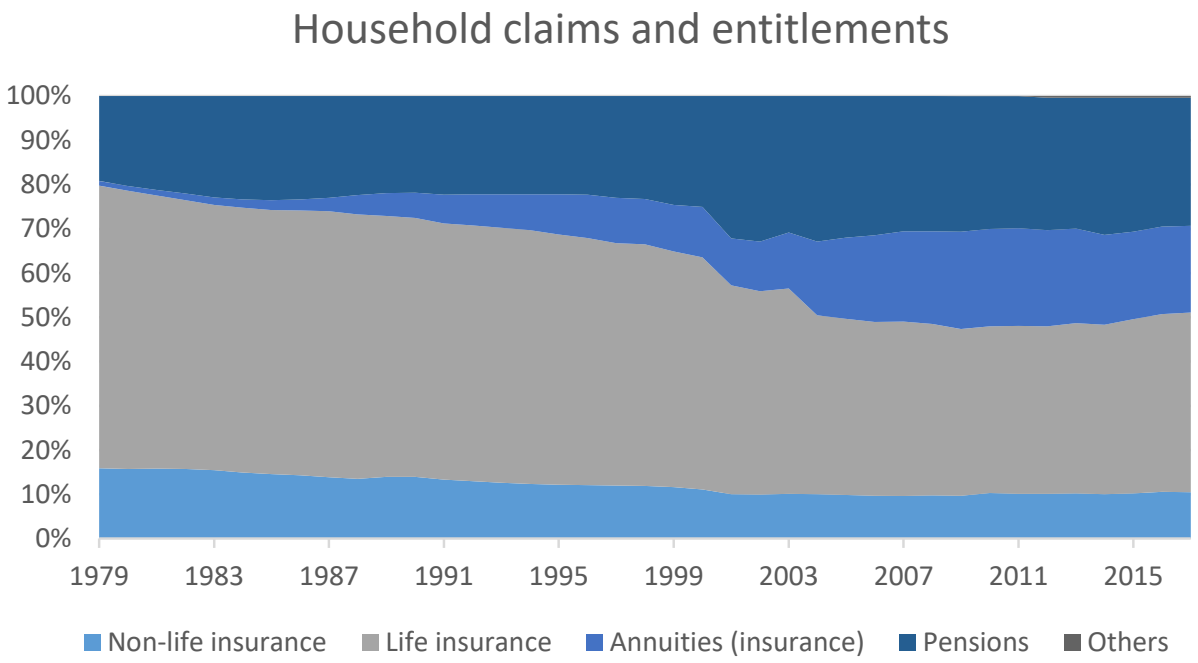

Figure 3.29 Data: Bank of Japan. Flow of funds.

These claims constitute a similarly-sized portion of the household assets of all three examined regions, but also exhibit certain particularities in the case of Japan. Insurances are discussed in the next section, whereas pensions are looked at within the context of tax-advantaged accounts later in this chapter.

Insurance

Relative size A notable distinction between Japan and the three comparator countries used in this research is its life insurance sector. Data from the reinsurer Swiss Re suggests that out of the four countries the Japanese allocate the largest portion of their insurance spendings to life insurance and even larger than South Koreans, whose life and non-life insurance premiums account for a larger portion of the gross domestic product.[125]

Looking at the overall data for developed nations, an undeniable pattern of East Asian preference for insurance and particularly life insurance emerges. Whereas Japan is only the seventh in terms of life insurance premiums to the gross domestic product, Hong Kong and Taiwan occupy the first two places with approximately 16%, followed by South Africa with 10.4%, South Korea with 4.3% and Denmark with 7.33%. Two places behind Japan's 6.23% is Singapore at 5.92%. Conversely, the United States ranks only fourteenth with 3.31% and Germany twentieth with 2.9%.

125. Swiss Re, *World Insurance in 2016: The China Growth Engine Steams Ahead*, Web Page, 2016, accessed 25 April 2019, `https://www.swissre.com/dam/jcr:1f198386-eab9-408e-a970-1b0f7fe20bf8/4sigma3_2017_en.pdf`.

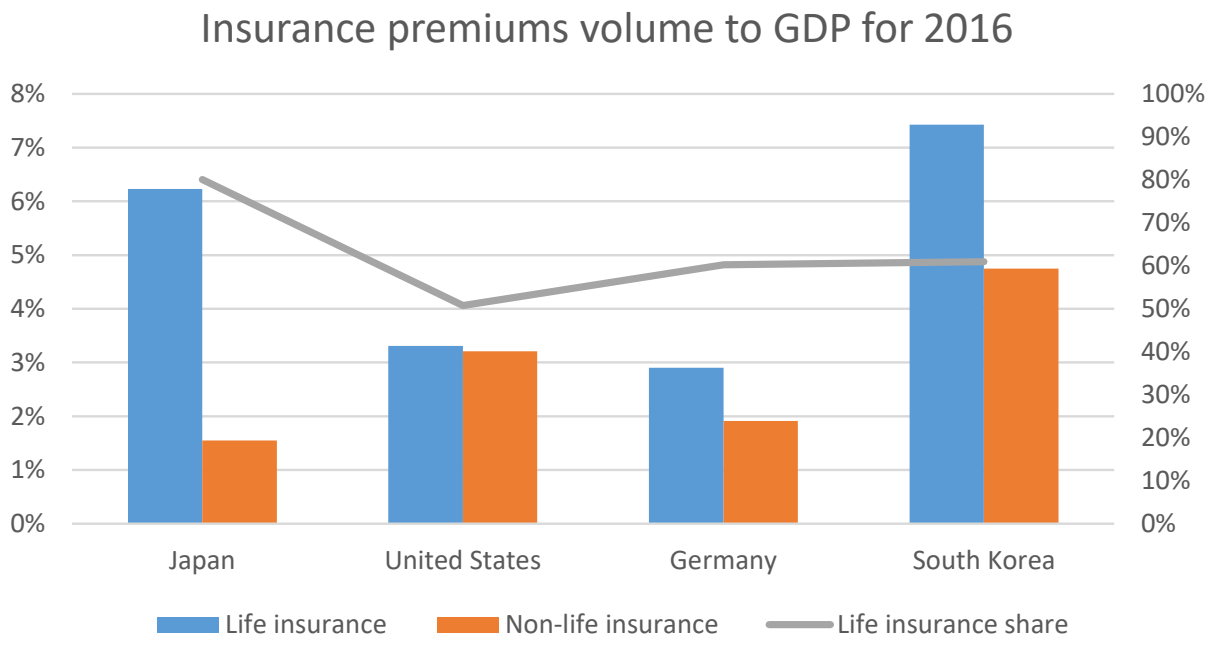

Figure 3.30 Life insurance and non-life insurance premiums as part of the gross domestic product correspond to the left-hand scale, the share of life insurance to life and non-life insurance corresponds to the right-hand scale.

Data: Swiss Re, *World Insurance in 2016: The China Growth Engine Steams Ahead*, Web Page, 2016, accessed 25 April 2019, `https://www.swissre.com/dam/jcr:1f198386-eab9-408e-a970-1b0f7fe20bf8/4sigma3_2017_en.pdf`.

In terms of non-life insurance, the situation could not be more different. Although South Korea occupies the first place with 4.75%, it is followed by the United States at 3.21% and a host of European or European emigre countries, including Germany at fourteenth place with 1.91%, with the next East Asian country being Japan at twenty-fifth place with mere 1.55% of the gross domestic product.

In terms of total insurance penetration, the top three countries are Taiwan, Hong Kong, and South Korea. By claims volume, Japan made up for 16.21% of all insurance premiums in the world, only behind the United States' 20.43% despite having only a third of the population. The largest Japanese life insurer has been the Japanese postal service.[126]

Composition Given the importance of life insurance in Japanese society, it is worth examining what such a plan actually entails.

Life insurance products are complicated and come in many variations. All life insurance products per definition come with a death benefit. This is the sum paid out to the beneficiary upon the death of the policyholder. While life insurance products should

126. Life Insurance Association of Japan, "Overview of Life Insurance Industry in Japan," 2015,

strictly speaking be advertised for the death benefit and not primarily as an investment vehicle,[127] this nonetheless does not prevent insurances acting as a major investment vehicle for large swathes of the population.

Two simplified distinctions can be drawn at this point. First, whether an insurance policy is a term policy that expires at a specific date or a whole life policy that continues until the death of the beneficiary. The premiums are typically renegotiated every time a term insurance is renewed depending on the age and sex of the policyholder, whereas they remain constant for whole life and are lower the younger the policyholder when they sign up. Second, policies can either be fixed or variable. A fixed policy pays out a pre-determined death benefit upon the death of the policyholder, whereas the death benefit of a variable insurance is calculated based on the allocation of the policyholder's premiums to separate sub-accounts, such as equity and fixed-income portfolios. Depending on the market performance of the sub-accounts, the beneficiary may receive a higher or lower death benefit upon the demise of the policyholder.

Furthermore, life insurance may provide certain additional benefits known as *riders* to the policyholder or the beneficiary. In Japan, these include: annuities, which are periodic payments towards the policyholder once they reach a certain age and are thus de facto disguised pension plans; juvenile insurance, which can provide for educational expenses if the policyholder dies; disability and nursing care for the policyholder; additional health insurance options; as well as stroke, cancer insurance and other highly-specific disease coverage. Contrary to what the name may suggest, in Japan the cancer insurance is not strictly a medical insurance that covers the expenses of the treatment, but rather an entire suite of compensations, including a lump sum of ¥1–3 million upon a positive diagnosis that the policyholder may use in whichever way they deem necessary.[128]

Research by Bank of Japan suggests that the life insurance policies held by Japanese, American, German and British residents were in fact very different despite all being grouped under the life insurance umbrella. A preference can be seen in the case of Japanese and German policyholders for insurance with a pre-determined benefit, whereas American and British policyholders have shown a preference for variable insurances. As the name suggests, variable insurances are higher risk—but still very safe as they are still insurance policies-but also offer higher rewards—which are also correspondingly lower than holding the underlying instruments directly, because these are still safe insurance

127. For example, in the United States, the Internal Revenue Code allows for a so-called "1035 Exchanges", wherein the policyholder of an insurance can transfer his policy towards a different better-suited policy. It is also possible to transfer an insurance policy to an annuity contract, but not vice versa.

128. See Lifenet cancer insurance for an example: Lifenet, *Raifunetto Seimei No Gan Hoken "Daburuēru" Hoken Naiyō No Tokuchō O Kaisetsu* [Explanation of the Features of the Lifenet Life Insurance "Daburuēru"], Web Page, 2019, `https://www.lifenet-seimei.co.jp/product/cancer/`.

policies. This is in line with this research's findings laid out in section 3.4.1 "Structure of household financial assets" suggesting a lower preference for risk assets than the comparator countries. To achieve the corresponding risk profile, American and British insurers held a considerably larger portion of equities than their Japanese and German counterparts. In the case of Japan, Japanese government bonds constituted 46% of the insurer's portfolio, whereas the Treasuries in the United States constituted only 7% of the overall portfolio.[129]

Further insight can be gained from the Life Insurance Association of Japan. By 2012, 85.8% of Japanese households had life insurance. This rate had been continuously decreasing since the mid–1990s but remained consistently above 88% between 1968 and 2003.[130] The Bank of Japan argues that life insurance became particularly important in the postwar when families were dependent on the income of a single earner at the head of the household. Correspondingly, 60% of Japanese life insurances are life and only 26% are term.[131] As of 2013, 31.4% of policies were distributed through such house visits with an additional 18.3% being sold at the prospective policyholder's workplace. Only 5.8% were sold directly via advertisements and 15.8% directly at the insurer's offices.[132]

As mentioned previously, the trend is an overall decline in life insurance expenditure with the portion of premiums to annual income having dropped from 10.1% in 1997 to 8% in 2012. Given the data from 2014, new insurance policies signed in 2014 demonstrate a greater shift towards medical and juvenile insurances with a marked decrease in whole life and term insurances, arguably in response to an increased number of female earners and a marked decrease in the number of marriages.[133] There is also a considerable trend towards an overall reduction in the number of claims paid by life insurers. In 2009, 56% of payments were towards claims; already by 2013, this figure had dropped to 45%. A quarter of the payments constituted surrender benefits, which are payments towards the policyholder who voluntarily terminate their policy before maturity.

The success of life insurers in Japan, in particular, is arguably attributable to the postwar promotion campaign for life insurance that had already begun under the Allied Occupation when the Insurance Commissioner had designated November as "The Mouth of Life Insurance". The month focused on the proliferation of life insurance products, including educational leaflets on taxation, advertising across various media, the com-

129. Kazuaki Washimi, Hiroki Inaba, and Kei Imakubo, "International Comparison of Life Insurers: Balance-Sheet Differences and Their Financial Stability Implications," *Bank of Japan Review*, 2017,
130. Life Insurance Association of Japan, "Overview of Life Insurance Industry in Japan."
131. Washimi, Inaba, and Imakubo, "International Comparison of Life Insurers: Balance-Sheet Differences and Their Financial Stability Implications."
132. Life Insurance Association of Japan, "Overview of Life Insurance Industry in Japan."
133. The Economist, "I Don't: Marriage in Japan," 2016, `https://www.economist.com/asia/2016/09/01/i-dont`.

memoration of the best staff and essay contests under the title "Life Insurance and Me". These activities outlived both the Occupation and Japan's rise as an economic superpower ending only in 2004.[134]

Along with the Month of Life Insurance, the by now well-established strategy of utilizing insurance saleswomen for door-to-door promotions had emerged, been put to a test and determined to be a major success. As of 1955, the best selling insurance product was the endowment insurance with term rider, which pays out certain a sum upon maturity even if the policyholder is alive. It was replaced by the whole life insurance with term rider in the 1980s. These allowed to increase the death benefit for a term without proportionally increasing the cost of the base whole life premiums. By the end of the 1980s, a hybrid of insurance and savings became a popular product.

What ended up halting the hay day of life insurers was the end of the Bubble Economy. Lower rates, bad loans, bankruptcies of insurers and decreased incomes of the workforce resulted in both poorer terms being offered by insurers and a reduced ability to pay premiums by the policyholders. This process was further aggravated by the balance sheets of the insurance firms themselves. Before the collapse of the asset prices, 22% of insurers' assets were in Japanese equities that would underperform for decades, 35% in loans many of which could not be repaid, and only 4.36% in Japanese government bonds. Given any significant exposure to the latter, the insurers would have been well-cushioned by book gains from long-term JGBs with old, high coupons in an environment of rapidly plunging interest rates. Whereas stocks and loans would have depreciated, risk-free bonds could have buoyed the insurers to surface, but alas that did not occur. As of 2014, close to 45% of insurers' assets consist of JGBs.

Despite the current trends towards less life insurance, as of 2012, the Japanese family is still very well-insured with 3.6 policies per household.

3.4.2 Barriers to entry

This section examines the broker-dealer infrastructure available to the Japanese investors from the perspective of availability, pricing and general barriers to entry as a possible cause of the low market participation.

Geographical availability

The geographic availability of brokerages does not appear to be an issue in Japan. This is in part aided by the high degree of urbanization, whereby approximately a quarter of the total population lives in a city of a million or more inhabitants, a third in a city of at least

134. Life Insurance Association of Japan, "Overview of Life Insurance Industry in Japan."

500 thousand, over a half in a city of at least 200 thousand and 85% in a settlement of at least 50 thousand. The trend towards greater urbanization continues with the largest growth in cities between 500 thousand and a million inhabitants that more than doubled in population since the 1980s.

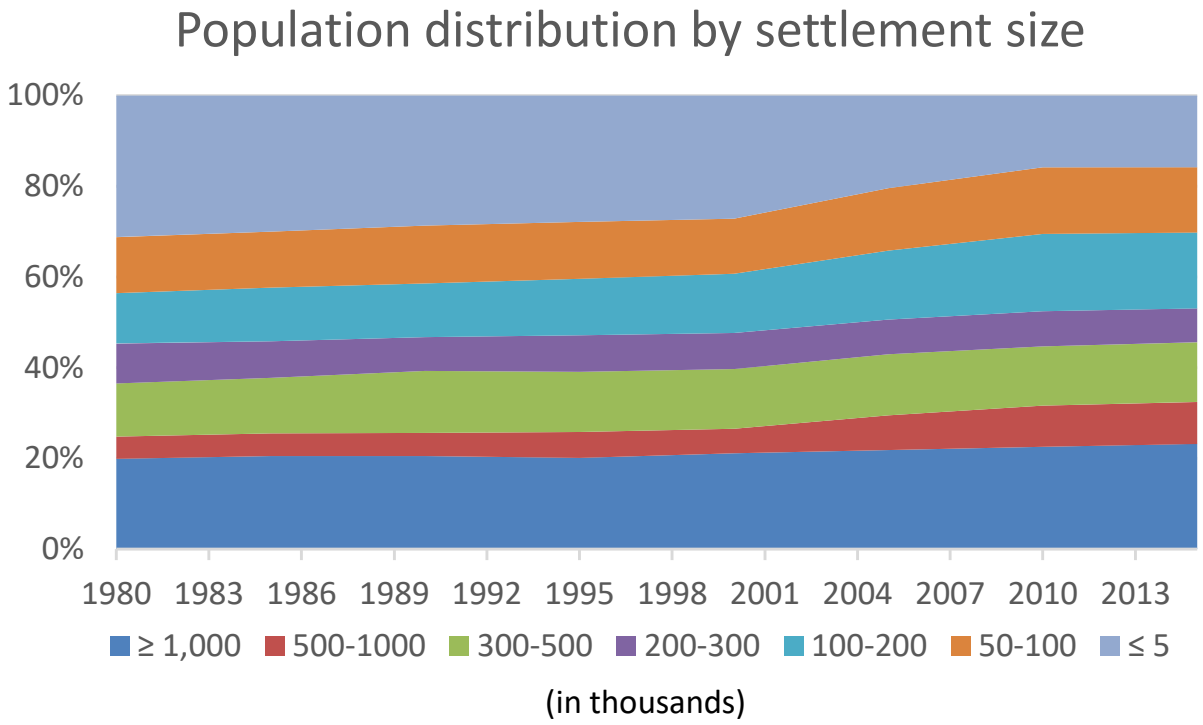

Figure 3.31 Data: Bureau of Statistics, "Table 9. Population and Number of Shi, Machi and Mura by Population Size Groups Japan, All Shi and All Gun (1920 to 2015)," 2015, `https://www.e-stat.go.jp/en/stat-search/file-download?statInfId=000031784244&fileKind=0`

Brokerages and banks were separated until the revision of the Bank Law in 1981, which allowed banks to offer brokerage services. Both institution types belong to the Japanese Securities Dealers Association of which there were 263 as of the end of 2018 and employed over half a million sales representatives. In terms of brokerage firms, there were 2,145 sales offices spread across Japan, 1,879 of which were branch offices. There had been at least one office in each prefecture with the largest being Tokyo with 554 offices, followed by Osaka with 168, and the smallest being the Saga prefecture with only five branch offices and no head offices. The above include only manned offices.[135] Of the major firms, the largest number of offices was held by Mizuho Securities with 263

135. Japan Securities Dealers Association, *Kaiin No Todōfuken Betsu Eigyō Shosū Ichiran* [List of Sales Offices by Prefecture], Web Page, 2019, accessed 15 April 2019, `http://www.jsda.or.jp/shiryoshitsu/toukei/eigyoshosu/index.html`.

branches,[136] Daiwa with 153,[137] Nomura with 156[138] and Nikko with 142.[139] Whereas the above are described as synthesis firms in that they provide services to both institutional and retail clients and engage in activities such as investment banking, there is also a group of smaller brokerages typically described as *jun'ōte* runner-up firms.[140] These put particular emphasis on relationship and individualized services provided to retail customers[141] and include SMBC Friends with 148 sales offices[142], Tokai Tokyo with 70 offices[143] and Okasan with 62 offices[144].

As of 2010, there have also been 2,409 offices of the five major Japanese banks. The largest was Mitsubishi UFJ with 823 offices followed by Mitsui Sumitomo with 679 offices, Mizuho with 453 offices, Risona with 322 offices and Saitama Risona with 132 offices.[145] These offer a considerably narrower selection of financial products than securities firms, but nonetheless give the clients access to a variety of mutual funds, term deposits, bonds, and tax-advantaged accounts. Certain securities, most notably common stocks, that are not offered by the bank directly can be offered through a securities firm that the bank is partnered with. While this combination of banking and brokerage services in itself is not uncommon outside of Japan, the ability to buy lottery tickets from the same menu that offers wire transfers, loans, and mutual funds is somewhat more unusual.

Given both the large number of relevant financial institutions and the clear preference for urban environments as a primary residence, accessibility to the brick-and-mortar investing opportunities appear to be plentiful. Since the beginning of the 2000s, the Japanese investment landscape also began to see the growth of online-only brokerages as

136. Mizuho Financial Group, Inc., "Mizuho FG: Shōken Gaisha Tenpo Sū Nanbā 1" [Mizuho FG: Number 1 Securities Company by Store Count], 2019, accessed 15 April 2019, https://www.mizuho-fg.co.jp/no1/cases/group/detail37/index.html.

137. Daiwa Securities, *Daiwa 2018 Management Strategy Meeting*, Web Page, 2018, accessed 15 April 2019, http://www.daiwa-grp.jp/data/attach/2498_2018-J-Management_Strategy_Meeting.pdf.

138. Nomura Securities, *Sales Division*, Web Page, 2018, accessed 15 April 2019, https://www.nomuraholdings.com/jp/services/retail/.

139. SMBC Nikko Securities, *Kaisha Gaiyō* [Company Overview], Web Page, 2019, accessed 15 April 2019, https://www.smbcnikko.co.jp/company/info/profile/index.html.

140. Japanese: 準大手.

141. Akiyama Ken'ichirō, *Saishin Shōken Gyōkai No Dōkō to Karakuri Ga Yoku Wakaru Hon* [A Book That Shows the Latest Trends in the Securities Industry], 4th ed. (Shūwa Shisutemu, 2017), ISBN: 9784798051710.

142. SMBC Nikko Securities, *SMBC Furendo Shōken to No Gappei Ni Tsuite* [About the merger with SMBC Friends Securities], Web Page, 2018, accessed 16 April 2019, https://www.smbcnikko.co.jp/news/release/2018/pdf/180104_01.pdf.

143. Tokai Tokyo, *List of Locations*, Web Page, 2019, accessed 16 April 2019, http://www.tokaitokyo.co.jp/anshin/shop/list.html.

144. Okasan, *Okasan Shōken No Gaiyō* [Okasan Securities: Outline], Web Page, 2019, accessed 16 April 2019, http://www.okasan.co.jp/about/outline/.

145. Japanese Bankers Association, *Zenkoku Ginkō Shihonkin, Tenpo-Sū, Ginkō Dairi Gyōsha-Sū, Yakushoku Insū Ichiranpyō* [List of Bank Capital, Number of Stores, Number of Bank Agents, Number of Executives and Employees Nationwide], Web Page, 2010, accessed 15 April 2019, https://www.zenginkyo.or.jp/fileadmin/res/abstract/stats/year2_02/account2010_interim/sihon22m.xls.

well as the possibility to manage one's portfolio at an existing brokerage through their online platform. The most prominent online brokers operating at the moment are the SBI, Rakuten, Manekusu, Matsui and GMO Kuriku. With the derivatives boom occurring in the 2000s, firms specializing in highly speculative derivatives business, such as Certificate for Deposit (CFD) and foreign exchange (FX), have also gained prominence. Among them are the Himawari, Toreidazu, Invasto, and Bansei.[146]

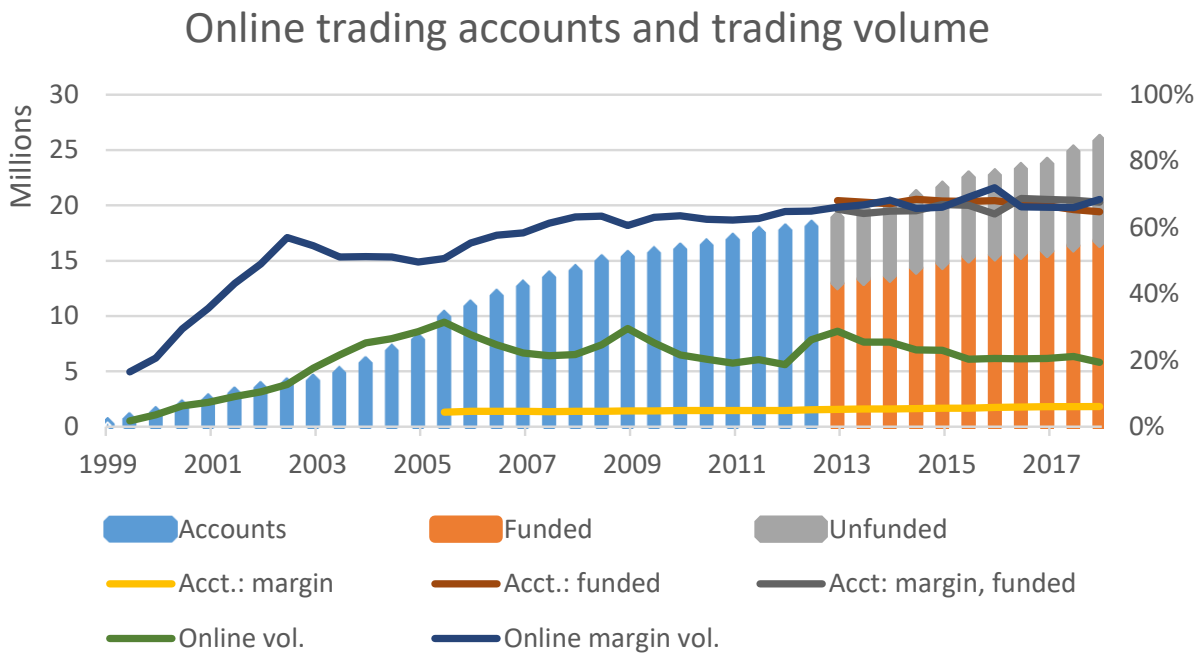

Figure 3.32 The bars of the above graph correspond to the left vertical axis and represent the number of online trading accounts open by each date. From the end of September 2013, these accounts are separated into unfunded accounts and funded accounts with at least ¥1 deposited into the account.

The lines are percentages and correspond to the right vertical axis. From the end of March 2006, the percentage of total online accounts that are margin accounts is stated. From September 2013, percentages of funded accounts to total online accounts and funded margin accounts to total online margin accounts is given.

The online volume represents the percentage of the total trading volume of equities, computed in Japanese yen, that occurred through online accounts and includes exchange-traded funds (ETFs) and real-estate trusts. The online margin volume indicates the percentage of total online trading volume that occurred on margin.

Data: Japan Securities Dealers Association, *Intānetto Torihiki Ni Kansuru Chōsa Kekka Ni Tsuite.*

The number of online accounts has been rising at a steady rate, although as more detailed data available from 2013 indicates, a third of these accounts appear to remain perpetually unfunded. This rate remains steady across the observed period of 2013–2018. It is not entirely clear why these accounts remain in such state, but possible explanations include a change of heart on behalf of the owner or no intention to use the account in

146. Ken'ichirō, *Saishin Shōken Gyōkai No Dōkō to Karakuri Ga Yoku Wakaru Hon.*

the first place, which could occur if the owner was enticed to open the said account by being offered freebies for doing so. Even though more investors created or are migrated to online accounts, the share of the online trade volume in stocks does not appear to rise and has indeed stagnated since the Livedoor scandal in 2006 and the brief collapse of the Japanese exports following the financial crisis. A possible explanation may be that direct access to the account from one's home or mobile device allowed the investors to adjust their behavior as the situation developed rather than letting it slide due to a lack of time or interest in making changes through the brick-and-mortar sales office.

Both the equity trade volume share of margin accounts and their share remained relatively constant. Unsurprisingly, margin accounts make up for a much bigger trade volume, as these are effectively accounts used for active trading rather than passive investment and would thus naturally result in a higher turnover over financial instruments.

Lastly, all age groups appear to be represented well in the ownership of online accounts. The trade volume on accounts without leverage is split roughly equally at 21% plus-minus 2% for the people in their 40s, 50s, 60s, and 70s. The tricenarians make up only for 12% of the trade volume and those under 30—and presumably with even less disposable income—only make up for 2% of the total unleveraged trade volume. In terms of margin trading, the individuals in their thirties and forties each gain an additional 10%, whereas those in their 70s shrink by half. Surprisingly, the current generation in their twenties make up for a larger share of cash transactions than margin transactions hinting either at a generational shift or the possibility that stock market speculation appeals less not only to the seniors but also to students and newer employees.[147]

Pricing

Another crucial aspect of participation in the stock market are the associated costs. These can be expressed as either running fixed costs, running variable costs or transaction costs of either fixed or variable character. The first two typically refer to the upkeep of the brokerage account itself, whereas the latter is deducted when a transaction is executed.

It must be stressed that the distinction between fixed and variable costs is an important one as it places two different kinds of entry barriers. A fixed cost for maintaining an account or executing a transaction will by its very nature disincentivize individuals initially unable to unwilling to commit a large sum towards the account. The smaller the sum, the longer will it take for the investment to recover the cost of the transaction. If a student wanted to buy a stock with 100 dollars, the transaction fees were 10 dollars and

147. Japan Securities Dealers Association, *Intānetto Torihiki Ni Kansuru Chōsa Kekka Ni Tsuite* [About Internet Trading Survey Results], Web Page, 2018, accessed 16 April 2019, `http://www.jsda.or.jp/shiryoshitsu/toukei/interan.html`.

the stock market returned 10% per annum, it would take them three years to just break even. Similarly, a running account upkeep fee could either greatly impact the student's performance or even reduce its value below zero. Conversely, a variable fee based on a percentage of the transaction or the cash in the brokerage's cash account would be appealing to a student, but less so to someone in their prime accumulation phase, as it could reduce their long-term returns to a greater degree than a fixed one-off fee. A typical example of such a variable fee is a sales charge computed as a percentage of the invested sum and deducted either at the entry, exit or both. Although upkeep fees appear to be less common today than they were in the past, many brokerages offer a combination of a fixed and variable transaction fee that requires a certain minimum fixed payment and rises as the investment amount increases based on a predetermined formula.

An extreme example of barrier reduction both in terms of cost, but also location and time, is the U.S. American brokerage Robinhood. Founded in 2013, the U.S.-only platform is a prime example of an amalgamation of all that is modern. Originally available only as a smartphone app Robinhood let its customers sign up through a process akin to that of creating an email address and allowed one to trade without having to pay either an account upkeep fee or any commissions on the trades themselves. Although as of early 2019 the brokerage does not allow trading foreign equities except for those listed on U.S. exchanges through American Depositary Receipts (ADRs), domestic or foreign bonds, mutual funds or more exotic instruments from the point of view of a retail investor such as preferred stock or those sold only over-the-counter (OTC), the service covers a broad range of products such as ETFs, options and even Bitcoin and other cryptocurrencies.[148] The company finances its operations by retaining the interest on uninvested cash in the accounts of its clients rather than paying it out as done by a number of other brokers and allegedly by passing on the orders to market makers that pay the firm more for its clients than they would otherwise, thus raising the potential of costing its users more on a variable basis than some alternatives.[149]

There are no free lunches, but Robinhood's existence clearly demonstrates the presence of entry barriers for individuals with scarce funds. As of March 2019, the company had 6 million users,[150] or three times as many as it did less than two years prior, 78% of

148. Robinhood Financial LLC, *Investments You Can Make on Robinhood*, Web Page, 2019, `http://support.robinhood.com/hc/en-us/articles/360001226746-Investments-You-Can-Make-on-Robinhood`.

149. Suzanne Woolley Simone Foxman Julie Verhage, *Robinhood Gets Almost Half Its Revenue in Controversial Bargain With High-Speed Traders*, Web Page, October 2018, accessed 17 April 2019, `https://www.bloomberg.com/news/articles/2018-10-15/robinhood-gets-almost-half-its-revenue-in-controversial-bargain-with-high-speed-traders`.

150. Polina Marinova, *Exclusive: Robinhood Made Its First Acquisition Ever — and It's a Financial Newsletter*, Web Page, 2019, accessed 17 April 2019, `http://fortune.com/2019/03/25/robinhood-acquires-marketsnacks/`.

which were under the age of thirty-five.[151] This unsurprisingly led to the most popular stock on the platform, held by close to 7% of its total clientele, being a Canadian growth company Aurora Cannabis Inc that had been founded the same year as Robinhood and traded at a price-earnings ratio of over forty,[152] followed by the structurally troubled General Electric and Ford. As will be shown later, this strongly hints towards lower financial literacy and disposable funds among the Robinhood's clientele.

Although Robinhood is as of the time of this writing an exception rather than the rule, the trend towards a reduction in brokerage fees is one that has continued for quite some time now. In the American case, historical studies of the American markets suggest that there had been a trend towards lower fees for most of the 20th century and continuing at a rapid pace into the 21st.[153] The biggest immediate drop had resulted when the Securities Exchange Commission had liberalized the broker commissions in 1975. Japan followed a similar pattern with a liberalization under the Financial System Reform Act of 1998. Research by the Japan Securities Research Institute suggests that since 1998 the percentage of net operating income of Japanese securities firms generated from commissions had dropped from 43.3% to 15.8%.[154] Whilst an important actor in this process had been the emergence of internet brokerages and the computerization of the industry as a whole, the complete liberalization of the brokerage commissions as part of the Financial Big Bang in the late 1990s was even more important.

Although Robinhood does not yet have a direct equivalent in Japan, online brokerages such as SBI and Rakuten come very close. SBI Securities, which labels itself as the "Number One Online Brokerage"[155] and at 4.4 million[156] clients accounts is second in Japan only to Nomura Securities, offers its clients two comparatively inexpensive plans. All of the following refer to domestic ¥common stock trades only and include the sales tax. The standard plan allows purchases up to ¥50,000 at a total of ¥54(minimum 0.11%) with the commission increasing up to ¥30,000,001 at which point the fee rises to a maximum of ¥1050 (maximum 0.004%). Alternatively, the clients can pay on a per-day basis with transactions up to ¥100,000 bearing commission to being charged ¥432 for

151. Ainsley Harris, "How Brokerage App Robinhood Got Millennials to Love the Market," 2017, `https://www.fastcompany.com/40437888/how-brokerage-app-robinhood-got-millennials-to-love-the-market`.

152. Yahoo Finance, *Aurora Cannabis Inc. (ACB) Stock Price, Quote, History & News*, Web Page, 2019, accessed 17 April 2019, `https://finance.yahoo.com/quote/ACB?p=ACB`.

153. Charles M. Jones, "A Century of Stock Market Liquidity and Trading Costs," *Available at SSRN 313681*, 2002, ibid.

154. Kenkyūjo Nihon Shōken Keizai, *Henbō Suru Kinyū to Shōkengyō* (Tokyo, 2018), ISBN: 9784890320547 4890320547.

155. *Netto shōken gaisha sōgō hyōka No. 1.* Japanese: ネット証券会社総合評価No. 1.

156. Money Times, *Shōkenkaisha No Netto Kōza Kaisetsu-Sū Rankingu 1-I Wa? Jōi 5-Sha No Tokuchō Mo Shōkai* [Online Securities Company With the Most Accounts? Introducing the Top Five], Web Page, 2019, `https://moneytimes.jp/investment/detail/id=1878`.

every ¥1,000,000 transacted within a single day (0.04–0.09%).[157] However, should the investor decide to order through a staffed call center as he would have twenty years ago, SBI would charge the client between ¥2,160 for a transaction up to ¥500,000 (minimum 0.43%) and ¥6,400 for a transaction of ¥1,500,001 or higher (maximum 0.43%).[158] Unlike Robinhood, SBI offers a full suite of financial products including foreign stocks, bonds, FX trading, CFD trading, and precious metals that are not offered by Robinhood directly, although they can be purchased to a certain degree through a large number of ETFs listed on the American exchanges.

In contrast to online brokers like SBI, Japanese traditional brokers are expensive. The third-largest broker is Daiwa Securities with 3.2 million accounts.[159] The smallest order executed through the broker's online platform already results in a ¥2052 commission (minimum 0.41% at ¥499,999) or ¥2,700 if done at the firm's office (minimum 0.54%). At the aforementioned ¥30,000,000, Daiwa charges ¥149,007 (maximum 0.5%) or ¥198,936 (maximum 0.66%) respectively.[160] Daiwa is not alone in this pricing scheme, as a Muzuho exhibits a similar pricing rage, whereas Nomura and Nikko charge more than SBI but still considerably less than the aforementioned brokerages. By contrast, popular American brokerages Fidelity and TD Ameritrade charge a flat fee of $4.95 (¥554)[161] or $6.95 (¥778)[162] regardless of the transaction volume. This leads to comparable fees of 0.11%/ 0.16% for a ¥500,000 transaction or 0.002%/0.003% for a ¥30,000,000 one. These fees are comparable to those of other well-known American brokerage houses.

This leads one to conclude that although very inexpensive brokerages are available, not in the least Japan's largest brokerage house Nomura, there is considerable variability in the pricing of their online platforms. If the potential investor decides to select a brokerage themselves and does not get interested in investing by word of mouth of someone who had already done prior research, their transaction costs could vary dramatically. This author concludes that it is not difficult to find out that SBI or even Nomura offer considerably cheaper transaction fees through a simple online search, but were the potential client

157. SBI Securities, *Kokunai Kabushiki No Tesūryō O Oshietekudasai* [Inform me of fees pertaining to domestic equities], Web Page, 2019, accessed 17 April 2019, `https://faq.sbisec.co.jp/faq_detail.html?id=46107`.

158. SBI Securities, *Tesūryō* [Fees], Web Page, 2019, accessed 17 April 2019, `https://www.sbisec.co.jp/ETGate/?_ControlID=WPLETmgR001Control&_DataStoreID=DSWPLETmgR001Control&burl=search_home&cat1=home&cat2=price&dir=price%2F&file=home_price.html&getFlg=on#call`.

159. Money Times, *Shōkenkaisha No Netto Kōza Kaisetsu-Sū Rankingu 1-I Wa? Jōi 5-Sha No Tokuchō Mo Shōkai*.

160. Daiwa Securities, *Tesūryō* [Fees], Web Page, 2019, accessed 17 April 2019, `https://www.daiwa.jp/service/fee/`.

161. Fidelity, *Straightforward and Transparent Pricing - Fidelity*, Web Page, 2019, `https://www.fidelity.com/why-fidelity/pricing-fees`.

162. TD Ameritrade, *Online Trading Pricing*, Web Page, 2019, accessed 17 April 2019, `https://www.tdameritrade.com/pricing.page`.

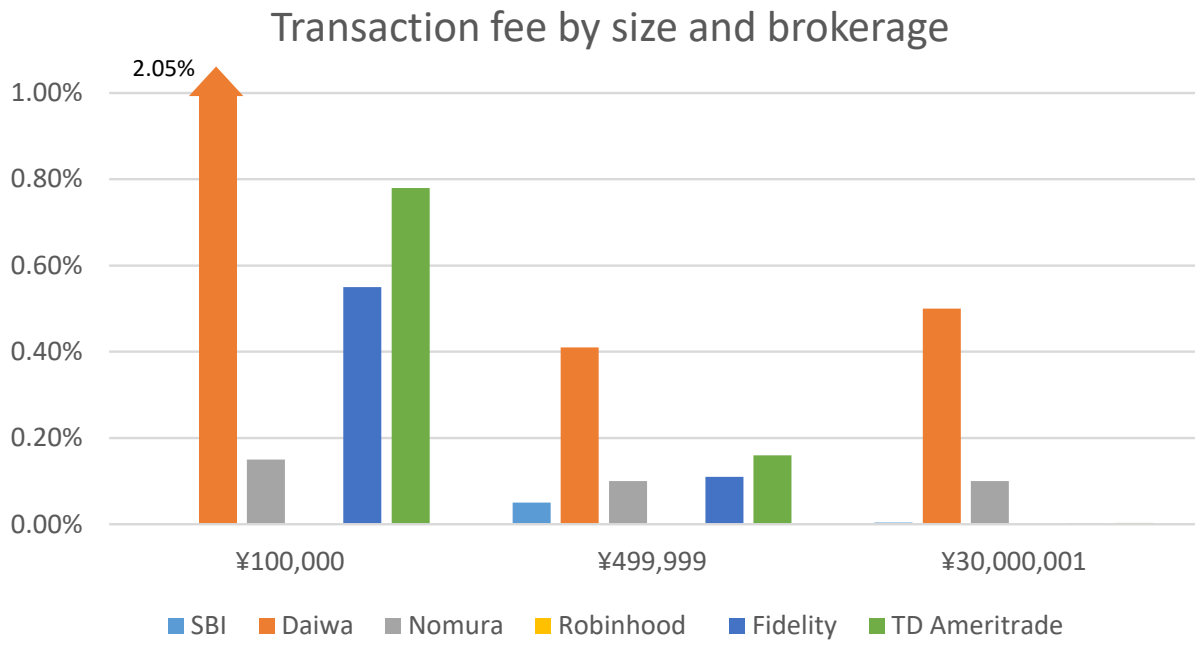

Figure 3.33 Graph is cut off at 1%, with Daiwa reaching 2.05% for a 100,000 yen transaction. Data: Individual brokerages.

simply to choose one of the four major brokerage firms by the presence of their offices in the investor's area of residence, study or employment, they would stand a fifty percent chance of opening a disproportionately expensive account. If the said investor were to just walk into an office of a brokerage, the odds of choosing Daiwa or Mizuho over Nomura and Nikko would be even slightly higher due to Mizuho and Daiwa ranking first and second in terms of the number of offices. In the case of Daiwa in particular, it is this author's subjective and difficult to verify the impression that the firm also utilizes better real estate in more prominent locations than its competitors. This assumption is furthermore reinforced by the fact that despite having considerably higher fees than the competition, Daiwa is also the third-largest broker with only 25% fewer accounts than SBI. To put matters into perspective however, Daiwa also notes that it also has the "highest number of CFPs [Chartered Financial Planers] in the financial industry", which one may argue means that a number of its customers that utilize the said advisory services may be getting more for their high transaction fees than merely purchase and sell orders.[163]

As such, while Nomura Research Institute's survey's 35% of respondents who have no experience in investing answered that investing is for "people who can afford it"[164] would not be entirely wrong depending on where they would try investing, it also appears that it is very inexpensive or even free to invest for people who have very little money

163. Daiwa Securities, "Integrated Report 2018," 2018, `http://www.daiwa-grp.jp/english/pdf/ar2018/ar2018e_all.pdf`.

164. Nomura Research Institute, "Jakunensō O Chūshin to Shita Kojin Ni Yoru Tōshi No Genjō to NISA No Riyō Sokushin Ni Muketa Kadai Ni Kansuru Chōsa."

with a vibrant brokerage landscape not all that different from the United States, which is typically compared favorably to Japan in terms of public participation in the markets. Those merely walking into a brokerage or being attracted to one by a salesperson could however quickly and incorrectly discover that they cannot afford the transaction fees.

Effort and disincentivizing factors

The last hurdle examined in this section pertains to how difficult it is to open a brokerage account and to what degree the prospective clients are discouraged from engaging in investing and trading activities during this process. While aspects such as peer-pressure and discouragement from friends and family are undoubtedly important, this section deals solely with the process between the client and the brokerage.

In the previous section 3.4.2 "Pricing", the brokerage Robinhood has been discussed as a pinnacle in terms of costs for investors with few available funds. Remarkably, the brokerage is also perhaps a pinnacle in the ease of registration—cryptocurrency exchanges operated under dubious circumstances aside. The entire registration process is done through the app and requires little more than the client's name, age, address, contact details, and their social security number as well as a disclosure whether the client or his immediate family are 10% shareholders of a publicly-traded enterprise or employed at a brokerage. The latter pertains to federal regulations aimed at preventing insider trading by requiring further disclosure from the individuals falling into the above category. After that, the user can look at some news, fund his account and has to wait until his application is approved by the firm.

The process is similarly easy albeit somewhat more cumbersome in the case of a Japanese brokerage. For this research, online registration at SBI Securities and an in-shop registration at Daiwa Securities have been observed. In general, the process is similar to that of Robinhood in both cases with similar questions about large shareholders and brokerage employment with the peculiarity that the client is asked whether they or the head of their household falls into either category. The firms furthermore ask whether one is a *foreign politically exposed person (PEP)*[165], which is a term defined in the Criminal Proceeds Transfer Prevention Act of 2016.[166] Instead of the social security number, the client's My Number[167] is requested. In the case of online registration, if the My Number card does not have the client's photograph, a copy of their health insurance

165. *Gaikoku PEP* or less commonly *jūyō na kōteki chii ni aru mono.* Japanese: 外国ＰＥＰ and 重要な公的地位にある者.

166. *Hanzai shūeki iten bōshi hō.* Japanese: 犯罪収益移転防止法. From Japan Financial Intelligence Center, Hanzaishūekiitenbōshihō No Kaisetsu, Paburikku Komento [Commentary on the Crime Revenue Transfer Prevention Act: A Public Comment], Web Page, 2019, accessed 18 April 2019, https://www.npa.go.jp/sosikihanzai/jafic/hourei/law_com.htm.

167. *Mainanbā.* Japanese: マイナンバー.

card and an ID with a photograph is requested. Unlike Robinhood that merely requires the social security number, the cards must be photographed and uploaded. The clients are furthermore asked for supplementary information such as their employment status, income and the value of their current financial assets. A supplementary bank account is typically created to be used with the brokerage account. In the case of SBI, the entire process takes place online and the user can transact as soon as the brokerage confirms their account. In the case of an in-store registration at Daiwa, the client must wait for their access information and cards to arrive per mail.

A notable difference is that the client is asked to provide information about his investment goals and the level of investment experience, such as how many years if at all they have been trading stocks, bonds or performed transactions on margin. A warning is given in the case of margin transactions instructing the client that the firm retains the authority to liquidate any of their assets should the client exhaust their maintenance margin.

The brokerages also offer several auxiliary services and accounts directly at registration. The most important of these are the options to open an Individual Defined Contribution account (iDeCo) and a Nippon Individual Savings Account (NISA) both of which are discussed in greater detail in section 3.4.3 "Tax-advantaged plans". Directly after being asked to open a retirement account, the clients are also prompted to open a highly speculative margin accounts for stock trading and FX accounts. SBI assumes "yes" as a default answer to both.

Also in the case of SBI and in a typical Japanese fashion, the client is offered to create an SBI-branded JCB or Mastercard credit card to collect points on all of their purchases. Similar services are offered by American brokerages such as Fidelity, Charles Schwab, and TD Ameritrade, but not by German brokers such as Flatex and Onvista.

Although the process is somewhat longer in the Japanese case, not in the least because both SBI and Daiwa offer a full suite of brokerage services as opposed to the rather minimalist Robinhood, it is less intimidating than a brokerage registration process in Germany, wherein a questionnaire similar to the one asking the Japanese investors about their level of experience is presented. In contrast to the Japanese questionnaire, the user must select their experience with assets are classified into multiple risk classes based on their loss potential, with the lowest being bonds and the money market that had an average historical loss potential of 0%–0.1% per year and the highest being derivatives that can lead to losses greater than the invested capital.[168] After this, the firm is obligated as per article 63 paragraph 10 of the German Securities Trading Act to perform an

168. Deutsche Bank, *Risikoklassen-Informationsblatt*, Web Page, 2018, accessed 18 April 2019, `https://www.deutsche-bank.de/pfb/data/docs/ser-risikoklassen-infoblatt.pdf`.

Figure 3.34 Opt-out screen for retirement accounts, margin accounts and others.

assessment of the client's ability to trade the said asset classes. Should the brokerage determine that the user is not suitable, the firm must inform them of such, the odds of which occurring for someone investing for the first time are considerable not in the least because the common stock, as the most well-known asset, class are classified as risk class 4–5 out of 7. No such warnings appear to be given on a Japanese brokerage and domestic common stocks appear to be the first item asked about during the registration procedure.

Although there does not appear to be research on this specific topic, it is the contention of this author that the absence of such a disclosure reduces the odds of the potential client canceling their application mid-way through the process. While ultimately well-meaning, the requirement results in clients being strongly advised to read a short explanatory manual which in many cases at two-hundred pages constitutes a considerable commitment for someone just wanting to buy their first stock of Aurora Cannabis.

To conclude, it is very easy to create a brokerage account for anyone with a Japanese tax identification number that one would have in order to earn the money transferred into the said brokerage account in the first place.

Taxation overhead

In terms of the bureaucratic overhead related to taxation that may arise from participating in the capital markets, the situation is very favorable in Japan.

Since 2003, the account holder can specify whether they would prefer a regular or a tax withholding account. In the case of a regular account, taxes on capital gains and distributions have to be declared at the tax office using a report provided by the brokerage firm. In the case of a tax withholding account, the brokerage withholds the taxes directly at the source and no tax report needs to be filed on behalf of the account holder.[169]

This means that in practice, individuals with complex tax conditions and those willing to undertake additional tax optimization have the opportunity to do so during the next tax season. Those who merely want to invest and are in agreement with taxes being deducted immediately do not have to file any further forms.

3.4.3 Tax-advantaged plans

Several tax-advantaged accounts are offered in Japan. These function as incentives to promote savings and investment by considerably increasing the saver's performance. There are typically two points at which tax advantage can be given to a retail investor.

First, the investor can be given a tax deferral. The most prominent of such systems due to their membership numbers are the American Individual Retirement Accounts (IRAs) and employee 401(k) accounts. Tax deferral allows the saver to deduct up to a certain limit the sum added to the savings account from the income tax of the year when the investment was made. As such, the investor pays less taxes in the year he makes a contribution. When the investor decides to retire, he can begin withdrawing funds from his savings account and pay the previously withheld income tax. Because the investor is retired and has a reduced income relative to when the contributions were made, they pay fewer taxes due to now being in a lower tax bracket. In the case of an employee savings account, the employer may also match the employee's contribution, thus effectively increasing the employee's income at no additional effort to the employee.

Second, the investor may be allowed to withdraw from a tax-advantaged account tax-free. Well-known examples of these include Roth IRA and 529 or Coverdell ESA (CESA) plans allowing parents to save for their children's education. Income taxes are paid as usual, but the increase in the value of the account through capital appreciation and dividends is no-longer taxed. As with tax-deferred accounts, these are typically bound to certain conditions, such as reaching the age of 59 1/2 for Roth IRA accounts or spending

169. SMBC Nikko Securities, *Hajimete Demo Wakari Yasui Yōgo-Shū* [A Glossary Easy to Understand Even for Beginners], Web Page, 2019, accessed 29 April 2019, `https://www.smbcnikko.co.jp/terms/japan/to/J0077.html`.

the withdrawals exclusively for education-related needs in the case of 529 and CESA plans.

In the following sections, we look at two principal groups of tax-advantaged accounts available in Japan: the individual savings accounts and the retirement accounts. When these accounts are described as "savings" or "retirement" accounts, the accounts in question are largely fully-fledged brokerage accounts as opposed to "savings accounts" at a banking institution that one would open for their child and allow for limited access to the funds.

Individual savings accounts

There are currently two individual savings accounts in Japan: the *Nippon Individual Savings Account* (*NISA*) and the newer *Tsumitate NISA*, literally meaning the "Accumulating NISA".

The Japanese NISA has been first launched in January 2014 with a two-fold aim: on the one hand, it should allow the Japanese long-term investors to accumulate capital, on the other hand, it should provide the Japanese corporations with a more stable equity financing source, as an increased introduction of long-term retail investors would provide stability to the equity valuations. As the name suggests, it is Japan's take on ISA accounts, which originally launched in the United Kingdom in 1999.

Unlike the British ISA, the *NISA* in its original iteration appears to be at first a short-lived program, although due to how recently the legislation has been put into effect it is not yet entirely clear how it will develop in the long term. The program allows one to create one account per individual that lasts for five years. During the account life period, the account holder could originally invest up to ¥1 million each year, which could be withdrawn tax-free for a period of five years from the year of the investment. From 2016, the limit was raised to ¥1.2 million. The account holder could close the account and reopen a new account starting the process all over again. The latest the account maybe be opened is in December 2023 after which no further NISA accounts may be created. The accounts are very flexible and allow investment into funds, including ETFs and REITs, as well as individual Japanese and foreign equities.[170]

In 2016, a special type of NISA aimed at minors was introduced. The *Junior NISA* is in principle identical to the regular NISA, but with a lower annual contribution limit of ¥800 thousand. The account further differed in that no tax-free withdrawals could be made until the beneficiary reached eighteen years of age and remained managed by the minor's guardians until that point.

170. Tsuguo Kohno, *To NISA or Not to NISA?*, Web Page, 2019, accessed 27 April 2019, `https://www.morganmckinley.co.jp/en/article/nisa-or-not-nisa`.

Since 2018, a new variant known as the Tsumitate NISA became available. The principles were the same as with the regular NISA, but there were some notable differences. The duration of the investment was drastically increased from 5 years to 20 years at the cost of the amount investible being reduced from ¥1.2 million to ¥400 thousand. Therefore, unless further adjustments are made as had been the case with NISA in 2016, it would take three times as long to invest the same amount into Tsumitate NISA as it would in the regular NISA. Furthermore, whereas NISA allowed investment into individual equities the Tsumitate NISA could only be used to invest into a select list of investment funds.[171] This is a considerable limitation on investible securities, although the list of available securities at a major broker such as SBI is long and includes inexpensive funds tracking Japanese, global, developed and emerging indices as well as so-called balance funds consisting of a combinations such as a 50–50 split between Nikkei 225 and Tokyo REIT. A handful of active funds with higher expense ratios were also made available. Conversely, this presented a considerable limitation of NISA itself, as it made it impossible not only to invest in individual stocks but also certain asset classes such as REITs, bond or commodity ETFs without selecting a balance fund containing the said assess class along with some other asset.

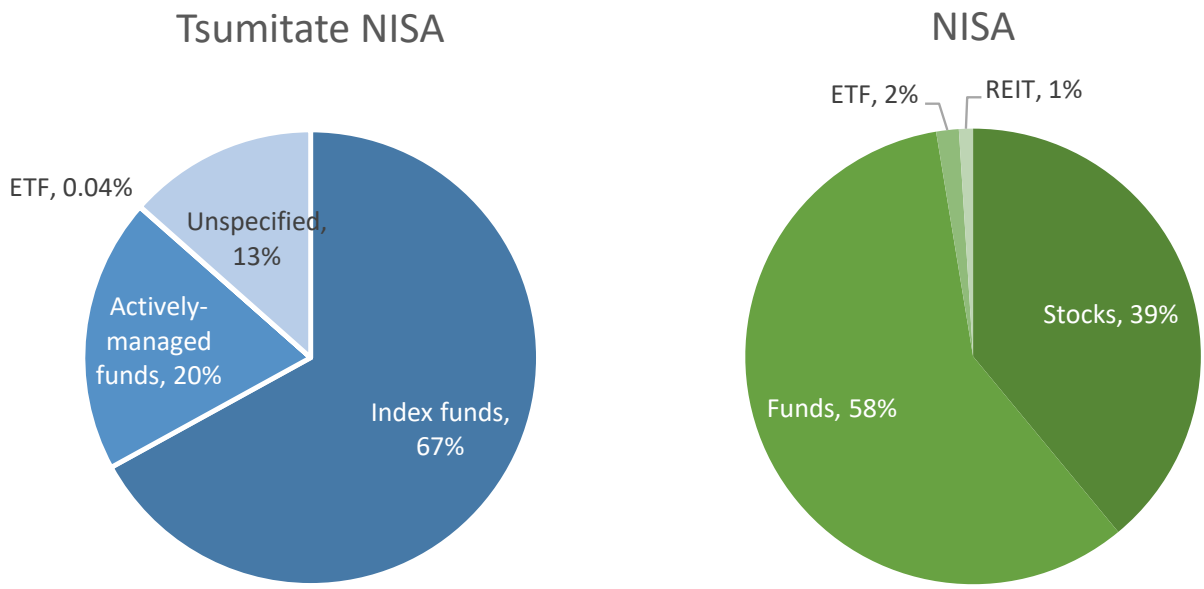

Figure 3.35 Aggregate NISA and Tsumitate NISA compositions for 2018. Data: Financial Services Agency, *NISA Kōza No Riyō Jōkyō Chōsa (Heisei 30-Nen 9 Getsumatsu Jiten).*

While this will undoubtedly annoy personal finance enthusiasts with a great deal of confidence in their stock-picking skills, given the lacking financial literacy later discussed

171. Takekawa Minako, "NISA Kaishi Kara 5-Nen. Waku 120 Man En Ga Neagari Bun Rōruōbā Kanōde Meritto Kakuda" [Five Years Since NISA Began. Roll-Over Is Possible With the Price Increase of 1.2 Million Yen], 2019, `https://media.rakuten-sec.net/articles/-/17665`.

in section 3.5 "Financial literacy" this may have been a favor in disguise to investors opting to build non-diversified portfolios. By comparing the composition of assets in NISA and newer Tsumitate NISA accounts, it is possible to determine that Japanese investors are being pushed into funds and away from individual stocks that previously constituted nearly 40% of the portfolios. The near absence of REITs in NISA and ETFs in both accounts is also notable. Intentionally or not Tsumitate NISA appears to be designed towards safety through diversification rather than personal choice.

Research by Nikko Securities suggests that already by September 2015, there had been 9.6 million NISA accounts, which corresponds to one-tenth of the adult population. However, the account system failed to attract young people and instead was largely utilized by individuals in their sixties to deposit their retirement bonuses. In a survey of random responders in their twenties, a half replied: "I don't the name and I don't know what it [NISA] is."[172]

By December 2018, the number of accounts had grown to 12.8 million, suggesting that after the initial rush most people who wanted one had opened one as soon after they became available. Only 2.5% of the accounts were Junior NISA and 8.27% of adult NISAs were Tsumitate NISA. The volume of assets in the accounts had increased from ¥2.4 trillion in June 2014 to ¥5 trillion in June 2015 to ¥16.9 trillion in December 2018. 0.74% of these were in Junior NISA and 0.59% in Tsumitate NISA.[173] Since Tsumitate NISA had only been available for a year at that point, this suggests that only 22% of the total amount that could be contributed to Tsumitate NISA had been filled.

This demonstrates a pattern similar to that of 2014 when only 45% of the accounts had contributions made to them with most high investment volume accounts being those of the individuals close to retirement. The use of NISA by a select group is further reinforced by the fact that at that time NISA and British ISA accounts had approximately the same number of funds in them despite there being three times as many British ISA accounts as NISAs. This has to be taken into consideration given that British ISA accounts allowed for much higher contribution limits at £20,000 (¥2.9 million) annually in contrast to NISA's ¥1.2 million.[174] In other words, whereas the ISA appears to a relatively diverse group of investors, NISA seems to attract individuals with sufficient disposable funds. This has not changed following the most recent survey in September 2018, wherein 58% of the total assets in NISA accounts were owned by individuals 60 or older.

While the introduction of NISA appears to be a step in the right direction towards

172. Nikko Research Center, *Nihon Keizai to Shihonshijo.* Page 293–295.

173. Financial Services Agency, *NISA Junia NISA Kōza No Riyō Jōkyō Chōsa (Heisei 30-Nen 12 Getsumatsu Jiten (Sokuhō-Chi))* [Junior NISA and NISA Account Usage Study (as of the End of December 2018)], Web Page, 2018, accessed 27 April 2019, `https://www.fsa.go.jp/policy/nisa/20190213/01.pdf`.

174. Nikko Research Center, *Nihon Keizai to Shihonshijo.* Page 293–295.

incentivizing greater direct investment among retail investors, the Japanese NISA is still not as good of a deal and does not necessarily appear to get better with time despite being introduced fifteen years after its British progenitor. The ISA offers a possibility of investment into stocks, funds, bonds, insurances, and cash, whereas NISA only allowed for stocks and funds and Tsumitate NISA only offered a selection of funds. There is no time frame for when ISA accounts could be opened and ISA investments can currently be held indefinitely, whereas NISA is only presumed to run until 2023 with tax advantages expiring five years after every investment. This is not necessarily conducive to the desired long-term holdings. As mentioned previously, even the newer NISA annual contribution limits are less than half of those of the ISA. Dividends reinvested through NISA count towards the yearly contribution limit, which means that no dividend reinvestment option exists in the ISA and most other tax-advantaged accounts known to this author. Finally, it is also not possible to replace one financial instrument with another, which is a typical property of tax-advantaged accounts.[175]

An introduction of a system like NISA was undoubtedly better than having no simple tax-advantaged savings system, but in its present state, it also appears to be vastly inferior to the British ISA. That is however only when considering ISAs in isolation of the pension system as a whole. Also notable is that not every jurisdiction offers tax-advantaged accounts to begin with and their launch in Japan is likely to incentivize further direct investment regardless of the potency of this incentivization.

Retirement accounts

Retirement is one of the primary goals of investment. This is not in the least a result of the sustainable exponential growth resulting from the compound interest effect gaining in magnitude towards the longer time frames. Retirement systems, however, are radically different from one jurisdiction to another and show a great degree of specificity.

The Organisation for Economic Co-operation and Development (OECD) divides public pensions into first-tier pensions and second-tier pensions, wherein the first tier are redistributive pensions providing general coverage to prevent elderly poverty and second-tier pensions, which as of 2005 were equally mandatory in all but two OECD states, aim to provide a higher standard of living. The payout of the first tier pension is generally not related to the retiree's earnings but may depend on the number of years worked and the availability of other sources of income during retirement. Second-tier pensions augment the first tier pensions and are in most cases dependent on the retiree's previous income or contributions to the pension scheme.

The Japanese system is generally classified as a first-tier "basic" type pension with a

175. Nikko Research Center, *Nihon Keizai to Shihonshijo*. Page 293–302.

second-tier defined benefits elements scheme.[176] Participation is mandatory for all persons between the ages of 20 and 59 with an address in Japan, but also available to those aged 60 to 64 as well as Japanese citizens residing overseas. The contribution amount for the fiscal year 2019 was ¥16,410 per month, however partial or full exemptions for students, individuals with disabilities and low-earners were possible. Those who had contributed for 40 years and were retiring were entitled to a yearly pension of ¥780,100.[177] Widows of individuals who had not claimed pension benefits and those outliving their partners after they had begun receiving pensions also had a certain limited claim on the pension.[178]

The second tier system is considerably more complicated and only a brief simplified account is provided here. The insured are separated into three categories each of which is insured by the basic pensions outlined above:

Category 1: Self-employed and students. 17.4 million insured.
Category 2: Company employees and public servants. 36 million and 4.4 million insured respectively.
Category 3: Dependent spouses of Category 2 insured. 9.3 million insured.

Category 2 company employees are insured by the governmental Employee's Pension Insurance scheme[179], whereas public servants are provided with the *Mutual Aid Pension*. The contribution rates were approximately 15% of the earned income. Alternatively, employers could offer *corporate defined benefit* (*DB*) or *corporate defined contribution* (*DC*) pension schemes which were introduced with the Defined Contribution Pension Act and the Defined Benefit Corporate Pension Act in 2001 to supplement the existing Employee Pension Insurance. Although Category 1 individuals did not have access to the aforementioned schemes, they and employees whose employers had not set up any of the above were able to invest in a government-operated DB scheme known as the National Pension Fund. All individuals, except those whose employers explicitly did not allow it due to the structure of their own corporate pension schemes, were able to contribute to individual defined contribution (iDeCo) schemes.

To explain the terms above, defined benefit accounts are contracts that specify how

176. Organisation for Economic Co-operation and Development, "Pension-System Typology," *Public Policies across OECD Countries*, 2005, `https://www.oecd-ilibrary.org/docserver/pension_glance-2005-3-en.pdf?expires=1556367960&id=id&accname=guest&checksum=AE66217C7A541927C431B8DE75CDACC5`.
177. Although by and large not meaningful due to changing rates, this means that the current payer, who has contributed for forty years, would break even if they lived for a little over 10 years following retirement.
178. Japan Pension Service, *National Pension System*, Web Page, 2019, accessed 27 April 2019, `https://www.nenkin.go.jp/international/english/nationalpension/nationalpension.html`.
179. *Kōsei nenkin*. Japanese: 厚生年金.

much the account holder is required to contribute at a defined pace to receive a specified counter-performance at the end of the accumulation phase. In the context of Japanese pensions, these are typically distributed as annuities, although no such limitation exists on defined benefit plans in general. Because the account holder merely agrees to a specified framework, the implementation of the fund and the investment risks are borne entirely by the employer or a contracted financial. Conversely, defined contribution accounts specify merely how much the account holder or their employer can contribute to their account. The asset allocation is performed by the employee from a selection of available funds. This gives the account holder greater freedom but also forces them to bear the investment risk themselves in return for being able to reap greater rewards. An employer may offer both a defined benefit and a defined contribution plan to their employees, however while doing so at lower contribution limits.

As of spring 2019, most with the exclusion of certain employees could contribute to an individual defined contribution plan. The contribution limits were dependent on the account holders category and other active plans. For example, category 1 account holders were able to contribute the greatest amount of ¥816 thousand per year. Category 3 individuals and category 2 employees whose employer did not offer DB or DC plans were the second highest with ¥276 thousand per year. The next tier consisted of category 2 employees with a corporate DC plan of a maximum of ¥420 thousand, who could contribute up to ¥240 thousand to their individual account. The last were category 2 employees with a DB and a DC plan, employees with a DB plan only and all civil servants, who may only contribute up to ¥144 thousand.

The Japanese pension plans were thus particularly generous. This is the most obvious in the case of iDeCo, wherein one could not only contribute one's income pre-tax as is the case with the American 401(k) and reinvest the dividends without paying the typical 20.315% tax but also withdraw from the account tax-free up to a limit after reaching retirement.[180]

Utilization and composition of defined-contribution accounts When Nikko Research conducted their research in 2016, only 4.1% of the population had a defined-contribution account, whether it was a corporate, an individual account or both. In a

180. iDeCo Koushiki, *What Is iDeCo?*, Web Page, 2019, accessed 28 April 2019, `https://www.ideco-koushiki.jp/guide/`; Ministry of Health, Labor and Welfare, "Chapter 1 Overview of the Pension System in Japan," 2008, `https://www.mhlw.go.jp/english/org/policy/dl/p36-37p2.pdf`; Akiko Nomura, "Japan's Pension System: Shft Toward Greater Self-Reliance Is Unavoidable," 2009, `http://www.nicmr.com/nicmr/english/report/repo/2009/2009sum03.pdf`; Akiko Nomura, "Taking Japan's Defined Contribution Pension Plans to the Next Level," 2013, `http://www.nicmr.com/nicmr/english/report/repo/2013/2013win01.pdf`; Ministry of Health, Labor and Welfare, "Corporate Pension System," 2015, `https://www.mhlw.go.jp/english/org/policy/dl/150407-05.pdf`; Japan Pension Service, *National Pension System*.

December 2014 survey, a third of the individuals who already had a defined-contribution account responded that they did not know what defined-contribution accounts were or what the value of the assets in their defined-contribution accounts had been at the time of the survey.

In fact, it appears likely that a large group of account holders do not necessarily understand the assets they are holding. A comparison of Japanese DB accounts with assets selected by professional money managers and those inside DC accounts constructed by account holders themselves shows that just as with insurance, the future Japanese pensioners live by the slogan "better safe than sorry". An aggregate of DB accounts from March 2015 had shown that approximately 6% of the accounts' value consisted of cash instruments. This is not unusual for a fund, because some cash needs to be set aside to cover operational expenses and the salaries of its managers. The remained consisted of 30.4% equities, 39.6% bonds and a remainder 24% of other assets. Given that pension annuities are considered to be safe investment vehicles that assume little risk, one would presume that individual investors not bound by regulation would have held more risk assets. This is however not the case, as only 18.2% of DC accounts consisted of equities, 9.4% consisted of bonds, 13.5% consisted of unspecified other instruments and the entire remaining 58.9% consisted of principle-protected investments (PPIs)[181].

What are the principle-protected investments? They are complex instruments that allow participating in the markets without risking one's invested capital. Typically a PPI would lock in the invested capital for a certain period of time during which it cannot be withdrawn without paying a surrender charge equal to a percentage of the invested capital, making them less liquid than the underlying equities, however given the fact that pension accounts are already locked until the account holder reaches the age of sixty this may seem like less of a problem.

Where the "no free lunch" aspect comes into play is the performance of these securities and their questionable suitability for the investor. Every retail investor with sufficient time on their hands can in practice create their own quasi-PPI by simply buying an index fund and put options on the underlying index. If the market performs well, the investor benefits. If it does not, the investor can exercise their options and sell the index fund at the price they purchased it at. The catch is that constantly purchasing put options to protect oneself from a market downturn is expensive as one is de facto buying insurance against losses. A PPI fund typically makes this already expensive insurance more expensive by not only having to finance its own insurance the same way an individual investor would, but also by having paid full-time management and sales teams structuring and

181. *Ganpon kakuho gata.* Japanese: 元本確保型. Nikko Research Center, Nihon Keizai to Shihon-shijo. Pages 303--310.

marketing the fund. Since PPIs guarantee that the original investment will be returned even in poor market conditions upon maturity, they furthermore need to find ways of financing their operations for people who do benefit from them by withdrawing early. This is typically done through participation rates and annual return caps. As the names suggest, a participation rate is how much of the return is passed onto the investor and how much is kept by the fund. If the assets appreciate by ¥1 million in a year, the investor may receive only ¥0.8 million with the remaining ¥0.2 million going to the fund. Similarly, an annual return cap rate is the maximum percentage that the investors' assets can appreciate. The remainder is kept by the fund. For example, a PPI capped at 5% would never return more than 5% in a single year. While 5% annual return may sound good in theory, one must remember that even in the case of the poorly performing Nikkei 225, as of 2019 the investors would have missed out on six out of the past ten years with the greatest opportunity cost being incurred in 2013 when the index appreciated as much as 56.7%.

The PPI's are thus subject to a number of risks that make them safe only in nomenclature. One of these is inflation, which unlike the PPI does not have a yearly cap. Another one is the associated fees that may considerably impact the investor's performance. Finally, these instruments are by their very definition tied to the survival of the fund. In case of a sufficiently strong shock to the financial system and despite all the protections in place, the financials issuing the securities may find themselves unable to honor the condition of the protected principal, whereas a basket of the underlying stocks themselves could realistically soldier through the crisis and emerge whole at its end. This is not a purely hypothetical example either as demonstrated by the $1.84 million worth of S&P 500 index-pegged principal-protected notes sold by one of the world's most known investment banks of its day, Lehman Brothers.[182] The PPIs were sold in August 2008 after which already by September 15 of the same year the firm filed for Chapter 11 bankruptcy. Conversely, those who had invested in the index itself had broken even as soon as by February 2011.

Succinctly, these are not the best instruments for long-term capital accumulation. They perform poorly compared to index funds or even well-diversified baskets of stocks and expose their owners to several easily avoidable risk factors while offering insurance of dubious utility for a pension account. For comparison, the defined-contribution savers across the Pacific Ocean demonstrate an entirely different asset allocation. U.S. DC account holders kept 65.5% of their contributions in equities. Only 9.1% were kept in PPIs, wherein elder generations showed a higher degree of allocation to PPIs than the

182. Aidikoff, Uhl, and Bakhtiari, *Lehman Brothers Principal Protected Notes*, Web Page, 2019, accessed 1 May 2019, `http://www.securitiesarbitration.com/lehman-brothers.php`.

younger ones, never exceeding 11.7% even for those in their sixties. Until the age of fifty, approximately 3/4 of investments were kept in equities. Overall American investors demonstrated a pattern that is in line with general good personal finance principles, whereby the share of volatile investments such as equities is being gradually reduced as the investor gets closer to retirement and is replaced by bonds, money market instruments, and PPIs. The only minor drawback in the American case appears to be a high percentage of financial assets that are held as shares of the company employing the investor, which exposes the investor to unnecessary risk of losing both their employment and a sizable portion of their savings if the company goes under.[183]

This is not to say that there were no positive developments in the Japanese case. The number of iDeCo accounts rose rapidly in recent years and increased from 206 thousand in December 2014 to 915 thousand in May 2018. The individuals enrolling the most appear to be Category 2 company employees, who would already be insured through other schemes, as opposed to self-employed and dependent spouses of company employees. Most contributors were being paid by enrollees in their forties followed by the close second in their fifties. This age difference appears exclusively in the case of iDeCo as corporate DC plans mandate that all employees enroll and thus do not allow one to opt-out much less ask one to opt-in. This latter trend of older contributors appears to be something that financial educators will have to strive to rectify in the future as early contributions provide much higher utility due to the compound interest effect.[184]

3.5 Financial literacy

In 2014, a then 64-year old bachelor from Hiroshima began making rounds on Japanese television. Although Mr. Kiritani Hiroto was a high ranking shogi player, he became better known as the most famous investor in Japan. However, whereas investors like Warren Buffett, Peter Lynch or George Soros had largely become famous either through consistent, long-term outperformance of the overall market or by "breaking the Bank of England", Mr. Kiritani's fame comes cycling around Tokyo, collecting and living off shareholder gifts such as ¥1,000 bookstore vouchers and 5 kilogram packs of rice.[185]

According to KabuYutai.com, a website that as its name suggests[186] specializes in shareholder gifts, approximately 38% of all exchange-listed enterprises offered shareholder

183. Nikko Research Center, *Nihon Keizai to Shihonshijo*. Pages 303–310.
184. Hisashi Kanko, "Japan's Individual Defined Contribution Pension Plan Enrollment Soon to Surpass One Million," 2018, `http://fis.nri.co.jp/~/media/Files/publication/kinyu-itf/en/2018/lakyaravol287.pdf`.
185. Ben McLannahan, "Japanese Shareholders Reap Quirky Perks," 2014, `https://www.ft.com/content/457d65ce-9a34-11e3-a407-00144feab7de`.
186. Translation: Shareholder gifts.

gifts in 2017.[187] This is not a purely Japanese phenomenon, as companies of other nationalities can also declare dividends either in cash, goods or shares. However, with a small number of exceptions, these dividends are paid out in cash. Conversely in Japan, this practice has been extended so far that some brokerage firms offer a special informational view on their online platforms dedicated strictly to the account holder's present gifts and akin to how one can switch between charts, the company's financials or analyst reports at most brokerage interfaces. These shareholder gifts range from discounts on domestic flights to packs of ramen to visits to Disneyland.

The system works by allowing investors with a specified number of shares to receive dividends in the form of the company's products. These must be owned separately, so investors owning large sums in funds or ETFs do not qualify. For example, as of spring 2019, the owner of 100 shares of the convenience store MiniStop could receive five ice cream vouchers twice a year. A slightly more major shareholder of 200 shares would furthermore receive three vouchers for a small coffee and someone owning as many as 1,000 shares would qualify for twenty ice cream vouchers.[188] Being a particularly widespread phenomenon, Mr. Kiritani is merely the most prominent beneficiary of these ice-cream and small coffee programs.

There are naturally entirely rational reasons for individual investors to sign up for such remuneration schemes. Since the upper limit for MiniStop ice creams is still a little shy of ¥2 million, this provides an asymmetric dividend payout favoring small investors. As ice creams have a retail price of ¥220, this means that at ¥1,752 per share, the investor is receiving an additional 1.26% dividend yield than one who does not cash-in the vouchers. By contrast, an investor with ¥10 trillion invested into the same stock would receive all forty ice creams and their six small coffees, but their dividend yield from ice creams and small coffees would only be an additional 0.001% or three orders of magnitude smaller.

This kind of program becomes unreasonable and shows the first hints of issues with the average retail investor once one computes how much it costs to get the said number of necessary shares. The current price of a MiniStop share being ¥1,752 means that to qualify for the biannual five free ice creams the investor would need to own ¥175,200 worth of MiniStop shares. The six additional small coffees would already set the investor back ¥350,400 and the forty ice creams a year deluxe package at least ¥1.75 million. Any fewer than ¥175,200 worth of stock and the investor gets no ice cream and no small coffees.

187. KabuYutai, "Hajimete Okoshi No Hito E Go Aisatsu" [A Greeting to Beginners], 2019, `https://www.kabuyutai.com/beginner/`.

188. KabuYutai, *Minisutoppu (9946) No Kabunushi Yūtai & Haitō* [Ministop (9946) Shareholder Benefits & Dividends], Web Page, 2019, accessed 29 April 2019, `https://www.kabuyutai.com/kobetu/shoku/ministop.html`.

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[SOR] [単元未満株] [無期限買] [貸借] [貸株] [NISA] [日計り買] [15日売] | 対象eワラント

株価 | ニュース | チャート | 評価レポート | 四季報 | 業績 | 適時開示 | 株主優待 | 分析

現在値 3,603 -4 (-0.11%)

現物買 | 現物売 | 信用買 | 信用売

更新日	19/4/22
権利確定月	3月 9月
権利付最終日	次回:2019/09/25 前回:2019/03/26
URL	http://www.jal.com/ja/investor/individual/guidance/

優待内容名		優待獲得株数	備考
株主割引券	1枚	100株以上	(3月のみ) ※3年以上継続保有(株主名簿に同一株主番号で連続7回以上記載)の場合、300株以上1,000株未満の株主には1枚、1,000株以上10,000株未満は2枚、10,000株以上は3枚追加 ※JAL・JTA・JAC・RACが運航する国内線全路線対象、普通席大人普通運賃(小児の場合は普通席小児普通運賃)1名分の片道1区間が50%割引 ※有効期間:6月1日～翌年5月31日
	2枚	300株以上	
	3枚	500株以上	
	4枚	700株以上	
	5枚	900株以上	
	5枚(以下1,000株以上保有の場合、500株ごとに1枚増)	1,000株以上	
	203枚(以下10万株以上保有の場合、1,000株ごとに1枚	10万株以上	

Figure 3.36 SBI Securities view of the Japan Airlines Co., Ltd. (JAL) shareholder gifts program for April 2019. The tab is located between the price forecasts for the stock and a stock typology breakdown. The coupon offers a 50% discount on a domestic flight for holders of a minimum of 100 shares or at ¥360,000 worth of JAL stock.

This poses certain incentive issues. For one, to be properly diversified given the typical 15 to 20 assets per portfolio rule, the forty ice creams investor would need to have ¥26 to ¥35 million in financial assets. The average financial assets of a household with two or more members were ¥11.5 million at the time only 11% or ¥1.3 million of which were in equities[189]. This leads one to believe that either only the very rich households eat forty dividend ice creams a year and thus most retail investors do not care about ice cream or small coffees. Alternatively, it may be that the investors may not be diversified correctly and are over-invested into specific stocks. Furthermore, one may even go as far and state that ice creams and coffees may well be pushing investors into owning securities they would not buy otherwise. One may thus become a shareholder not because one is firmly convinced that after some years ownership of the MiniStop stock would provide competitive returns, but rather because one likes ice creams with small coffees and has a MiniStop close to their office.

Anecdotally, this author could never shake off an overwhelming impression of sudden excitement appearing when touching the topic of shareholder gifts in Japan. This seems reasonable, as it is unlikely that nearly two-fifths of the exchange-listed enterprises would offer dividends as vouchers if there was no demand for them. Government of Japan survey data confirms these suspicions, whereby "I want to get the shareholder gifts" is stated as the fourth most popular reason for owning securities with 26.5% of responders ticking the box. The reasons superseding ice cream were expectations of stock price appreciation (49.4%), expectations of dividends (37.1%) and wanting to manage financial assets that are not cash deposits (34.3%). 3.4% fewer men chose shareholders gifts than women and unemployed homemakers constituted the professional group that at 37.2% liked shareholder gifts the most.

A more striking revelation of the survey is that the groups the most interested in shareholder gifts are also the ones with the lowest income. 36.7% of respondents in their twenties and 38.1% of respondents in their thirties stated gifts as their reason for investing vis-a-vis only 25%, 22.6% and 15.9% for individuals in their forties, fifties, and sixties. Individuals aged seventy and older also liked shareholder gifts at 25%. While it is on the one hand reasonable that people with the least amount of money would put greater value on ice creams and small coffees, one cannot fail to remark that these are also the same individuals that would be affected the most by the lack of diversification precisely because they have to reach the shareholder gift thresholds while having comparatively few financial assets and would thus expose themselves to unnecessary non-systemic risk of the businesses of their choice declaring a sudden bankruptcy or reducing earnings forecasts.

Unfortunately, the Japanese practice of paying out dividends in vouchers in its current

189. Bank of Japan. See section 3.4.1.

state is a lose-lose proposition even for those who chose to avoid it. Retail investors who participate in such schemes and buy considerable numbers of shares expose themselves to unnecessary non-systemic risk or even buy shares of enterprises they value of the services of rather than their ownership of the business. Conversely, individuals following the good practice of diversification, whether it is through ownership of small quantities of individual shares or by participating in funds, also lose as they forfeit a considerable dividend.

3.5.1 Heartaches by the number

While the fascination with dividends being paid out as gifts might already provide first hints at non-ideal sets of priorities, quantifiable financial literacy data is also readily available for Japan. The Central Council for Financial Services Information, which is a group within the public relations department of the Bank of Japan, conducts surveys on the topic similar to those conducted by FINRA and the OECD. The surveys poll a large group of twenty-five thousand individuals covering a wide range of personal finance-related topics not limited only to investing, but also more general topics such as life planning, budget management, and loans and credit.

As of the survey for 2016, the Japanese respondents noticeably underperformed both American and European respondents in similar surveys conducted overseas. This held true both in terms of knowledge and behavioral questions, such as considering the affordability of something before buying it. The only category where Japan had closely outperformed a peer group was the "attitude" when compared to the United Kingdom. The category unsurprisingly related to prioritizing savings over consumption and avoiding living for today, something that is well established to be a Japanese savers' forte. Overall, Japanese respondents lay 7–17% percent behind their peers. In comparison to the United States, only 43% of the Japanese to the U.S.'s 75% understood compound interest. Significantly more American high schoolers answered this question correctly than did Japanese university students. A smaller yet lesser knowledge differences were observed pertaining to inflation, mortgages, and bonds, which as has been established earlier only a few Japanese owned. Conversely, 41% of Japanese respondents answered correctly as to how long it would take for a loan to double, whereas only 33% of Americans could answer a comparable question. A probable cause of this discrepancy appears to be that only 7% of the Japanese reported having participated in "financial education" as opposed to 21% of the surveyed Americans. It must be noted that the surveys conducted at home and abroad are not necessarily comparable to higher degrees of precision as the financial instruments and services differ across the regions. Furthermore, there is an issue with how the questions are asked. It seems paradoxical that whereas the Japanese

answers were only 2% apart, less than half of Americans who answered the compound interest question correctly answered fundamentally the same question about loan growth correctly.[190]

The intra-national patterns within the two countries are however the same and suggest that financial literacy positively correlates with age and income. For example, both individuals between the ages of eighteen and twenty-nine and students had performed particularly poorly answering only approximately 42% of the questions correctly. Financial literacy appears to rise with age and peaks with individuals in their sixties, then drops off slightly for those in their seventies. Although the Bank of Japan survey does not discriminate between academic attainment, it appears likely that the cause may be lower high school and university graduation rates for those who entered the workforce in the 1960s compared to the later periods.

In terms of occupation, the highest performing group in Japan is the governmental employees, scoring nearly 10% higher than those working in private enterprises. Full-time homemakers, who are traditionally seen as the financial managers of the households, performed only marginally better (0.2%) than company employees answering 56.1% of questions correctly. If the traditional view of the housewife managing family finances were to hold true, this would be disconcerting as Japanese homemakers are almost per definition wives and thus, given the mean marriage age of thirty, would be in aggregate older than the broad group of company employees, who entrust the said homemakers with financial planning.

The Bank of Japan survey goes beyond those of FINRA by also testing the respondents for behavioral biases discussed in Behavioral finance biases. The tested biases were loss aversion, myopic and herd behavior.

The respondents had generally shown strong loss aversion wherein 78.6% stated that given a capital of ¥100 thousand, they would not risk losing ¥10 thousand to gain ¥20 thousand if the odds of winning and losing were equal. This is not entirely rational behavior from a purely financial point of view, as the expected return on such a proposition would be 5%. It is, however, something one would expect given the findings of behavioral finance stating that the pain of losses is higher than the pleasure of winning. Loss aversion has been observed to be 15–20% higher for Japanese women than men and rising for men in their thirties to the end of their sixties. This bias appears to be exhibited stronger in those with higher financial literacy scores.

Myopic vision or shortsightedness tested whether respondents would take ¥100 thou-

190. The latter question appears to be identical in the United States and Japan, based on the original FINRA report and the official Bank of Japan translation of their study. Financial Industry Regulatory Authority, "Financial Capability in the United States 2016," 2016, `https://www.usfinancialcapability.org/downloads/NFCS_2015_Report_Natl_Findings.pdf`.

sand now or ¥110 thousand a year later. Given that at the time a 1-year Japanese government bond yield had been negative, foregoing a 10% annual risk-free return would have been only rational for individuals in immediate need of money or alternative very lucrative investment possibilities. Nonetheless, 47.1% chose to take the payout immediately. This included 42.2%–49.1% of individuals in their forties and fifties, who would have been in their prime earning ages and in no need of immediate liquidity. 6% more men were shortsighted than women.

Lastly, respondents were tested for herd behavior by being quizzed whether they bought products that were best selling rather than the one they assessed as best for themselves. Most answered neutrally with more stating that they would rather buy something they believed was best for themselves rather than the most popular product. 3% more women exhibited herd behavior than men and the bias subsided gradually as individuals got older.

Shortsighted individuals and those following the herd reported a higher occurrence of financial troubles, had more consumer loans and thought they had too much debt. Fewer loss-averse individuals bought stocks.

It is difficult to make a more detailed international comparison concerning the above figures due to the American data showing a much lower degree of granularity than that supplied by the Bank of Japan. While the degree of financial literacy among the Japanese populace appears to be low in comparison to the listed comparator nations, the trend is nonetheless optimistic. Only 6% of the 30–59 and 60–79 group reported that they had received financial education in contrast to as many as 14% of students aged 18–24. Given that the presence of financial education was by far the most important individual factor in the respondent's ability to score high on the test, this suggests that although Japan is not yet there, it is definitely heading in the right direction should the government and individual families continue to provide, broaden and improve upon existing programs.

3.6 Conclusion

This chapter has outlined the history and the present state of the Japanese investing landscape from the perspective of the retail investor. Several notable points can be raised from these findings.

For long stretches of the Japanese postwar history, the domestic markets themselves were not all that remarkable. There were the years of the postwar unrest, a number of shocks associated with the Bretton Woods system and the oil crises that followed shortly after the liberalization of exchange rates. Throughout this period the percentage of the market capitalization of the Japanese exchange-listed enterprises owned by the

households had continued to decline at a steady pace until finally coming to a halt in the 1980s. Although many financial instruments were unavailable and government-issued bonds had only come into existence towards the middle of this period, investment vehicles such as investment funds had been created quite early in the postwar history and remained largely unchanged until the end of the Bubble economy. Most notably, the Bubble economy itself does not appear to have had nearly as strong an effect on the relationship between households and equities, as the most prominent instrument of the financial markets, as is commonly asserted. Whilst there had been a greater degree of participation in investment funds and odd stories about investments into soon-to-be-privatized telephone companies, the common stock has never been popular among Japanese retail investors throughout the postwar history and this attitude appears to have remained largely unchanged after the burst of the Bubble.

That is not to say that the Bubble did not have profound effects on the Japanese investment infrastructure. The performance of the Japanese equity markets had been poor not only from the point of reference of the peak of the Bubble but also from the perspective of anyone entertaining the idea of entering the market prior to the Abenomics reforms. Not in the least contributing to these was the general economic malaise of the 1990s and the high valuations of the Japanese enterprises relative to their cash flowers at the peak of the Bubble. Even when accounting for the dividend distributions and the very mild inflation rates through the period, Japanese equities had considerably underperformed all comparator countries. That is not to say that there were no investment opportunities that could have somewhat improved a balanced multi-asset class portfolio, be these the commercial immovables purchasable through J-REITs from 2001 onwards or bonds throughout the entire period.

What can be determined is that these assets were not purchased with portfolios rather kept as cash and cash equivalent instruments that following the reduction of the interest rates during the Lost Decade exhibited minimal yields. In recent years, these had furthermore begun a transition into a home-building boom, which in contrast to commercial real estate does not demonstrate even remotely comparable return rates. Even the interest-paying instruments that were kept as short-maturity term accounts could have been kept as long-maturity bonds and thus provided better yields following the lowering of the interest rates. None of these favorable decisions appears to have been made by the general public.

This raises the question of why that is the case. This cannot be due to high barriers for entry as the Japanese brokerage industry provides all necessary instruments in a convenient manner and very often at reasonable prices. From the lawmaker perspective, a great deal of emphasis has also been put on providing a favorable investment environment

and incentives for everyday savers to participate in the growth of not only national but the global economy. Taxation is easy, savings accounts allow investors to purchase equities and funds without taxation and further relief is provided to those seeking to invest for retirement. For someone beginning from the Decartian tabula rasa, Japan may not be the very best place to begin investing, but it is also far from being the worst.

The answer seems to lie in the very fact that members of society are not blank slates and already bear a considerable burden by the time they reach the age when they can make financial decisions. This is most visible in the internationally low level of financial literacy among the Japanese of all ages and sexes, which in one fell swoop results in a greater exhibition of behavioral biases and the general lack of understanding of how and why one would invest for long-term returns. While hindsight demonstrates that even someone suffering from extreme forms of home bias and investing only in Japan could have still purchased asset classes that did appreciate, this lack of understanding of personal finance is also visible in the composition of the defined contribution portfolios of this very day. Whereas American savers buy high-return high-volatility stock indices when they are young and gradually reduce their rate in favor of bonds as they get older, Japanese investors believe that it is better to be safe than sorry by purchasing assets of questionable suitability for someone decades away from retirement. The composition of assets selected by professional money managers who administer defined benefit plans conversely appears to be closer to that of the retail investors in the United States.

This seeming propensity for extreme risk aversion did not materialize out of nowhere and can be traced back at the very latest to the postwar years that appear to play a crucial role in what Garon Sheldon describes as the framework of social management characterized by cooperations of the national bureaucracy and citizenry groups.[191] Both the more well-known Japanese propensity to save cash and the lesser well-known preference for extensive life insurance coverage was at first implanted from the above by the national and Occupation bureaucracies to address the existing problems of the day. The perpetuation of these two habits was then driven in no small part by the populace and the private sector themselves, be that through individuals volunteering to propagate the values of saving or those seeking to participate in the events associated with the months of life insurance. As with many elements of the Japanese economy, these well-established rotes had begun to break down with the end of the high growth period and the burst of the Bubble. The yield that was once produced by the Japanese postal service term account was now but a distant memory and the knowledge of how one should operate in this brave new world had simply not been present. While this situation has begun

191. Max Kubát, "Virtual Currency Bitcoin in the Scope of Money Definition and Store of Value," *Procedia Economics and Finance* 30 (2015): 409–416, ISSN: 2212-5671.

to change for the better in recent years with increased financial education of the upcoming generations and governmental incentives, it appears unlikely that this aspect of culture will be changed overnight less the government were to counteract the status quo bias and change optional participation in second-level pension plans to optional exclusion from participation as suggested by some authors.[192] Furthermore, there is also another much less risk-averse side of this same cultural coin that emerged as a result of the Lost Decade and had ultimately lead to the very topic of this research: Bitcoin's sudden rise to popularity in 2017 Japan.

192. Tina Rosenberg, "The Opt-Out Solution," 2010, http//opinionator.blogs.nytimes.com/2010/11/01/the-opt-out-solution/.

Chapter 4

Bitcoin's role within Japan

4.1 Gambling

Having previously laid out the excessive risk-averseness of the Japanese households, this chapter focuses on the coexisting polar opposite constituting a propensity among certain groups of the population to engage in high-risk activities of a gambling-like character. This author contends that it is precisely here that Bitcoin comes into play while at the same time being a tendency that existed well before the inception of the cryptocurrency. To begin, one can first look at the most prominent exhibition of gambling-like behavior that is gambling itself.

Although gambling is typically not considered a topic related to finance or investing, it is the contention of this author that it is particularly pertinent in the case of Japan. As will be shown later, Japanese retail investors constitute a disproportionately large portion of the global foreign exchange trading volume, which in its very essence is a zero-sum game. Once accounted for commissions and the bid-ask spread, it becomes a negative-sum game. This makes Japan in aggregate unusual in its attitude towards the relationship between money and speculative behavior that in aggregate will inadvertently lead to a loss. This very same behavior occurs in gambling.

From a strictly legal point of view, gambling is illegal in Japan. Articles 185, 186 and 187 of the Penal Code corresponding to "gambling" in general, "running a gambling place" and "lotteries" layout in no uncertain terms the penalties ranging from petty fines to imprisonment with work. Nonetheless, some 42 million Japanese spend the equivalent of $200 per year on lottery tickets. This game of chance alone ranked as the sixth most popular leisure activity after "restaurants, domestic trips, driving, karaoke, and watching videos at home".[1]

1. Naoko Takiguchi and Richard J. Rosenthal, "Problem Gambling in Japan," *electronic journal of contemporary japanese studies*, 2011, ISSN: 1476-9158.

Takiguchi and Rosenthal explain in their 2011 paper that the apparent disconnect between gambling legislation and gambling reality arises from the exception in the Japanese penal code allowing to "[bet] a thing which is provided for momentary entertainment." In a detailed study of gambling addiction, its origins and the attempts to combat it, the researchers argue that the current situation is caused by the change in the Japanese work culture occurring as a result of the recession following the Bubble. In the researchers' words "work environment, which used to emphasize open communication, group achievement, and mutual help [...], became a field of competition and mistrust".[2] Escapism and withdrawal from stress led to not only to the proliferation of gamblers, but also the appearance of the *hikikomori* shut-in phenomenon and a drastic increase in the suicide rates.

As of 2007, 38.3% of Japanese played lottery spending the equivalent of $200 per year, which in aggregate corresponds to a ticket every second or third day one would go to work;[3] 6.9% bet $717 dollars a year on national horse racing, 1.1% bet $183 on provincial horse racing; 4.2% spent an average of $98 on football bets and an audience of around 1% spent approximately $700 dollars on motorboat and bicycle racing each. The greatest cash cow that amounted to over a thousand dollars a year from 13.1% of the Japanese population were the pachinko and pachislot machines.[4] This later category shows some remarkable characteristics. Writing in 2006, The Economist reported that although the number of players had dropped from 29 to 18 million over the decade, "the Japanese collectively spend some ¥30 trillion ($260 billion) a year playing pachinko and its upstart cousin, pachislot—roughly equal to spending on health care." To provide something to compare the figure to, this was in the same ballpark as the gross domestic product of entire countries such as Portugal, Vietnam, and Peru.[5] The weekly proceeded, noting that "[b]orrowing money to play pachislot is thought to account for almost half of consumer debt."[6]

At present, it appears that the pachinko and pachislot industry continues its long decline that began in mid–1990s. According to a 2017 report of Sega Sammy Holdings, a $3 billion corporation deriving roughly a half of its revenue from the pachinko-pachislot business until 2015, the industry has entered a vicious circle of declining player population leading to higher costs per player which leads to declining investment which again leads to

2. Takiguchi and Rosenthal, "Problem Gambling in Japan."

3. Assuming average price of the ticket at 233 yen as offered by SMBC and 250 workdays. Sumitomo Mitsui Banking Corporation, *Hajimete No Kata E (Roto, Nanbāzu)* [For Beginners (Lotto, Numbers)], Web Page, 2019, accessed 24 April 2019, `https://www.smbc.co.jp/kojin/takarakuji/beginner/index01.html`.

4. Takiguchi and Rosenthal, "Problem Gambling in Japan."

5. The Economist, "Rules of the Game," 2006, `https://www.economist.com/business/2006/07/27/rules-of-the-game`.

6. Ibid.

Figure 4.1 The opportunities to make bets are so prevalent that they can be even be found on the banking interface of major Japanese financials. Controls of a Japanese online banking interface. The two right-hand buttons in the middle row read "Lottery" and "SMBC Toto", a football betting service.

a decline in the player population. The report notes that particularly young adults, that constituted a core demographic, have been leaving for new sources of entertainment such as smartphone games as well as due to legislative changes that made certain machines less appealing to the core audiences.[7] The decline of pachinko and pachislots activity does not, however, necessitate a decline in gambling. Takiguchi and Rosenthal point out that technological innovation may have drawn players towards other venues such as online casinos,[8] although it is still difficult to determine the magnitude to which these new gambling opportunities are exploited and what should and should not be counted as gambling or gambling-like behavior.[9] A 2017 Nihon Keizai Shimbun report suggests that gambling addiction still remains a problem for 3.6% of the adult population. In line with

7. Sega Sammy Holdings Inc., "Pachislot and Pachinko Machine Business," 2017, `https://www.segasammy.co.jp/english/media/file/ir/management/market/market_data.pdf`.

8. Takiguchi and Rosenthal, "Problem Gambling in Japan."

9. In recent years questions of whether video game items can be considered gambling have been raised across the world. In the case of Japan specifically, there is a preponderance of so-called "Gotcha" video games for mobile phones where random in-game awards are drawn by chance.

the findings reported in this research's previous sections in terms of behavioral finance and as will be later seen Forex trading and cryptocurrencies, men are affected more than women at 6.7% against only 0.6%.[10]

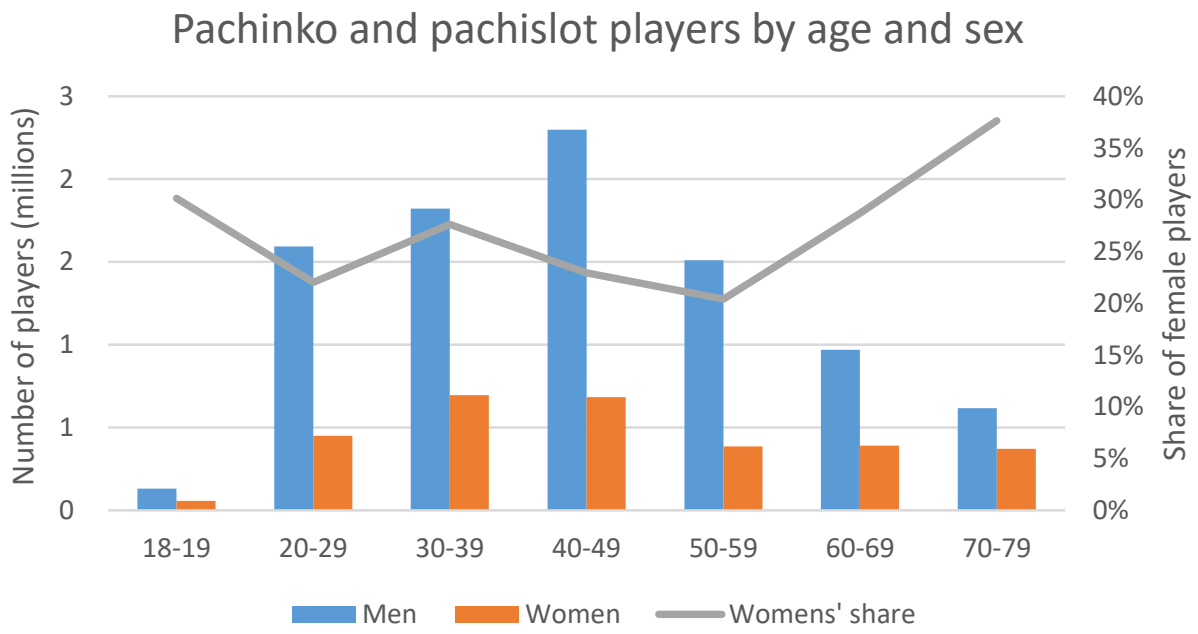

Figure 4.2 Pachinko and pachislot players by gender and sex. Data: Amusement Press Japan Inc., "49-Sai Ika Yaku 7-Wari, 10-Dai-30-Dai No Sankasha Ga 4-Wari Shimeru."

In 2016, the pachinko industry alone generated ¥21,626 billion ($205.44 billion) in revenues. This accounts for 4.16% of the gross domestic product.[11] Using other gambling activities from Takiguchi and Rosenthal's research as an estimate, the share increases to 6.7%. By contrast, the revenues of American casinos constituted only 1% of the GDP of the United States.[12] In Europe, the European Union average lay at 0.52% for 2003, with Germany at 0.4%, the United Kingdom at 0.8% and Ireland at 0.97%.[13] Notably, none of the figures include unregulated gambling in either region.

Concerning household spending, using the data presented by Takiguchi and Rosenthal in combination with the household spending data from the Bureau of Statistics for the

10. Nihon Keizai Shinbun, "Gyanburu Isonshō Utagai 320 Man Nin Kōrōshō Suikei, Sho Gaikoku to Kurabe Takaku" [Ministry of Health, Labor and Welfare Estimates: Suspected Gambling Addiction 3.2 Million People, Higher Than Other Countries], 2017, https://www.nikkei.com/article/DGXLASDG29H65_Z20C17A9CR8000/.

11. Kenkyo Investing, "Declining Pachinko Industry Still Worth a Bet? - Kenkyo Investing," 2018, https://www.kenkyoinvesting.com/2018/03/30/declining-pachinko-industry-worth-bet/.

12. Ron Dicker, "Casino Industry Accounts for Significant Slice of U.S. Economy: Study," 2012, https://www.huffpost.com/entry/casino-industry-gdp_n_1260038.

13. DKM Economic Consultants, "Economic Assessment of a Regulated Casino Gaming Sector," 2007, https://www.ey.com/Publication/vwLUAssets/ey-economic-assessment-casino-gaming-sector-ireland-2008-2020/$FILE/ey-economic-assessment-casino-gaming-sector-ireland-2008-2020.pdf.

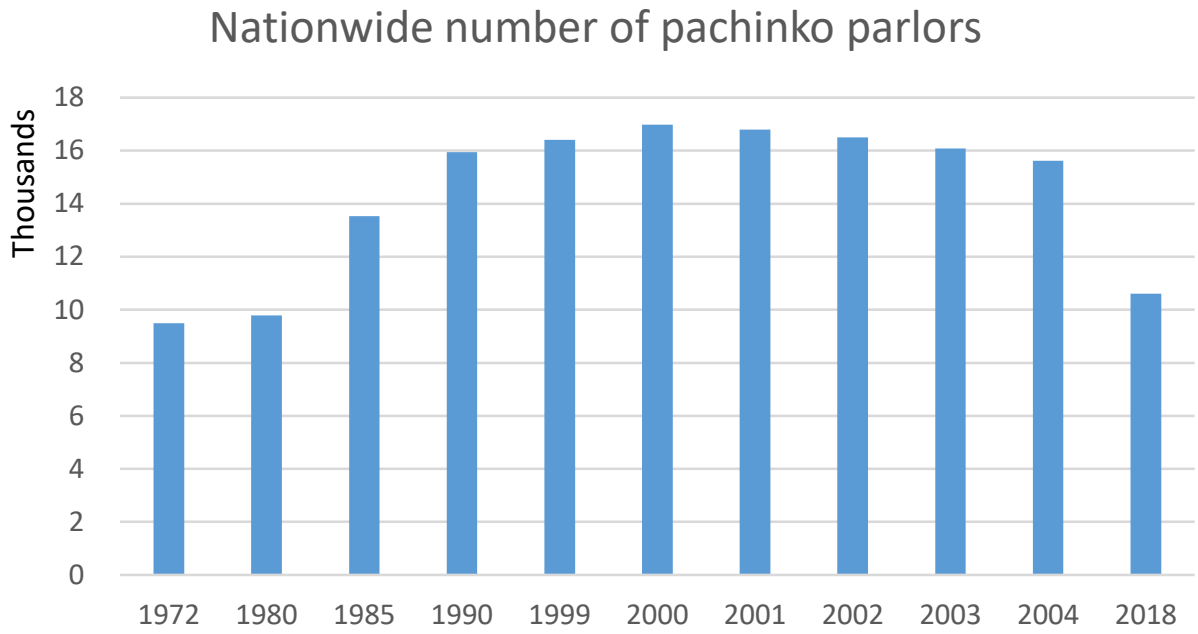

Figure 4.3 Pachinko parlors in Japan. Data: 1972–2004: Ministry of Land, Infrastructure, Transport and Tourism, *Pachiko Parlors*; 2018: Chan, "Japan's Pinball Gambling Industry Rakes in 30 Times More Cash Than Las Vegas Casinos."

same year suggests that out of approximately ¥300,000 consumed each month per household, gambling accounted for ¥7.3 thousand or approximately 2.5%.[14] This corresponds to a tenth of spending on food, 41% of spending on housing, 55% of spending on medical care or 56% of spending on clothing and footwear. It is more than twice the amount spent on alcohol and seven times that spent on tobacco. Using the flow of funds data for households provided by the Bank of Japan and described in greater detail in Structure of financial assets, the aggregate spending on gambling corresponded 23% of flow of funds into Japanese household savings and investments or 43.9% of what the households had collectively added to their currency and deposit accounts.

In contrast with the Japanese propensity for high savings, the strong preference for low-risk investments and the perception that stocks are "scary", gambling appears to be not only a major industry in Japan but also a significant portion of household expenditure. It may appear at odds with the general perception of the Japanese financial behavior described in the previous chapter, yet it is precisely the propensity for this behavior among certain groups of the Japanese society that pave the way to speculative Forex

14. The calculation has been performed as follows:
Total gambling spending is calculated as the number of participants multiplied by annual per player spending and converted to Japanese yen at the 2007 closing rate of ¥117.78. The national average of persons per household is taken from the Bureau of Statistics as 3.1 for the same year. After dividing the total population of 128 million, this results in 41.29 million households. Dividing the annual per player spending by the monthly household spending and dividing by 12 produces the monthly household spending on gambling.

trading to be discussed next and the recent forays into the Bitcoin market.

4.2 Margin accounts

Before looking into margin trading one must revisit what it entails. A margin account is a special type of brokerage account that allows the trader—rather than an investor—to borrow funds or financial instruments from the broker-dealer for the purposes of trading. This allows for the amplification trading returns relative to the starting capital of the trader. This amplification through borrowed funds known as leverage is typically specified as a ratio or a multiplier, such as 25:1 or 25x. For every ¥1 earned without leverage, a trader using at the aforementioned 25:1 leverage would earn ¥25. This allows for both much more spectacular returns, such as 2400% with 25:1 leverage on a price movement that would lead only to 100% without, and for returns on assets that typically move only very slightly over time, such as major national currencies relative to each other.

The drawback of leverage is that it can also lead to equally phenomenal losses in a way unleveraged investments cannot. To engage in margin trading, the trader must deposit a margin with his broker-dealer. This is a quasi-safety deposit necessary to engage in trading with leverage. Should the price move against the trader, they may receive a margin call informing them that the funds previously deposited by the account holder are soon going to be insufficient to cover their losses on the borrowed funds. In this case, the trader can either add additional funds or sell their position at a major loss. As time is of the essence in such a case, the broker-dealer is at liberty to liquidate whatever assets belonging to the account holder necessary to close the position. The higher the leverage, the higher the potential returns, but also the sooner does the trader receives a margin call if their predictions do not hold.

Unlike in the case of unleveraged purchasing of equities or bonds, the trader can thus quite easily lose their entire original investment. To achieve this outcome with equities or bonds, the enterprise of the corresponding issues would have to declare bankruptcy and even then some funds may still be recovered during the liquidation of the company's assets. In the case of margin trading, all it takes is a single unexpected price movement.

To make things even riskier, there is in fact potential to lose more than one has invested originally. This is particularly the case with foreign currency trading, where currency pairs move only minutely relative to even well-diversified instruments such as the stock indices and thus typically require the use of considerable leverage to achieve worthwhile returns. Traders can protect themselves by instructing their broker-dealers to close their positions if a specified degree of loss has been incurred, but this does not always work. The most famous example of such an event was the January 2015 Swiss franc

movement, wherein the Swiss National Bank unexpectedly unpegged the exchange rate of the franc from the euro. As a result, the franc appreciated from 1.20 francs per euro to 0.85 overnight.[15] Given the rapid movement and decreased liquidity, stop-loss orders intended to prevent extraordinary losses could not be filled. One publicized example of such a loss was an unnamed Irish school teacher, who at the time earned €25 thousand per year after taxes and incurred a loss of €400 thousand while he was teaching a class.[16]

4.2.1 The scope of Japanese margin trading

Margin trading in foreign exchange (Forex), or FX as it is commonly referred to in Japan, is by far the most popular type of margin trading in Japan and only a relatively recent phenomenon. Much of the groundwork was laid following the liberalization of the financial sector during the Financial Big Bang in the late 1990s and to a degree aided by the computerization of Forex trading as a result of the spread of Internet connectivity during the same period. In 2005, the Financial Futures Trading Law had been revised imposing stricter regulations upon futures traders and attempting to legitimize the business by forcing the registration of sales representatives.[17] The same month, the Tokyo Financial Exchange (TFX) launched the Click365 FX daily futures exchange providing regulatory enforcement of the dealers participating in the exchange and protecting the investors' funds should their dealer go out of business.[18]

Immediately after the regulatory framework had been established, the number of Japanese retail Forex traders began to rise rapidly from a small fraction of the world's total to overtaking all other counties combined by early 2009.[19] By 2013 when the Bank of Japan began rolling out its new quantitative easing (QE) program, the Japanese margin traders had already accounted for 68% of all Forex spot transactions. In fact, so strong is the influence of the Japanese retail Forex traders that it has lead to the creation of a nearly mythical entity known in financial circles only as *Mrs. Watanabe*.

As her nomenclature suggests, Mrs. Watanabe both Japanese and married. She is

15. C. W., "Why the Swiss Unpegged the Franc," 2019, https://www.economist.com/the-economist-explains/2015/01/18/why-the-swiss-unpegged-the-franc.

16. Russell Lynch, "How Could a Teacher on £18,000pa Lose £280,000 Spread Betting?," 2015, http://www.independent.co.uk/news/business/analysis-and-features/how-could-a-teacher-on-18000pa-lose-280000-spread-betting-10115157.html.

17. Financial Futures Association of Japan, *The Association*, Web Page, 2019, accessed 4 May 2019, http://www.ffaj.or.jp/en/outline/index.html.

18. Click365, *What's Click365?*, Web Page, 2019, accessed 4 May 2019, https://www.click365.jp/en/about_fx/. Junko Suzuki, *Margin Forex Trading Risky Despite New Rules*, 2005, https://www.japantimes.co.jp/news/2005/09/27/business/margin-forex-trading-risky-despite-new-rules/#.XM2l7DAzapp.

19. Paz Havier, "Retail FX: Market Overview ECB Briefing," *Aite Group*, 2011, https://www.ecb.europa.eu/paym/groups/pdf/fxcg/111005_FX_retail_trading.pdf?497ed9c2dc1cce81f236a6bf84faf205.

a housewife. When she is not looking after the kids or doing chores, she spends her time managing the family's finances and earning a bit on the side by trading the U.S. dollar-Japanese yen exchange pair. Occasionally she also dips her toes into Australian and New Zealand dollars. At times, the trading activities she and her friends engage in accumulating to such an impressive amount that among them they manage to cause noticeable price movements of the world's major currency pairs. As the legend goes, Mrs. Watanabe had led a content life keeping her family's savings as time deposits at her local post office and earning a steady interest on the accumulated savings. However, following the sharp drop in interest rates, a change of strategy was in order and she began trading foreign currencies. Instead of term deposits, Mrs. Watanabe would engage in what is known as a carry trade. She would sell her Japanese yen for currencies whose central banks offered higher yields and keep those to accumulate interest returns she could no longer get from the post office.

4.2.2 Who is Mrs. Watanabe really?

The term itself dates to the 1990s when Japanese interest rates began their slow descent. In 1997, The Economist argued that Mrs. Watanabes were indeed housewives that already at the point sought fixed-income returns outside of the term deposit system. At this point, this typically constituted Japanese yen-denominated or partially yen-denominated foreign-issued bonds. Investors lacking financial knowledge would be sold bonds issued by entities of such creditworthiness as the 1990s Ukraine, Kazakhstan and Uzbekistan. In some cases, the same investors would even be sold bonds that had to be partially redeemed in foreign currencies, thus exposing the bondholder to the very real possibility of exchange rate risk. The bonds could not be sold on an exchange and were distributed through the sales channels of the Japanese brokerage houses.[20]

Things have changed somewhat in the past twenty years. The Financial Services Futures Association of Japan (FFAJ) is a self-regulatory organization (SRO) that oversees futures dealers and publishes regular reports on the retail investors engaging in margin trading through Japanese firms. A March 2018 report gives insight into who the fabled Mrs. Watanabe actually is in aggregate.[21]

Contrary to what the international media and anecdotes of many Japanese people themselves would lead one to believe, Mrs. Watanabe is not a housewife or at the very

20. The Economist, "Mrs. Watanabe, Mind Your Fingers," 2019, https://www.economist.com/finance-and-economics/1997/03/27/mrs-watanabe-mind-your-fingers.

21. Financial Futures Association of Japan, ""Gaikoku Kawase Shōkokin Torihiki No Torihiki Kokyaku Ni Okeru Kin'yū Riterashī Ni Kan Suru Jittai Chōsa" No Gaiyō" [Outline of "The Survey on Financial Literacy among Trading Customers of Foreign Exchange Margin Trading"], 2018, http://www.ffaj.or.jp/performance/data/report_20180927/20180927_summary.pdf.

least no longer a housewife. Rather, given the medium through which modern margin trading is conducted, the old and by now discredited adage about the nature of the early days of the Internet appears to apply even here, stating that it is a place "where the men are boys, the women are men, and all children are undercover FBI agents". Looking at active trading accounts, the FFAJ determined that less than a quarter of Mrs. Watanabes is in fact women. Those who are are spread quite evenly between the ages of twenty and sixty. By contrast, there are more men in their thirties alone than there are women in total and equally as many men in their forties. In aggregate, the thirties-forties demographic made up for nearly two-thirds of the total Forex dealers' clientele.

A third of these traders earned between ¥4 and ¥7 million per annum, followed by the ¥2–4 and ¥7–10 million groups at 20% respectively. 15% were those individuals earning more than ¥10 million, but only 8.7% earned less than ¥2 million, suggesting that this is not an activity that particularly appeals to the lowest earners but rather somewhere towards the middle of the pack. For reference, ¥4.5 million is what a professional nurse or an electrician earns around the age of forty. The three largest trader groups were non-managerial employees at 43%, the unemployed at 13.2% and managerial employees at 12.5%. The infamous Forex trading homemakers constituted a meager 7% share.

A peculiar characteristic of margin traders is that they believe that trading is a way to increase one's capital and have by and large been at it for quite some time. Almost half reported that they have been trading for five or more years and 4/5 reported that they had at least a year of experience. Another 4/5s believed they could increase their financial assets despite the fact that only 3/5 thought they had the skills to generate returns. One cannot fail to emphasize the difference between "thought" and "did have the skills", as nearly a half of the respondents did not know what the bid/ask spread is and more than a half could not tell how much they would lose if the currency pair they traded at 25:1 leverage moved against them. The overwhelming majority knew the different types of limit orders, which suggests that the participants understand how to trade from a mechanical point of view, but do not grasp the implications of market making by their dealers. 59% of the individuals believing in Forex trading as a way to gain wealth had expectations of high returns. Two-thirds had learned to trade by reading web materials and a little under a third had read books; 14% stated that they had not bothered to learn at all.

An important characteristic of this margin trading by Japanese retail investors is that what Mrs. Watanabe accomplishes in numbers does not necessarily correspond to the impact on an individual Mrs. Watanabe himself. Of all respondents, two thirds never suffered losses or realized gains in excess of ¥200 thousand. Extreme outliers are the 7.5% that gained ¥1 million or more and the 3.2% that lost the same amount. At this

point, it is important to note that the survey favored individuals who have conducted transactions recently, with 93.4% of the respondents trading at the moment the survey was conducted. This results in a considerable survivor bias as it effectively eliminates all those individuals from the survey who have lost and decided to quit as a result. Naturally, it also excludes anyone who has won and decided to quit, but it seems unlikely that this group would be more than a small fraction of the overall "quitters" group as it stands to reason that someone thinking that they have rediscovered themselves as profitable traders would probably not quit while the train is running. Furthermore, since this is a survey of traders rather than a systematic query of their earnings from the Forex dealers' databases, one may wonder if some traders are not underreporting their losses or exaggerating their profits, something that as will be evidenced momentarily is not entirely uncommon among individuals engaging in speculative bets.

43% averaged less than ¥100 thousand per transaction, 66% less than ¥500 thousand and 92% less than ¥3 million. The number of transactions per year varied greater as did the use of leverage from fractional leverage to the legal limit of 25:1.

Overall, 60% reported gains in the previous year, 40% reported losses or a lack of gains. A notable characteristic of this is that the largest group of traders closed their new positions between one day and a week. Despite the discussions of how Japanese investors trade on interest rates, only 12% of the surveyed margin traders stated that they emphasized forward points.[22] This runs contrary to the idea that Japanese investors are actively seeking returns in foreign exchange markets to profit from the discrepancy between the perpetually low-interest rate in Japan vis-a-vis the foreign markets such as the United States, Australian, and New Zealand; 75% of respondents replied that they attempt to profit from price movements based on either fundamental or the more prevalent technical analysis—which in itself is a matter of dubious usefulness outside of high-frequency trading systems. Two-thirds of the above speculators have acknowledged that they seek short-term rather than long-term profits based on the movement of the currency pairs. Although the aforementioned 60% of respondents reporting gains may sound optimistic, Forex trading nonetheless remains a negative-sum game when accounted for costs and that even for a slightly longer time frame of 2015 to Q2 of 2017 the loss ratio had already been at 57%.[23] Even in a good year such as 2018, some gained more, such as

22. Forward points are interest rate-dependent increases or decreases in the exchange rates. These are calculated based on how much interest could be earned in each currency calculating the difference. As such, the Japanese yen which earns almost no interest due to the Bank of Japan policies would earn less than the U.S. dollar which currently yields 2.39% on a 1-year Treasury Bill. As a result, spot points would be earned by traders going long on the U.S. dollar.

23. Masao Muraki, Horishi Torii, and Tao Xu, *The Identity or Who Is Propping Up the Bitcoin Market*, Report (Deutsche Bank Group, 2017), `https://www.db.com/newsroom_news/Global_Financial_Strategy_Dec_14.pdf`.

individuals with higher income and particularly those employed in managerial positions, whereas others had lost much more than even their losing peers. The most prominent example of the latter are individuals earning less than ¥200 thousand per year, of whom 65.5% incurred losses, 7% of whom lost more than ¥100 thousand, which constitutes at the very minimum a half of the trader's yearly income.[24]

Of those who decided to stop engaging in foreign exchange trading, only 7.5% reported that it was because they had achieved their profit goals. 41.5% stated that they could not earn as much as they had expected, 32.1% said that they ran out of money and 28.3% stated that they unexpectedly incurred large losses.[25]

Further inquiry by the Bank of Japan highlights another curious fact. From the first quarter of 2008 to that of 2016 the number of trading accounts has increased fivefold to over 6 million accounts. Similarly, trading volume has increased sixfold, rising from under ¥250 trillion to ¥1.5 quadrillion per quarter with most of the increase occurring in the later years. The number of accounts that have indeed traded within any given quarter, however, has remained nearly constant throughout the entire period, fluctuating around 500 thousand traders and showing only relatively minor growth.[26] It has already been established from the FFAJ survey that most traders engage in comparatively short-term trades, whereby 70% of respondents hold a position for no longer than a month and 83% no longer than six months. This necessitates that the first group must perform at the very least one trade per quarter and the latter at the very least one trade per two quarters, thus qualifying for the BOJ statistics. This, in conjunction with 81% of respondents having at least a year experience of trading currencies and 45% having over five years experience, hints at a possible explanation that there is an established clientele of retail margin traders. These are then either eventually replaced by upcoming but already comparatively long-term margin traders or remain the core demographic and are only slowly supplied with the aforementioned newcomers. These individuals are not the average individual opening a margin account; they are there to stay.

4.2.3 Recent developments in the application of leverage

Since the rise of the Japanese Forex margin trader, there has been an overall gradual reduction in the use of leverage.

24. Financial Futures Association of Japan, "Gaikoku Kawase Shōkokin Torihiki No Torihiki Kokyaku Ni Okeru Kin'yū Riterashī Ni Kan Suru Jittai Chōsa: Chōsa Kekka Hōkoku-Sho" [Survey on Financial Literacy Among Trading Clients of Foreign Exchange Margin Trading: Survey Results Report], 2018, http://www.ffaj.or.jp/performance/data/report_20180927/20180927_result.pdf.

25. Muraki, Torii, and Xu, *The Identity or Who Is Propping Up the Bitcoin Market.*

26. Tomohiro Niimi, "Recent Trends in Foreign Exchange (FX) Margin Trading in Japan," *Bank of Japan Review*, 2016, https://www.boj.or.jp/en/research/wps_rev/rev_2016/data/rev16e05.pdf.

This change did not occur due to a change of strategy by the traders themselves caused by any endogenous or exogenous shocks to the system but rather was mandated from above by the Financial Services Agency (FSA) and the Forex dealers to protect both the traders and the said dealers themselves. Originally, use of 100:1 leverage and higher had not been uncommon among retail traders and many had been successful in the stable environment leading up to the financial crisis.[27] Among others, the Australian dollar had been one of the favorites not in the least for carry traders, who ended up benefiting from both the higher interest rates in Australia and the steady appreciation of its currency against the Japanese yen.[28] From July 2008 onwards, the tides shifted and the Australian dollar that over the three past years alone had appreciated by as much as 25%, enriching Mrs. Watanabes of all skill levels, began to rapidly depreciate and dropping nearly by half in mere six months. Fortunately for everyone involved, already a year earlier new loss cutting rules had come into effect leading to Forex dealers liquidating positions upon reaching the margin and avoiding the aforementioned situations that the Irish school teacher had found himself in. As a result, the average leverage had declined from 8.5:1 in the first quarter of 2007 to 5.7:1 a year later.[29] By 2010, the FSA mandated that retail investors should not have access to more than 50:1 leverage. A year later, this ratio had been further reduced to 25:1.[30] In 2018, news had spread that the FSA again intends to lower leverage, this time to 10:1, and impose limitations not only on retail investors but also on institutions serviced by the Forex dealers. Presently it is not clear whether the new rule will be imposed as it has met some pushback with the rate continuing to remain at 25:1 for retail and varying based on the currency pair for the institutions.[31] The lack of such limitations notably does not preclude the Forex dealer from imposing lower leverage limits on its clients.

Returning to the survey data, it appears that under the present limits of 25:1 leverage, 22.7% of respondents have admitted to being in the 20:1 to 25:1 range. Given that the share of traders otherwise gradually decreases as leverage use grows, from 31% on 1–5:1 to 24% on 5–10:1 to 12% on 10–15:1 to 3.4% on 15–20:1, a sudden concentration of traders of this magnitude in the highest leverage bracket suggests that there is a considerable

27. Tai Terada, Naoto Higashio, and Jun Iwasaki, "Recent Trends in Japanese Foreign-Exchange Margin Trading," *Bank of Japan Review*, 2008, https://www.boj.or.jp/en/research/wps_rev/rev_2008/data/rev08e03.pdf.

28. Reserve Bank of Australia, "Japanese Retail Investors and the Carry Trade," 2009, https://www.rba.gov.au/publications/bulletin/2009/mar/pdf/bu-0309-1.pdf.

29. Terada, Higashio, and Iwasaki, "Recent Trends in Japanese Foreign-Exchange Margin Trading."

30. Ricardo Esteves, "Japan's Potential Leverage Cap at 25:1 for Institutional FX," 2016, https://financefeeds.com/japans-potential-leverage-cap-at-251-for-institutional-fx-is-a-reminder-of-snb-crisis/.

31. Nikkei Asian Review, *Japan Eyes Tighter Leverage Cap on Forex Trading*, Web Page, 2019, accessed 5 May 2019, https://asia.nikkei.com/Business/Markets/Currencies/Japan-eyes-tighter-leverage-cap-on-forex-trading.

portion of traders leaning towards extreme risk and the application of the highest leverage available.[32]

4.2.4 Mrs. Watanabe's problem

In June 2017, the online edition of the reputable Japanese paper Tōyō Keizai ran a story titled "Why are the Chinese living in Japan addicted to Forex trading?"[33] The story does not appear to have attracted much attention, but its contents are interesting nonetheless, not in the least because they provide an outside Japanese perspective on what for all intents and purposes appears to be a general domestic issue. The piece recounts the story of a certain Mrs. Z, a Chinese immigrant and a housewife engaged in Forex trading. Mrs. Z describes how she came to Japan and, faced with the language barrier that isolated her from the rest of the society, succumbed to boredom until one day her husband told her to 'just give it a go'. Mrs. Z said that she previously had "done" mini shares[34], but had no experience with Forex. Upon trying it, she quickly discovered that it very much resembled a video game she had been playing to kill time. The financial crisis occurred shortly after she started trading and Mrs. Z lost ¥3 million in a single day.

Mrs. Z told her husband that she suffered a considerable loss, but did not disclose the magnitude of the loss and, as a result, was told by her husband to give it a few more attempts. The story continues with the eventual success of Mrs. Z, who, after several years of trading at a loss and listening to online seminars, managed to hit it big. She bought a car, a house and got her child through cram school. As of the time the article was published, Mrs. Z ran her own WeChat[35] group for Chinese people trading Forex and offered generic advice, such as it being best to avoid trading at night when the child returns from school or not overdoing it. It is not clear from the article whether Mrs. Z charges anything for the participation in her group or merely enjoys spreading word of her experiences.

Mrs. Z's story is not unique and could have easily taken place anywhere in the developed world. Particularly interesting are the following elements: the transition to Forex from a video game, and Mrs. Z's long path from major losses to becoming a Forex guru who promotes good practices among neophyte traders.

32. Financial Futures Association of Japan, ""Gaikoku Kawase Shōkokin Torihiki No Torihiki Kokyaku Ni Okeru Kin'yū Riterashī Ni Kan Suru Jittai Chōsa" No Gaiyō."

33. Masami Uchida, "Zainichi chūgokujin ga FX torihiki ni "hamatte iru" riyū" [Why Chinese in Japan are "addicted" to Forex Trading], 2017, `https://toyokeizai.net/articles/-/174432`.

34. Traditionally company shares have been sold in large batches that made them inaccessible to low-income retail investors. The introduction of 'mini shares' allowed buying shares in smaller quantities thus democratizing investment. *Minikabu*. Japanese: ミニ株.

35. WeChat is a popular chat application used in mainland China and covers a wide range of services. It is generally uncommon among Japanese users who instead depend on a similar application LINE.

Figure 4.4 Meta Trader 5 interface on the Apple iPad tablet.

It is not difficult to see why Mrs. Z felt right at home trading currency pairs after playing video games. Above is a screenshot of MetaQuotes Software Corporation's *Meta Trader 5* interface, version 4 being "the most popular Forex trading platform" according to its developer. All the trader has to do is sign up with a Forex brokerage firm, deposit the funds and log into Meta Trader with their brokerage's credentials. With that done, they can trade to their heart's content or the depletion of the funds in their account.

The entire trading experience is indeed rather game-like. The exchanges are open all day every day and do not close for weekends, bank holidays, in the evenings or for lunch. If one cannot sleep at night, Forex is there at the night table always ready and waiting. Similarly, unlike investing in equities or bonds, the experience of trains Forex on margin account lies in the moment. The quotes blink in red and blue, the chart keeps plotting pixels like a polygraph in a Hollywood summer action flick and the values of current positions are updated continuously and by the second. A currency pair is selected from a comparably short list and a buy order is executed by clicking a large button that resonates with a loud noise once the transaction is complete.

In contrast to regular brokerage accounts wherein purchases of equities, bonds and options are settled anywhere between one or two business days, the purchased or short-sold currencies appear in the list of open positions immediately after purchase with their

updated price. The use of leverage greatly accelerates the minute movements in either direction and significantly speed up the price action. Whereas a good or bad investment in a stock may be unapparent as to its nature for many years, a highly leveraged trade on a margin account regardless of the instrument being traded can show good or bad results in mere minutes. In this sense, it is not difficult to see how something as trite as buying and selling currencies has been successfully gamified to be the experience of keeping the players at the edges of their seats.

Mrs. Z's account bears a stark resemblance to the description of those individuals engaging in gambling as described by Takiguchi and Rosenthal.[36] In a survey by the Entertainment Business Institute referenced by the researchers, over 53% of heavy pachinko players and 39% of light pachinko players gave "because pachinko is 'easily accessible and solitary'" and 50% of the light players listed "to pass time" as the reasons for gambling. Both of these answers appear to be more than just merely applicable to Forex trading. Takiguchi and Rosenthal also point towards pachinko as being a way of dealing with stress for the heavy player demographic. Unfortunately, it is not yet clear whether this same principle applies to Forex traders.

In the past decade, the gambling element of Forex or trading on a margin in general has nevertheless been gathering increased attention. As with everything in investing, Benjamin Graham had already begun addressing this issue in *Security Analysis* as a 1933 follow up to the irrational exuberance of the late 1920s. The author separated behaviors into "intelligent" and "unintelligent speculation", wherein the former involved "taking of a risk that appears justified after careful weighing of the pros and cons" and the latter was "[r]isk taking without adequate study of the situation". The former was said to be investing and the latter gambling.[37]

More recent research on the topic comes from specialists from the fields of medicine and psychiatry rather than asset allocation and appears to very much reinforce the notion that it is indeed gambling that is being discussed here.

Guglielmo et al. propose that this form of gambling has been thus far by and large overlooked with the presence of individuals exhibiting pathological traits effectively slipping through the hands of the medical community. The researchers note that in their estimation the current trading platforms do indeed resemble video games and reinforce the illusion of control by offering real-time information whenever the trader needs it. Traders can start with essentially no financial knowledge and, as they invest more and more time by reading about trading and participating in trader communities, they incorrectly convince themselves that they have become more proficient at it. Rather than attributing

36. Takiguchi and Rosenthal, "Problem Gambling in Japan."
37. Graham and Dodd, *Security Analysis: Foreword by Warren Buffett*. Page 110.

their losses to their compulsive behavior, individuals convince themselves and their loved ones that these were merely a result of individual bad investments. Particularly notable is that traders often exhibit delusions of omnipotence, whereby they rationalize away the losses and develop a selective memory for profits. In the case of pathological traders, trading summarily takes over their lives and affects their past hobbies, relationships, and careers. An increasing number develop suicidal ideation and indeed commit suicide.[38]

A year prior, Grall-Bronnec et al. specializing in gambling disorder management provided a look at French compulsive traders. The study separates gambling from investment using several criteria, one of which is provided by an online investing website stating that investing is a continuous process, whereas gambling is "an immediate event or a series of events". A further, somewhat questionable, distinction is made stating that by and large investing relies on fundamental analysis, such as a company's price-earnings ratio, whereas trading largely relies on technical analysis, which is a way of analyzing the development of prices and attempting to predict what the next price will be based on previous outcomes. Trading corresponds to gambling in matching its four criteria: "money betting, irreversible betting, a binary win or lose outcome, which depends entirely or partly on chance". Furthermore, prior research by Jadlow and Mowen suggests that investing and gambling can be distinguished by the following three formalized criteria already touched upon within this section that are indicative of gamblers, but not stock market investors: present-time orientation, emotional instability, and impulsiveness. Despite the lengthy speeches about studying to become a good trader, a high need for learning was not exhibited by gamblers, whereas it was by investors as was future-time orientation. The criteria the two groups shared were material needs, competitiveness, superstition, the lack of financial conservatism and numeracy proficiency.

The researchers agree both that trading is in fact gambling and that for some traders it may exhibit addict-like behavior. The study concludes with each of their patients, who self-reported that they had a trading addiction, displaying an addiction-like disorder. The following paragraph is particularly indicative of characteristics of individuals engaging in excessive trading:

Indeed, both of the following criteria were systematically present: "Is preoccupied with trading" and "Lies to family members, therapist, or others to conceal the extent of involvement with trading", followed by the criteria "Has made repeated unsuccessful efforts to control, cut back, or stop trading" and "After losing money by trading, often returns another day in order to get even ("chasing" one's losses)", present in all except

38. Riccardo Guglielmo, Lucia Ioime, and Luigi Janiri, "Is Pathological Trading an Overlooked Form of Addiction?," *Addiction & health* 8, no. 3 (2016): 207–209, ISSN: 2008-4633, https://www.ncbi.nlm.nih.gov/pubmed/28496959.

one patient.[39]

To connect this research with that of Takiguchi and Rosenthal, "half of [the study's] participants seemed to use trading as a way to escape their boring everyday lives and to avoid depression. The other half became depressed as a consequence of excessive trading." Every single person in the study was convinced that they had become an expert, which the researchers note to closely resemble the illusions of control exhibited by gamblers, particularly those betting on horses and sports or playing poker. Just as with traditional gambling, occasional good trades reinforced the gamblers' belief that they are becoming better, thus encouraging their behavior. The closest comparison was that retail traders are akin to poker players, who engage in a competition not against the bank, but rather professionals that are both better informed, equipped and trained, which ultimately leads to consistent losses on behalf of the retail trader.[40]

4.2.5 Conclusion

This section examined the Japanese margin trading practice in its most prominent form. Rather than being something that immediately strikes those tangentially interested in Japan, as any tourist or traveler would immediately notice the preponderance of pachinko parlors, this practice has reached such magnitude that it has begun affecting price action in foreign exchange, which in itself is one of the deepest is not the deepest market in existence. Promptly, these retail investors received their own nickname in the financial world and Mrs. Watanabe was born.

This practice has been theorized to be at least partially attributable to the rapid end of the Bubble period and the ensuing low-interest-rate environment. What began as alleged housewives buying junk bonds that nobody else wanted appears to have slowly morphed into a new game of chance that mostly attracts men around the middle-of-life age.

This latter point bears reiterating because while this section examined the specifics of margin trading, it did not categorize it from a fundamental point of view. Previously in this book, the idea of zero-sum and non-zero sum games has been discussed. In the former, one's win is another's loss; in the latter, both participants can win through the increasing value of whatever resource the game centers around. Playing pachinko as discussed in the previous section is by its very nature a zero-sum game in terms of the

39. Janice W. Jadlow and John C. Mowen, "Comparing the Traits of Stock Market Investors and Gamblers," *Journal of Behavioral Finance* 11, no. 2 (2010): 67–81, ISSN: 1542-7560, doi:10.1080/15427560.2010.481978, https://doi.org/10.1080/15427560.2010.481978.

40. Marie Grall-Bronnec et al., "Excessive Trading, a Gambling Disorder in Its Own Right? A Case Study on a French Disordered Gamblers Cohort," *Addictive Behaviors*, 2015, ISSN: 0306-4603, doi:10.1016/j.addbeh.2015.12.006, https://dx.doi.org/10.1016/j.addbeh.2015.12.006.

money involved. Either the parlor loses and the player wins or much more likely the player loses and the parlor wins.[41] By contrast, creating a self-regulatory organization like the FFAJ or the FINRA is a process that generates value for all participants by increasing the public trust in financial institutions and thus boosting their clientele.

The process of participating in the financial markets can be both. A classic example of a non-zero sum game is an investor buying a corporate bond, which provides financing for the enterprise's ambitions, helps in the creation of new products and services, and provides a return to the investor for lending their money and accepting the risks. This same logic can be extended for equity markets, but not to commodities, currencies or certain types of derivatives if these are purchased for financial rather than strategic purposes. Furthermore, even in the case of equities and bonds, "trading" them on a short time horizon rather than "investing" into them on the long time horizon would constitute a zero-sum game. The act of investing adds fuels the financial system that can be used for the purposes described above, but also by its very nature includes a smaller or greater element of competitiveness because assets traded in the markets are not priced perfectly. A company or its bonds may be underpriced or overpriced, whereby investing in the former and selling the latter would give the investor a higher return than the business would generate through its activities. Trading reduces the aforementioned process of investing solely to this latter part and may revolve solely around buying and selling at price differences that are little more than noise.

To take it a step further, trading for retail investors is rather a negative-sum than a zero-sum game. This is due to how the business of the Forex and CFD dealers is structured. In the past and still to a large degree in the financial markets outside of Forex and CFDs, investors were required to pay a number of commissions when executing a trade. These commissions are one of the sources of revenue that allow broker-dealers to provide their services and generate revenue. The Forex and CFD world has largely moved away from this business model in favor of charging no direct commissions and instead generating revenue from the fees paid by investors associated with borrowing funds from the dealer and the spread between the price of buying an instrument and the price of selling it. This presence of the spread creates a middle-man that, given sufficiently prudent risk management on the dealer's behalf, results in the funds being slowly drained away out of the game and leading to the sum of all assets between the players being less at the end of a round than it was at its start.

As has been shown by survey data, half of the traders do not actually know the term, which leads one to believe that despite their purported expertise many do not

41. One can, of course, argue that it is a non-zero sum game, because although the parlor wins and the player loses, the player receives a non-quantifiable element of joy from the act of playing itself thus creating added value, but doing so would detract from the more general discussion at hand.

understand the fundamental structure of the game they are engaging in. To put it in a more traditional gambling context, this akin to claiming to be a well-informed roulette player and not understanding that the odds are stacked against oneself because there is one field that is neither red nor black.[42] The individuals engaging in this activity, however, do appear to be rather an exception than the rule as even in face of steady and very substantial growth of accounts, only a modest and very slowly growing share of account owners appear to actively engage in the trading. They constitute 0.71% of the adult population. This puts the number of these individuals somewhere in the same range as betters on bicycle racing or slightly under a twentieth of the pachinko group. Data suggests that individual transactions executed by these traders are comparably small with the largest group being under ¥100 thousand, yet, in conjunction with Mrs. Watanabe's prominence of affecting exchange rates, the total volume of this small number of transactions by this small group of trader is nothing to scoff at. As of the third quarter of 2018, it had been ¥3.8 quadrillion per annum or ¥4.8 billion per active trader.[43]

4.3 Interim

The amalgamation the 4.1 "Gambling" section's findings, dealing with gambling in its more traditional sense, and the 4.2 "Margin accounts" section's findings, dealing with what for all intents and purposes is slightly more refined gambling with a veneer of investing pulled over it, puts Japan in aggregate in a peculiar situation. One cannot emphasize too much that this is not a statement about the Japanese people in general, but rather an underlying aspect of the society that appears to be reflected in a small fraction of its population and is largely looked down upon as a whole. Nonetheless, one also cannot ignore that the facts are what they are.

It is also this author's contention that the Bubble is not the primary cause of either of these phenomena, but rather just a catalyst added to a reaction already waiting to happen. Non-financial gambling has flourished even before the Bubble had begun; margin trading did not, but the cause of it appears to be rather regulatory and technical than the much-discussed "search for yields" absent in the domestic bonds. Although Japan

42. The following is a brief explanation of how the roulette games benefit the house. Assuming that a roulette produces a random outcome every time, a roulette table with without a zero field would indeed be entirely random and given sufficient time to produce an equal number of wins and losses. However, as there is a zero field that is green, the chances of betting either red or black are always 18/37 or 48.649%, which given a large enough reserve of the house and sufficiently small stakes will over time drain the reserves of all the players and make the house the ultimate winner.

43. Financial Futures Association of Japan, "Kin'yū Sakimono Torihiki No Dekidaka Jōkyō 2018 (Heisei 30) Nendo Dai 3 Shihanki Gaikyō" [Financial futures volume for third quarter of 2018: overview], 2019, http://www.ffaj.or.jp/performance/quarter_total_data/new/quarterly_report_2018_3q_j.doc.

is a front-runner of the low-interest rate policies, a comparable low fixed-income yield environment in the Euro Area has been observed since 2009 and 2015 without any signs of Mr. and Mrs. Maier, Martin or Garcia coming into existence. Rather, it appears that both games of chance and trading, which as has been discussed above share a number of similarities, particularly appeals to a small subset of the Japanese populace.

This research does not provide a definitive answer as to why this is the case, but perhaps there is some relationship between the reckless risk-seeking for small quantities of available funds and the strongly risk-averse attitude for the remainders of the financial assets. Both of these circumstances can be argued to be reinforced, if not caused, by a multi-factor combination of behavioral biases that are furthermore reinforced by comparatively low levels of financial literacy.

Concerning margin trading and gambling, a case can be made for their isolationary nature. Although the ubiquitous pachinko parlors can hardly be described as private spaces, the act of playing is a perfectly solitary one and very different from games of chance such as poker, blackjack or even the roulette. Even more so, if one were to walk into such a parlor, one would see that the players are overwhelmingly gambling by themselves as opposed to Japanese game parlors that are often frequented by groups of friends. There is nobody standing behind the player and cheering them on as they insert more and more metallic balls into the machine. This is even more so the case for margin trading. Although the act itself a fundamentally public one of buying and selling to a willing other, technological innovation has made it possible to do so without ever having to say a word even to one's broker, who until the popularization of Internet services had to be called or contacted by mail. Bitcoin filled this very same gap.

4.4 Bitcoin: Being one's own bank

By its very nature Bitcoin appears to be both the antithesis of all things Japanese and an asset symbolizing them best. This chapter investigates not only why this is the case, but also why it largely does not matter to its place in Japan thus far.

4.4.1 Relationships of trust

One of the cryptocurrencies' key selling points and a fundamental element of all public—but not private—blockchains is that these systems can be described as "trustless". This idea has already been discussed in detail, but to reiterate, a transaction occurring over a public blockchain or a contract signed through a blockchain like Ethereum is in principle guaranteed by the computer code of the network or the specific contract. As long as there are no errors, neither party to the transaction needs to have faith in the counterparty or any middlemen. The globally distributed computer system that is the blockchain merely executes a deterministic process and the only way it can be reversed or altered in any fashion is the unlikely event of more than half of the system agreeing to do so. No financial or governmental institution can hinder it and no way for the participants to back out. Even the coins themselves may be stored in the owner's wallet and are the responsibility of the owner and the owner alone. There are no armored vaults, no men with guns and in most cases no insurance funds to rely upon if anything goes wrong. The only element of trust is in that the majority of the network has trust in the network itself, which is reinforced by having skin in the game in the form of the ownership of network tokens.

If this seems to run contrary to the entire structure of Japanese society, it is because it does. In its very fundamental form, the traditional view is that Japanese society more so than the American and European societies strongly relies on the notion of personal relationships and relationships of trust. This is both immediately obvious to any student of Japan and something documented through survey results. Whereas Americans are more trusting of others in general, the Japanese rely more on interpersonal and organizational relations with others.[44] This generally accepted dichotomy between those in the inside group, the *uchi,* and those in the outside group, the *soto*, is most evident in the structure of Japanese enterprises that for the longest time promoted lifetime time employment and seniority-based promotion, thus turning a firm into a strongly interlinked group of insiders as opposed to a strict employer-employee relationship in the Western sense. Although these may have arisen not in the least due to the turbulence of the

44. Toshio Yamagishi and Midori Yamagishi, "Trust and Commitment in the United States and Japan," *Motivation and Emotion* 18, no. 2 (1994): 129–166, ISSN: 1573-6644, doi:10.1007/bf02249397, https://doi.org/10.1007/BF02249397.

postwar years and its numerous strikes, it is not a characteristic that has emerged in Western nations that had found themselves in comparable circumstances. This necessity for personal relationships is evident even in such areas as Japanese contract law, where it is, for example, very difficult for a supplier of a good to terminate their contract with the distributor and Japanese courts often siding with the distributor, which is often a much smaller business and thus at the mercy of the supplier's opportunism. Typically such a unilateral termination would require unavoidable reasons[45] to be present, of which there are four: breakdown of the relationship of trust, a serious breach of contract, anxiety concerning other party's reliability and change of circumstances. While the latter three are mostly related to business issues such as defaulting on a contract or considerable shifts in business dynamics, the breakdown of a relationship of trust[46] is not strictly codified, deriving from case law, and includes reasons such as the distributor having been convicted for a crime or not cooperating to find an adequate payment method.[47]

Furthermore, one needs to remember that one of the reasons Bitcoin came into being was specifically the hardline libertarian sentiment of the community around it and most likely even its very creator. Distrust of the banks is imbued into the very first block and "being your own bank" is perhaps one of the key slogans among Bitcoin's evangelists. Given the general tone of the conversation, there is a particular antipathy to one specific type of bank: the central ones. Although investment banks undoubtedly came under the greatest public scrutiny following the collapse of America's housing market, it is not a stretch to argue that the staunchly libertarian community that gave birth to, fostered and now stands behind Bitcoin has an even greater ax to grind with the bureaucracy than it does with the men and women working on the Wall Street. The latter merely benefiting from the unfair structure created by the former is a common argument.

Although there does not appear to be any data on the popularity of bureaucrats in Japan as opposed to other countries, there it is a generally accepted truism that the industrial policy dictated by the central bureaucracy over the second half of the twentieth century had played an integral role in the creation of Japan as it is today. While there is and will always be a considerable volume of criticism directed at the bureaucratic apparatus of any country or even those operating on the supranational level, one can argue that the image of "a bureaucrat" is positively different in Japan than it is in Europe and the United States. This is perhaps aided in no small part by the fact that the most well-regarded ministries are staffed by the cream-of-the-crop emerging from Japan's academic establishments. For example, 80% of the Ministry of Foreign Affairs

45. Yamuoenai jiyû. Japanese: やむを得ない理由.

46. Shinrai kankei hakai. Japanese: 信頼関係破壊.

47. Willem Visser t'Hooft, *Japanese Contract and Anti-Trust Law: A Sociological and Comparative Study* (Routledge, 2003), ISBN: 1135790043. Page 27–29.

consists of Tokyo University graduates; the share is even higher at 90% for the Ministry of Finance with a disproportionately large share of the said university's law students.[48] Unsurprisingly, the current Governor of the Bank of Japan himself, Haruhiko Kuroda, had studied at the faculty of law of the Tokyo University and had joined the Ministry of Finance upon graduation. Whatever the image each Japanese national may have of these individuals, it is not likely to be one of somebody without any idea of what they are doing and be easily superseded by the use of a new fancy electronic currency system.

4.4.2 Relationships of distrust

A different argument entirely can be made was one to distance themselves from the central bureaucracy and look at the reality of "being your own bank" in Japan. A simple fact is that many people are doing that very same thing at this very instant.

In *Principles of Economics*, Gregory Mankiw poses an interesting question: in 1998 there were $460 billion dollars of coins and banknotes circulating somewhere. If one were to divide that by the number of American residents at the time, one would come up with each American holding $2,240 in cash. As this was evidently not the case, one could ask where that money was. Mankiw gives two explanations: foreign countries where economic instability causes people to prefer keeping their savings in a more stable foreign currency, and criminals who do not want to leave a paper trail by putting the currency in the banking system.[49]

In Japan, the most recent estimate is that out of ¥100 trillion that are in circulation about a half is kept at home under the proverbial mattress.[50] The practice is known as *tansu yokin* and translates as literally a *drawer deposit*. In fact, the magnitude of hoarding has reached such levels that currently 92% of all Japanese yen banknotes are of the highest ¥10,000 denomination as opposed to only 78% in the case of the United States with the $100 notes. Even then, there are plans to begin issuing additional banknotes to meet the demand.

The reasons for this behavior are manyfold and there is perhaps no one right answer. There is as always the Bubble. On the one hand, it led to a reduction in interest rates on bank deposits and made them entirely unattractive to the point that at the current yield of 0.001% it would take a little short of 70,000 years—the equivalent of the time it took humanity to go from the first prehistoric drawing to entering the space age—for the value

48. Hugo Dobson et al., *Japan's International Relations: Politics, Economics and Security* (Routledge, 2003), ISBN: 1134549962. Pages 40–56.

49. Mankiw et al., *Principles of Economics*. Page 612–613.

50. Nihon Keizai Shinbun, "Tansu Yokin, Shinsatsu Hakkō De Ugoku Ka" [Money Under Mattresses: Will It Move With the Issue of New Banknotes?], 2019, `https://www.nikkei.com/article/DGXMZO43796520W9A410C1EN2000/`.

of the deposit to double and even that only in nominal terms. On the other hand, the period had been wrought with uncertainty about the financial system. This had become most evident in 1997 when runs on the bank began to occur with account holders waiting outside in long lines waiting to withdraw their funds from a bank they suspected to be in trouble and bank employees struggling to hand out tickets to contain the situation.[51] There are more recent reasons for withdrawing one's savings and keeping it at one's home. In 2015, the government raised the inheritance tax to 55% making it the highest in the world. This was followed promptly by the introduction of the tax identification number called *My Number* that seeks to consolidate financial data across areas such as welfare, income, and health care. Attempting to avoid the unwanted government scrutiny before the system crosses over to banking institutions, depositors began withdrawing even more of their savings as banknotes and keeping them somewhere within their homes. Indeed, the volume of savings has increased drastically even following the Lost Decade starting at mere ¥15 trillion in late 2000, increasing to ¥25 trillion in 2003 and then increasing slowly until beginning to accelerate anew following the financial crisis.[52]

As some may remember, it has already been discussed in section 1.4 "Economical" that hoarding bitcoins is not the same as investing them and the situation is similar, although less grave due to the inflation, in the case of *tansu yokin* hoarders. Rather than investing the money into value-generating businesses directly or depositing it at the bank and doing the same thing indirectly, there is no good coming from this practice and it has been a goal of the Ministry of Finance to put an end to it. Perhaps the only businesses that do derive a benefit from it are safe manufacturers, whose sales have only gone up since the introduction of the higher inheritance tax and My Number. The problem has now furthermore merged with that of the increasing number of abandoned homes appearing all over Japan and reaching recently over 13% of all homes. In a recent story broken by the Nikkei, a demolition unit found a cache containing the equivalent of more than $200,000 in an abandoned house in Tokyo. While the story is extraordinary due to the high amount, in 2018 alone the Tokyo Metropolitan Government had collected ¥560 million in caches that neither the finder nor the original owners placed a claim upon.[53]

Despite all the possible discussions of relationships of trust and the elite central bu-

51. Karube Kensuke, "Kin'yū Kiki Kara 20-Nen: Sono Kyōkun Wa Nanika" [20 Years After the Financial Crisis: What Did We Learn?], 2017, `https://www.nippon.com/ja/currents/d00360/`.

52. Dai Ichi Life, "Kyūzō Suru Tansu Yokin" [Rapidly Growing Drawer Deposits], 2015,

53. Tomohiro Ebuchi and Shohei Nomoto, *Aging Japan Grapples With 8m Empty Homes and Stashed Cash*, Web Page, 2019, `https://asia.nikkei.com/Economy/Aging-Japan-grapples-with-8m-empty-homes-and-stashed-cash`. Toru Fujioka, "Tucking 10,000-Yen Bills Under the Mattress Spells Worry for Abe," 2016, `https://www.bloomberg.com/news/articles/2016-02-24/tucking-10-000-yen-bills-under-the-mattress-spells-worry-for-abe`.

reaucracy leading the nation ahead, this particular aspect of "being your own bank" and the popular idea of dodging taxes in various Bitcoin communities very much aligns with this particular practical reality of the Japanese cash hoarding practice. In many ways, the people have already begun being their own banks even before cryptocurrency had been invented, making the step from hoarding the currency issued by the Bank of Japan to hoarding a currency generated by algorithms executed over the Internet a smaller one than it would be in most other developed nations.

4.4.3 Summary

Ultimately, these properties of Bitcoin were unlikely to matter with regard to its sudden rise to popularity in 2017. For one, bitcoins presently do not exhibit sufficient similar properties with cash hidden in the drawer to attract cash hoarders regardless of their attitude towards central bankers and their levels of trust in the rest of the society. As it has already been mentioned, there were two primary impetuses for the rise of the money-under-the-mattress practice.

The first is fear that the depositor's bank will go into bankruptcy and the deposits will be lost. In behavioral finance terms, this is perhaps a somewhat extreme degree of loss aversion. Bank deposits in Japan are insured by the Deposit Insurance Corporation of Japan (DICJ) every bit as much as they are insured by comparable organizations in other developed nations. Even if the depositors withdrew only the excess of the first ¥10 million that would have fallen outside of the scope of the insurance, they did not appear to have deposited the savings at a different bank which would have been protected up to a separate ¥10 million by the DICJ. Although this information is hardly common knowledge, it is also not difficult to obtain through a consultation with one's banking representative. There is notably also the possibility of the DICJ running out of insurance funds, but such an event would certainly attract an intervention of the fiscal authorities as it did in 2000, when the government guaranteed all bank deposits regardless of their size.[54] Whatever the rationale may be, there is little dispute that individuals engaging in such runs on the banks are sufficiently frightened of the loss of their lives' savings that they would not decide to harbor them in a new poorly-understood asset created and maintained by unknown individuals on the Internet. While Bitcoin and other cryptocurrencies may very well appeal to such individuals at some point in the future, their sheer volatility had made them nothing like cash under the mattress in the eyes of anyone but the most vehement technology evangelists.

The second group are those individuals trying to dodge taxes, whereby the most

54. Curtis J. Milhaupt, "Japan's Experience With Deposit Insurance and Failing Banks: Implications for Financial Regulatory Design," *Wash. ULQ* 77 (1999): 399.

common reason is to avoid the world-leading inheritance tax of 55%. The basic idea is to keep the money at one's home so that the Tax Office cannot find out how much is passed on to one's decedents by simply cross-checking the bank records. It is perhaps not a stretch to argue that such an approach is at least somewhat naive. The statutory exception for inheritances is presently at ¥30 million and increases by another ¥6 million per every beneficiary. It is also possible to increase these limits through proactive means much as gifting the heirs ¥1.1 million every year, which is covered by a different tax exemption or moving one's assets overseas to countries that do not have an inheritance tax, such as Singapore. The latter has to be done sufficiently early as the tax exemption only comes into effect once the individual has lived outside of Japan for at least ten years.[55] In either case, should there still remain doubt that the heir has declared the inheritance correctly, the Tax Office can order a search of the house, attempt to discover any hidden caches and, given that such searches are conducted by experts who do nothing else, most likely do so with a considerable degree of success.

Section 1.4 "Economical" has provided a brief insight into the groups that would benefit from the censorship-resistant properties of Bitcoin. These are primarily individuals operating outside of the law or those whom the law does not protect to a sufficient degree. Tax evasion is one such example. Would it then be appropriate to argue that a large portion of the bitcoin buyers did so to avoid the Tax Office? Most likely not. While Bitcoin can certainly be used for money laundering purposes several key points make it unsuitable for this specific case. Firstly, such an operation requires a considerable degree of technical finesse that is unlikely to be found in octogenarians keeping money under their mattress or even their children. Following that, there is also the difficulty of converting the Japanese yen into bitcoin without going through the banking process. By 2017, major exchanges both within Japan and overseas already required personal information of the account holders, which would expose the tax evader every bit as much as keeping the deposit in a bank. The transfer of funds to the exchange itself to buy bitcoin in the first place would require the individual to have the sum in question in the bank, which immediately defeats the purposes of the entire plan. There is certainly the option of attempting to convert cash into bitcoin through criminal networks, but this again would require very specific knowledge most aging grandmothers do not have and is a proposition that is so risky that one may as well call it absurd. Lastly, there is again the issue of risk for a questionable gain. Most people hiding caches at home most likely do not expect a tax officer with a search warrant to begin with, which leads to any attempt to convert one's savings to a new unknown Internet currency appear considerably riskier

55. Ata Tax Accountant Office, *I. Inheritance Tax*, Web Page, 2019, accessed 13 May 2019, `http://www.ata-tax.jp/service/index02_en.html`.

than just continuing to keep the cash at home.

4.5 Bitcoin: Money of tomorrow

It is important to address the issue of Bitcoin as a medium of exchange in Japan. One of the key chinks in the cryptocurrency's armor had been that the currency had not in fact been used as a currency. This use case not existing largely undermined any claim the project had towards mass adoption, with its use being largely restricted to people who made it their objective to use it despite the hurdles doing so had posed. This led to the creation of mutual help communities such as Reddit's *Living on Bitcoin*, who describe themselves as "hardcore Bitcoin enthusiasts who are avoiding to own/use fiat money [… and] are using the real money - Bitcoin".[56] There had been and perhaps still is a common misconception though that there is a place where one can and does use Bitcoin for everyday transactions. That place had naturally been none other than Japan, which since the 1980s continued to enjoy a certain mystique as a place where traditionalism and high technology blend together. This image is not entirely undeserved, as Japan as a whole continues to amaze the world's public with its latest developments in robotics, mechanized toilets as well as its proliferation of vending machines selling everything from soft drinks to culinary fish stock broths. It is also true that some major Japanese stores introduced Bitcoin as a means of payment, which had been reported in Bitcoin-centric blogs abroad and understood by the enthusiasts as the Japanese commerce embracing the currency. As with everything, the devil is both in the detail and in the context, both of which were missing.

The doors opened for transactions in bitcoin in April 2017 when the revision of the Payment Services Act allowed for greater commercial deployment of the cryptocurrency. The revision has specifically targeted the cryptocurrencies to address the Know Your Customer (KYC) and anti-money laundering (AML) concerns. As a result, cryptocurrencies had been firmly defined, exchange operators were required to register with and come under the supervision of the Financial Stability Agency (FSA) and protection of the customers' property had to be insured. Customers would need to provide identification just as they do when registering with a regular brokerage and suspicious transactions would need to be reported. Furthermore, following a revision of the Annual Tax Revision Plan for fiscal year 2017, from July 2017 onward transfers of bitcoin would no longer be subject the consumption tax.[57]

56. Reddit Living on Bitcoin, *Community Details*, Web Page, 2019, accessed 13 May 2019, `https://www.reddit.com/r/livingonbitcoin`.

57. Kazuyuki Shiba, "Enforcement of Japanese Law on Crypto Currency and Future Issues," *Institute for International Monetary Affairs*, no. 20 (2017), `https://www.iima.or.jp/en/docs/column/2017/0`

The timing of these changes could not have been better for Bitcoin, which had already begun to reignite media attention with its spectacular appreciation. Almost immediately after the law had been passed, several major store chains began accepting payments in bitcoin. The two most prominent of these are the electronics retailer Bic Camera and the department store Marui. In many ways, this had been a major step into the mainstream for Bitcoin as it has previously been limited either to smaller businesses or those intrinsically ties to the savvier denizens of the Internet, such as the video game distribution platform Steam.

A minor but important detail is that this roll-out worked best with the funds stored at one specific exchange called bitFlyer. In fact, both in the case of Bic Camera and Marui, the signs informing the customer that they may pay with bitcoin at this and that terminal had bitFlyer's logo and other corporate symbols. The reason for that is that both were campaigns by the exchange, which had entered into agreements with the two retail chains and provided them with the necessary architecture by processing the transactions through its bitFlyer Wallet.[58] As such, there was a distinction made upon payment whether the customer used the bitFlyer's wallet app or a third-party wallet. Users of bitFlyer paid no transfer fees, were eligible to participate in a raffle to be one of the ten lucky ones to win ¥3,000 each month and given a number of reports generally experienced smoother transactions with fewer failures. For example, authors of the blog BitcoinTsukaikata.com[59] dedicated to using Bitcoin had attempted to buy a jigsaw puzzle featuring Disney's popular character Elsa with the wallet app of bitFlyer's direct competitor CoinCheck, which resulted in a confused staff member, a call to the support center and the disclosure that CoinCheck's wallet cannot be used with bitFlyer's system.[60]

The above characteristics, aside from the raffle, strongly hint towards the possibility that during this entire process Bitcoin itself remained largely unused. Particularly the absence of fees and the incompatibility with an alternative provider suggest that what had occurred is that bitFlyer effectively became a regular Japanese yen payment proces-

410_e.pdf.

58. bitFlyer, "Marui Gurūpu Ni Bittokoin Kessai Sābisu Teikyō Kaishi No Oshirase: Shinjuku Marui Anekkusu De 8 Gatsu 7-Nichi (Getsu) Kara Shiken Dōnyū Kaishi" [Marui Group Announces Launch of Bitcoin Payment Service: The Test Introduction Starts from Monday, August 7 at Shinjuku Marui Annex], 2017, https://bitFlyer.jp/pub/bitFlyer-marui-shinjuku-20170804.pdf; bitFlyer, "Bikku Kamera E No Bittokoin Kessai Sābisu, Zen Tenpo Ni Dōnyū O Kakudai" [Bitcoin payments service is expanded to all Bic Camera stores], 2017, https://bitFlyer.jp/pub/bitFlyer-biccamera-20170726-ja.pdf.

59. Japanese literal translation: HowToUseBitcoin.com.

60. BitCoinTsukaikata.com, "[Gazō-Tsuki] Bittokoin No Tsukaikata O Shiru Tame Ni Bikkukamera Demo Kessai Shite Mita (Tejun, Chūi-Ten, Tesūryō, Kessai Toraburu Kaiketsu)" [[With images] I shopping in Bic Camera to see how to use Bitcoin (procedure, notes, fee, solving problems with transactions)], 2017, http://bitcointsukaikata.com/how-to-use-bitcoin-biccamera.

sor. It is unclear under what terms the transactions were settled, but what had most likely occurred is that a customer would scan a QR code with the bitFlyer app on their smartphone, bitFlyer would deduct the corresponding number of bitcoins from the user's balance and at some point transfer the equivalent yen value to the retailer. There is little to suggest that any blockchain transactions took place during this time.

While this by itself may not seem like an issue to anyone without particular partisanship to the technology in question, it also has to be recognized that nobody purchasing items in such a way is being their own bank. This is because the bitFlyer wallet, just as about almost every other wallet provided by a cryptocurrency exchange, is not a Bitcoin wallet in the traditional sense. The owner of the bitcoins does not hold the file containing his private keys required for signing the transactions on the blockchain. Rather, the coins are stored in the wallets of the exchange itself, which acts as a bitcoin bank. A transfer between one bitFlyer wallet and another therefore is not subject to any transfer fees of the Bitcoin system itself as all that happens is that bitFlyer subtracts a certain number of bitcoins from one customer's account and adds them to another. In the eyes of this author, this is a very pragmatic practice that makes a great deal of sense whilst increasing some risks and reducing some others,[61] but there is little discussion to be had about this being any kind of declaration of independence from the banking sector. The possibility itself exists by transferring bitcoins from a personal wallet at a fee, but the incentive structure is undeniably to keep them in an exchange that acts as a de facto banking institution.

There is also the issue of context, which in this case is in as dichotomic relationship as Japan's popular image of a kimono-clad geisha texting on her smartphone. On the one hand, research by the consultancy firm McKenzie & Company suggests that despite a massive growth of electronic payments in China, which are expected to reach 60% by 2022, Japan remains "a largely untapped market" with "close to 70 percent of Japanese consumers across all age groups still prefer[ring] to use cash when making in-store purchases, mainly due to security concerns with mobile payments."[62] On the other hand, Japan is a veritable jungle of prepaid electronic payment systems and point cards. The most common one of these in the Kantō region is the SUICA card provided by the East

61. Specifically, since the exchange provider assumes custody of the users' bitcoins, they also assume the responsibility for guarding the said bitcoins. In the case of a hacking attack on the exchange, these bitcoins can be stolen and the exchange can declare bankruptcy without being able to refund its users. Conversely, the user can still get his bitcoins if they forget their password and are protected by the security architecture provided by the exchange. Notably, the user's account can also be frozen, which is not something that can happen with a personal wallet.

62. Sukriti Bansal et al., "Global Payments 2018: A Dynamic Industry Continues to Break New Ground," *Global Banking*, 2018, `https://www.mckinsey.com/~/media/McKinsey/Industries/Financial%20Services/Our%20Insights/Global%20payments%20Expansive%20growth%20targeted%20opportunities/Global-payments-map-2018.ashx`.

Japan Railway Company. The card's main advantage is that it allows the holder to enter and exit train stations without having to purchase a separate paper ticket from a nearby vending machine, which drastically reduces the time cost. A typical trip involves simply touching an NFC panel on an entry gate and another panel at the exit gate of the destination with the cost of the trip computed automatically and deducted from the card. A card can be bought and topped up at almost every station, the payment merely requires a touch of the card with no internet connectivity on the reader and automatically recharging variants are also available. What is more, the ubiquity of SUICA cards among Tokyoites has made it economically important enough for many third party locations to begin accepting the card for smaller payments. Although a hard limit of ¥20,000 charged to a card makes it unsuitable for buying a new television set, cafes, restaurants, small sushi, and ramen stores appear to accept SUICA cards more often than they accept credit cards.

SUICA is, however, by far not the only electronic payment system fighting for the Japanese market share. First, there is an astonishing number of SUICA-like cards depending on where one lives. There are an ICOCA and Pitapa in the Kansai region, Toica and Manaca in central Japan, Kitaca in Hokkaidō in the north, Sugoca and Nimoca in Kyūshū in the south, and Pasmo, TOICA, Iruca and a handful of others too many to list here. Previously, these cards were largely incompatible with one another, but as of about a decade ago they have been unified so that a card from a Kansai company would work just as well in Kantō and vice versa. Aside from these transit cards, there are also credit card payment systems iD and QUICPay that allow one to use the credit card without inserting it in the reader. Then, there are largely chain-specific touch payment systems such as Rakuten's Edy, the Seven & I Holdings convenience store chain's Nanaco and supermarket chain AEON's Waon. These work the same way as the transit cards. There are also QR-code payment systems such as once again Rakuten's Rpay, the iniquitous chat application LINE's LINE Pay, Origami Pay, SoftBank's and Yahoo! Japan's PayPay as well as the Chinese WeChat Pay and Alipay systems. Lastly, there are the two Silicon Valley newcomers Apple Pay and Google Pay, which are run from the owner's smart device, but nonetheless use a touch payment system. Rather than operating their own payment systems, these two typically allow the owner to import some of the cards they already own and pay with for example SUICA or iD through the NFC system in the smart device itself.

Although convenience stores would typically accept a large number of the aforementioned systems and transit cards generally work almost everywhere with an electronic payment terminal, the above cards are all but accepted everywhere. Some work in some stores, others work in other stores. The issue is further complicated by an at first un-

believable number of loyalty point cards available in Japan, which are often integrated into or award preferential treatment when a specific card is used in the store affiliated with its issuer. As these bonuses accumulate very quickly at the stores that one patrons often and few people seem to be concerned about their supermarket aggregating their lettuce shopping data, it is a very common occurrence to see even men carry double-sized wallets, which are typically reserved for women in Europe and United States, filled to the brim with plastic cards of all varieties.

Given this situation, one or two large retailers entering a partnership with the major Bitcoin exchange and accepting bitcoin payments at a small handful of all registers hardly appears as groundbreaking as it may to an overseas cryptocurrency enthusiast. As a matter of fact, it appears that the entire process has been executed in a well-rehearsed manner as it had been done with electronic payment providers before and after bitFlyer. A recent example of the latter is the still somewhat niche PayPay system that is attempting to gain ground by running an aggressive cashback campaign. Featuring a popular television personality Daisuke Miyagawa, the company advertised its service heavily as offering a 20% cashback on purchases completed through PayPay with up to ¥1,000 per purchase and a possibility to win higher cash backs. Very soon internet sites began describing how to use the campaign in the most optimized fashion to get a 36% discount on all of one's purchases. Although bitFlyer's pockets are nowhere near as deep as those of Softbank and its $100 billion Vision Fund, it nonetheless follower a similar playbook. It had advertising on television and billboards. It had its catchy song wherein the word bitFlyer was repeated to the tune of the nineteenth-century Russian song *Korobeiniki*, know best as the theme of the popular video game *Tetris*. It had its cashback campaign, where users of its platform could win ¥3,000. As far as venture capital-funded rollouts of electronic payment systems go, bitFlyer's Bitcoin was about as vanilla as it gets.

Throughout 2017, the volume of transactions conducted via Bitcoin in Bic Camera stores did not exceed 1%.[63] It is not clear how close to 1% the said volume had been as Bic Camera does not publicize that data, but as of June 2018, the electronics retailer reported that its popularity had been increasing. An interesting factoid is that originally Bic Camera anticipated that most bitcoin transactions would be from foreigners visiting Japan, which turned out to be not the case. Given the media attention given to Bitcoin in 2017 and its appreciating price, such a result does not appear unlikely, but given the overall low volume and the fact that the service was advertised, it appears unlikely that the large volume of yen-denominated Bitcoin purchases seen in late 2017 were for shopping in Bic Camera. While Japan may or may not allow for a greater use of Bitcoin

63. Reuters Editorial, "Bikku Kamera, Nihon No Bittokoin Riyōsha Wa Jojonidaga Zōka Shite Iru to Happyō" [BIC Camera Announces That Bitcoin Users in Japan Are Gradually Increasing], 2018, `https://jp.reuters.com/article/idJP00093300_20180615_00720180615`.

from a foreign perspective, not in the least due to its regulation, it hardly seems that domestically Bitcoin as means of payment had ever become more than any of its dozens of siblings and in fact followed a very similar trajectory to those of other payment providers.

4.6 Bitcoin: Not investing more than one could afford to lose

So what is it that made Japan the biggest buyer of Bitcoin in the last months of 2017? This author hypothesizes that in this regard the reasoning had been very much the same as it had been for the majority of Bitcoin buyers in other developed countries: its rapidly appreciating price. This by itself should strike any reader as a too painfully obvious a conclusion this late into this work, but again it is the details and the circumstances of Bitcoin's appearance in Japan, its magnitude and its role in the greater scheme of things that are more curious and to a degree uniquely Japanese than the universal human desire to get rich quick.

4.6.1 Relationship between popularity and price

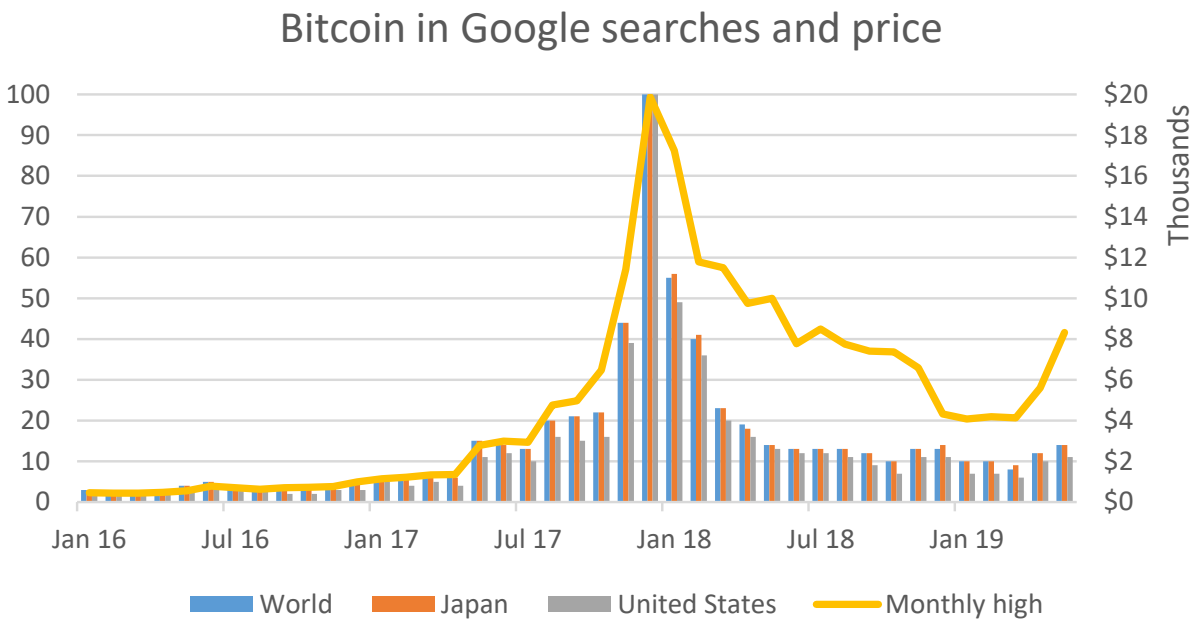

Figure 4.5 Interest in Bitcoin as expressed by searches on Google. Each line is in relation to itself, wherein 100 is the month when the search term was the most popular in the region, 50 is the month when it was half as popular as in the most popular month and so on. To include both Japanese spellings, the keywords filtered for had been both "bitcoin" and its Katakana spelling. Search data: Google Trends; Price data: investing.com.

When the legislation pertaining to the use of bitcoins as a payment method had been passed in April of 2017, Bitcoin had already begun to attract increasing media attention and with that the attention of the populace in general. Above is the popularity of Bitcoin as shown by the increased number of searches in Google and its price between January 2017 and the end of the Heisei Era in May 2015. If there had been any question of whether the primary reason why the public at large was interested in Bitcoin had been its price appreciation, the above chart should cast away the said doubts. Although there is no hard method of determining the beginning of a rally, May 2017 when the price had jumped from $1358 to $2781 seems like a good starting point. At the same time, the popularity of Bitcoin both worldwide and in Japan had nearly tripled. The pattern continued as the price rose, reached its peak in December after which it began its gradual decline. Examining the correlation between Bitcoin's price and its popularity as a search term provides some interesting insight specifically into the rally of 2017.

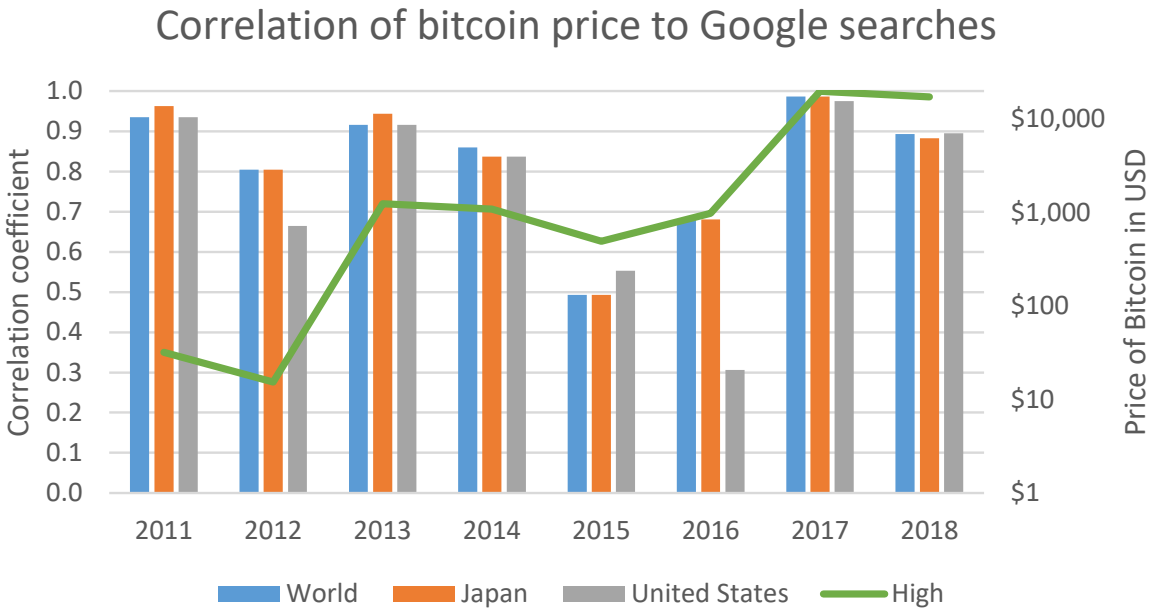

Figure 4.6 Search data: Google Trends; Price data: investing.com.

Bitcoin's popularity had always been strongly correlated with its price. In many ways, it is unavoidable because it was still a very new asset and had been unknown to most until recently. As more people found out about it, more searches had occurred and more new participants bought it resulting in a positive correlation. Similarly, as the price had increased the asset received more attention and more people looked for it online, creating a positive feedback loop. More importantly, it is evident that 2017 had not been a regular year even for Bitcoin with an already very tight relationship between price and popularity reaching its highest levels to date. It is presently not clear whether 2017

had been Bitcoin's final rally or if there are more to come, but given that its correlation coefficient on a worldwide basis had been 0.987 for the year—in other words, nearly perfectly correlated—it appears difficult to argue that it had been anything other than its skyrocketing price attracting the attention of the general public. In other words, two mutually non-exclusive conclusions can be drawn that either more people that had been attracted to Bitcoin were buying bitcoin, or that even more than before participants were buying and selling bitcoin based solely on its price action.

4.6.2 Emergence of the bubble

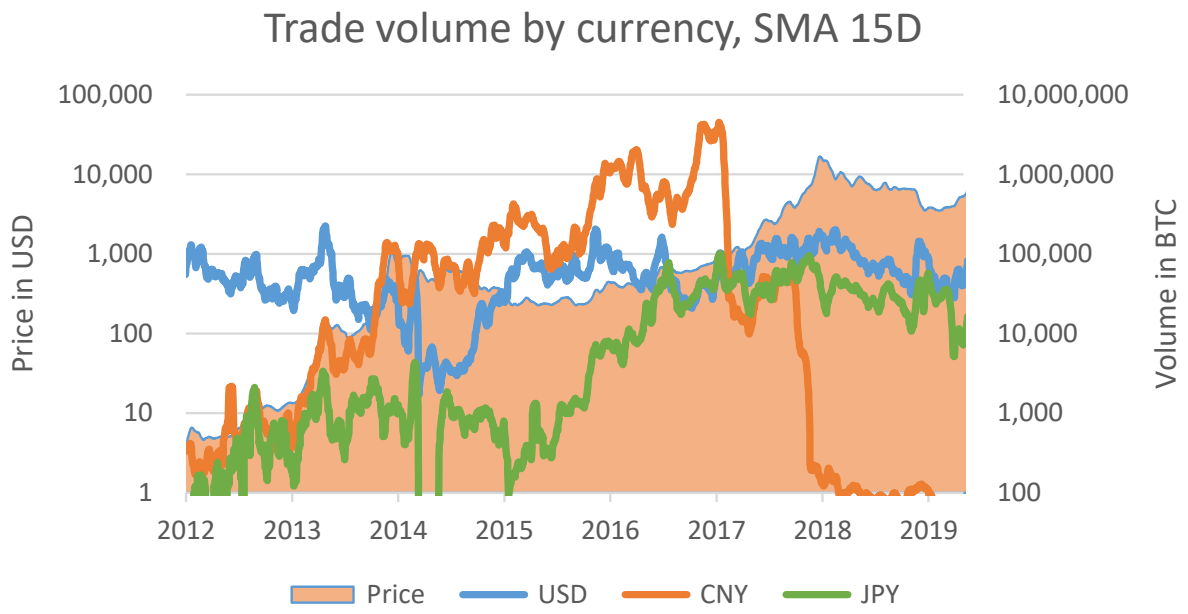

Figure 4.7 Trade volume by currency and price of a bitcoin. Smoothed out for readability with a 15-day moving average. Data from CryptoCompare was selected over Bitcoinity as it more closely aligns with the research of the major financials and the financial press. Due to the CryptoCompare data being considerably less consistent in the earlier periods, it had been substituted by the Bitcoinity data for the renminbi until 2014, until 2015 for the yen and until May 2016 for the Korean won.

Data: CryptoCompare, *BTC - USD Total Volume 1 Month*; Bitcoinity, *Bitcoin Trading Volume*.

Given the recency of Bitcoin and its generally unregulated nature, it is difficult to come by any data that can be claimed to be of quality anywhere close to the data provided on trading pertaining to traditional financial exchanges. On the one hand, cryptocurrency exchanges are typically not bound by the same legislation applying to securities exchanges and are often located in countries without strong regulatory enforcement. On the other hand, assembling the data per definition includes trying to get information from as many exchanges as possible and it is easy to oversee the smaller ones and neigh impossible to detect those operating covertly. There also appear to be significant discrepancies between

the available data sets and it is not clear whether the research published by reputable organizations engaging in financial research is indeed based on correct data, as it appears to come from these same third-party aggregators. Nonetheless, it is possible to get a general sense of what has been happening during a given time frame.

One of such queries is the national currency used on exchanges to buy bitcoin. This allows one to get a general sense of who is buying or selling bitcoin as it would be logical to assume that the British would pay with British pounds, the Japanese with the Japanese yen and the Chinese with the Chinese renminbi. This, however, is only an approximation as it is entirely possible that a British or a Japanese person would use a Norwegian exchange, which would make their payments appear in Norwegian krones. Furthermore, currencies such as the euro do not limit one to a single country and in the case of the United States dollar, it is very likely that a large portion of transaction volume is non-American simply due to the importance and the ubiquity of the currency. Given all of these caveats, one can nonetheless wager an approximation as it is the best result one will ever get.

One thing is patently clear: both the rally between 2012 and 2014 and the mid–2015 to end-of–2017 rallies appear to strongly coincide with increases in trade volume coming from China. The same does not apply for the drops in bitcoin's price following the disappearance of the Chinese trading volume in 2017, which will be discussed momentarily.

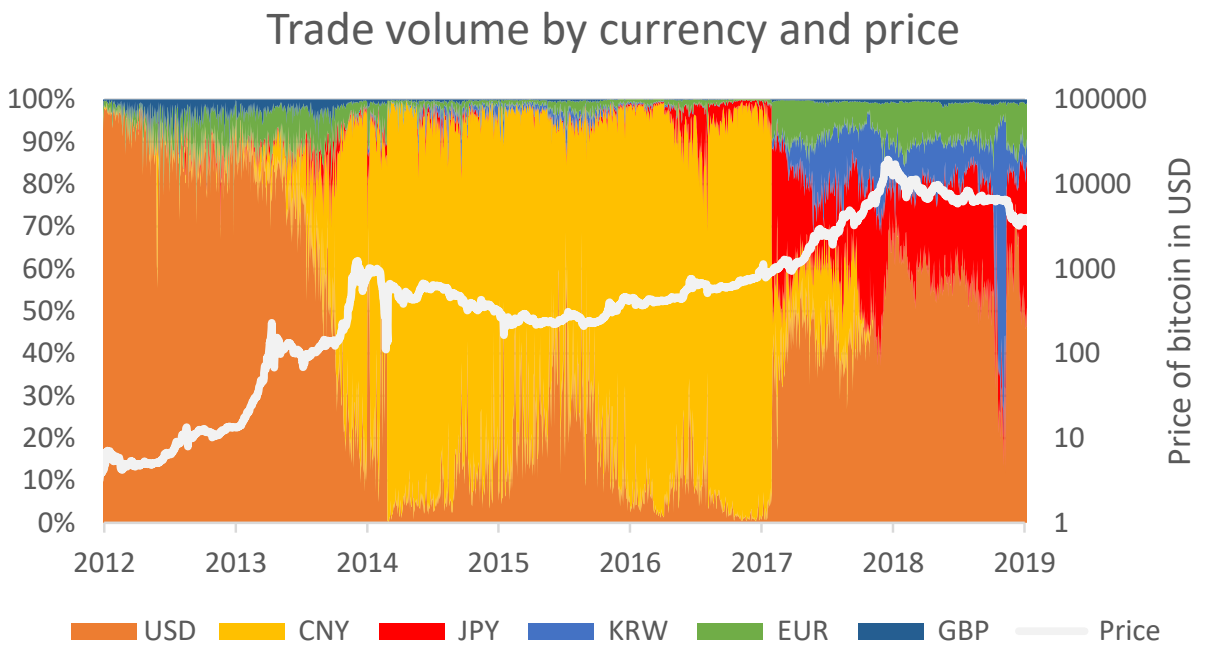

Figure 4.8 Trade volume data: CryptoCompare, *BTC - USD Total Volume 1 Month*. Price data: investing.com.

The interest in Bitcoin as expressed by its price had been somewhat waining since

2011 and the cryptocurrency had at best been moving sideways relative to its previously explosive growth. Much of the said growth occurred while bitcoins still cost under ten dollars and were not a widely known phenomenon. At this stage of Bitcoin's growth, it had been purchased by only a small group of individuals that were either interested in it for its technical ingenuity, its underlying ideology or simply as a necessity to buy drugs through on the Dark Web.

From 2013 onwards, however, Chinese cryptocurrency buyers appear to be the leading cause of the rapidly rallying price. Already by January 2014, the buyers of bitcoin in renminbi had overtaken all other national currencies including the United States dollar. Another look at the chart suggests that the strongly correlated price of a bitcoin and the Chinese buyers' appetite had been somewhat disconnected with an overall drop in price despite a quickly recovering trade volume in renminbi. While that is true, it is likely that the drop in price would have been much worse had the Chinese buyers not been there to soak up the supply as the period around the New Year of 2014 had been Bitcoin's first major existential crisis. It was only in October 2013 that the Federal Bureau of Investigations had cracked down on Silk Road and arrested its owner, leaving its patrons without narcotics and Bitcoin without a major reason d'être. This by itself did not appear to bother the buyers of bitcoin and rather than drop it had increased in value from $140 at the beginning of October to $1200 by December 1. Only five months later in February 2014, the Tokyo-based exchange Mt. Gox, which at the time had been handling 70% of all bitcoin transactions and had been the first large exchange in the cryptocurrency's brief history, had been hacked and $500 million worth of bitcoins belonging to the exchange's customers were declared stolen.[64] After an initial fall, the price had rebounded and slowly subsided into the to $200–300 range until a slow recovery at the end of 2015.

Meanwhile, Chinese trade volume had two major jumps in one in the fall of 2015, which was preceded by an increase in June and another one in the fall of the following year. The volume plummeted by a factor of hundred by February 2017, remained unstable, then dropped again by a factor ten from August to October and finally by another factor ten the following month. From there onwards, it slowly dwindled away until disappearing entirely from the dataset by February 2019.

This poses the question of what the nature of the renminbi-using Bitcoin aficionados could have been and why the volume from one specific emerging economy, large as it may be, had taken on the proportions of such magnitude and apparently inflated the price of the asset. Could it be that some Chinese shoppers had embraced the spirit of libertarianism and decided to use Bitcoin rather than WePay as their preferred medium of

64. M. Kutylowski and J. Vaidya, *Computer Security - ESORICS 2014: 19th European Symposium on Research in Computer Security, Wroclaw, Poland, September 7-11, 2014. Proceedings* (Springer International Publishing, 2014), ISBN: 9783319112121. Page 314.

payment for everyday expenses? Or were they interested in day trading cryptocurrency pairs to make a little money on the side like Mrs. Watanabe? Perhaps they merely appreciated the beauty of its mathematical simplicity?

While any of the above may be true to some extent for some buyers, it is the contention of this author that the answer is much simpler.

China as the "C" in the BRICS of the promising emerging economies developed rapidly over the past decades. In only twenty-five years, the percentage of the population living under the International Poverty Line of $1.90 has dropped from 66.2% in 1990 to as little as 0.7% by 2015. At the same time, its gross domestic product per capita had shifted from $317 to $8000 and continues to grow at a rapid pace.[65] This lead to a formation of a new upper-middle classes and upper classes that could now afford goods and services that were previously only difficult to buy, whether it be Californian smart devices, Italian sports cars or luxury accessories from Switzerland. Many of the newly-rich sought to invest in the future of their children by sending them abroad with over 600 thousand Chinese students presently studying abroad, mostly in the United States.[66]

During the same period, a similar process took place in Russia. However, whereas the Russian nouveau riche own summer homes and yachts at the French Riviera, real estate in London and an occasional Premier League football club, most of the Chinese wealth remains within the borders of the People's Republic. This is arguably less so due its citizenry undying patriotism and a strong belief into the momentous investment opportunities in their home country, but rather a result of stringent capital controls of the central government that seeks to prevent the outflow of the Chinese currency which may destabilize the renminbi and lead to a considerable loss of the republic's foreign reserves. These capital controls have been becoming increasingly strict throughout most of the 2010s. For example, while Chinese citizens were allowed to withdraw up to the equivalent of $50,000 of foreign currency abroad at the beginning of 2017, by the end of the year this number had been reduced to $15,500 with no more than $1,555 in a single day.[67] Furthermore, these withdrawals should be performed for consumption purposes, whether it is tourism or education, and not for purchasing real estate or other foreign assets.

65. The World Bank, *Poverty & Equity Data Portal*, Web Page, 2019, accessed 17 May 2019, http://povertydata.worldbank.org/poverty/country/CHN.

66. The Economist, "For China's Elite, Studying Abroad Is De Rigueur," 2019, https://www.economist.com/special-report/2018/05/17/for-chinas-elite-studying-abroad-is-de-rigueur.

67. Laney Zhang, "China: New Rules Increase Restrictions on Overseas Cash Withdrawals | Global Legal Monitor," 2018, doi://www.loc.gov/law/foreign-news/article/china-new-rules-increase-restrictions-on-overseas-cash-withdrawals/, https://www.loc.gov/law/foreign-news/article/china-new-rules-increase-restrictions-on-overseas-cash-withdrawals/. Coco Liu, "Why Are China's Middle Classes Moving Their Money Abroad?," 2017, https://www.scmp.com/week-asia/society/article/2095827/why-are-middle-class-chinese-moving-their-money-abroad.

As crafty individuals persisted to find ways to circumvent these regulations the government persisted to clamp down on these attempts. Popular schemes involved pretending to spend the money on a vacation or studies abroad whereas it had really been invested into real estate, making multiple trips and carrying as much cash as is allowed on one's person, varying kinds of accounting fraud, hiring smugglers, using multiple credit cards and hoping that nobody will notice, and lastly buying disproportionately large quantities of Hong Kong-based insurance.[68] If were to combine several of the above methods of subtly moving capital out of the country, having multiple children each of whom until recently added another $50,000 to the limit or had a sufficient number of accomplices, a €250,000 Greek property purchased on a credit card offered not only diversification from the renminbi and these Chinese asset prices, but also a five-year renewable visa for the European Union.[69]

Section 1.4 "Economical" laid out how Bitcoin can be more useful than regular banknotes or bank transfers to certain specific groups. Although the focus had been mostly on organized crime evading airport security and refugees fleeing the country, there is no reason why the same principles cannot be adopted for individuals illegally attempting to bypass capital controls, which while in itself most likely involving a fair share of organized crime is not the first image that comes to when mentioning the term. In fact, given some absentmindedness on behalf of the financial authorities and the tax office, Bitcoin is arguably even more useful for this one specific purpose than it is to the two aforementioned target groups.

Unlike gold, diamonds, Renoir paintings or even the United States dollar, bitcoins can be created virtually anywhere given sufficiently large quantity electricity, sufficiently large number of processors and a sufficiently large fan to keep the former from overheating. All of the above can be purchased in China with ease and unlike cocoa plantations in South America are not at risk of an aerial assault by the local government.

In many ways, it is a perfect crime. A Bitcoin mining operator sets up a farm and begins minting new bitcoins, which they then either keep for themselves or sell to someone over a domestic exchange. The bitcoins are then transferred to a private wallet, which can be sold directly through a transfer of renminbi. The only thing suggesting that the new owner even posses the said bitcoins is the knowledge of the transfer between them and the previous owner. No record is left on either the exchange or the blockchain. A single flight away, the owner can exchange their bitcoins for whatever the buyer is willing to offer them. This could be foreign national currency, real estate or just about anything else. Since bitcoins do not occupy a physical space regardless of the miner's origin, there

68. Liu, "Why Are China's Middle Classes Moving Their Money Abroad?"

69. Liz Alderman, "In Greece, an Economic Revival Fueled by 'Golden Visas' and Tourism," 2019, https://www.nytimes.com/2019/03/20/business/greece-economy-golden-visas-tourism.html.

is also no way to know which physical person owns what quantity of bitcoins or if a specific passenger of a Beijing-Los Angeles flight is carrying a password to zero or several millions worth of bitcoin in their memory. Sidestepping the already circumvented $50,000 limit had suddenly become much easier.

Returning to electricity, processors, and fans, Chinese electricity prices, which constitute the lion's share of the cost of mining, are some of the lowest in the world at only $0.08 per kilowatt-hour.[70] There is also some dispute about whether or not most of the electricity is produced through the burning of coal or by using the excess of the hydroelectric power generated in Sichuan in the southwest of the country.[71] Research suggests that that, by the end of 2018, 73% of application-specific integrated circuit (ASIC) devices, which are the most economically efficient way to mine bitcoin, were manufactured in China itself and thus required neither import permits nor outbound currency transfers.[72] Lastly, although China is at a considerable disadvantage to countries such as Iceland, which had also become a popular destination due to its cheap hydroelectric power and a climate that greatly aided the cooling of the mines, cheap electricity and large fans kept the equipment sufficiently ventilated to run a profitable operation.

Ultimately, mining in China may have as well had been more expensive than abroad and it could still have been advantageous, because the equation itself had been fundamentally different than in Iceland, Canada or the United States. Whereas the purpose of mining in the latter three had been to generate bitcoins that were worth more than the depreciation costs of the equipment, electricity and the other expenses relative to the international price of bitcoin, the purpose of doing so in China was to create something using the local currency that could be exchange abroad for a foreign currency. Were the operation unprofitable internationally—it appears unlikely that it was—it could still be very profitable for those evading capital controls simply because the risk-adjusted cost of keeping the entirety of one's capital in China would have been higher than the loss on mining bitcoin.

The timing of these spurs of bitcoin activity on exchanges trading in renminbi is not coincidental either. By July 2015, the current President of the United States Donald J. Trump had entered the electoral campaign and ran for the office. At the time Candidate Trump distinguished himself from his competitors through stronger than usual rhetoric concerning issues such as immigration, medical insurance and America's position vis-a-vis China and a host of other nations it conducted trade with strong trade ties. Although

70. Statista, "Electricity Prices Around the World 2018 | Statista," 2019, `https://www.statista.com/statistics/263492/electricity-prices-in-selected-countries/`.

71. Digiconomist, "A Deep Dive in a Real-World Bitcoin Mine - Digiconomist," 2017, `https://digiconomist.net/deep-dive-real-world-bitcoin-mine`.

72. Michel Rauchs et al., "2nd Global Cryptoasset Benchmarking Study," *Available at SSRN 3306125*, 2018,

the odds of the Candidate winning at the time still seemed to be small, with the then-incumbent President Barrack Obama famously mocking Candidate Trump by saying "at least I will go down as a president",[73] by October 2016 it was abundantly clear that the race had been reduced to the former Secretary of State Hillary Clinton and Candidate Trump, who proceeded to criticize the trade relationship with China. A possibility of an all-out trade war, which had not erupted until early 2018, posed a considerable threat to owners of assets valued in the Chinese currency. If the risk had previously been the somewhat incorporeal possibility of a real estate property bubble or some unforeseen action by the central government, by mid–2015 the renminbi had begun on its slide downward relative to the U.S. dollar until President Trump finally assumed office and nothing seemed to happen. The President's failure to abolish the Affordable Care Act as promised on the campaign trail cast doubts about his other claims and renminbi rallied again until the first tariffs on steel and aluminum were imposed in spring in 2018 and with the talks of future tariffs the renminbi continuing its gradual decline.

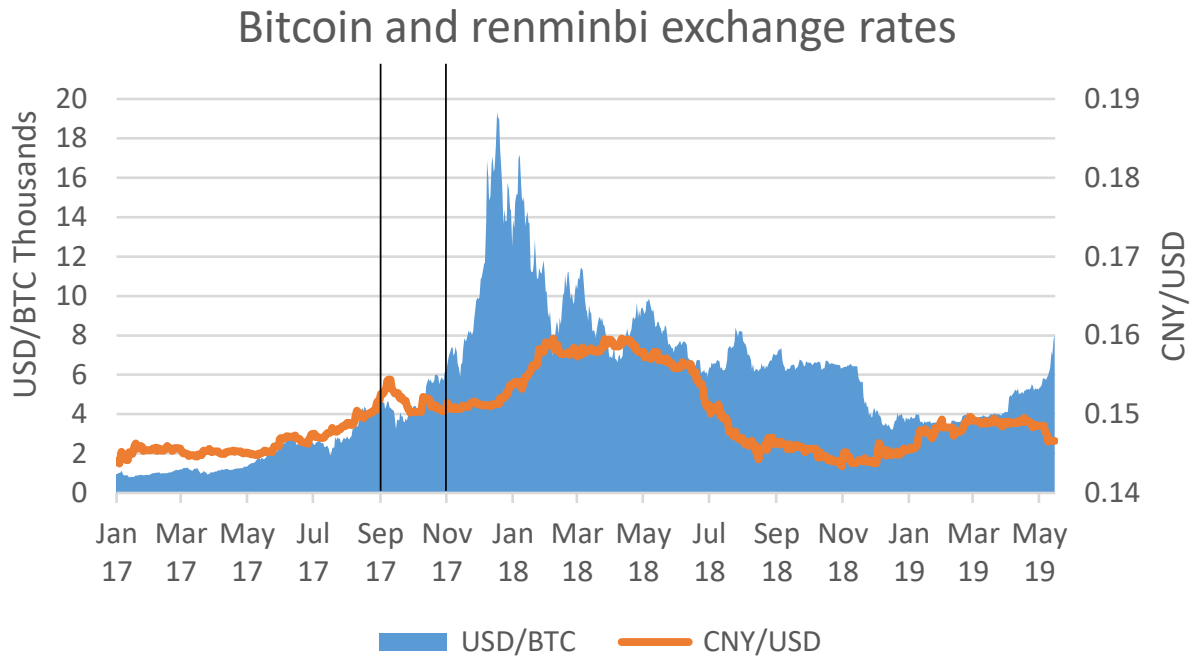

Figure 4.9 Price of bitcoin and the Chinese renminbi in United States dollars. The vertical lines denote points when the closing of exchanges was announced and enacted. Bitcoin price data: investing.com; Dollar-renminbi spot data: The Federal Reverse Bank of St. Loius, "China / U.S. Foreign Exchange Rate | FRED | St. Louis Fed."

By this point, the Chinese authorities had already cracked down on the exchanges and the trade volume had practically disappeared. The collapse of the Chinese bitcoin trading volume had begun in January 2017 when the Shanghai branch of the People's

73. Deena Zaru, "Obama Reads Trump's Mean Tweet About Him on 'Jimmy Kimmel Live!'," 2017, https://edition.cnn.com/2016/10/25/politics/obama-mean-tweets-jimmy-kimmel/index.html.

Bank of China, the nation's central bank, launched a series of on-site inspections of the exchange BTCChina (BTCC), "looking for evidence of violations, such as market manipulation or money laundering, and assessing the safety of customer funds."[74] At the time, BTCC had been the largest exchange in the world by trading volume. Shortly thereafter, similar investigations began on two further exchanges of comparable size, Huobi, and OKcoin. The regulators ordered a suspension of fee-less margin trading on suspicions of market manipulation. Already by February, a smaller provider HaoBTC stated that it will discontinue its exchange services. A few days later, the co-founder and CEO of BTCC, Samson Mow, left the company without providing any public statements as to why. Futures volume collapsed across the exchanges and the provider LocalBitcoins, which allows for peer-to-peer trading without a central hub, saw an explosion in volume. Writing for the cryptocurrency-centric blog Bitcoin.com at the end of February, Justin Connell notes that as a result of the inspections, Chinese exchanges had begun to "phase-in new AML and KYC procedures, such as ID uploads and other verification processes – neither of which existed before the recent meetings."[75]

By September of the same year, Chinese authorities announced a deadline at the end of October by which all Chinese exchanges were to cease the receipt of deposits or withdraws in renminbi from mainland China.[76] This had spelled an end to the transaction volume on the exchanges themselves, but the mining operations that required considerable capital expenditure on the infrastructure continued. What happened to the bitcoins created by these mines, who owns them and what purposes they were used for remains unknown. It is entirely possible that the mining continued in hope of an easing of the regulatory restrictions—and therefore covering the cost of the expensive ASIC mining equipment—as the miners too were undoubtedly already under stringent supervision by the financial authorities. Equally, it remains unknown to all but the regulators and the miners themselves if any of the bitcoins minted from November 2017 onwards were redeemed for foreign exchange or still remain in the hands of Chinese citizens.

As of May 2019, Chinese authorities were contemplating banning all domestic Bitcoin mining because the miners "did not adhere to relevant laws and regulations, were unsafe, wasted resources or polluted the environment."[77]

74. China Daily, *Bitcoin Price Slides as Officials Inspect Local Exchange*, Web Page, 2017, accessed 18 May 2019, `http://www.chinadaily.com.cn/kindle/2017-01/13/content_27949054.htm`.

75. Justin Connell, "Here's (Most Of) What Has Happened to Bitcoin in China So Far in 2017 - Bitcoin News," 2017, `https://news.bitcoin.com/happened-to-bitcoin-in-china-2017/`.

76. Kenneth Rapoza, "Cryptocurrency Exchanges Officially Dead in China," 2019, `https://www.forbes.com/sites/kenrapoza/2017/11/02/cryptocurrency-exchanges-officially-dead-in-china/`.

77. Brenda Goh, "China Wants to Ban Bitcoin Mining," 2019, `https://www.reuters.com/article/us-china-cryptocurrency-idUSKCN1RL0C4`.

4.6.3 Setting the table

While the authorities were putting the nails into Bitcoin's coffin in China, Japan and its relationship with the cryptocurrency were on the trajectory to enter the headlines not only in the small sphere of cryptocurrency aficionados but also that of major financial press agencies and financial research institutes of the world's most prominent banking institutions. Mrs. Watanabe was already getting her purse ready for another shopping spree.

Faces of Bitcoin

Even before the major advertisement campaigns began, Bitcoin had been something that attracted sufficient attention of the Japanese regulators to amend the Payment Services Act and specifically clarify the legal position of cryptocurrencies and the requirements the exchanges were supposed to fulfill. Setting up a proper legal framework can be argued to have been particularly important in the case of Japan, because it was nowhere other than Tokyo that the world's first major exchange Mt. Gox filed for bankruptcy after the hackers fled with the customer's bitcoins—an event the aftermath of which continued well into 2019. To prevent this from happening again, expected customer protection, know-your-customer, and anti-money laundering regulations were written into law. One of the important lesser mentioned additions to the law was that this new branch of financial services firms had also received the governmental clearance to create their own self-regulatory organizations (SRO) akin to those of the broker-dealers and an integral stepping stone in gaining customer's trust through self-policing within the industry.

In late 2016 and throughout much of 2017, Japanese cryptocurrency exchanges had considerably increased their advertising. The exchanges that featured particularly prominently were bitFlyer being the first to launch its campaign already in May,[78] Coincheck and to a lesser extent Zaif. What made these exchanges particularly noticeable was that they not only advertised on the web pages but also ran a high volume of advertisements on national television, which is not something that the often questionably-run cryptocurrency exchange sector was known for. What had once been a niche Internet project for technology enthusiasts and individuals with less than amicable feelings towards central bankers had now been played back on the screens of everyone with a television set.

The series of television ads themselves were very much what one would expect to see during a Japanese commercial break. The firms presented a recognizable face to feature in their ads. Coincheck decided to go with humor by putting the comedian Tetsurō Degawa into a three-piece suit, but leaving out the trousers; bitFlyer set up several

78. Bunta Sugawara, "bitFlyer Yūzā Sū 200 Ni Man Nin Toppa." [2 Million bitFlyer Users Breakthrough.] 2019, `https://cc.minkabu.jp/column/364`.

Figure 4.10 BitFlyer advertising on the front page of Yahoo! Japan in December 2016. The ad features Riko Narumi in orange and bitFlyer campaign's catchphrases "the coin that may change the world" and "for bitcoin, bitFlyer". Source: ShumaiBlog, *2016 Nen O Furi Kaette*.

musical numbers with the actress Riko Narumi dancing as the name of the company was being repeated to the tune of Tetris. Of the two, the orange dress-clad Narumi perhaps more so than Degawa had succeeded in becoming the face of Bitcoin in Japan as her image had been visible not only on the television but on front page Yahoo! Japan and as an advertisement on semi-trucks with special-purpose trailers that drove around central districts of Tokyo with the bitFlyer theme set to play on repeat.

A major non-Bitcoin specific company that had also entered the advertising the race was DMM.com. Originally an online video, electronic book and games service, the company had expanded into general online retail and eventually began offering Forex services known as DMM FX. Perhaps seeing cryptocurrencies trading as a natural extension of its existing line of services, DMM.com had created DMM Bitcoin and opted for the model turned advertising celebrity Rola as the face of their platform. Like bitFlyer and Coincheck, DMM had a television ad, but perhaps even more noticeably a large number of billboards in central districts of Tokyo. The choice of Rola was also one that would

undoubtedly invoke a familiar face, with the model being ranked first among women in the 2017 "Television commercial talent ranking" by Em Data[79] and visible on several, often adjacently placed, advertisements of often different companies in the carts of the Tokyo train network.

Figure 4.11 DMM.com advertisement in front of the Shimbashi Station. As with all of DMM Bitcoin's billboards, the model Rola is covered in golden glitter on a golden background, while holding a golden Bitcoin coin. January 2018. Photograph by this author.

Safe trading

Whereas famous models, actors, and comedians certainly attracted attention and lent the new commodity a veneer of credibility, there had also been an important change resulting from the aforementioned legislation. As of November 2016, bitFlyer had been insured against losses from hacking attempts by the Mitsui Sumitomo Insurance Company, a

79. Oricon News, "Nenkan CM Kiyō Sha Sū, Joō Wa Rōra & Hirose Suzu, Dansei Wa Endō Ken'ichi" [Number of CMs appointed yearly, Queen: Rola & Suzu Hirose, Male: Kenichi Endo], 2019, `https://www.oricon.co.jp/news/2101773/full/`.

¥2 trillion firm with a reputable name.[80] Although the clients are not insured against investment losses on Bitcoin and various other cryptocurrencies available on the platform, they are protected against the loss of the said assets in the not unlikely event that the exchange becomes a successful target of a cyberattack.

Although bitFlyer is not unique in this regard and similar protection is offered to customers of major American exchanges such as Coinbase and Gemini, the importance of having such insurance cannot be overstated and more than anything else a sign of how far the Japanese cryptocurrency sphere had come compared not only to themselves mere years ago but also to their contemporaries at that very moment. The list of exchanges bankrupted or otherwise heavily damaged through losses resulting from cyberattacks and theft of the cryptocurrency under their custody is long and proceeds to grow without showing any signs of slowing down. bitFlyer's major rival, Coincheck, had become a target of such a successful attack later in 2018 and was strategically acquired by the broker-dealer Monex. As an insured custodian, bitFlyer thus in principle corrected many of the major drawbacks cryptocurrencies display when viewed from a strictly pragmatic angle. The most obvious one is that it essentially removes the possibility of the trader losing his cryptocurrency while he is trading it on the exchange. More importantly, it turns the exchange into a better place to store cryptocurrency than one's cryptocurrency wallet. One may forget or lose one's private key, have it stolen by one of the myriads of malware programs designed specifically for this very purpose or otherwise endanger one's wallet through negligent behavior, but bitFlyer not only has the duty to look after one's asset but also offers protection against loss if they fail—something the individual using a personal wallet does not have access to. Even this insurance notably does not protect the users entirely from their recklessness, as it extends only to cyberattacks on bitFlyer and not the users themselves. It covers any fraudulent withdrawals of Japanese yen from the account, should someone illicitly acquire the user's credentials, but it does not protect them from having their bitcoins withdrawn if the said user happens to be using some of the more popular and easily guessable passwords such as their date of birth, "password" or "monkey".[81] To be covered by the protections offered by bitFlyer the users furthermore were required to have activated 2-factor authentication (2FA), which is a method of adding a second layer on top of user password by typically requesting a one-time code sent to the user's phone via SMS or displayed in a separate app upon the entry of a correct password.

80. bitFlyer and Mitsui Sumitomo Insurance Company, "Co-Development of Japan's First Cyber Insurance Policy for Bitcoin Businesses," *bitFlyer*, 2016, `https://bitFlyer.com/pub/bitFlyer_msad_en.pdf`.

81. Sean Gallagher, "Born to Be Breached: The Worst Passwords Are Still the Most Common," 2012, `https://arstechnica.com/information-technology/2012/11/born-to-be-breached-the-worst-passwords-are-still-the-most-common/`.

How many individuals engaging in buying bitcoin in 2017 were aware or cared much for the protection awarded above is questionable, but it nonetheless significantly legitimatized Bitcoin from its past status of an asset traded on shady exchanges and its unfortunate relationship with Mt. Gox particularly in Japan.

4.6.4 Japan becomes a major Bitcoin player

In October and December 2017, the financial press began reporting on Japan being a major participant in the ongoing bitcoin purchases. On December 11 or just a week before bitcoin would hit its Heisei Era peak price, the Nikkei Keizai Shimbun published an article stating that bitcoin transactions in Japanese yen had overtaken those in the U.S. dollar and made up for 40% of the total transaction value.[82] Three days later on December 14, Reuters reported that "Mrs Watanabe-the metaphorical Japanese housewife investor-South Korean retirees and thousands of others [were] trying to escape rock-bottom savings rates by investing in the cryptocurrency."[83] A day later, the Guardian published an article titled "Japanese company to start paying employees in bitcoin", wherein it detailed that GMO Internet, a sizable internet services company that offered securities, Forex and now cryptocurrency brokerage services itself, had decided to allow its employees to receive up to ¥100,000 per month of salary paid out in bitcoin to "improve [their] own literacy of virtual currency by actually using it".[84] It seemed that of all places, it was Japan that Bitcoin was taking by storm.

Going by trade volume alone provides a somewhat conflicting story. Yen-denominated bitcoin trading had been rapidly winding up since 2015 latest and its growth appears to have plateaued in 2017. That is not to say that it had not experienced extreme volatility, although it had still been less than that experienced by any other national currency.[85] Furthermore, although some datasets indeed do suggest that yen-denominated bitcoin trading volume had indeed exceeded that of the United States dollar on certain days, such state of affairs had been neither consistent nor lasting.

More importantly, in terms of volume alone 2017 there had been no marked increase from the beginning of the year to the time when the press agencies began publishing about Japan's dominance in the cryptocurrency sector. Most articles touched on the

82. Nihon Keizai Shinbun, *Bittokoin, Torihiki Shea Nihon 4 Wari Kojin No Tōki Taihan* [Private Speculation by Japanese Retail Investors Makes Up for 40% of Bitcoins Trading Share], Web Page, December 2017, `https://www.nikkei.com/article/DGXMZO24500490R11C17A2MM8000/`.

83. Minami Funakoshi, "Corrected: Fretting Over Savings, Mrs Watanabe Turns to Bitcoin," 2017, `https://www.reuters.com/article/us-bitcoin-asia-idUSKBN1E729L`.

84. Agence France-Presse, "Japanese Company to Start Paying Employees in Bitcoin," 2017, `http://www.theguardian.com/technology/2017/dec/15/japanese-company-paying-employees-bitcoin`.

85. Daily standard deviations for trade volume of bitcoin in major currency pairs for 2017: USD: 0.55; CNY: 0.51; JPY: 0.46; KRW: 0.53; EUR: 0.57; GBP: 0.49.

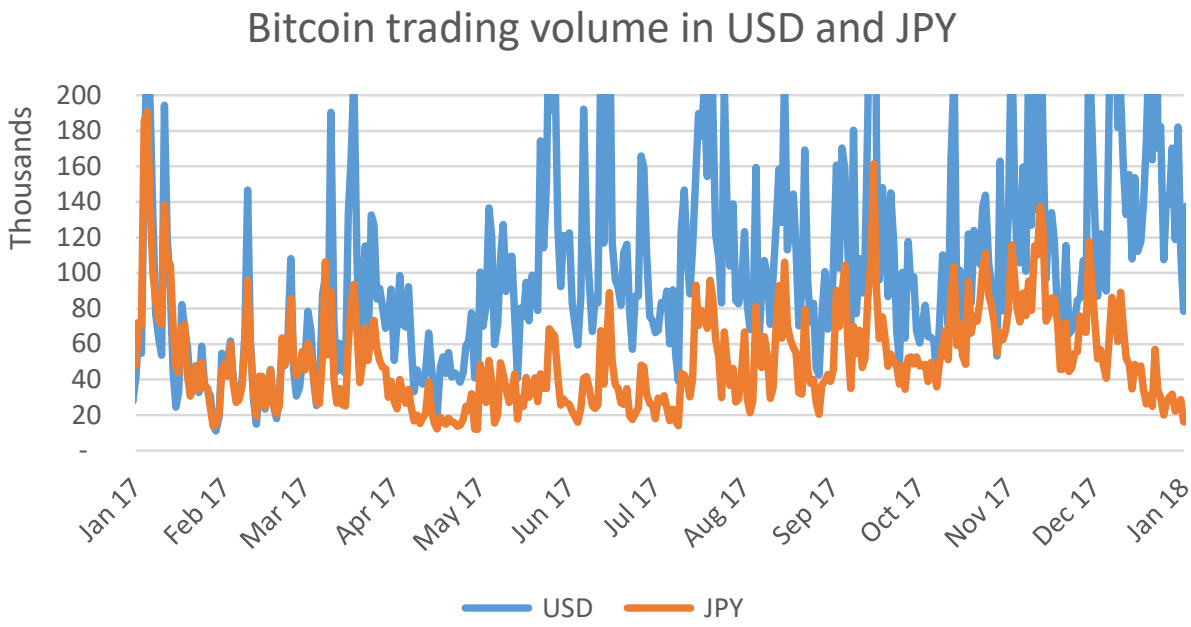

Figure 4.12 Trade volume in the United States dollar and the Japanese yen. Data: CryptoCompare, *BTC - USD Total Volume 1 Month*.

fact that Chinese volume had diminished, but none of those published in the mainstream press had given a significant degree of attention to the relationship between the renminbi volume and that of the yen. If one were to subtract the Chinese trading volume, it would immediately become apparent that there had been a rapid growth of trade on Japanese exchanges not in late 2017, but 2015 and 2016, and that this share relative to other major currencies had already made Japan a major participant. As impressive as 40% may have sounded in December, a markedly higher percentage relative to non-renminbi currency had already been achieved in the months leading up to January and unlike the end of the year, this status was sustained for an entire quarter. Also notable is the fact that a large portion of this volume share had been reduced almost immediately after the first of the two Chinese shocks. There does not appear to be any obvious reason for these movements of yen-denominated volume relative to other currencies, as the collapse of the Chinese trade had effected all currency pairs and the volume proceeded to oscillate upward with Japanese volume merely recovering slower than that of the dollar and the won.

A more useful metric appears to be the increase in the number of users that followed from both bitcoin's price appreciation, the pervasive marketing campaign and the new regulatory measures that gave Japanese brokerages a greater domestic appeal than they enjoyed previously.

Due to the nature of Bitcoin, it is not yet possible to tell how many Japanese people owned bitcoin throughout 2017. This data may appear at some point in the future as the industry matures and the SROs in charge publish a chronology but given that

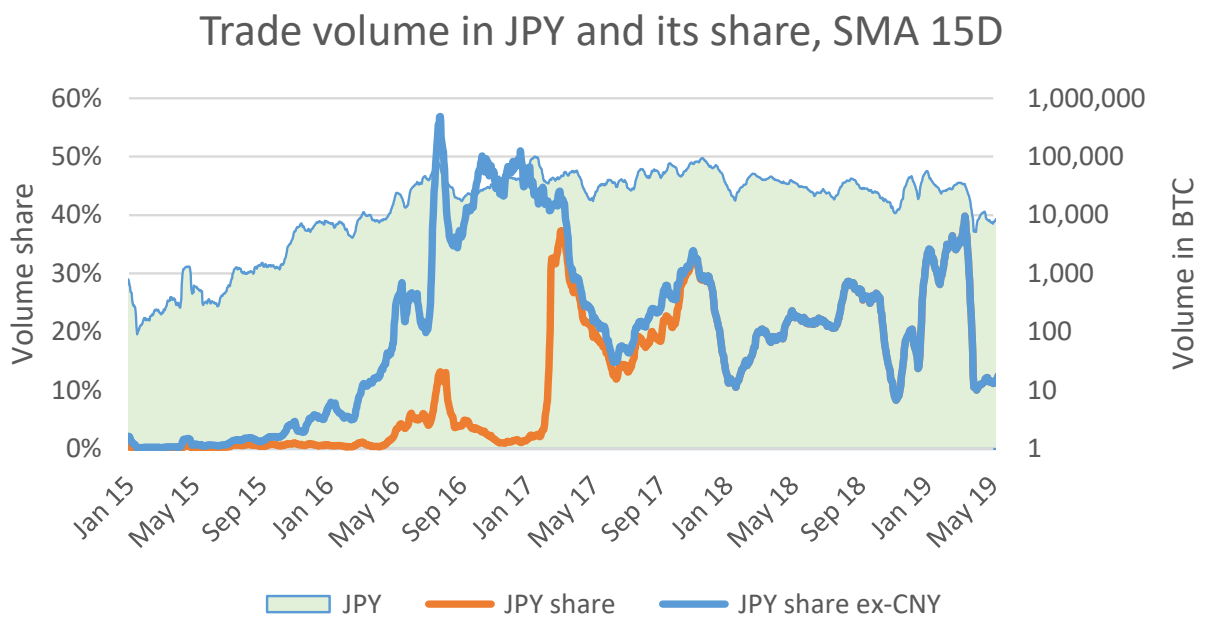

Figure 4.13 Trade volume in the Japanese yen and the share of trade volume in the Japanese yen relative to most traded currencies (USD, CNY, JPY, KRW, EUR, GBP) and its share to most-traded currencies excluding the renminbi. Data: CryptoCompare, *BTC - USD Total Volume 1 Month*.

by that point many exchanges may no longer exist this information may never surface. The matter is furthermore complicated by the fact that the two major exchanges during the period, bitFlyer and CoinCheck, had been private companies with very minimal disclosure requirements and no public earnings calls. CoinCheck has since been acquired by Monex, but that occurred only after 2017. This leaves only the data that has been published by the respective companies for advertising purposes. Fortunately, bitFlyer has been historically very forthcoming with this data and their announcements have been assembled by Bunta Sugawara of the investing portal Minna no Kabushiki. Given that it had also been the largest exchange, this gives a general idea as to the size of the phenomenon.

At the beginning of the year, bitFlyer had slightly above 400 thousand users, by the end of the rally this number had been in the region of 1.3 million.[86] For comparison, this is only 10% shy of the total number of online margin accounts during the same period and nearly three times as many as there had been funded margin accounts. The overall survey of the press, as well as the increase in the compound annual growth rate of bitFlyer's users from 126% in the period preceding June, to 238% by November and 723% by March of the following year, suggests that this user growth had been increasing as the year progressed and had been the highest in the last months of the rally, hinting that may have been considerably higher on December 18 and stagnated from thereon. It

86. Estimate produced by taking the growth rate between the nearest two data points and applying it to the period between the present data point and December 18, 2017, when bitcoin reached its peak.

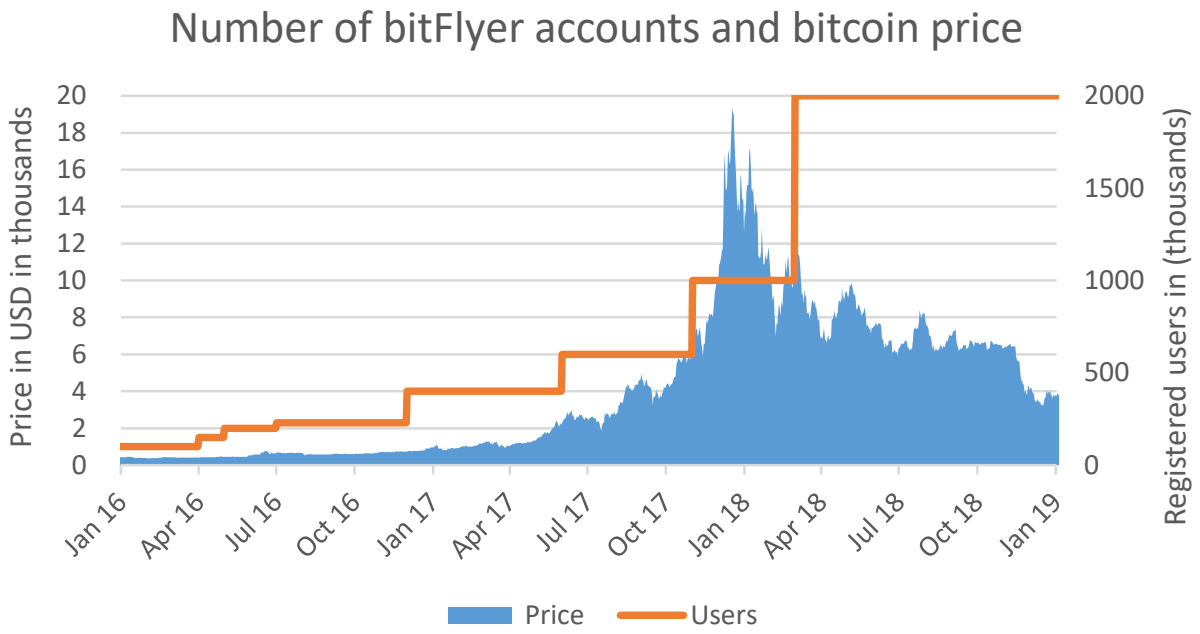

Figure 4.14 Number of accounts registered on bitFlyer and the price of bitcoin. Price data: investing.com; users data: public announcements by bitFlyer aggregated in Sugawara, "bitFlyer Yūzā Sū 200 Ni Man Nin Toppa."

is not clear whether the user growth had plummeted with the end of the rally and the television advertising campaign as no announcements past the 2 million user milestone could be located in the months that followed. Although the absence of evidence is not evidence of absence, it does not appear that the company has ever published reaching the 3 million mark, which given the previous growth rate should have occurred already by mid-May of 2018 or two months after the two million mark. Unless this had been a deliberate change of strategy on the company's part, this suggests that the user growth had decreased significantly the latest by March 2018 or, if the correlation coefficient of 98% between bitFlyer's user base size and the price of bitcoin is anything to go by, by early 2018 when the price action reversion had become apparent.

The marketing firm Values Consulting & Creation Group surveyed installations of bitFlyer and CoinCheck mobile apps, which constituted the advertised way of using the platforms, on the Android platform and come to a similar conclusion with the usage peak being reached in January 2018. The firm's assessment places the number of users during the peak at between 0.8 and 1.4 million which continued to grow for another month, albeit slower, up to 1.9 million and then proceeded to decline. What is also notable are the rates of growth, which suggest that bitFlyer's bitcoin chant had been successful in boosting the number of their users. The data suggests that although unique users were already growing at a rapid pace increasing by an additional 40% in March and April after the ad campaign began in May this growth had increased to over 200%

thus more than tripling the number of accounts in the first month. Following this initial spurt, the growth continued albeit slower until accelerating once again from October to December, whereupon Bitcoin's price action itself reversed. Notably, this pattern also largely coincides with the price action of bitcoin itself,[87] which may mean that either that bitFlyer's television ad had been largely responsible for the price of the cryptocurrency more than doubling in May or that the ad campaign and the favorable price action had resulted in a synergy attracting users.

Another observation that can be made refers to the age groups participating in Bitcoin. Throughout 2017, the share of participants in their twenties lay at an average of 45%. This share decreased gradually with each of the older categories, at 26% for those in their thirties, 15% for those in their forties, 11% for those in their fifties and only 4% for those over sixty. This is not surprising, given that the advertised way of using the exchanges had been the smartphone, the usage of which in itself declines with each of the preceding generation. Nonetheless, it appears not to be the primary reason as research on Forex margin trading, which is also conducted on a smartphone or a personal computer with a comparable interface, suggests that it was most popular among individuals aged thirty to forty-nine.[88] This by itself is an important detail as it would erroneously suggest that Bitcoin fundamentally appeals to a different, perhaps more tech-savvy, demographic than does speculation on the Forex markets, but that is apparently not so once the second derivative, that is the change of the rate of growth itself, is taken into account. Although users in their twenties still made up for the largest demographic and grew the largest in absolute terms, especially in the months of October and November when the number of new users in this age group surpassed the number of new users in all other age groups combined, this pace of growth had been slowing down as had that of the users aged fifty and older. The only group whose growth had accelerated were those in their thirties in forties. This acceleration had been the most marked in the final months of the year when Bitcoin was reaching its peak when especially the growth of those in their twenties and those in their fifties had been decelerating rapidly. In the long run, this suggests that were the conditions of 2017 to persist one would eventually observe a notable expansion of the same age group that forms the primary clientele of Forex brokers.

A further similarity lies in that, as with Forex, it is again not Mrs. Watanabe, but Mr. Watanabe being engaged in trading. Whereas the Forex men-to-women ratio had been 76:24, Bitcoin exchanges lay at a comparable 82:18. Students constituted a higher portion than the mere 1.6% of Forex users but had been reduced substantially in

87. Correlation coefficient of 89.52% for highest monthly price of bitcoin and number of users on a monthly basis.

88. Financial Futures Association of Japan, ""Gaikoku Kawase Shōkokin Torihiki No Torihiki Kokyaku Ni Okeru Kin'yū Riterashī Ni Kan Suru Jittai Chōsa" No Gaiyō."

proportion from approximately fifth of all users to under a tenth for most of the months since the commercials began airing in May. Conversely, the shares of salaried workers and managerial employees increased, the former constituting half of all users from May onwards. Particularly the change in the share of students, in line with the deceleration of growth of younger users, suggests that a change in the principal user base had been occurring from May onwards. Whereas the previously comparably small numbers of users perpetuated the idea of speculating on Bitcoin within their social circles, a large portion of which appears to have been the college campuses, the airing of commercials popularized the asset among the general public and removed its niche status.

In August 2018, Nikkei Style published the results of the annual "Retail Investor Survey"[89] survey conducted by Nikkei Money in which the editors had asked investors about their participation in cryptocurrencies.[90] The results of the survey conflicts partially with the findings of Values Consulting & Creation Group, which may be partially explained by Nikkei's survey being conducted from the pool of its readership, whereas the previously discussed survey drew its data from Android phone analytics, thus biasing it only with regard as to in how far the behavior of Android users differs from those of the Apple iPhone.[91] For example, Nikkei's survey suggests that only 14.7% of cryptocurrency buyers were under thirty, with nearly two-thirds being in their thirties (36%) and forties (26%). If the Nikkei data is more representative of the overall pattern, the distribution of ages is close to identical to that of Forex traders. Differently from the Forex data, which may have been subject to a certain degree of survivorship bias, Nikkei's cryptocurrency buyers appear to be largely inexperienced with 26% having been investing for less than a year and 48% for less than three years. Furthermore, 52% of the buyers have also stated that they held less than ¥5 million in financial assets. The Nikkei argues that 2017 thus had been a "bubble for young people" with little capital, but one must also note that according to the 2014 survey of the Financial Services Agency the mean financial assets for those in their twenties and their thirties were ¥3.6 and ¥6 million respectively, the two demographics that according to Nikkei's generational data make up the said 52%. If anything, this suggests that, among the readers of the journal, there had been no wealth tilt either way among the majority of buyers.

More importantly, the survey provides a basic insight into the profits and losses of the bitcoin buyers. Over the investment period, nearly half of the buyers reported unrealized gains of 2 to 5 times their original investment. However, failing to cut losses or investing

89. *Kojin tōshika chōsa.* Japanese: 個人投資家調査.

90. Nihon Keizai Shinbun, "Kasō Tsūka Tōshi, 6 Wari Ga Sonshitsu O Kakaeru Kojin Tōshi-Ka Chōsa" [Virtual Currency Investment: Survey Suggest 60% of Individual Investors Suffer Losses], 2018, `https://style.nikkei.com/article/DGXMZO34787770Q8A830C1000000/`.

91. As of 2018, iPhones constituted approximately 70% of the market share in Japan with Android retaining the rest. Remaining smartphone operating systems made up for less than one percent.

too late, 60.5% of all respondents reported that they suffered a loss as a result of buying Bitcoin. Fortunately, these losses appear to have been limited for most individuals with approximately 25% having purchased less than ¥100 thousand worth of cryptocurrency or 60% less than ¥500 thousand. Nonetheless, one should also not discount the fact that roughly 8% of the respondents had put forth ¥5 million of capital or more and another 20% invested between ¥1 and ¥5 million.

4.6.5 Mrs. Watanabe's new cloth?

There is a popular hypothesis surrounding the discussions of Bitcoin as a commodity and its relationship with the Japanese Forex traders. It is an idea that appears repeatedly both in the Japanese financial press,[92] in research reports of financial institutes[93] as well as occasional publications in the foreign press.[94] The basic premise of all of these pieces published either during the bull run of 2017 or in its immediate aftermath when the future direction of bitcoin's price action remained unclear, is that retail traders were moving from Forex to Bitcoin or any of its siblings. This idea is sometimes furthermore expanded into stating that the reason for this shift had been the low volatility of the Japanese yen and that the entirety of this behavior is in some way linked to the low-interest-rate environment, which causes Japanese investors to venture into Forex to attain the yield absent from their savings accounts.

There is some truth to the statement that the volatility of the Japanese yen had taken a downturn since the financial crisis. Since price movements are the bread and butter of a trader and especially those engaging in short-term trades, it would stand to reason that a decline in volatility would have made it more difficult to both gain or lose money in the exchange markets. However, examining the Japanese trading volume of bitcoin that had been on a steady rise already since 2015, it is not entirely clear whether the volatility increases from their 2014 bottom would indeed be that discouraging. One should also keep in mind that this period included uncertainty in the market resulting from events such as the British vote to leave the European Union in mid–2016 and a rather turbulent American election.

92. Nihon Keizai Shinbun, "Bittokoin Torihiki Kyūgen Pīku No 4 Bun No 1 Ni" [Bitcoin Trading Declines Sharply to a Quarter of the Peak Values], 2018, `https://www.nikkei.com/article/DGXMZO28230920W8A310C1EA2000/`. Nihon Keizai Shinbun, "Kasō Tsūka 20-Bai Ni Bōchō, FX Kara Ryūnyū 17-Nendo Torihiki-Gaku" [Virtual Currency Expands by 20 Times, Flows From Forex: Transaction Volume for 2017], 2018, `https://www.nikkei.com/article/DGXMZO30706480Y8A510C1SHA000/`. Nihon Keizai Shinbun, *Bittokoin, Torihiki Shea Nihon 4 Wari Kojin No Tōki Taihan.*

93. Muraki, Torii, and Xu, *The Identity or Who Is Propping Up the Bitcoin Market.*

94. Finance Magnates, "Mrs Watanabe Gets a New Hobby: Trading Crypto," 2017, `https://www.financemagnates.com/forex/analysis/mrs-watanabe-gets-new-hobby-trading-crypto/`. Funakoshi, "Corrected: Fretting Over Savings, Mrs Watanabe Turns to Bitcoin."

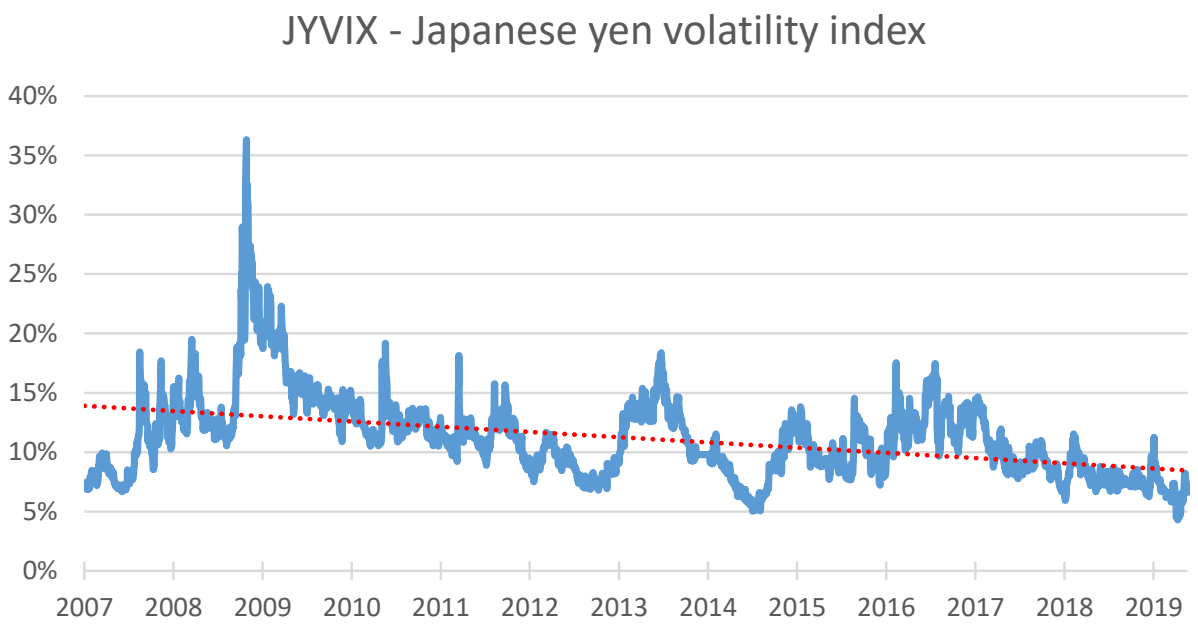

Figure 4.15 The volatility index of the Japanese yen. Data: Chicago Board of Exchange, *Volatility on Currencies*.

Perhaps more so than the volatility itself, it is the regulatory flexibility of Bitcoin and its rapid appreciation that may have attracted Mmes. Watanabe. Recall that in 2010 and 2011 the leverage available to traders had been cut in half to 50:1 and 25:1 accordingly. This alone in conjunction with decreasing volatility would have made Forex less attractive for some, especially given the notion that a sizable group within the Forex trading demographic enjoys high leverage, as described in section 4.2 "Margin accounts". By contrast, even though the Japanese exchanges offered lower leverage at 5–15:1 than their Forex counterparts, the Internet-based nature of the asset had not hindered any want-to-be trader from opening an account at a foreign exchange and trading with 100:1 leverage. In the recent past, even if the said buyer was not very good at timing the market, it is the appreciation of the bitcoin alone would have likely made them better off than they would have been in the Forex market.

In many ways, bitcoin can be argued to have been a commodity that has offered better opportunities to its traders than margin accounts, whether they be those used for Forex or otherwise. As it has already been discussed, margin trading is a risky activity that can easily lead to the loss of principal and, given sufficiently unfortunate circumstances, losses above the principal that can lead to a personal bankruptcy on behalf of the trader. On the other hand, the upside is that given fortunate circumstances the trader can gain much more within a short period of time than they would by trading cash equities or similar unleveraged instruments. For example, even a really good year of holding an S&P 500 indexing security would typically not exceed 25% in returns. A company stock can

naturally perform much better, but would equally as likely bear very high risk and have low liquidity if it exhibited the price swings seen in the case of bitcoin. Naturally, the trader could buy the said index or stocks on margin and significantly amplify his wins and losses, but this would expose them to potential short-term swings of the underlying security in the direction opposite to that the trader bet on and lead to a margin call. In other words, the trader's long-term thesis can be correct, but they can still have their entire position wiped out by noise in the market. Notably, the traders could always revert to medium-term bets by buying put or call options, which would eliminate the risk of radical price swings until the options' expiration, but also reduce the potential returns due to the increase in options' pricing the father the expiration is from the present day and still pose the risk of the losing the entire stake despite the thesis being correct some time after the option has expired.

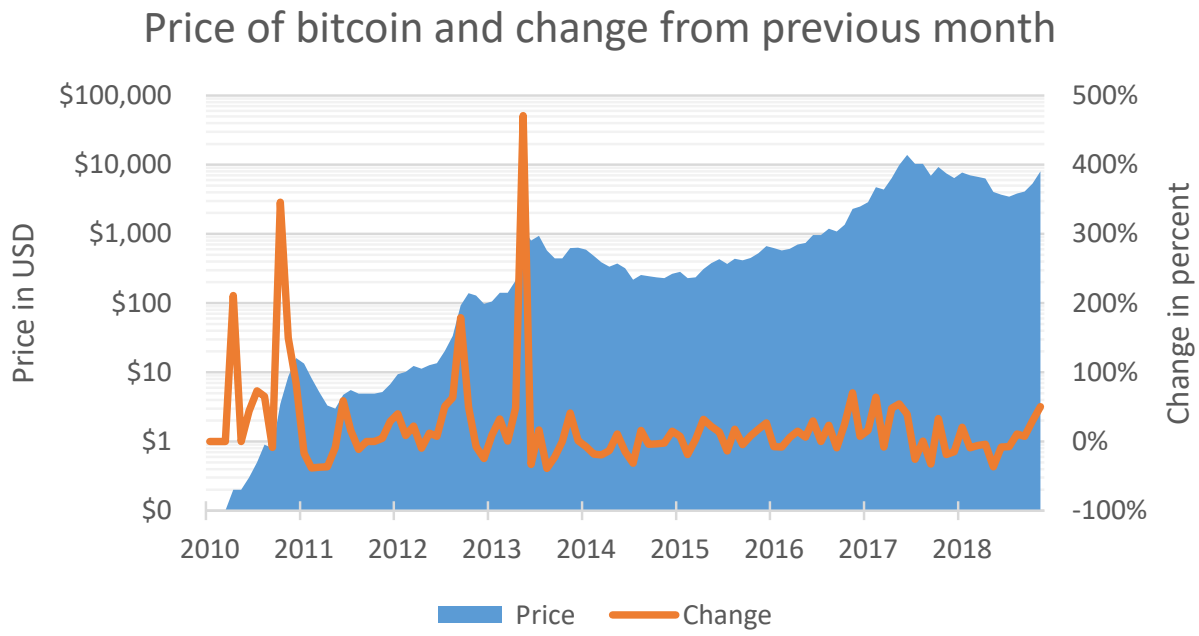

Figure 4.16 Data: investing.com

Over the past years, Bitcoin has been in a very peculiar position that arguably made it possible to earn high returns at lower risk than one would be exposed with margin accounts and options. While exchanges have offered leverage for some time now, it has always been possible to just trade bitcoins themselves without using credit. Although there had always been the risk of the entire cryptocurrency movement dying out as more and more people were finding out about the asset and its ever-increasing price, this prospect seemed less and less likely with each passing year. Unlike an OTC-only traded equity, Bitcoin has been something very unique from its very inception, which gave it a certain degree of resilience that an SME equity may not have had. Conversely, bitcoins

were always a 'virtual nothing' as certain critics have described it, never generated any cash flows and have remained mostly useless for most people in any practical sense. Nonetheless, the aforementioned advantages of bitcoin for traders with longer horizons cannot be dismissed.

There had also been the possibility of trading between cryptocurrencies using alternative coins. The first of such altcoins were the Namecoin and the Litecoin which appeared already in 2011; the former is mostly forgotten by this point and the latter has been traditionally described as the "digital silver" to contrast with Bitcoin's description as the "digital gold". These trades would occur on exchanges wherein participants would submit buy and sell orders for the cryptocurrencies they held in exchange for other cryptocurrencies. While some coins constituted legitimate projects, such as Ethereum's strive to combine blockchain and distributed computing, trading most altcoins has been similar to trading penny stocks if penny stocks were traded without any regulatory oversight. Low liquidity, projects of questionable value from questionable creators and the rampant spread of pump-and-dump schemes hardly made this a market suitable for risk-averse investors. For those seeking momentary gratification and fast-pace trading without the use of leverage, it became a whole new world of opportunities. Furthermore, especially from 2015 onwards as many new altcoins were being developed—the vastest majority of them thinly veiled scams—it allowed anyone with a little bit of spare money and a lot of spare time to become a crypto-venture capitalist looking for the next big coin, something that in the realm of traditional private equity investment generally required one to either have a salary upwards of $200,000—and thus presumably other things to do—or financial assets in excess of $1 million.

All these advantages and disadvantages must nonetheless be weighted against the acumen of the individuals engaging in Forex trading. This author posits that the reports of the exodus into Bitcoin trading may be greatly exaggerated. For the longest period of its existence, although perhaps China is an exception to the rule, Bitcoin was very much a niche topic of greatest interest to individuals with a passion for technology, Internet freedoms and among other things open-source software, and those whose political beliefs lead them to the rejection of large governments and by extension central banks. There is no evidence whatsoever to support the claim that these two groups are particularly strongly represented by salaried workers between the ages of thirty and fifty, who allegedly conduct an equal measure of both fundamental and technical analysis, have been trading for over five years and put the greatest importance on the broker's reputation and how easy it is to execute an order.[95] For the longest time, using Bitcoin required downloading

95. Financial Futures Association of Japan, ""Gaikoku Kawase Shōkokin Torihiki No Torihiki Kokyaku Ni Okeru Kin'yū Riterashī Ni Kan Suru Jittai Chōsa" No Gaiyō."

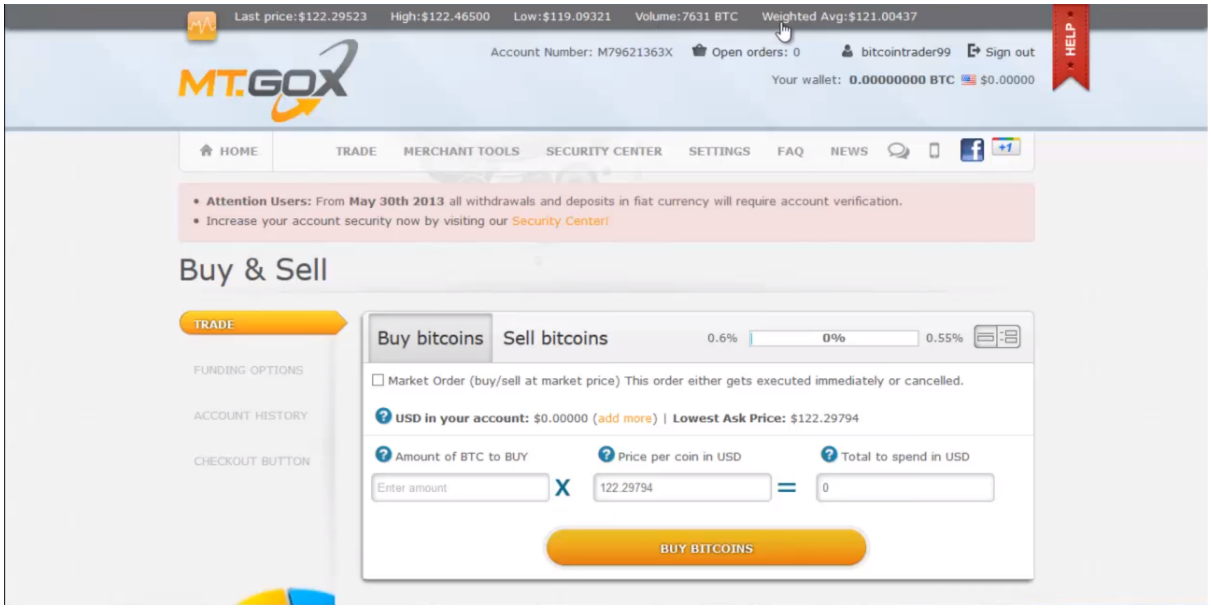

Figure 4.17 Mt. Gox interface circa 2013. From Bitcoins Made Easy, *How to Create a Mt. Gox Bitcoin Trading Account*.

a client, waiting for the client to download the entire blockchain, finding an exchange to buy the bitcoins and then somehow ensuring that one keeps their bitcoins safe from the next hacking attempt on the exchange or malware trying to steal their wallet. There have been no advertisements to speak of and this information had to be sought out rather than sent from above. While not difficult, this is hardly something that most people would do, not in the least because of the intangible nature of bitcoins. Conversely, advertisements for Forex brokers can be found in Japanese trains, magazines, around cities and just about anywhere else. In the case of Japan specifically, these advertisements will often feature everyone's favorite model or former idol and advertise the business's safety, how even the said model or former idol can use it and the number of awards it has received. Most potential customers have at least seen what the U.S. dollar looks like as a banknote and do not have to understand how someone's name is but in actually is not Satoshi Nakamoto. This is all very different from the Bitcoin-related apps still being banned from the Apple AppStore in 2014.[96]

This too has changed as years went by. In the case of Japan, advertising of Bitcoin-services firms has become every bit as pervasive and, given the large number of televised commercials, perhaps even more pervasive than that of Forex brokerages. An extensive examination of the Bitcoin-centric press does not suggest that any campaigns of similar magnitude had been executed in the North American or major European markets.

96. Jon Southurst, *Apple Removes Blockchain Bitcoin Wallet Apps From Its App Stores*, Web Page, 2014, accessed 24 May 2019, `https://www.coindesk.com/apple-removes-blockchain-bitcoin-wallet-from-app-stores`.

Figure 4.18 Recruiting Mrs. Watanabe: a Forex firm advertising on the Yamanote Line of the Tokyo Japanese Rail East network. The text reads:

Starting without worries. Twenty-four-hour support.[happy musical note]
Nana Suzuki [fashion model/general celebrity, aged 30 at the time] started investing through Minna no FX *[broker's name, literally: Everybody's Forex; the word "investing" is transcribed in the phonetic script, presumably so that those not meeting general educational standards can still read it, and has the Japanese "beginner" sign*[97] *attached to it].*
Campaign currently running! Those who open new accounts and use the mobile app get ¥1,000 cashback!
[The large print is followed by awards, small print, and the search keywords to find the site online.]

Photographed by this author. February 8, 2019, Okachimachi Station, Tokyo.

Eventually, Bitcoin has also been embellished with familiar faces with the most notable example being that of Rola.

However, while trading bitcoin may have been unappealing for Forex traders histori-

97. The sign is a yellow and green booklet that looks like an arrow pointing downwards. The sign is a mandatory sticker on cars of drivers with less than one year of driving experience, but has since become a general symbol for beginners and is often used to denote that even a beginner can use or understand the item in question. It is often used on covers of instructional books for adults or even consumer products such as dental floss, denoting how easy it is to use.

cally, there have been other changes that arguably made it very appealing indeed. The most important one of these is the legislative clarity offered by the Japanese government and its recognition that bitcoins can be used as a medium of exchange. It has long been unclear as to how bitcoins should be treated from the point of view of taxation with the worst possible interpretation being that exchanging one coin for another was akin to selling a recently purchased physical good, which would make any attempts at trading cryptocurrencies prohibitively expressive and bureaucratically burdensome. Although a popular view existed in the cryptocurrency community that taxes on cryptocurrency would not have to be paid at all or that the problem would somehow go away eventually, this is hardly something that many individuals who conduct perfectly legal, albeit sometimes overly optimistic, trades in foreign exchange markets would be willing to entertain. In 2017, the National Tax Agency clarified its position on cryptocurrencies stating that these should be treated as miscellaneous income.[98] This rate can go up as far as 40%, but that would require an income of ¥40 million or more, which does not appear to likely have been a problem for most buyers. More importantly, the tax situation has been clarified making the situation unambiguous.

The exchanges themselves have been professionalized considerably. This is seen not in the least in the fact that the present chief executive officer Yuzo Kano is a former Tokyo University graduate, and settlement systems developer and derivatives trader at Goldman Sachs and BNP Paribas. The private equity investors that provided capital to the company during its creation and expansion were no less reputable Japanese names: Sumitomo Mitsui, Mizuho, Mitsubishi UFJ, SBI and so forth.[99] No matter from what side one approaches the business, there is little left of the ad hoc one-person on top operation that categorized Mt. Gox or many of bitFlyer's overseas contemporaries.

This is also seen in the trading interface itself. It is a modern interface for casual traders and virtually identical to that offered by Meta Trader 4 to other Forex traders discussed in Margin accounts. In fact, it is so familiar that were one to remove all references of bitcoins themselves there would be nothing to tell the two apart. A second interface called Lightning[100], which is modeled on more sophisticated interfaces used for trader wishing more intricate tools, is also available to those wishing to use it. This too is in stark contrast to Mt. Gox and many of the exchanges following it that were rather aimed at individuals buying bitcoin for long-term investment purposes than active trading. Ultimately, this enabled a very easy transition for any Japanese Forex trader seeking to dip their toes and perhaps eventually transition into bitcoin.

98. Muraki, Torii, and Xu, *The Identity or Who Is Propping Up the Bitcoin Market*.

99. Crunchbase, *Yuzo Kano*, Web Page, 2019, accessed 25 May 2019, `https://www.crunchbase.com/person/yuzo-kano`.

100. No relation to the second layer Lightning network.

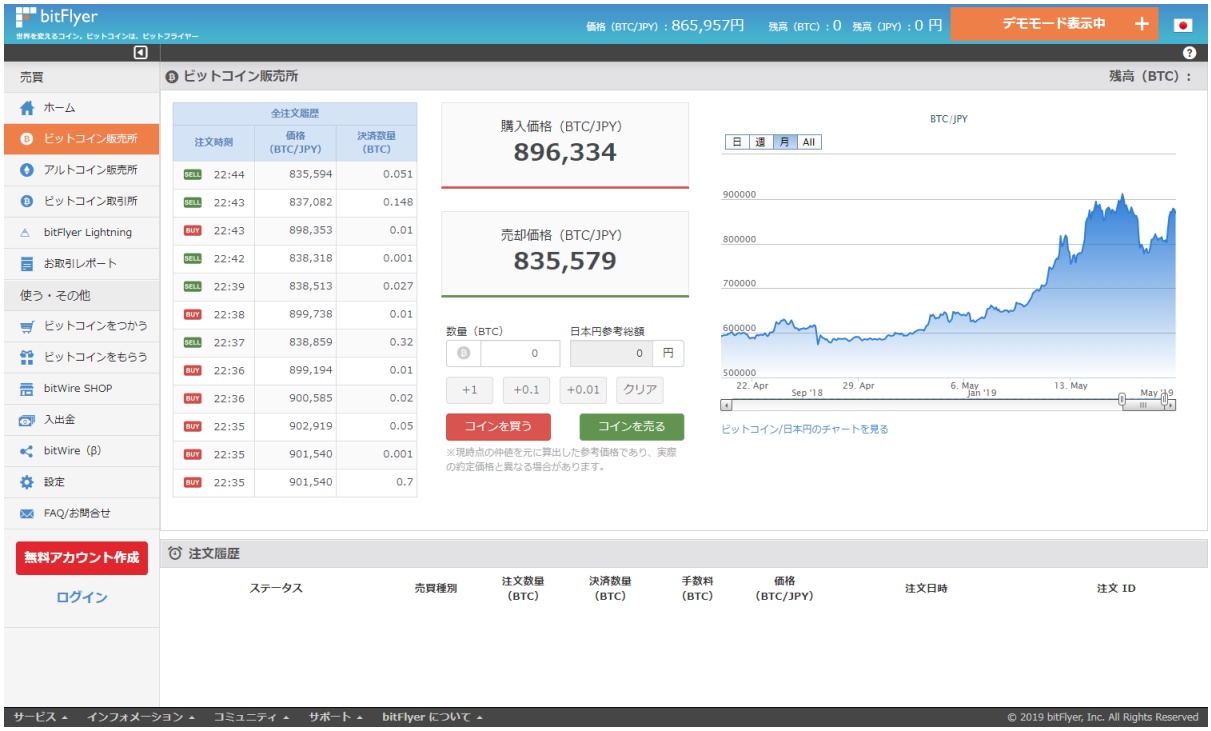

Figure 4.19 Screenshot of a bitFlyer basic trading interface as of May 2019. The screenshot in question is that of a demonstration version. From bitFlyer, *Bittokoin Torihikijo*.

As such, the argument that some Forex traders have migrated to trading bitcoin does not appear unfounded.

4.6.6 Beyond Watanabe

It is nonetheless the opinion of this author that focusing on Forex traders alone presents a vastly distorted picture, even if as Deutsche Bank's report suggests over 21.3% of those in their thirties and 15.2% of those in their forties have experimented with it at some point.[101] An important distinction that has to be drawn is that between experience and actual ongoing trading, wherein data suggests that the number of accounts trading at least once per quarter has remained constant at around 500,000 since 2008.[102] Even if one assumed that some traders hold very long-term positions in foreign exchange, a notion that contradicts the FFAJ survey,[103] it appears unlikely that the entirety of two million accounts on bitFlyer alone were all opened by these elusive long investment horizon Forex traders. Rather, this research would like to present a more holistic explanation in the form of a synthesis of the previous chapters of this book.

101. Muraki, Torii, and Xu, *The Identity or Who Is Propping Up the Bitcoin Market*.
102. Niimi, "Recent Trends in Foreign Exchange (FX) Margin Trading in Japan."
103. Financial Futures Association of Japan, "Gaikoku Kawase Shōkokin Torihiki No Torihiki Kokyaku Ni Okeru Kin'yū Riterashī Ni Kan Suru Jittai Chōsa: Chōsa Kekka Hōkoku-Sho."

In light of the previous findings, the Japanese bitcoin frenzy of 2017 appears to have been largely disconnected both from the so-called "search for yield" resulting from the present low-interest-rate environment and the traumatic effects of the burst of the asset price bubble in 1990 and 1991. Rather, the issue is a long-term side effect of the policies enacted during the Allied Occupation of Japan and the succeeding industrial policy of the high growth period. While this may at first appear to be too long a time frame, this is not a new approach and is typically described by institutional economists as path dependence, which in brief states that past decisions have enduring consequences and influence future events long after the conclusion of the original conditions during which the decision had been made. An economy is thus set on a certain trajectory that cannot be changed easily in the future. The postwar is perhaps the most recent proposition and the is nothing preventing one from extending the same reasoning into history both ad infinitum and ad absurdum.

There is a large number of works critical both of the policies of the Occupation authorities and the Japanese policymakers following Japan's independence.[104] This is not one of them. Japan had moved from selling cheap trinkets after the war to being believed to be the next superpower to supersede the United States in the 1980s and had become the world's second-largest economy until being overtaken by the much more populous China in mid–2000s. No matter what the optimal trajectory may have been, from the current point of view Japan appears to be one of the biggest success stories of the past century with its various administrations undoubtedly playing a major role in this success. However, the Occupation and the industrial policy have also taken their toll. Dower describes in vivid detail how the nascent democracy has been subject to the suppression of native voices from the JSCAP censors. Kohama describes a similar suppression of the Japanese industrialists by the almighty Ministry of International Trade and Industry. However, depending on the perspective, this lack of freedoms can also be viewed as either an authoritarian suppression of individualism or as an anthropomorph of caring mother state coddling its children and keeping them from burning their hands at the hot stove. The question is then what happens when the freedoms are suddenly granted and little guidance has been passed on as to how to use them.

It has been shown in previous sections that the Japanese everyman is a large buyer of life insurance products and a major supporter of keeping one's investments in cash. This is not coincidental. The collapse of the large family structure in the postwar has prompted the Occupation authorities to promote life insurance policies. Without a well-functioning social security system or an extended family to fall upon, these have been an essential

104. To name an example for each: Dower, *Embracing Defeat: Japan in the Wake of World War II* and Hirohisa Kohama, *Industrial Development in Postwar Japan* (Routledge, 2007), ISBN: 1134075227.

instrument to protect the family from certain ruin and get children through school should the head of the family and the main earner perish before the children enter the workforce. Such an event was not to be ruled out with both lower work safety standards and generally more dangerous work outside of the white-collar sector being prominent. The wages earned by these workers and their successors would then be deposited into savings accounts. With productivity still low and the nation continuously working on allocating whatever little resources were available to the industries deemed most necessary by the central bureaucracy, its members have quickly understood that the more of the said wages remained in the savings accounts the more could be used towards the development of strategically important industries. As such, savings were encouraged over consumption and education about their importance was passed down from above. Yet throughout this entire process the manner in which one saved never exceeded the aforementioned simple strategy. Investment trusts existed and a large quantity of equity had been given to the Japanese populace following the dissolution of the zaibatsu conglomerates, yet the former never gained much popularity and the latter slowly trickled away from the hands of the households' stashes. Interest continued to be paid on the savings deposits and neither equity purchases nor NTT and later central government bonds ever reached the popular consciousness of the public.

When the Bubble burst and dislodged the old order, the Japanese saver was caught off-guard. The yields of the savings accounts began to slither away and on an unprecedented scale in the postwar history banks, brokerages and insurers began to declare bankruptcies. The well-coordinated warship formation led by the Ministry of Finance began to scatter with its unsinkable flagship itself coming under fire from bow to stern. Hearing of the first banks' closures, the savers began withdrawing their lives' savings and choosing to keep them in unassuming drawers of their living quarters. As the Ministry of Finance was morphing from its Ōkurashō towards the current Zaimushō, the troubled financial sector itself was being reforged in the reforms known as the Financial Big Bang.

From the turn of the millennium, the changes in the retail financial industry began to accelerate. New internet brokers were beginning to compete with the surviving established brokerage houses. Purchasing real estate allowed for shareholder participation in massive real estate investment trusts. Margin trading and betting on foreign exchange currencies became possible. A British retirement savings system was adapted for the Japanese savers and offered as a lucrative avenue to the long-term accumulation of personal capital. Eventually, even non-retirement-specific savings accounts were put in place engaging the savers to participate in the capital markets.

In the meantime, the average investor was none-the-wiser and long-term investment participation levels remained the same as they were in the good old days. Instead, some

ventured into buying fixed-income securities of dubious quality. Others decided to try their hand at guessing the direction of the exchange rates of the world's currencies and succeeded in amassing the volume necessary to move one of the deepest markets on the planet. While this occurred, every second person continued to play lotto and every tenth slid tiny metallic balls into the pachinko machine decorated with their favorite characters from popular media. Financial literacy remained a matter to be lamented about.

What is occurring in Japan can, in fact, be compared to a legitimate mode of managing one's capital, albeit with some major caveats. Known as the *barbell strategy*,[105] the idea has been popularized in recent years by the former derivatives trader and hedge fund manager Nassim Taleb, whose post-Global Financial Crisis works have attracted the attention of the general public. The strategy derives its name from the shape of a barbell used for weight training, wherein the weights are allocated towards the two extreme ends of a steel bar. Taleb describes the strategy as a "dual strategy of mixing high risks and highly conservative actions [that] is preferable to just a simple medium-risk approach to things" and one that "removes the risk of ruin" while "keeping the benefits of potential gains".[106]

Figure 4.20 Illustration of an athlete standing with a barbell. Artist: Everkinetic, *Wide Stance Squat With Barbell*.

While not exclusive to finance, the strategy can be executed by keeping the majority of one's portfolio in risk-free assets such as inflation-protected government-issued bonds and putting the remainder into speculative securities that have a high risk of failure. This is in contrast to the typical approach of aiming at the golden middle by holding securities with medium or high levels of risk, such as corporate bonds and equity, which the market has thus far typically rewarded with high returns for assuming the risk. As the title of the book this strategy has been detailed in suggests, Taleb aims to achieve what he terms as *antifragility*, a state when the risk of ruin is nil, which is not the case with the medium-risk securities. The return is argued to stem from the occasional successes achieved with the speculative portion of the portfolio, whilst the risk-free portion of the portfolio wards one from being wiped out.

The status quo observed in Japan appears to be at least superficially an unintentional barbell strategy with some benefits of the strategy and considerable drawbacks resulting from its haphazard execution. Although investors do not appear to favor the Japanese

105. Note that there is also a different barbell strategy practiced in the realm of fixed-income investing, where the investor purchases bonds with short and long term maturities thus reducing their risk through diversification. Excluding the barbell imagery, it is in no way related to the strategy at hand.

106. Nassim Nicholas Taleb, *Antifragile: How to Live in a World We Don't Understand*, vol. 3 (Allen Lane London, 2012).

government bonds, the risk-free portion can be argued to be implemented through large cash positions and high premiums paid towards insurance firms that themselves are highly protected by the Japanese government. The speculative portion consists of Mrs. Watanabe playing the currency pairs, buying lottery tickets and, eventually, bitcoins.

This is, of course, nothing close to Taleb's strategy. On the one hand, the savings portion is in no way antifragile. Insurers can go bankrupt and while the government is likely to do their utmost to protect the insured, this protection is in no way guaranteed much the same way as the insurer American International Group's (AIG) survival had not been guaranteed when Lehman Brothers collapsed in 2008. The JGBs account for less than half of life insurers' balance sheets, approximately a third of which consists of risk assets. Concerning cash, whilst bank deposits are protected, given that approximately half of the household's financial assets are allocated to cash a share of these households may exceed the Deposit Insurance Corporation of Japan's limit of ¥10 million. More importantly, the vast sums kept under the households' mattresses as ¥10,000 banknotes either out of distrust for banks or in an attempt to avoid taxation are most assuredly not insured by anyone neither from fire nor burglary. It must also be noted that neither bank accounts nor cash under the mattress protects the households from inflation, which, while much lower in other developed economies, had nonetheless at 0.54% per annum eroded 15% of the value of the yen during Heisei era and increased significantly to 0.87% per annum since the beginning of the Abenomics reforms in 2013.[107] One must also note that the Japanese government does, in fact, offer inflation-protected bonds and has done so since 2004, notably suspending their sale from 2008 to 2013.[108]

There is also a major issue with how the speculative portion of the portfolio is allocated as it creates a net drain on the aggregate household savings. There is no need to go in-depth regarding the effects of traditional gambling and Forex trading on the average household profit and loss profile as these should be self-evident by this point. It can, however, be argued that until the commercials began airing in early 2017, the situation had been different for bitcoin. Although it can hardly be described as unknown by that point, the digital asset had not been known universally as can be seen by the large portion of bitcoins held by the younger generations. Although it had always been a zero or negative sum game of redistributing existing wealth between those in the know early and those with a suitable exit strategy, it can also be argued that investment into Bitcoin can

107. Data: Bloomberg.

108. Yukinobu Kitamura, "Experiences in Japan: Inflation Indexed Bond Markets," in *International Conference on Annuity Markets: Structure, Trends and Innovations* (2009). Ministry of Finance, "10-Year Inflation-Indexed Bonds (JGBi)," 2019, `https://www.mof.go.jp/english/jgbs/topics/bond/10year_inflation/index.htm`. Reuters Editorial, "Japan's Inflation-Linked Bonds Attract Strong Demand," 2013, `https://www.reuters.com/article/markets-japan-jgb-inflation-idUSL4N0HY0S420131008`.

be seen as buying an asset that others will want later. In financial cryptocurrency circles, this typically described as buying the railroads of a major financial system of the future, which while optimistic given the inherent problems of the network is not a possibility that can be dismissed at this point. The share of buyers whose depth of analysis prior to purchasing bitcoin reached even this rudimentary level of analysis is unknown but is not likely to be significant.

As it appears rather unlikely that the Japanese savers decided to pursue the barbell strategy based on Nassim Taleb's works before they were written, this research returns once again to the reasons behind the persistence of this strategy. It is factually not at all the same barbell strategy, but that can be argued as irrelevant. What matters is that it is perceived as such on an instinctive level. In his 1873 essay *On Truth and Lies in an Extra-Moral Sense*, the German philosopher Friedrich Wilhelm Nietzsche argues that it is more important what a thing is named rather than what it really is. The aggregate Japanese perception is that their assets are "safe" and that their participation in wealth-destructive activities "may" lead to returns while offering a degree of entertainment in the process. As has been described over the course of the past chapters, neither one is really true and neither one is in any way, shape or form exclusive to Japan. To a greater or lesser degree, this factually incorrect perception is present across the globe and is reinforced through fundamental misunderstandings of the underlying financial systems and the behavioral biases. Both of these can be rectified to a considerable degree through financial education, which at the present is lacking in Japan relative to other developed economies.[109]

To give a nearly universal example that is more tangible than the behavioral biases themselves, there is a fundamental disconnect between the reality of purchasing real estate for residential purposes and its perception among the general public. This is in no way to deride property owners, since in a closed system someone must own land and homes for people to live in them, but if this aspect of the society is not socialized and spread evenly among the members of the public, one can pose the question as to whether owning a home rather than renting it from someone else is more suitable to one's life's goals. This is a multifaceted issue and no one size fits all, but on aggregate one can observe some interesting trends. Section 3.4.1 "Structure of household financial assets" laid out the structure of financial assets, most of which are cash. What is omitted were the non-financial assets in the form of homes owned by the households. Governmental data suggests that these made up for 66.5% percent of the total household wealth 2014, followed by financial assets that made up for only 29.8% and with the remainder consisting of consumed goods at 3.7%. Out of the primary residence value, 78.8% was the value

109. Baker and Nofsinger, *Behavioral Finance: Investors, Corporations, and Markets.*

of the land itself and the remainder constituted the structure.[110] By comparison, this is considerably higher than the United States, where the primary residence made up for only 27.2% of the total household assets.[111] It is thus indeed no stretch to describe Japan as a "landowner economy".

Not many people within the developed world are afraid of owning a home and most hold a belief that its value will appreciate with it. In terms of the cultural common sense, it is a very safe purchase that is expected to generate revenue mostly on its own either by removing rent from the list of monthly expenses or by collecting it from someone else. Neither of the above assumptions is founded as in terms of risk wholly-owned immovables are one of the riskiest equity assets that a retail investor can own due to an almost perfect lack of diversification. An earthquake or a fire can destroy one or multiple assets in minutes, asset prices can collapse locally or regionally for any number of reasons, or the owner may have to move, leaving them with an asset that is expensive to sell both in terms of transaction costs at 8.5% and in terms of the time committed to finding a buyer. Insurances can be bought for some of the above, but those merely cut into the owner's returns, which themselves have not been very high from a historical point of view. Between 1970 and 2009 Japanese immovables appreciated by 0.2% per annum in real terms. The entirety of the later period starting from 1991 consisted of nothing but depreciation relative to purchasing power. The situation had been similarly unfavorable in the United States with 0.5% per year, Germany with 0% and Britain, France, Italy, and Spain being outliers at above 2%.[112]

In objective terms, these homes form the barbell into something more akin to a mountain by placing a considerable portion of one's assets around the middle of the steel bar. However, in terms of perceptions of the general public and it is these perceptions that define the aggregate behavior until they do not, the home is on the same end of the bar as the cash or even further towards the edge. This is not a Japan-specific phenomenon, but it illustrates the oft unspoken assumptions drawn upon to satisfy one's behavioral biases, in this case, the familiarity bias and loss aversion expressed not only by a strong preference for defensiveness but also the illiquidity of the asset leading to ambiguity in its pricing. The majority if not all of the behavioral biases can be remedied to some degree by increasing the degree of the financial literacy of the population, something that is adversely affected by both the lack of interest and the lack of time on behalf of the retail

110. Bureau of Statistics, "Heisei 26 Nen Zenkoku Shōhi Jittai Chōsa - Sōmushō Tōkei Kyoku" [2014 National Consumption Survey - Ministry of Internal Affairs and Communications Statistics Bureau], 2016, `https://www.stat.go.jp/data/zensho/2014/pdf/gaiyo4.pdf`.

111. Benjamin, Chinloy, and Jud, "Why Do Households Concentrate Their Wealth in Housing?"

112. Data assembled in Gerd Kommer, *Kaufen Oder Mieten?: Wie Sie Für Sich Die Richtige Entscheidung Treffen* (Campus Verlag, 2016), ISBN: 3593501570.

investor.[113] It is also something that is in fact passed down in a hereditary manner through what Richard Dawkins famously termed a meme,[114] whereby individuals raised in richer households outperform those from poorer households. As mentioned previously, this difference is very noticeable in the case of Japan today, wherein individuals who described their parents as having more financial assets than the average vastly outperformed those who did not in terms of financial literacy with richer parents men answering approximately 60% more questions correctly and richer parents women answering almost twice as many correctly as those from the poorer households. Children of richer parents also notably exhibited financial decision making characteristics such as showing a greater willingness to work abroad and strive for financial independence within a marital bond.

This general wisdom regarding immovables highlights a strong component laid out as an aggravating factor of behavioral biases: interest in learning about the investment opportunity and having time to do so. Multiple variables such as the effects of leverage, maintenance and transactions costs, the cost of rent, tax incentives and expenditure tax deductions for property owners as well as conflicting literature and advisory make this field difficult to understand comprehensively, which is more than can be demanded from someone who merely just seeks a place to live and is furthermore influenced by emotional factors such as mental accounting in shape of the house being an inheritance passed down from one's parents. At the same time, given that the said home will make up for two-thirds of the entire household's wealth, it is hardly a matter than can be dismissed easily because of the stakeholders having better things to do with their time. Although a valid argument can be made that a home is not an investment but a lifestyle decision for a large portion of the population, it must also be acknowledged that regarding it solely as such is making the said lifestyle decision haphazardly by entirely dismissing its opportunity costs and the impact the said costs will have on the said lifestyle henceforth.

This raises a critical question: if one were to agree that a monumental decision of how to go about the ownership or the potential ownership of one's own home is not given sufficient consideration, how well-considered are smaller financial decisions such as whether or not to speculate on the price of bitcoin?

In the first chapter of this book, the reader has been provided with a compact overview of Bitcoin. This had been done in an attempt to describe Bitcoin for what it is rather than to sell a futuristic vision of what it one day may become, as is often the case in books published by individuals actively involved in the cryptocurrency space. The section highlighted the advantages the system offers, its major drawbacks and the potential bottlenecks. While by no means comprehensive, even this rudimentary overview required

113. Baker and Nofsinger, *Behavioral Finance: Investors, Corporations, and Markets.*
114. Richard Dawkins, "The Selfish Gene: With a New Introduction by the Author," 2006,

the reader to spend an hour or more engaging in concentrated reading and understanding some basic yet not quotidian concepts from the fields of computer science and economics. If Bitcoin were an exchange-listed company, reading the above would be more akin to reading the description of the business than an analyst report and the absolute minimum foundation of understanding what it is one is considering buying. Whilst difficult to quantify, the survey of the cryptocurrencies space leads this author to affirm that the overwhelming majority of cryptocurrency enthusiasts do not have a good grasp of the majority of the concepts discussed and rather focus on the price action, disputes between competing products and the political aspects of a decentralized cryptocurrency when compared to those administered by the central banks. Given that these are the individuals devoting considerable time to the matter, the overall knowledge level of retail investors entering the market at the beginning of 2017 cannot be assumed to be anything other than rudimentary.

So why did so many individuals buy bitcoin in 2017 despite knowing very little about what it is they were buying? As has previously been determined, cryptocurrencies were for a long domain the domain of the younger generations and were mostly thrust into the consciousness of the working-age individuals following the spring 2017 advertisement campaigns. Men in their thirties and forties, as the target group typically associated with speculative investments, had been the one group that experienced an acceleration in the speed of growth following the initial surge. Until the bubble burst and the bitcoin began depreciating rapidly, it the largest group nonetheless remained those in their twenties and, depending on sources, thirties. These were the individuals exhibiting the lowest rates of financial literacy across all age groups and thus most affected by behavioral biases related to investing. It must also be noted that were one to take a particularly cynical point of view of bitcoin, these would also be the individuals with the least life experience and thus also the least likely to have experienced Ponzi scheme-like offers to buy into some new asset that eventually may become the foundation of the future's financial system. Many of the points in the Bitcoin's ethos are very similar to those perpetuated by traditional MMM-like Ponzi scheme victims-in-the-making: fear of missing out, the vilification of the central banks and demonstrations of profits to the uninitiated all the way until the scheme's collapse.

The link between gambling and speculative investments is not coincidental either. In a comprehensive 2009 study, Alok Kumar providers an analysis of U.S. residents engaged in investing and playing lotteries. No similar studies could be found for Japan, but a reasonable assumption can be made that some of the traits will reoccur. His findings are that the demographics engaged in lotteries are also more likely to invest in what Kumar terms as "lottery stocks", speculative investments with high risk and potentially

high upside. These investors can generally be characterized as "younger, less wealthy, less educated, nonprofessional single men". Although Japanese brokers do not provide data on the wealth or the level of academic attainment of its clients, which in itself can be argued to vary greatly depending on the university attended, and it is difficult to tell which portion of Japanese *salarymen* would qualify as engaging in "managerial or technical" activities that constitute the definition of a professional in the study above, the factors of young age and maleness closely correspond to observations from Japanese Forex and bitcoin trading. Comparisons with gambling are more difficult as it encompasses a large number of avenues from pachinko to mobile phone games. Nonetheless, even with regard to pachinko, which is an older form of gambling practiced the most by those in their forties and is currently struggling to attract young people,[115] those in their twenties still outnumber those in their fifties, sixties or seventies. Here too women make up for only a quarter of all gamblers.[116]

The study however also hints at a causal element other than financial literacy. Individuals who live in urban settings and earn less than other investors within a forty-kilometer radius tend to purchase more lottery stocks than they would otherwise. The author of the study posits that this hints at lottery stock investors attempting to "maintain or increase upward social mobility".[117] This is in line with the general attempts to engage in Forex trading by hoping to make returns and then quitting typically for reasons of not being able to live up to one's expectations when entering the market. Although similar surveys for cryptocurrencies do not yet exist for the Japanese market, qualitative surveys suggests that the possibility of sudden immense profits is always on the radar of the cryptocurrency speculators. This is most famously expressed by the ongoing joke among cryptocurrency traders that the appreciation rate of their assets will soon get them a "lambo", which is a shorthand for the Lamborghini sports car, typically the Aventador model that at $400 thousand per car is prohibitively expensive to the vastest majority of denizens of the developed world.[118] This hope for escape from the current socio-economic reality had been raised by the writer Rachel Premack for neighboring Korea, wherein young Koreans went from betting substantial sums on the cryptocurrency in 2017 and to having the temperature of the Han River added to one of Korea's popular Bitcoin

115. Tara Francis Chan, "Japan's Pinball Gambling Industry Rakes in 30 Times More Cash Than Las Vegas Casinos," 2018, `https://www.businessinsider.com/what-is-pachinko-gambling-japan-2018-7`.

116. Amusement Press Japan Inc., "49-Sai Ika Yaku 7-Wari, 10-Dai-30-Dai No Sankasha Ga 4-Wari Shimeru" [About 70% of people under 49 years old, 40% of participants in teens to 30s], *Amyūzumento Japan Chōsa*, 2016, `https://amusement-japan.co.jp/article/detail/10000217/`.

117. Alok Kumar, "Who Gambles in the Stock Market?," *The Journal of Finance* 64, no. 4 (2009): 1889–1933, ISSN: 0022-1082.

118. The joke has been embraced by some Lamborghini dealerships proudly advertising that they will, in fact, accept bitcoins for their cars if the interested buyers contact their sales hotline.

websites, a Korean euphemism for committing suicide.[119]

Unlike South Korea with its abundance of broken lives tales relating to the cryptocurrency, Bitcoin does not appear to have had as much of a detrimental effect on the Japanese speculators as far as public reports are concerned. There are sporadic accounts of 38-year-old businessmen investing ¥8 million and their bonus into bitcoin shortly before the bubble's burst,[120] but by and large these reports seem to be far apart with the previously examined survey data suggesting that most speculators used what can be best described as "play money" to participate in the new market. Cumulatively, this play money seemed to be enough to make Japan the leading Bitcoin nation for a couple of months after this Chinese volume vanished, suggesting that a considerable portion of funds have been allocated to bitcoin purchases. This dual view of play money and non-play money in itself can be argued to be a major fallacy observed in the market.

Whether it is the lottery, visiting the pachinko parlor once a month, trading the dollar-yen pair or buying digital assets one clearly does not understand after seeing a couple of well-produced commercials the mentally accounted money towards what cannot be described as anything other than gambling is no different from any other money. Given an intelligent investment strategy, especially at younger ages, any disposable income wasted on such gambles has its losses amplified far beyond the speculators' imagination. The lack of financial literacy and a risk-averse investment tradition effectively precluded such investment strategies has lead the Japanese government to attempt to rectify the problem by introducing various tax-advantages. Arguing that this allocation of funds towards the extreme right end of the barbell is merely a folly is however perhaps equally fallacious.

The fields of behavioral economics and behavioral finance sprung up attempting to explain the phenomena, which at first appear in contrast to the old belief in the *homo economicus* or the *rational man*. If economic actors behave in rational self-interest, why would they opt for what appears to be inferior strategies? If most individual stock pickers[121] underperform the market, why do individual investors still engage in stock picking rather than buying the entire market through an investment fund? If playing pachinko is known to lead to losses, why do supposedly rational actors play pachinko? The answer is the same as to the question of why highly intelligent people choose to become musicians and live modestly rather than studying dentistry and living large: the

119. Rachel Premack, *South Korean Millennials Are Reeling From the Bitcoin Bust*, Web Page, 2018, accessed 30 May 2019, `https://www.theverge.com/2018/4/3/17192886/bitcoin-cryptocurrency-south-korea-millennials`.

120. Fred Imbert, *Here's Who May Be Behind Bitcoin's Wild Surge*, Web Page, 2017, accessed 30 May 2019, `https://www.cnbc.com/2017/12/14/behind-bitcoins-wild-surge-japanese-men.html`.

121. A practice of attempting to identify and buy companies that are trading for cheaper than they should be to achieve returns higher or risk overall lower than that of the overall market.

very act of trading and gambling creates value for the partaker relative to their perceived costs. It is fun.

There is indisputably a subset of the overall clientele of the respective services that has an unhealthy relationship with all of the above services, but the entertainment factors offered by all of the above activities cannot be denied. Traditional gambling does not need to be explained. Many watch sports or play video games, which pachinko and pachislot shares a great many similarities with. It is not much of a stretch to argue that all that money does is raise the stakes and make the already exciting activity of cheering for a desired outcome more meaningful, be that a horse running faster, a metal ball going in the desired direction or the exchange pair moving where one predicted it would. These activities are furthermore augmented by audiovisual feedback and in some cases group dynamics, such as the blinking of the pachinko machines, the cheers of the public at a race and the feeling of camaraderie in online group chat centered around Forex trading.

This is quite different from investing. Even stock picking for value or momentum investing, which constitutes the active side of investing, often has time horizons of several years to see if one's prediction had been correct. On the passive side, investing in index funds involves no skill whatsoever and the only thing the investor is required to do is to not liquidate their portfolio during stages of high market volatility. Ideally, the process should involve no excitement at all, whereby a Utopian portfolio is one yielding more than anything else, having no volatility and no risk.

Perhaps more so than any of the previous instruments, Bitcoin presented a perfect opportunity to gamify these very aspects of investing. Being the de facto standard and the cryptocurrency that the overall market correlated with, bitcoin presented what appeared to be a high-speed version of fund investing. Whereas equities could leave one with the hope of doubling one's original investment approximately every number years at the cost of market noise and an occasional bear market, Bitcoin accelerated this process with significantly higher returns and losses per unit of time as well as much more impressive bull and bears markets. Removing the risk of losing one's investment through a margin call made it a considerably more attractive proposition than just betting one's savings on a highly leveraged Forex position. For those seeking the fun of stock picking, the plentiful market of altcoins provided an opportunity to conduct what could be best described as "coin research" and investing in those coins that seemed to have the best development team behind them. Even initial public offering investing, which is typically outside of the domain of retail investors, became possible with the deluge of initial coin offerings throughout the year of 2017. Similarly to studying a prospectus for an IPO, investors could read the white papers of individual projects and buy their coins on a first-come-first-served basis in hopes of selling them at a higher price later. There would be a

project claiming to implement a purely automatic exchange the profits of which would be redistributed to the coin holders, another offering an online advertising platform, yet another to reward authors of online blogs and so forth. For those feeling overburdened with all of the above, just buying and holding bitcoin would be sufficient as any spike in popularity of the altcoins would inevitably bring more participants to the mother of them all.

At last, there remains the question of why these practices were so prevalent in Japan. Although it would be elegant to give one striking answer that unravels this puzzle, in truth, it appears that all of the above contributed to the propensity of a certain demographic to engage in such gambles and by extension be one of the major groups to join the latest major financial gamble that was cryptocurrency. There is little doubt that practical considerations, such as using it as a payment method, were unlikely to be the main reason for Bitcoin's ascent. Conversely, the 2017 regulations and advertisement campaigns gave an air of legitimacy to the new market, which is perhaps the major comparative distinction between Japan and other markets. Yet it would not be enough to limit the cause to those two factors alone, as Bitcoin's very nature appealed to the same basic principles that made various forms of gambling and speculative trading so appealing to certain demographics. Why all three—that is gambling, Forex, and Bitcoin—make up for such a considerable part of what is, in essence, the everyday portfolio is a different question.

This author does not believe that the answer lies in low interest rates or the poor performance of the Japanese stock market, as anyone equipped with even a rudimentary knowledge of personal finance could easily overcome these problems through an allocation to world markets for growth and Japanese inflation-protected bonds as a hedge, paving the way to assume that the primary issue may be a lack of financial literacy and a lack of the investing tradition that leads to deficiencies in the former. An assertion that the lack of investment, yet a high propensity of speculative trading, is caused by a kind of mass fearfulness as a result of the losses incurred during the bursting of the asset price bubble appears equally unlikely as the investor behavior has not seen substantial changes from the pre-Lost Decade period, save for the transfer of term deposits to cash and the emergence of Forex trading, which was previously impossible both due to the lack of Internet trading platforms and the necessary regulation. Given the recent government initiatives and the advertising thereof by the brokerage houses themselves, perhaps this state of affairs will begin to shift in the foreseeable future.

At present, the main cause of Bitcoin's success was the illusory barbell strategy. Neither cryptocurrencies nor Forex or pachinko were ever a replacement for the previously nominally high-interest rates on term deposits and the two issues are thus entirely sep-

arate from the perspective of perception. The bulk of the savings remains allocated to risk-free assets and assets that are incorrectly believed to be low-risk, such as life insurances, personal housing, and principal-protected securities. This perception is incorrect, but it provides a subjective feeling of safety that dominates the Japanese retail investment landscape. The second end of the bar that only appeals to a certain demographic is not an extension of the overall portfolio but rather occupies an entirely separate space and is characterized by a large number of small speculative bets. Whereas the safe portion has been created through decades of education that appears to have not stood the test of time, this second portion rather draws on solitary gambling experiences offering momentary gratification that appear to have existed prior to the collapse of the asset price bubble but were magnified by it and branched out into new fields as more opportunities presented themselves. Forex was the one examined in this research as it appears to be that shares the most similarities with bitcoin investing: it can lead to fast returns, it is something one does on their own and it has a mythology woven around it convincing the participants that they can win a zero-sum game. Rather than replacing Forex, Bitcoin had merely found a home where it could flourish.

Conclusion

Throughout this research, the topics of Bitcoin and the Japanese retail investor have been thematized. A precursory examination could lead one to believe that the two would mix like oil and water.

Bitcoin had appeared from a lengthy tradition of activist software developers, whose particular distrust of central authorities had lead them to propagate ideas and software that would enable even those with minimal technical skills to evade the surveying eye of the nebulous governmental authorities. At first, this was achieved by allowing for private communication, then through the creation of the Tor network that allowed anonymized access to websites located on the ominous dark web and finally through the creation of a truly digital currency that existed purely on the Internet itself. This final piece of the puzzle had emerged during a period of economic unrest when the future of the financial system itself was shrouded in uncertainty. Appearing seemingly from nowhere and developed by an anonymous coder the first cryptocurrency appears to have been the amalgamation of the cypherpunk's ideals and was, as predicted by its author, indeed of interesting to individuals of a libertarian set of mind.

With its immense freedoms both from regulations and banking institutions, Bitcoin had also brought a series of drawbacks that had either not existed previously or had been eradicated as the world's monetary and financial systems matured. If one were to look at Bitcoin like one would look at any other tool, this new creation had two major purposes being that of a means of payment and that of an investment commodity. While the cryptocurrency did not and still does not satisfy the conditions that would qualify it as money, there is nevertheless no argument to be made that it cannot be used to execute payments either in person or remotely, while its investment commodity function allowed for the typical financial operations associated with the asset class be it speculation, hedging or arbitrage. As with most other tools, this dual purpose of Bitcoin was also what made it less than ideal as either a means of payment or an investment commodity. It is slow and cumbersome, requiring multiple steps for individuals living in the world of national currencies to move the money accepted by most vendors from one place to money accepted by most vendors in another place. Conversely, it is also

not ideally suitable as an investment commodity precisely because of its digital and irreversible nature.

Yet nonetheless, Bitcoin can be argued to have been a major success as far as electronic cash goes. This appears to have had little to do with the ideology behind the project, but rather in that it allowed one to speculate on an unregulated asset that could be obtained with little more than a credit card number or even by merely running a freely downloadable program on one's home computer. Whereas previous electronic cash attempts were on a budget and under time constraints, Bitcoin had no milestones to meet and no lack of adoption to worry about, the latter of which remains lackluster even after Bitcoin became known to almost everyone. This is not to say that Bitcoin had been used exclusively for the purposes of speculating as it has indeed allowed even the most controversial figures to continue receiving funding for the campaigns. It had also contributed significantly to the proliferation of various criminal enterprises from trafficking to malware. This later side effect had not been a surprise to the movement behind the cryptocurrency, as the use of cryptography for nefarious purposes had already been accepted by cypherpunks in the early 1990s and thus well before Bitcoin came into being.

It thus may appear odd that Japan as a nation known for its risk-averse practices would surface in the financial press as the biggest trader of Bitcoin during its most prominent rally to date. The Japanese markets had seen the share of equities owned by the households gradually dwindle throughout the immediate postwar and the rapid growth periods, while postal office deposits and investments into life insurance plans had enjoyed a globally unprecedented success. Promoted by the government and supported by citizen educators, the Japanese saver had become the very embodiment of the term as the asset allocation remained firmly low-risk. This system of relative complacency had come to an end when the asset price bubble burst and the interest rates began their slow descent towards zero. As the Lost Decade trudged along and the general malaise of the tightly regulated Japanese financial system did not seem to dissipate, the government finally embarked on a major series of liberalization reforms one of the consequences of which had been the emergence of the Japanese Forex trader. Despite the incentives in the shape of pension and savings accounts put into place, the financial asset allocation of the Japanese saver firmly remains in cash and life insurances with the overall asset allocation showing a high allocation towards personal homes even in comparison to the United States. Even in the cases when the savers had been convinced to purchase risk assets as part of their defined contribution plans, the measurable lack of financial literacy presently leads to a disproportionately high allocation to principal-protected securities not only among the individuals close to retirement but also those still in the early stages of their careers. This state of affairs does not appear to be caused by any of the existing factors

such as the investment environment for retail investors appears to be very favorable with a wide range of inexpensive and readily available products in services. Rather, it appears to be a lasting effect of perhaps not so much the lack of the investment tradition into risk assets but rather the presence of path dependence to keep one's savings as risk-free cash and bank deposits. While the participation in life insurance and a greater degree of financial education among the younger generation bears a possibility of greater risk asset participation in the future, Japanese retail investors in aggregate remain extremely risk-averse even in comparison to already risk-averse nations such as Germany, thus making Japan an odd country to become the greatest trader of an asset that the world's leading financiers advised to avoid like plague.

The reasons why Bitcoin reached such prominence in Japan appear to be manyfold and largely disconnected from the low-risk investment behavior save for the encouragement of foolhardy behaviors being augmented by the low financial literacy. The most mundane of these is that Japan had only reached its status and entered the headlines of the global press because Chinese financial authorities had wiped the trading emerging from the People's Republic off the map in what appears to be an attempt to crack down on the evasion of capital controls. Such claims nonetheless only obscure the picture as the Japanese trading volume had already been substantial prior to the Chinese inspections and had begun gathering momentum at increased rates from spring onwards. This can be linked to two strongly intertwined causes.

While Japanese savers indeed continue to keep their savings as cash at the bank or not uncommonly at home in a drawer, there is a particular demographic that appears to be attracted to high-risk behavior with a high likelihood of total loss of invested capital. This group generally consists of men who are salaried workers in their thirties and forties. In this research, the two specific types examined were traditional gambling, the most prominent example of which is pachinko, and foreign exchange margin trading. Although the latter had not been investigated by clinicians until recently as a manifestation of gambling and the former is typically not examined in financial literature, both of these activities manifest themselves in Japan notably when compared to its European and American counterparts. Whereas the prolific spending on gambling and the archipelago's fascination with lotteries remain a phenomenon that is mostly of domestic interest, margin traders had by now led to the creation of a vastly disconnected from reality image of the Forex trading housewife Mrs. Watanabe. The noted similarity between gamblers and margin traders lies not only in the demographics engaging in the behavior but also in their most prominent qualities: availability, solitude, momentary audiovisual feedback, and quick gratification. It is this part of the society that made Bitcoin possible.

It would nonetheless paint an incomplete picture to say that Bitcoin merely had

found its niche in Japan. Before the cryptocurrency's growth exploded, it had to be prepared for Japan. This involved several developments the most pivotal of which had been the Japanese government's decision to regulate Bitcoin and clarify its legal status. Whereas the asset had been still mostly a novelty in many other jurisdictions, it was the Japanese authorities that had to deal with the aftermath of Mt. Gox's unfortunate demise and nearly a half-billion dollars simply disappearing from bitcoin owners both domestic and foreign. Rules on protection of the clients' funds had been put in place, bitcoin were no longer subject to the consumption tax and the members of the industry were allowed to create self-regulatory organizations. This legitimized the Japanese exchanges similarly to the legitimization of the Forex brokers in the early 2000s. Not only that, but one of the exchanges had also found a financial ready to insure it against the losses of cryptocurrencies caused by inevitable cyberattacks. The final stroke of the brush was laid with the appearance of the Bitcoin advertisements on the Japanese television, in print and online, wherein some of the nation's best-known celebrities had in one way or another given face to an asset the very technical nature of which puts it well beyond the reach of the popular understanding.

Whilst the originators of Bitcoin were enamored with its ability to be used as a means of payment or to distance oneself from the banking sector, both of these properties appeared not only irrelevant but were largely transformed to their polar opposite as Bitcoin rose to popularity. While keeping one's own savings at home as cash indeed appears to be something practiced to a significant degree in Japan, the reasons behind it being what appears to be an attempt to avoid taxation and an irrational fear of the collapse of the banking sector, yet not the currency itself, do not seem to align with the purchase of bitcoin. The electronic payments, on the other hand, is something that Japan appears to be in a particularly difficult relationship with, whereby the number of competing electronic payment systems is abundant and the desire to use them absent. The exchange bitFlyer had attempted to advance itself as one such payment system and succeeded in securing several prominent partners, but, given the transaction share data, it does not appear that the Bitcoin popularity was caused by this particular use case. The transactions on terminals themselves strongly hint at having been largely performed through the provider's own network and without utilizing Bitcoin's blockchain, which in some cases led to wallets of other firms not working on their competitor's terminal.

What appears to have been deemed necessary for Bitcoin's success in Japan had been this legitimization of the cryptocurrency and the invocation of trust. Whereas its originators sought to create a global, bankless currency that would take away the power from the governments and the banks and create a trustless system with no central authorities, Bitcoin in Japan had been precisely about trust and was vastly advertised by

quasi-banking institutions using the same celebrities and the same techniques of jiggles and comedy that appear in advertisements of any other product. This push into the masses had begun a process of slowly dislodging Bitcoin's previous core demographic of young people with a trend towards the same established target group that typically became Forex trader. This trend remained nothing but a trend as the sudden depreciation of the cryptocurrency in December 2017 appears to have promptly eroded whatever interest there remained at that point with the price of bitcoin remaining well beneath its peak price as of the conclusion of the Heisei Era.

Mrs. Watanabe's curiosity had subsided for now.

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