Incentive Contracts for Politicians

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Verena Liessem
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Vorwort

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Verena Liessem

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Chapter 1

Introduction

1.1 Issues

In liberal democracies, free and anonymous elections are the fundamental mechanisms causing incumbents to be accountable. While in many parts of the world people desire or even fight to have the right to vote,[1] countries more experienced in democratic procedures seem to display a certain tiredness with elections and politics, which manifests itself in constantly decreasing voter participation.

One of the main causes for this tiredness may be that elections are perceived to have shortcomings in guaranteeing accountability. Indeed it is widely recognized that democracy may lead to inefficiencies.[2] As the literature on electoral accountability[3] initiated by Barro (1973) and Ferejohn (1986) and extended by Persson, Roland, and Tabellini (1997) points out, elections can control political behavior to a certain extent if voting behavior is retrospective, since the possibility of reelection induces self-interested politicians to act in the interests of the electorate. However, the potential of elections for making politicians accountable is diminished if there are information asymmetries between politicians and voters, and/or aspects other than past performance influence reelection chances, for example, the leadership and communication skills of the incumbent, or the perceived competence of a competitor. We call this multi-factor voting.

This poses the question whether there are supplementary mechanisms that could en-

[1]Examples are the fall of the wall in the German Democratic Republic 1989, or the end of the apartheid regime in South Africa.

[2]For surveys, see Drazen (2000) and Persson and Tabellini (2000).

[3]For a survey of the political science literature on accountability, see Przeworski, Stokes, and Manin (1999).

hance the accountability of politicians without impairing the principle of free and anonymous elections as an expression of the free will and power of the people. In this thesis, we consider such additional mechanisms in the form of incentive contracts for politicians, i.e., contracts that make the utility of a politician dependent on his behavior in office.[4]

Specifically, we consider two forms of such incentive contracts. First, following Gersbach (2002) and Gersbach (2000), who introduced these contracts as a way of solving the under-investment problem for projects with long-term beneficial consequences by making the politician's future utility dependent on future developments, we design monetary incentive contracts that become effective upon reelection to motivate politicians who face a bundle of projects with short-term consequences. We will label the parts of the thesis that deal with such contracts *"monetary incentive contracts"*.

Second, thresholds for reelection mean that a politician should only have the right to stand for reelection if he has fulfilled certain requirements during his term of office. Such contracts increase the relationship between past performance and reelection chances if there is multi-factor voting. A reelection threshold contract is equivalent to a conditional and self-imposed term limit. Thus, it does not diminish the scope of the fundamental liberal principle of free and anonymous elections.[5],[6] We will label the parts of the thesis dealing with such contracts *"reelection threshold contracts"*.

[4]While in this thesis we combine incentive contracts for politicians with the democratic requirements of free and anonymous elections, there is a rapidly growing literature on incentive contracts for central bankers where democratic requirements play no role. This was initiated by Walsh (1995a), Walsh (1995b), and developed by Persson and Tabellini (1993), Lockwood (1997), Svensson (1997), and Jensen (1997). Moreover, there is an abundant literature on incentive contracts in organizations.

[5]For comprehensive discussion of constitutional and unconditional term limits, see Carey, Niemi, and Powell (2000), Dick and Lott (1993), and Petracca (1992). For dynamic models of the relative performance of term limits, see Akemann and Kanczuk (1999).

[6]While we are aware of the discussion on whether term limits are compatible with democratic requirements, the reelection threshold contract is a self-imposed term limit and thus in our view does not diminish the democratic rights of a politician.

1.2 The Structure of the Thesis

1.2.1 Monetary Incentive Contracts

Incentive Contracts for Politicians with Multi-Task Problems (Chapter 2)

The thesis is organized as follows. In chapter 2 we examine whether monetary incentive contracts are a suitable supplementary instrument to induce a politician to act in the interest of voters when he is working on projects with short-term consequences.[7] In particular, we design such contracts for the cases where a politician faces a multi-task problem, i.e., has to expend effort on more than one task.

We present a model in which an elected politician has to expend effort on two tasks, both of which create benefits for the public. Whereas the benefits of effort on the one task (say unemployment) can be observed by the public, the benefits of effort on the other task (say reformation of the judiciary system) are only observable with noise. Based on its benefit observations, the public makes its reelection decision. We consider two scenarios. First, elections are the only incentive mechanism used by the public. In the second scenario, we combine the election mechanism with a monetary incentive contract.

The model shows that even if voters behave retrospectively under the election mechanism, a large information asymmetry between voters and politician, i.e., a noisy benefit observation, leads to an under-investment (over-investment) of effort in the task whose benefits are noisy (fully observable) from a socially optimal viewpoint. We introduce monetary incentive contracts that are effective upon reelection and reward the politician if he has reached a certain benefit level for the task with the noisy signal. Then the politician has a higher incentive to expend effort on this task. Together with the reelection mechanism the under-investment problem disappears.

Thus, the model suggests that politicians should be rewarded specifically for expending effort on tasks whose benefit signals are noisy, like, for example, a reform of the health-care system or of the judiciary system. Although we work with monetary incentives, the extra reward could also be increased social prestige.

In contrast to chapter 2, we assume for the remainder of the thesis that there is multi-

[7] This chapter is partly based on Gersbach and Liessem (2000).

factor voting involving both retrospective and prospective elements.

1.2.2 Reelection Threshold Contracts

Reelection Threshold Contracts (Chapter 3)

In chapter 3 we introduce reelection threshold contracts.[8] We present a model in which an elected politician who is motivated by holding office expends effort on one task. Expending effort incurs costs for the politician and creates benefits for the public. The benefits are only observable with noise. Based on the benefit signal, the voters take their reelection decision. However, there is multi-factor voting, i.e., there are also other factors, such as the emergence of a new competitor or changes in the preferences of voters, and these influence the voting outcome.

The model shows that multi-factor voting leads to a socially undesirable outcome under the election mechanism as high benefit levels are not rewarded sufficiently with high reelection probability and low benefit levels are not punished sufficiently with low reelection probability. As a consequence, the politician does not expend effort to an extent that is socially desirable.

We next allow an independent institution to introduce a reelection threshold contract that prescribes a certain benefit level which the incumbent must reach in order to have the right to stand for reelection.[9] Examples for such a contract could be the statement by the former US president George Bush "Read my lips, no new taxes", or the announcement by the German chancellor Schröder in 1998 that he would lower unemployment levels to 3.5 mil. in 2002. Under a reelection threshold contract, neither politician would have had the right to stand for reelection if they had acted as they did.

We suggest that the reelection threshold contract alleviates some of the difficulties posed by multi-factor voting. The reason is that low benefit levels are severely punished, as the contract then prohibits reelection. As a consequence, the incentives to expend effort can be substantially increased. In a nutshell, "Read my lips" will turn into "Read my contract". However, in general, the effort will not reach the social optimum, as the reelection threshold contract can only punish low effort but not provide sufficient

[8] This chapter is partly based on Gersbach and Liessem (2001).

[9] We also analyze the case where politicians themselves offer the contracts during the campaign.

rewards for high effort.

Reelection Threshold Contracts with Heterogeneous Voters (Chapter 4)

In chapter 4 we extend the analysis of reelection threshold contracts and incorporate them in a political game with heterogeneous voters and unknown policy preferences on the part of the candidates. We consider a model in which two political candidates from two parties campaigning for office have policy preferences that can only be imperfectly assessed. The median voter is decisive. Once in office, the elected candidate decides on a fully observable policy. The voters cast their reelection vote based on the observed policy, but voting is additionally influenced by other factors.

We first consider the case in which only elections are used. There exists a fully separating equilibrium which is not socially optimal. Since a deviation from the median voter's preferred policy is not severely punished, the politician has an incentive to indulge in his own political preferences.

In the next step, we introduce reelection threshold contracts. These contracts are designed as follows. During the campaign for the first term the candidates announce a policy range. If the elected candidate does not choose a policy from the range announced he does not have the right to stand for reelection.

We show that a pooling of reelection threshold contract announcements exists. All types of candidate from one party offer precisely the same contract, namely the one that maximizes the expected utility of the median voter from voting for a candidate of their party. In contrast, there exists a fully separating equilibrium when candidates are elected and decide on policies. As there was pooling at the announcement stage, some types of politician might be better off by not matching the contract and indulging in their own preferences. This is a potential drawback of the reelection threshold contract, because these types no longer have any incentive to move toward the policy preferred by the median voter. However, the countervailing effect is that politicians who are better off matching the contract may have to choose a policy closer to the median voter's preferred policy than under the election mechanism. We show that from an ex ante point of view a reelection threshold contract increases social welfare.

Reelection Threshold Contracts and the Information Efficiency of a Democracy (Chapter 5)

This chapter concludes the theoretical analysis of reelection threshold contracts. We examine whether such contracts are suitable for increasing the information efficiency of a democracy in a campaign model with two political candidates. Once in office, the elected candidate is faced with the implementation of a reform project which requires passing a new law that is a priori unknown. The candidates have the possibility to acquire information about this law before the election takes place. The search is costly.

During the campaign, the candidates can make law announcements for the implementation of the reform project which are not verifiable. Entrepreneurs decide whether or not to base their investment decisions on these law announcements. If they invest on the basis of a law announcement and the candidate has gathered information, i.e., the law announcement is appropriate, the development of the country is favorable. In the reelection decision there is multi-factor voting, hence poor performance of the country is only punished to a certain extent.

Under the election mechanism, a candidate will only invest in information acquisition if the costs of this information are compensated by a sufficient increase in reelection probability. Furthermore, the probability that the candidate has acquired the information must be high enough for entrepreneurs to base their decisions on the law announced.

Introducing reelection threshold contracts forces candidates to announce a proposal for a law during the campaign. If the elected candidate fails to implement the law announced, he does not have the right to stand for reelection. As a consequence, the contract increases the incentives for information-gathering, as passiveness is severely punished. This, in turn, increases the credibility of law announcements and makes entrepreneurs more willing to invest. However, a potential drawback of the reelection threshold contract is that once in office an elected candidate may not undertake the reform if he cannot fulfill his contract.

Whether or not the reelection threshold contract increases social welfare depends on the extent to which the credibility of law announcements is increased and also on how important early investment is for the performance of the country.

1.2.3 Summary

The thesis fathoms the potentials of incentive contracts in politics. Although there are a number of conceivable practical issues, it appears that such contracts are welfare-enhancing. Lastly, and most importantly, the introduction of such contracts depends on the willingness of politicians to impose self-constraints.

Chapter 2

Incentive Contracts for Politicians With Multi-Task Problems

2.1 Introduction

Politicians in the executive branch have many tasks. They are called upon to design tax schemes, fight crime and unemployment, design public education and health systems, be responsible for national defense, etc. Democratic societies use elections and reelections to try to motivate politicians to choose an expenditure of effort in accordance with the desire of voters. This makes for a difficult motivation problem, because the outcomes of tasks may be difficult to measure and observe. Whereas the consequences of fighting unemployment or the consequences of fighting crime can be derived from a time series of a single number,[1] the outcome of a reform of the health-care system is long-term and not measurable in simple figures or with any high degree of precision.

In this chapter, we first examine how the democratic election mechanism works for the multi-task problems faced by politicians given that the outcomes of some tasks are measurable with a high degree of precision while others defy any really accurate assessment. Second, we combine incentive contracts for the politician and elections to improve the functioning of democracies. We show that it is beneficial to add an incentive contract to which the politician must agree in order to stand for reelection, even if all possible information about the performance of the politician is available to voters at election date.

[1]Even for unemployment there are considerable definitional problems and real changes in unemployment can be obscured by using different definitions.

We develop our argument by considering the model of an elected politician facing a multi-task problem. The politician exerts effort on two tasks creating benefits for the public. While the benefit of the effort exerted in the one task is perfectly observable, all voters perceive about the benefits from his efforts in connection with the other task is a considerable amount of "hot air." At the end of the first period, the politician stands for reelection. The voters decide on reelection by implementing a reelection scheme that depends on the observed signals or efforts. The politician's efforts incur costs for him and he receives a fixed wage for each period he stays in office. We first investigate whether reelections alone are able to implement the social optimum. Later we supplement the reelection mechanism by an incentive contract in which the second-period wage is made flexible subject to a budget constraint.

Our main results are as follows: First, elections cannot provide sufficient incentives to implement the socially optimal solution when the benefit signals from a politician's efforts for a particular task are sufficiently noisy. The noise creates a distortion in effort allocation across tasks in the sense that the politician exerts more effort on the less noisy task and less effort on the noisy task. Even if the public can commit itself to a reelection scheme, the politician has an incentive to lower effort in the noisy task, since a higher level of effort has comparatively little impact on his reelection chances, while the costs accrue fully to him. As the public takes this effect into account and can observe the effort expended on the other task, the reelection scheme can induce a higher level of effort for the task without measurement problems. However, the result is an inefficient allocation of effort.

Second, we show that the combination of elections and a monetary incentive contract for the politician leads to the socially optimal solution despite the politician facing a multi-task problem. An incentive contract stipulates wages in the first and second period subject to a budget constraint. The optimal incentive contract involves zero first-period wages and high second-period wages.[2] Together with a reelection scheme that makes the reelection of the politician uncertain and thus lowers expected wage payments, the budget constraint can be fulfilled.

[2]Political science and the existing political economy models make the implicit assumption that being a politician is an attractive job because of perks associated with political office as most extensively discussed in the rent-seeking literature (e.g. Buchanan, Tollison, and Tullock (1980)). In all of these models, however, exerting effort for particular tasks or across different tasks is not a problem. We show how wages need to be determined in the first and second term in order to give the politician the best incentives to do a good job.

The combination (or hierarchy) of incentive contracts and reelection schemes eliminates distortion in effort allocation because the marginal benefit from exerting a unit of effort can be increased by paying a higher second-period wage and the lower reelection probability helps to satisfy the budget constraint but does not lower marginal benefits from making efforts. The incentive contract is self-financing and helps to solve the inefficiencies of the election mechanism, although the public does not have any more information about the politician's performance than it would under the scenario with elections alone.

Subsequently, we extend our analysis to wage caps on the remunerations of politicians and the inability of voters to commit themselves to a particular reelection scheme. We explore how the hierarchy of incentive contracts and elections can be used under such circumstances. In the latter case, we show that the first-best solution can be reached but self-financing of incentive contracts cannot be guaranteed anymore.

This chapter is related to the multi-task theory outlined in Holmström and Milgrom (1991) and to Dewatripont and Tirole (1999), who discussed the problem in politics. Holmström and Milgrom (1991) show that measurement problems for particular tasks create severe constraints for the use of incentive elements in multi-task environments. This chapter shows that while democratic elections have the same problems, the combination of elections and incentive contracts allow first-best allocations to be implemented even if both mechanisms are subject to the same informational constraints.

The chapter is organized as follows: In the next section we outline the model and our assumptions. In section 2.3, we identify the first-best solution. In section 2.4, we consider the potential and the limitations of the reelection mechanism in achieving the optimal solution. In section 2.5, we show that the combination of incentive contracts and reelection mechanism yields the social optimum. In section 2.6, we explore the robustness of our results with respect to wage caps and the inability of voters to commit to a reelection scheme. In section 2.7, we discuss some practical issues of implementing monetary incentive contracts in politics. Section 2.8 presents our conclusions.

2.2 The Model

We consider the voters' problem of trying to motivate an elected politician. The voters and the politician are assumed to be risk-neutral. There are two periods involved. In the first period, the incumbent has to allocate his efforts among two tasks. Let task 1 be the reform of the judiciary system and task 2 be the reduction of unemployment for example. The politician exerts effort e_1 on task 1 and effort e_2 on task 2 in period 1. The effort e_i on task i creates benefits B_i for the public; i indicates the task. The benefits from the efforts manifest themselves in the first period.[3] We assume

$$B_i = e_i. \tag{2.1}$$

The voters cannot observe B_i directly; instead, they receive signals b_i about the benefits. In practice, the noise distorting the signals can be low or high. For example, if the politician invests his effort in the reduction of unemployment, the results at a particular time can be observed precisely by looking at the unemployment figures. Suppose, however, that the government reforms an inefficient judiciary system. This may provide utility gains over the next periods, but is very difficult to measure because benefits may be widespread and not identifiable in simple quantitative terms. In such cases, the benefit signals can be very noisy. To model this situation, we assume the benefit signal of task 1 to be noisy and the benefit signal of task 2 to be perfectly informative.

With these assumptions, the benefit signals are given as:

$$b_1 = e_1 + \epsilon_1, \tag{2.2}$$

$$b_2 = e_2. \tag{2.3}$$

The factor ϵ_1 is a random variable assumed to be equally distributed on $[-a, a]$ with density function

$$f(\epsilon_1) = \frac{1}{2a}$$

and distribution function

$$F(\epsilon_1) = \frac{\epsilon_1 + a}{2a}$$

for $\epsilon_1 \in [-a, a]$. Factor a represents the noise of the benefit signal.

[3]Additional benefits may also materialize in the second period, but this has no bearing on the functioning of our model.

The expected utility for the public is denoted by U^P and given as:

$$U^P = E(B_1 \mid b_1) + E(B_2 \mid b_2). \tag{2.4}$$

E is the expectation about the benefits, evaluated after the benefit signal b_i has been perceived. Given our assumption that the benefit signal of task 2 is perfectly informative and that the benefit signal b_1 is determined by $b_1 = B_1 + \epsilon_1$, and thus $E(B_1 \mid b_1) = b_1$, we can write

$$U^P = b_1 + B_2. \tag{2.5}$$

An alternative interpretation would be that the public does not perceive signals about their benefits, but that the benefits themselves are affected by an external shock. This would model the situation of a politician who, say, exerts efforts on a labor market reform, but the benefits of the effort are affected by macroeconomic shocks. In this case, the utility function is given by

$$U^P = b_1 + b_2.$$

b_i now stands for the benefits for the public. Our results are valid for both perspectives on how noise makes it impossible for voters to precisely infer the efforts of the politician. We will work with the first interpretation.

The voters make their reelection decision dependent on their expected utility and therefore on the observed signals. In order to give the reelection mechanism the best chance to motivate the politician, we assume that the voters offer a reelection scheme $p(b_1, b_2)$ to the politician at the beginning of the first period and that they are able to commit themselves to it.[4] $p(b_1, b_2)$ is the probability that the politician will be reelected if the benefit signals b_1 and b_2 have been realized.

The utility of the politician is given by

$$U^A(b_1, b_2, e_1, e_2) = W_1 + q\{(e_1, e_2) \mid p(b_1, b_2)\}W_2 - C(e_1, e_2). \tag{2.6}$$

W_1 denotes the utility of the office in period 1, W_2 the utility of the office in period 2 and $C(e_1, e_2)$ the cost of exerting the efforts. We assume that there is no discounting.[5]

[4] This assumption may be appropriate when all politicians are equal in terms of their cost and utility functions. Then the commitment of the voters to their reelection probability scheme may be credible. However, the commitment assumption mainly serves as a benchmark for our investigation.

[5] Discounting could be easily introduced in our model but would not change any of our results.

The utility from holding office may include monetary benefits, such as a fixed wage, and non-monetary benefits, such as prestige or image. We assume that the utility of the office in both periods is equal and therefore that

$$W_1 = W_2. \tag{2.7}$$

$q\{(e_1, e_2) \mid (p(b_1, b_2)\}$ denotes the politician's expected reelection probability if he exerts the effort levels e_1, e_2 and the reelection scheme $p(b_1, b_2)$ is applied. To keep the following simple, we denote the expected reelection probability by $q(e_1, e_2)$. Then the overall expected utility of office in period 2 is given by $q(e_1, e_2)W_2$. The utility W_1 from the office in the first period is already given and therefore sunk. Thus, it will be neglected in the subsequent analysis. Then, the utility function takes the form:

$$U^A(b_1, b_2, e_1, e_2) = q(e_1, e_2)W_2 - C(e_1, e_2). \tag{2.8}$$

Given the utility function of the politician, the participation constraint (PC) amounts to

$$q(e_1, e_2)W_2 - C(e_1, e_2) \geq 0, \tag{2.9}$$

where the value of the outside option has been normalized to zero. Note that the PC requires that the politician is better off by standing for reelection than by simply finishing his term and renouncing efforts on both tasks. The politician chooses effort levels to maximize his utility, which is the incentive constraint (IC) voters face. Thus, the IC is given as:

$$(e_1, e_2) = \arg\max_{e_1, e_2} \{q(e_1, e_2)W_2 - C(e_1, e_2)\}. \tag{2.10}$$

In order to break ties, we assume that a politician who has no preference between different actions will choose those which yield the highest utility for the voters.

The costs $C(e_1, e_2)$ of the agent are assumed to be convex and given as follows:

$$C(e_1, e_2) = (c_1 e_1)^2 + (c_2 e_2)^2. \tag{2.11}$$

Factor c_i can be interpreted in two ways. Either it measures the agent's reluctance to provide the effort e_i, or it could be interpreted as the competency of the politician, with small c_i meaning high competency, i.e., achieving a certain benefit level does not require much cost from the politician. Throughout this chapter we assume that the cost function of all politicians is equal.

At the end of the first period, the benefits for the public and the politician are realized. The public observes the benefit signals b_1, b_2 and the reelection decision takes place.

The overall game is summarized as follows:

Stage 1: The voters commit themselves to a reelection scheme based on the observed benefit signals at the end of period 1.

Stage 2: The politician allocates his efforts among the tasks.

Stage 3: The benefits from all activities by the politician are realized. The public observes the benefit signals b_1, b_2 and executes its reelection scheme.

2.3 First-Best Solution

We first characterize the first-best solution assuming that the public has perfect information about the agent's efforts and enforces the socially optimal effort levels directly by a contract heavily punishing any deviation. Hence the voters' problem is to maximize their utility subject to the participation constraint of the politician. The participation constraint must be honored by the voters, because otherwise the politician would renounce the contract and leave office. Since voters must take the politician's PC into account, the reelection probability under a first-best solution must be equal to one. Otherwise, the public could demand higher effort levels, thereby still fulfilling the PC by increasing the reelection probability.

The perfect information assumption gives us

$$U^P = B_1 + B_2. \tag{2.12}$$

Hence, the maximization problem is given by

$$\max\{U^P = e_1 + e_2\}, \tag{2.13}$$

$$\begin{aligned} s.t. \quad W_2 - C(e_1, e_2) &\geq 0, \\ e_1, e_2 &\geq 0. \end{aligned}$$

Proposition 2.1

The first-best effort levels are given by

$$e_1^* = \sqrt{\frac{W_2}{c_1^2 + \left(\frac{c_1^2}{c_2}\right)^2}}, \tag{2.14}$$

$$e_2^* = \sqrt{\frac{W_2}{c_2^2 + \left(\frac{c_2^2}{c_1}\right)^2}}. \tag{2.15}$$

Proof of proposition 2.1:

Because the politician's costs are strictly increasing in e_1, e_2, the problem of the voters is given by

$$\max\{U^P = e_1 + e_2\},$$

$$\text{s.t. } W_2 - (c_1 e_1)^2 - (c_2 e_2)^2 = 0,$$

$$e_1, e_2 \geq 0.$$

The Lagrangian function is

$$L = e_1 + e_2 + \lambda\,(W_2 - (c_1 e_1)^2 - (c_2 e_2)^2).$$

The first-order conditions yield

$$e_1 = \frac{c_2^2}{c_1^2} e_2.$$

Using the participation constraint with equality, we obtain e_1^* and e_2^* given by equations (2.14) and (2.15).

■

The first-best effort levels depend on the politician's costs of undertaking the effort level e_i. The more costly an effort is, the less amount of effort the politician should exert in the first-best allocation.

2.4 The Reelection Mechanism

In this section we explore whether and under what conditions the reelection mechanism without incentive contracts is able to implement the first-best solution. We will show that even if the reelection scheme is designed optimally, first-best cannot be achieved if the noise of the benefit signal is significantly high. We use subgame perfect implementation; i.e., we look at reelection schemes and subgame perfect equilibria of the overall game that yield the first-best solution.

We investigate this topic using a threshold reelection scheme defined as

$$p(b_1, b_2) = \begin{cases} 1 & \text{if } b_1 \geq \hat{b}_1 \text{ and } b_2 \geq \hat{b}_2, \\ 0 & \text{otherwise.} \end{cases} \tag{2.16}$$

The politician is reelected with certainty if his benefit signals are above certain threshold levels, denoted by $\hat{b}_1$ and $\hat{b}_2$, where $\hat{b}_1$ and $\hat{b}_2$ are assumed to be greater than zero. If he fails to achieve one or both of the required benefit signals, he will not be reelected.

This reelection scheme has the best chance of motivating the politician, because the marginal benefits of an additional unit of effort are higher than under any other reelection scheme.[6] Accordingly, once the first-best solution is reached, the politician has the lowest incentives to deviate to lower effort levels. Thus, there is no other reelection scheme that yields a better solution, which makes our results valid for all other classes of reelection schemes. To simplify exposition, whenever we use the expression $p(b_1, b_2)$ or $q(e_1, e_2)$, in the following analysis, we will be referring to a threshold reelection scheme.

The expected reelection probability is derived as follows: Because the benefit signal b_2 is perfectly informative, the public can base its reelection scheme directly on the desired effort level e_2, which we denote by $\hat{e}_2 = \hat{b}_2$. This means that if the politician exerts an effort level $e_2 < \hat{e}_2$, his reelection probability is zero, which implies $e_2 \geq \hat{e}_2$ whenever the politician wants a positive reelection probability. Accordingly, the expected reelection probability, denoted by $q(e_1 \mid e_2 \geq \hat{e}_2)$, can be written as:

$$q(e_1 \mid e_2 \geq \hat{e}_2) = \begin{cases} 0 & \text{if } \hat{b}_1 - e_1 > a, \\ 1 - F(\hat{b}_1 - e_1) = 1 - \dfrac{\hat{b}_1 - e_1 + a}{2a} & \text{if } -a \leq \hat{b}_1 - e_1 \leq a, \\ 1 & \text{if } \hat{b}_1 - e_1 < -a. \end{cases}$$

The expected reelection probability is zero if the politician exerts an effort level e_1 that is too low, meaning that the threshold signal can never be reached. The expected reelection probability is $1 - F(\hat{b}_1 - e_1)$ if the politician exerts an effort level e_1 for

[6]This follows from the observation that for all expected reelection probabilities $\tilde{q}(b_1, b_2)$, the marginal increase in the reelection chance cannot exceed the density of the noise and thus: $\frac{\partial \tilde{q}}{\partial e_1} \mid_{e_1} \leq \frac{1}{2a}$.

which the threshold signal can be achieved with a certain degree of probability. Finally, reelection is certain if the politician chooses an effort level e_1 generating a signal that is definitely above $\hat{b}_1$. We obtain:

Proposition 2.2

Under the threshold reelection scheme $p(b_1, e_2)$ only three choices for effort levels are possible:

(i) $e_1 = 0$, $e_2 = 0$,

(ii) $e_1^{cor} = \hat{b}_1 + a$, $e_2 = \hat{e}_2$ *(corner solution),*

(iii) $e_1^{int} = \frac{1}{4ac_1^2} W_2$, $e_2 = \hat{e}_2$ *(interior solution).*

Proof of proposition 2.2:

The solution $e_1 = 0$, $e_2 = 0$ occurs when reelection probability zero provides the highest utility for the politician. In this case, the politician does not exert any efforts at all, because they would involve costs but no benefits.

The solution

$$e_1 = \hat{b}_1 + a, \quad e_2 = \hat{e}_2$$

occurs if the politician maximizes his utility by certain reelection. A reelection probability of one requires effort levels $e_1 \geq (\hat{b}_1 + a)$ and $e_2 \geq \hat{e}_2$. We call this solution the "corner solution." It is obvious that the politician would never choose effort levels greater than the ones required for certain reelection: effort levels greater than those required would imply higher costs and no additional benefits.

The third solution

$$e_1 = \frac{1}{4ac_1^2} W_2, \quad e_2 = \hat{e}_2$$

occurs if the politician maximizes his utility by choosing his effort level e_1 from the range $-a \leq \hat{b}_1 - e_1 \leq a$. His reelection probability in this case is $1 - F(\hat{b}_1 - e_1)$. The incentive constraint amounts to:

$$(e_1, \hat{e}_2) = \arg\max_{e_1} \{(1 - F(\hat{b}_1 - e_1))W_2 - (c_1 e_1)^2 - (c_2 \hat{e}_2)^2\}.$$

The first-order condition implies

$$f(\hat{b}_1 - e_1)W_2 - 2c_1^2 e_1 = 0,$$

and the politician exerts the efforts

$$e_1 = \frac{1}{4ac_1^2} W_2$$

and $e_2 = \hat{e}_2$. This completes the proof.[7]

■

In the following, we show that the reelection mechanism is able to implement the first-best solution for small values of the noise parameter a, but generates inefficiencies for larger values of a.

Proposition 2.3

If $a \leq \bar{a}$, the threshold scheme

$$p^*(b_1, e_2) = \begin{cases} 1 & \text{if } b_1 \geq b_1^* := e_1^* - a \text{ and } e_2 \geq e_2^*, \\ 0 & \text{otherwise} \end{cases}$$

implements the first-best solution. The critical value $\bar{a}$ is given by

$$\bar{a} = \frac{W_2}{4c_1\sqrt{W_2 - (c_2 e_2^*)^2}}.$$

Proof: see appendix A.

The reasoning of the proposition is simple: if the politician chooses the first-best effort levels e_1^* and e_2^*, his participation constraint is only satisfied by a reelection probability of one. Hence, if the politician chooses the corner solution, the optimal threshold reelection scheme must implement the first-best effort levels. According to proposition 2.2, the required effort level $\hat{e}_2$ is set as e_2^* and the required benefit signal $\hat{b}_1$ is chosen such that the politician will choose e_1^* under the corner solution. Since the first-best effort levels can only be implemented if the politician chooses the corner solution, we have to check whether he has an incentive to deviate to the interior solution. This is the case if the noise of the benefit signal is above a certain threshold. Then the utility loss from having a marginally smaller reelection probability is smaller than the gains through cost reduction and first-best can no longer be implemented.

In the next stage, we determine the threshold reelection scheme which is second-best if $a > \bar{a}$.

[7]Note that the case $e_1 = 0$, $e_2 = \hat{e}_2$ can not occur. Since $\hat{b}_1 > 0$, the reelection probability would be smaller than 1. Then either case (i) or (iii) provide higher utility for the agent.

Proposition 2.4

For $a > \bar{a}$, the second-best reelection scheme is given by

$$p^o(b_1, e_2) = \begin{cases} 1 & \text{if } b_1 \geq b_1^o = \frac{1}{4ac_1^2}W_2 - a \text{ and } e_2 \geq e_2^o = \frac{\sqrt{W_2 - \left(\frac{1}{4ac_1}W_2\right)^2}}{c_2}, \\ 0 & \text{otherwise} \end{cases}$$

with the effort levels

$$e_1^o = e_1^{int} = \frac{1}{4ac_1^2}W_2,$$

and

$$e_2^o = \frac{\sqrt{W_2 - \left(\frac{1}{4ac_1}W_2\right)^2}}{c_2}.$$

Proof: see appendix A.

In the proof we show that there is no threshold reelection scheme implementing for $a > \bar{a}$ an effort level e_1 that is higher than the effort level chosen under the interior solution, because the politician would always deviate. Thus, it is optimal to guarantee the politician certain reelection under e_1^{int}, but to set the required effort level $\hat{e}_2$ as high as possible in order to satisfy the participation constraint.

Obviously, this reelection scheme produces inefficiencies. For $a > \bar{a}$, the effort level e_1^o is smaller than e_1^* and the effort level e_2^o is larger than e_2^*. Hence, there is an inefficient allocation of efforts in favor of the measurable task. For $a < \bar{a}$, the threshold scheme $p^o(b_1, e_2)$ could also be implemented, but this is not desirable, as then the reelection scheme $p^*(b_1, e_2)$ leads to the first-best solution.

The comparative statics of the effort levels chosen under the second best reelection scheme are given as follows

Corollary 2.1

$$(i)\ \frac{\partial e_1^o}{\partial a} < 0, \qquad (iii)\ \lim_{a\to\infty} e_1^o = 0,$$

$$(ii)\ \frac{\partial e_2^o}{\partial a} > 0 \qquad (iv)\ \lim_{a\to\infty} e_2^o = \frac{\sqrt{W_2}}{c_2}.$$

The insights from corollary 2.1 are as follows: First, as the noise of the benefit signal of the first task increases, the marginal benefit of exerting a unit of effort on this task diminishes. This illustrates that less visibility of outcomes in politics (large noise) is associated with less attention or effort by politicians. When noise increases a higher level of effort has comparatively little impact on the politicians reelection chances, while the costs accrue fully to the politician. Second, since the public can choose their reelection scheme optimally, the politician has to increase his effort on the second task which is perfectly observable and where any deviation could be punished by denying reelection. This second effect is captured by (ii). Points (iii) and (iv) illustrate that as the noise on the first task becomes very large, the efforts of the politician will become solely concentrated on the second task.

2.5 Self-Financing Incentive Contracts

In this section, we assume that voters can supplement their reelection scheme by a monetary incentive contract. If he wants to stand for reelection, the politician must accept an incentive contract in the first period stipulating certain wage levels in periods 1 and 2. The incentive contract allows the public to base the politician's utility in the second period on variables observed in the first period. Throughout this section, this is assumed to occur via monetary transfers dependent on the benefit signal achieved. To focus exclusively on the differential impact of monetary transfers, we normalize all other components of the utility to zero, such as the desire to appear competent or statesman-like. Thus, in this section, W_1 and W_2 stand respectively for the additional utility a politician derives from monetary transfers in periods 1 and 2. The governmental actions are constrained by a fixed budget which can be used over two periods for wage payments to politicians in office. Therefore, an incentive contract must be self-financing in the sense that the associated expected wage payments cannot be larger than a fixed amount. We will show that the combination of incentive contracts and elections can implement the first-best solution.

The modified structure of the game is as follows:

Stage 1: The voters commit themselves to a reelection scheme based on the signals observed at the end of period 1.

Stage 2: The politician signs the incentive contract if he wants to stand for reelection.

Stage 3: The politician allocates his efforts among the tasks.

Stage 4: The benefits from all the activities of the politician are realized. The public observes the benefit signals b_1, b_2 and executes its reelection scheme.

The introduction of incentive elements implies that the fixed wages assumed in the previous sections here become variable. Therefore we relax the assumption of fixed and equal wages in each period and instead assume that an overall budget constraint must be fulfilled for the wage expenditures and thus for the incentive contracts.

We use $\bar{W}$ to denote the expected amount paid to the politicians in both periods.[8] The public's budget constraint is:

$$W_1{}^{inc} + q(e_1, e_2)W_2{}^{inc} + (1 - q(e_1, e_2))W_1{}^{inc} = \bar{W}. \tag{2.17}$$

$W_1{}^{inc}$ and $W_2{}^{inc}$ are the wages paid in the first and second periods under the "incentive contract scenario."[9] Note that if the incumbent is not reelected, a new politician is paid according to $W_1{}^{inc}$. The fact that the budget constraint can be formulated in expected terms only rests on the risk neutrality of the government or the public, respectively.

We first examine the optimal wage allocation over the both periods in the first-best solution.

From proposition 2.1, it immediately follows that an increase of the utility of period 2, W_2, leads to higher first-best effort levels e_1^* and e_2^*. Moreover, the first-best solution can be implemented for larger values of a, because $\partial\bar{a}/\partial W_2 > 0$. Accordingly, it is optimal to set $W_2{}^{inc}$ as high as possible and therefore,

$$W_1{}^{inc} = 0, \quad W_2{}^{inc} = \frac{\bar{W}}{q(e_1, e_2)}. \tag{2.18}$$

Equation (2.18) is an optimality condition.[10]

[8]Note that $\bar{W}$ could be determined endogenously as well by stipulating an overall objective function, since our results are valid for arbitrary values of $\bar{W}$.

[9]The superscript "inc" is used throughout the section as indicator for the variables under the incentive contract scenario.

[10]If there is a fixed minimum wage $W_1{}^{inc}$ payable to the politician in the first period or if a new politician can not be paid according to $W_1{}^{inc}$, then the public needs to increase the budget for politicians.

The first-best effort levels were obtained under the assumption that the public could enforce the desired effort levels under the restriction of the participation constraint. The reelection of the politician is certain. Under flexible wages, we therefore obtain

$$e_1^{*inc} = \sqrt{\frac{\bar{W}}{c_1^2 + \left(\frac{c_1^2}{c_2}\right)^2}} \tag{2.19}$$

and

$$e_2^{*inc} = \sqrt{\frac{\bar{W}}{c_2^2 + \left(\frac{c_2^2}{c_1}\right)^2}}. \tag{2.20}$$

Now we examine whether the combination of a threshold reelection scheme $p(b_1, e_2)$ and a variable second-period wage ${W_2}^{inc}$ can implement the first-best solution. We first obtain:

Proposition 2.5

For $a \leq \bar{a}^{inc}$, the threshold reelection scheme

$$p^{*inc}(b_1, e_2) = \begin{cases} 1 & \text{if } b_1 \geq b_1^{*inc} := e_1^{*inc} - a \text{ and } e_2 \geq e_2^{*inc}, \\ 0 & \text{otherwise} \end{cases}$$

and the wage announcement ${W_2}^{inc} = \bar{W}$ lead to the first-best solution. The critical value $\bar{a}^{inc}$ is given by

$$\bar{a}^{inc} = \frac{\bar{W}}{4c_1\sqrt{\bar{W} - (c_2 e_2^{*inc})^2}}.$$

Proposition 2.5 replicates the result in proposition 2.3. If the measurement error, captured by the value a is sufficiently small, the first-best solution can be implemented. The proof follows the same logic as the proof of proposition 2.3 and is therefore omitted here.

Now we investigate whether the combination of threshold schemes and flexible wages can implement the first-best solution for $a > \bar{a}^{inc}$. In contrast to the fixed wage scenario, we obtain:

Proposition 2.6

For $a > \bar{a}^{inc}$, the combination of the wage

$${W_2}^{inc}(a) = 4ac_1\sqrt{\frac{\bar{W}}{1 + \left(\frac{c_1}{c_2}\right)^2}}$$

and the threshold reelection scheme

$$p^{o,inc}(b_1, e_2) = \begin{cases} 1 & \text{if } b_1 \geq b_1^{o,inc} := e_1^{*inc} - \frac{2a\bar{W}}{W_2{}^{inc}} + a \text{ and } e_2 \geq e_2^{*inc}, \\ 0 & \text{otherwise} \end{cases}$$

implements the first-best solution.

Proof of proposition 2.6:

To achieve the first-best solution under $a > \bar{a}^{inc}$, it must hold that:

$$e_1^{o,inc} = e_1^{*inc}.$$

This is equal to the condition

$$\frac{1}{4ac_1^2} W_2{}^{inc} = \sqrt{\frac{\bar{W}}{c_1^2 + \left(\frac{c_1^2}{c_2}\right)^2}},$$

and therefore the second-period wage must fulfill

$$W_2{}^{inc} = 4ac_1 \sqrt{\frac{\bar{W}}{1 + \left(\frac{c_1}{c_2}\right)^2}}.$$

Because of the budget constraint, $W_2{}^{inc}$ must fulfill

$$q(e_1, e_2) W_2{}^{inc} = \bar{W},$$

which imposes a condition on the required benefit signal $b_1^{o,inc}$. This condition amounts to:

$$(1 - F(b_1^{o,inc} - e_1^{*inc})) W_2{}^{inc} = \bar{W},$$

which implies

$$(1 - \frac{b_1^{o,inc} - e_1^{*inc} + a}{2a}) W_2{}^{inc} = \bar{W}.$$

Therefore, the benefit signal is given by:

$$b_1^{o,inc} = e_1^{*inc} - \frac{2a\bar{W}}{W_2{}^{inc}} + a.$$

The budget constraint of the public is satisfied for this signal by construction.

The participation constraint of the politician amounts to

$$(1 - F(b_1^{o,inc} - e_1^{*inc})) W_2{}^{inc} \geq (c_1 e_1^{*inc})^2 + (c_2 \hat{e}_2)^2,$$

which can be rewritten as

$$\bar{W} \geq (c_1 e_1^{*inc})^2 + (c_2 \hat{e}_2)^2.$$

The PC holds with equality if $\hat{e}_2$ is equal to e_2^{*inc}.

Finally, the first-best solution can be implemented if there is a guarantee that the reelection probability under the effort levels e_1^{*inc} and e_2^{*inc} for the given benefit signal $b_1^{o,inc}$ is smaller than one and greater than zero, which is obvious as $b_1^{o,inc} - e_1^{*inc} \leq a$. The reelection probability is smaller than one if

$$b_1^{o,inc} - e_1^{*inc} \geq -a.$$

Inserting $b_1^{o,inc}$ yields the condition

$$\bar{W} \leq W_2{}^{inc}.$$

This condition is satisfied for $a > \bar{a}^{inc}$, since in the inefficient case the effort level under the interior solution is given as $e_1 = 1/(4ac_1^2)\bar{W} \leq e_1^*$ and in order to increase it $W_2{}^{inc} \geq \bar{W}$.[11]

■

Proposition 2.6 is the major result of this chapter. The reasoning for the result runs as follows: To achieve the first-best solution for $a > \bar{a}^{inc}$, the effort level $e_1^{o,inc}$ chosen under the interior solution must be the first-best effort level e_1^*. This yields a condition on $W_2{}^{inc}$. The budget constraint of the public and the participation constraint of the politician are satisfied if the expected wage payment in period 2 is equal to $\bar{W}$. This is the case if $q(e_1, e_2)W_2{}^{inc} = \bar{W}$. The threshold scheme $p^{o,inc}(b_1, e_2)$ satisfies this condition. The incentive contract works because we can enlarge the marginal benefit of a unit of effort by increasing the wage in the second period. In contrast to the second-best reelection scheme in proposition 2.4, the optimal reelection probability is smaller than one, because the budget constraint of the public must be fulfilled. Nevertheless, the smaller reelection probability does not destroy the possibility of creating first-best incentives due to the fact that the marginal return on efforts depends only on the level of second-period wages, not on level of the reelection probability. Clearly, to motivate the politician second-period wages need to be increased. The subtle question

[11]This could be also shown by mathematical derivations.

is: Can effort be increased such that no costs in expected terms arise for the public? It is necessary for the reelection probability to decline and therefore limit the expected costs for voters, if the wages of politicians are to be able to be increased in the second period. The whole point of this chapter is that this decline in reelection chances can be engineered in a way that achieves first-best solutions for multi-task problems.

2.6 Robustness and Non-Commitment

In this section we explore the robustness of our results with respect to the key assumptions of our model. First, we discuss what happens if the budget of the government is limited. Second, we discuss the role of tax distortions. Third, we relax the assumption that the voters can commit themselves to a reelection scheme.

Suppose that the government is restricted in its wage payment for the second period. The limitation of wages could arise because of increasing tax distortions when very high wages should be paid to a politician or due to popular concerns about "excessive" compensation of politicians. As a consequence, the government may not be able to pay ${W_2}^{inc}(a)$ for large values of the noise a and the first-best solution can not be reached. Nevertheless, as e_1^{int} is given as

$$e_1^{int} = \frac{1}{4ac_1^2} W_2,$$

even a small increase of W_2 raises the effort and thus a better solution can be achieved than under the reelection mechanism alone. A shifting of wage payments from the first to the second period and thus a higher second-period wage always has positive effects on effort and welfare. Thus, even if the budget of the government is limited, social welfare can be increased by adding monetary incentive contracts to elections.

A more general alternative to model the budget constraint would be to introduce welfare costs $\lambda(W)W$ of the wages. $\lambda(W)$ could for example measure the tax distortion. Since all decisions take place in the first period expected welfare costs matter. Thus, for $\lambda(W) = \lambda = const$, minimizing expected welfare costs does not change our result because expected wage costs and therefore expected welfare costs remain unchanged (and cannot be lowered). If $\partial\lambda(W)/\partial W$ is increasing in W the high second-period wages may not be optimal and the first-best solution may not be feasible.[12]

[12]Note also that there are alternative means of high benefits for politicians if they are reelected, for

The assumption that voters can commit to a reelection scheme has mainly been made in order to give the reelection mechanism the best chance to motivate politicians. However, in liberal democracies voters can not commit future citizens to adhere to a particular voting behavior. The commitment problem is rooted in the uncertainty about future electoral interest and the liberal principle of democracies to allow for free and anonymous voting behavior in every election.

The inability to commit to future voting behavior represents an important source of inefficiency outlined in different models by Glazer (1989), Persson and Svensson (1989), Alesina and Tabellini (1990), Gersbach (1993), and Besley and Coate (1998). We can integrate the inability of commitment in a simple way into our model.

Suppose the reelection mechanism is given by

$$p(b_1, e_2) = \begin{cases} 1 & \text{if } b_1 \geq \hat{b}_1 + \eta \text{ and } e_2 \geq \hat{e}_2, \\ 0 & \text{otherwise.} \end{cases} \tag{2.21}$$

The factor η is a random variable with density function $f(\eta)$ and mean $E(\eta) = 0$. η can be interpreted as an exogenous shock on the reelection chances of the politician representing future shifts of electoral preferences or emergence of attractive competitors. Thus, the benefit signal that the politician has to reach in order to get reelected itself becomes noisy. For simplicity we only consider shocks to reelection chances on the performance of the first task.

Given the reelection mechanism, the probability that the politician is reelected when he generates a benefit signal b_1 and exerts at least $\hat{e}_2$ is given as

$$\Pr\{b_1 \geq \hat{b}_1 + \eta\} = \Pr\{\eta \leq b_1 - \hat{b}_1\} = F_\eta(b_1 - \hat{b}_1),$$

and the probability that the politician is reelected when he exerts effort e_1 is given by

$$\Pr\{e_1 + \epsilon \geq \hat{b}_1 + \eta\} = \Pr\{e_1 + \epsilon - \eta \geq \hat{b}_1\} = 1 - G_{\epsilon-\eta}(\hat{b}_1 - e_1),$$

where $G_{\epsilon-\eta}$ is the distribution function of $\epsilon - \eta$. Thus, the shock on the reelection chances can be interpreted as additional noise to the benefit signal. Therefore, the analysis of this non-commitment problem follows the analysis in the previous sections but now within a more general class of probability distributions because the noise of

example pay-backs and other private perks associated with continued incumbency in office. In this respect the chapter provides an argument that private benefits after a politician has been reelected have a positive incentive component.

the benefit signal is given by $\epsilon - \eta$ instead of ϵ as in the previous sections and G will not be uniformly distributed.[13] A second-period wage ${W_2}^{inc}(a)$ can be found under which the politician exerts the first-best effort levels. While this incentive contract is still self-financing in most cases, there are some special cases in which additional payments have to be made.[14]

There might be a second and more extreme case of non-commitment when voters reject the incumbent at the reelection date with certainty in order to save future remunerations for the politician. In this case, the nature of incentive contracts can be amended in the following way. The incentive contract, i.e., the wage payment ${W_2}^{inc}(a)$ becomes effective if the politician reaches the optimal required benefit signal $\hat{b}_1$, regardless of whether he is reelected or not, allowing him to receive the wage payments even if he is not in office anymore. Such contracts need therefore a golden parachute clause.

2.7 Practical Issues

Our analysis suggests that the dual mechanism of competition for elections and monetary incentive contracts might alleviate some of the inefficiencies of the political process. Since the incentive contract only stipulates a wage which will become effective upon successful reelection there is no apparent practical problem in using these contracts. No performance measures or other information are needed and therefore such contracts are easily verifiable.

One might argue that the relationship between past performance of politicians and reelection chances are garbled by a lot of noise. For instance, voters may support a candidate based on personal qualities such as leadership or communication skills expressed during campaigns. A prominent example was the presidential election in the USA in 2000, since all economic indicators were looking highly favorable for Democrats. However as shown in this chapter incentive contracts are also helpful when there is a lot of noise in the relationship between performance in retrospect and reelection chances as long as reelection chances decline with bad past performance. Moreover, reelection threshold contracts as proposed in the following chapters of this thesis increase the

[13] Even if η is also uniformly distributed, $G_{\epsilon-\eta}$ is a triangular distribution.

[14] While first-best can always be achieved, it is an open issue for which classes of probability distributions self-financing contracts exist. Examples are available upon request.

relationship between past performance and reelection chances and could be applied additionally.

In order to apply the hierarchy in practice, a variety of future issues need to be dealt with. For instance, a procedure is needed to determine the content of the incentive contract and to enforce it. The contract could be designed by a court, either the constitutional court or a special court. We could also allow the politician to offer the incentive contract he would like to have before he gets elected for the first time. Standard Bertrand arguments suggest that two politicians competing for office would offer the first-best contracts.

In summary, although there are a number of practical issues in combining incentive contracts and democratic elections, arranging wage schemes for politicians as suggested in this chapter appears to be practical.

2.8 Conclusion

The major result of this chapter suggests that when politicians face multi-task problems, democratic societies might do better to add an incentive contract to the reelection mechanism. Since multi-task problems are ubiquitous in politics, the solution offered in this chapter may be of relevance in practical applications.

In the following chapters we analyze reelection threshold contracts.

Chapter 3

Reelection Threshold Contracts

3.1 Introduction

In this chapter we introduce reelection threshold contracts. As pointed out in the introduction of the thesis future reelection chances of a politician are uncertain if there is multi-factor voting, i.e. voting involves prospective and retrospective elements. For instance, voters' preferences at the reelection stage may shift, thus lowering politicians' reelection chances even if they have performed well in the past. Or newly emerging issues during campaigns may influence voting behavior. The randomness of a politician's reelection chances increases further when the benefits from the politician's efforts cannot be measured with sufficient precision or when benefits are affected by external shocks. Consider a reform of the judiciary system as an example for the former, or a labor market reform as an example for the latter.[1]

The randomness of future reelections may not provide politicians with sufficient motivation to devote a socially desirable amount of effort to certain tasks. For example when benefits and thus the efforts of politicians are not perfectly observable or the valuation of the effort allocation changes through shifting voter preferences, neither sanctions for deviations from the socially desirable amount of effort nor rewards for exerting the socially desirable amount of effort will be sufficiently high. Then, the politician has an incentive to choose the effort allocation according to his own preferences.

In this chapter we suggest that adding a reelection threshold contract to the election

[1] The potential benefits in terms of reduction of unemployment rates can be thwarted by negative macroeconomic shocks, which may make it very difficult for voters to assess the performance or the competence of the politician pursuing such reforms.

mechanism can increase social welfare without impairing the liberal principles of free and anonymous voting in democracies. A reelection threshold contract stipulates the minimum benefit or performance level a politician has to achieve in order to have the right to stand for reelection. Such contracts may appear to reenforce the problem that the politician is not rewarded for his efforts in the future, since the probability of remaining in office for a given effort level decreases. However, when reelection chances are uncertain, social welfare can be increased through the incentive contract because deviations to lower efforts are punished more heavily.

We consider a model in which an elected politician can exert effort on a public issue such as institutional reforms. The effort creates benefits for the public which are affected by noise, either due to measurement problems or due to shocks. The politician's reelection chances are increasing in the created benefits. Since the politician is assumed to be motivated by holding the office, the uncertainty of the reelection chances does not provide the politician with sufficient motivation to exert socially optimal effort levels. In this chapter we allow a court to stipulate a reelection threshold contract which the politician must accept upon election. Such contracts prescribe a level of benefits the politician must achieve to earn the right to stand for reelection. We show that the dual mechanism - incentive contracts and elections - can increase social welfare because it increases the marginal benefit from efforts.

Next, we discuss the possibility that politicians themselves might offer the reelection threshold contracts during their campaigns. We show that optimal contracts are offered if the politicians have the same competence, measured by their marginal costs of exerting effort. If the politicians differ in competence, then the politician with the higher competence will be elected.

In this chapter we make a new proposal to supplement the election mechanism in democracies by incentive contracts. While the existing literature has introduced incentive contracts which prescribe utility or monetary transfers after a politician has been reelected, the novel element here is the idea of thresholds for reelection. Additional hurdles for reelection can help to motivate politicians to invest in good policies despite the declining reelection probability.

As pointed out in the introduction of the thesis elections as a control device require retrospective voting behavior. In this chapter, we assume that the voters use many other criteria in elections and thus there is multi-factor voting. For instance, the competence and personal qualities of a competitor or communication skills and newly emerging issues in campaigns can influence voting and elections. When there is multi-factor voting, we show that reelection threshold contracts can provide appropriate incentives.

It does not appear very difficult to introduce reelection threshold contracts in democracies. Reelection threshold contracts would allow politicians to offer voters clear choices. Either a politician sticks to his campaign promise and can stand for reelection or he breaks his promise and that was his last term. In the famous example of when President George Bush announced "read my lips: no new taxes" reelection threshold contracts would have not allowed him to abandon his campaign promise and then stand for re-election. Reelection threshold contracts would have increased the commitment power of the promise if George Bush had wanted to commit himself to no increase of taxes. Another example where reelection threshold contracts could have made a difference was the campaign promise of Chancellor Schröder to bring unemployment down to 3.5 million by 2002. With the opportunity of reelection threshold contracts and competition between Schröder and the incumbent Kohl, either Schröder would have stopped short of making such promises or German voters could have been more confident that unemployment would have declined in 2002.

The chapter is organized as follows: In section 3.2 we outline the model. Section 3.3 presents the first-best solution. In section 3.4 we show how the reelection mechanism works. In section 3.5 we add the reelection threshold contract to the reelection mechanism and indicate the welfare implications. Section 3.6 gives an example of how the reelection threshold contract works. Section 3.7 discusses what happens if the politicians themselves offer incentive contracts at the campaign stage. Section 3.8 concludes.

3.2 The Model

We consider the voters' problem of trying to motivate an elected politician. The voters and the politician are assumed to be risk-neutral. There are two periods. In the first period, the incumbent has to exert effort e on a task T, which for example could be the reform of the judiciary system. The effort e on task T creates benefits B for the public in the first period.[2] For simplicity, we assume

$$B = e. \tag{3.1}$$

The voters cannot observe B directly; instead, they receive a noisy signal about the benefits. This refers to a situation when the benefits of political actions are not easily measurable. For example, if the politician works on the reform of the judiciary system, the benefits are widespread and could not be identified in simple quantitative terms. We assume the benefit signal to be given as:

$$b = B + \epsilon = e + \epsilon. \tag{3.2}$$

Factor ϵ is a random variable with the support $[-a, a]$, distributed with the density function $f(\epsilon)$. We assume $E(\epsilon)$ to be zero. Hence the benefit signal b is distributed with the density function $f(b) = f(e + \epsilon)$ on $[e - a, e + a]$.

The expected utility for the public is denoted by U^P. Upon observing b, U^P is given as

$$U^P = E(B \mid b). \tag{3.3}$$

E is the expectation about the benefits, evaluated after b has been observed. Given our assumption $b = B + \epsilon$ and thus $E(B \mid b) = b$, U^P is simply given as

$$U^P = b. \tag{3.4}$$

An alternative interpretation of our model would be that the public does not perceive a signal about their benefits, but that the benefits themselves are affected by an external shock. This would model the situation in which say a politician exerts effort on a labor market reform, but the benefits of the effort are affected by macroeconomic shocks. b now stands for the benefits for the public. Our results are valid for both perspectives on the way in which noise makes it impossible for voters to precisely infer the politicians' effort. We will work with the first interpretation.

The voters make their reelection decision dependent on their expected utility and therefore on the observed signal. From the perspective of the first period, however, the election at the beginning of the second period can be affected by many other factors

[2]Additional benefits may also materialize in the second period, but this has no bearing on our main results.

than the benefit signal. Therefore, reelection is uncertain for the politician when he decides on his engagement. We assume that reelection chances can be summarized by a continuous probability function $p(b)$ that is known to the politician at the beginning of the first period. $p(b)$ is the probability that the politician will be reelected if the benefit signal b is realized. The reelection probability is assumed to be monotonically increasing in b with support $[\underline{b}, \bar{b}]$. For $b < \underline{b}$ the reelection probability is assumed to be zero, for $b > \bar{b}$ the reelection probability is one. The fact that the reelection scheme is stochastic can be interpreted in several ways. For instance, while some voters may base their decision exclusively on the past performance of the politician (or the performance signal), others may make their reelection decision dependent on other factors, such as leadership and communication skills of the incumbent, or the perceived competence of a competitor emerging at the reelection stage, or on economic circumstances independent of current policies. Voter preferences may also shift, which induces noise at the reelection stage.

The utility of the politician is given by

$$U^A(b, e) = W_1 + q\{e \mid p(b)\}W_2 - C(e). \tag{3.5}$$

W_1 denotes the utility of the office in period 1, W_2 the discounted utility of the office in period 2 and $C(e)$ the cost of exerting the effort. For tractability, the cost $C(e)$ of the agent is assumed to be given as follows:

$$C(e) = ce^2. \tag{3.6}$$

The factor c can be interpreted in two ways. Either it measures the agent's disinclination to provide the effort e, or it could be interpreted as the competence of the politician, with small c meaning high competence, i.e., achieving a certain benefit level does not require much effort cost from the politician. The utility from holding office may include monetary benefits, such as a fixed wage, and non-monetary benefits, such as prestige or the desire for a statesman-like image. $q\{e \mid p(b)\}$ denotes the politician's expected reelection probability if he exerts the effort level e, and the reelection scheme $p(b)$ holds. The reelection probability is written in expectational form because the created benefit signal is a random variable. For simplicity of exposition, we denote the expected reelection probability $q\{e \mid p(b)\}$ as $q(e)$. Then, the overall expected utility of office in period 2 is given by $q(e)W_2$. The utility W_1 from office in the first period is sunk after the politician has been elected. Thus, it will be neglected in the subsequent analysis. Then, the remaining utility takes the form:

$$U^A(b,e) = q(e)W_2 - C(e). \tag{3.7}$$

Given the politician's utility, the participation constraint (PC) that the politician wants to stand for reelection amounts to

$$q(e)W_2 - C(e) \geq 0. \tag{3.8}$$

The politician chooses an effort level that maximizes his utility. Thus, the incentive constraint (IC) is given as:

$$e = \arg\max_e \{q(e)W_2 - C(e)\}. \tag{3.9}$$

In order to break ties, we assume that a politician who is indifferent between actions will choose those which yield the highest utility for the voters.

At the end of the first period, the benefits for the public are realized. The public observes the benefit signal b and the reelection decision takes place.

The overall game is summarized as follows:

Stage 1: Based on his expected reelection chances $q(e)$, the politician exerts his effort on task T.

Stage 2: The benefit from the politician's activity is realized. The public observes the benefit signal b and takes its reelection decision.

3.3 First-Best Solution

We first characterize the first-best solution, assuming that the public has perfect information about the agent's effort and could commit to a reelection scheme, i.e. the electorate does not depend on $p(b)$ in designing contracts. We assume that the public enforces the socially optimal effort level directly by a contract heavily penalizing any deviation from the effort level prescribed in the contract. Hence the public's problem is to maximize its utility subject to the politician's participation constraint.[3] The participation constraint must be honored by the public, because otherwise the politician

[3] We do not include the utility of the politician in social welfare because we consider elections in a large population.

would not seek reelection and would not enter into the contract. Since the PC must be taken into account, the reelection probability under a first-best solution must be equal to one. Otherwise, the public could demand a higher effort level, thereby still fulfilling the PC by increasing the reelection probability.

The perfect information assumption yields

$$U^P = B. \tag{3.10}$$

Hence, the voters' problem is given by

$$\max\{U^P = e\}, \tag{3.11}$$

$$\begin{aligned} s.t. \quad W_2 - C(e) &\geq 0, \\ e &\geq 0. \end{aligned}$$

From $W_2 = ce^2$ we immediately obtain

Proposition 3.1
The first-best effort level is given by

$$e^{FB} = \sqrt{\frac{W_2}{c}}. \tag{3.12}$$

This is the maximum effort level the public can implement; higher effort levels would not satisfy the participation constraint and the politician would not seek reelection and forgo the contract.

3.4 The Reelection Mechanism

In this section we explore the sub-game perfect equilibria of the game if only the reelection mechanism is at work. The politician chooses his effort according to the incentive constraint (IC) as:

$$e = \arg\max_e\{q(e)W_2 - ce^2\}.$$

The expected reelection probability $q(e)$ is given by

$$q(e) = \int_{e-a}^{e+a} p(b)f(b-e)db. \tag{3.13}$$

Note that $p(b)$ is zero for $b < \underline{b}$ and the reelection is sure for $b \geq \bar{b}$. Therefore, the expected reelection probability $q(e)$ has different forms for the cases $e-a < \underline{b}$, $e-a > \underline{b}$, etc., which we will address when necessary. We obtain:

Proposition 3.2

Under the reelection scheme $p(b)$ only three effort choices can occur:

(i) $e = 0$ *(lower corner solution),*

(ii) $e = \bar{b} + a$ *(upper corner solution),*

(iii) $e^{int} = \frac{\partial q(e)}{\partial e}\frac{W_2}{2c}$ *(interior solutions).*

Proof of proposition 3.2:

According to the IC, the politician chooses the effort level which maximizes his utility under the reelection scheme $p(b)$.

First, we observe $U^A(e) < U^A(\bar{b}+a)$ for all $e > \bar{b}+a$. An effort level $e = \bar{b}+a$ guarantees reelection, because the benefit signal $\bar{b}$ is reached with certainty. It is obvious that the politician would never choose an effort level greater than the one required for sure reelection: effort levels greater than the one required would imply higher costs without additional benefits. Therefore, we can restrict the problem to

$$\max_e \{U^A(e)\}; \quad e \in [0; \bar{b} + a].$$

Either there is a corner solution, i.e., $e = 0$ or $e = \bar{b} + a$, or there exists an interior solution.

In the interior solutions, the politician chooses his effort level according to the IC. The first-order condition implies[4]

$$\frac{\partial q(e)}{\partial e} W_2 - 2ce = 0,$$

and the politician exerts the effort[5]

$$e^{int} = \frac{\partial q(e)}{\partial e}\frac{W_2}{2c}.$$

■

[4]We assume that the second-order condition is fulfilled.

[5]Note that multiple interior solutions as local maxima can exist without further assumptions regarding $q(e)$. A sufficient condition for a unique interior solution is for instance that $q(e)W_2 - ce^2$ is concave on $[0, \infty)$.

The effort levels emerge from the incentive compatibility constraint of the politician. Under the possible solutions, the politician chooses the one which maximizes his utility. Let e^* be the solution of the politician's maximization problem, i.e., the global maximum

$$e^* = \arg\max\{U^A(e)\}.$$

We will now explore the efficiency of the reelection mechanism.

In most cases, the reelection mechanism creates inefficiencies compared to the first-best solution. The first-best solution would be implemented if $\bar{b} = e^{FB} - a$ and the politician chooses the upper corner solution. The first-best solution requires a reelection probability of one because otherwise the PC would be violated. Therefore, none of the interior solutions which imply $q(e) < 1$ can implement the first-best effort level and the upper corner solution is the only solution in which first-best could be reached. Moreover, if $\bar{b} \neq e^{FB} - a$ then first-best cannot be reached either because the politician can secure his reelection with an effort smaller than e^{FB} or because the politician will not be reelected with certainty even if he exerts the socially desirable amount of effort and thus his PC is violated.

In a next step we will give a more general picture of the circumstances under which the reelection mechanism is relatively efficient and creates high efforts and of the circumstances under which this is not the case.

First of all, the reelection mechanism works best and creates the highest effort if the politician chooses the upper corner solution. We will now show the conditions under which this is likely to happen. Let e^j, $j = 1...k$ denote any other effort level of the interior or lower corner solutions. Then, the politician chooses the upper corner solution if

$$W_2 - c(\bar{b} + a)^2 \geq \int_{e^j - a}^{e^j + a} p(b) f(b - e) db W_2 - c(e^j)^2 \geq 0 \quad \text{for all } j$$

and thus if

$$\left(1 - \int_{e^j - a}^{e^j + a} p(b) f(b - e) db\right) W_2 \geq c(\bar{b} + a)^2 - c(e^j)^2 \geq 0 \quad \text{for all } j.$$

Thus, for the politician to adopt the upper corner solution, the loss through higher costs has to be outweighed by the gain in expected reelection probability. The costs of exerting the effort $e = \bar{b} + a$ increase in a (the bounds of the density function of the noise) and $\bar{b}$. The gain in expected reelection probability is high if $p(b)$ has a high gradient.[6]

We now derive conditions for a high effort in the interior solution. Therefore we write the effort e^{int} as

$$e^{int} = \frac{\partial \int_{-a}^{a} p(e+\epsilon) f(\epsilon) d\epsilon}{\partial e} \frac{W_2}{2c}.$$

Using the rules for differentiation of parameter integrals,[7] this can be written as

$$e^{int} = \int_{-a}^{a} \frac{\partial p(e+\epsilon)}{\partial e} f(\epsilon) d\epsilon \frac{W_2}{2c}.$$

which can finally be transformed to

$$e^{int} = \int_{e-a}^{e+a} \frac{\partial p(b)}{\partial e} f(b-e) db \frac{W_2}{2c}. \tag{3.14}$$

Thus, e^{int} increases the higher the gradient of the reelection scheme is and the lower the variance of the benefit signal is.[8] Additionally, the effort level in the interior solution depends on the benefits of holding the office and on the costs of exerting the effort.

3.5 Reelection Threshold Contracts

In this section, we explore whether the introduction of a reelection threshold contract leads to a superior solution without impairing the liberal democracy principle of free and anonymous voting. We assume that there is an independent institution, for example a court, which has the same utility function as the voters and which has the right to decide whether or not the politician is allowed to stand for reelection. The reelection decision is given as follows: The court announces a threshold signal $\hat{b}$ at the beginning of the first period. If the benefit signal realized at the end of the first period is smaller than $\hat{b}$, the politician cannot stand for reelection. If the benefit signal

[6] Moreover, one can show that the gain is high and thus the corner solution more likely to be adopted, when the benefit signal has a small variance.

[7] Note that e and ϵ are the two independent variables and $b = e + \epsilon$.

[8] One can show that the variance of the benefit signal influences the outcome as follows: the higher the variance of the benefit signal is, i.e. the lower $f(b-e)$, the less impact the design of the reelection mechanism has. If the variance is very high then it makes no difference whether $p(b)$ has a high gradient or not because the expected reelection probability remains approximately the same.

realized is equal to or higher than $\hat{b}$, the politician can stand for reelection. Then, the usual democratic election process with free and anonymous voting takes place. Thus, a hierarchy of incentive contracts and elections is formed. First, the decision is taken whether the politician has the right to stand for reelection, then the usual reelection mechanism takes place.

The overall game is summarized as follows:

Stage 1: A court prescribes a threshold signal $\hat{b}$ that the politician has to reach if he wants to stand for reelection. The required signal is known to the politician. Voters have a stochastic reelection scheme $p(b)$.

Stage 2: The politician exerts his effort on task T.

Stage 3: The benefit from the politician's activity is realized. The public and the court observe the benefit signal b. If $b < \hat{b}$, the politician leaves office and does not stand for reelection. If $b \geq \hat{b}$ the politician stands for reelection and the reelection procedure takes place.

As the incentive contract is at work and the court announces $\hat{b}$, the expected reelection probability for a given effort changes to

$$q(e,\hat{b}) = \int_{e-a}^{e+a} p(b)f(b-e)db - \int_{e-a}^{\hat{b}} p(b)f(b-e)db. \tag{3.15}$$

The last term measures the decline of the expected reelection probability due to the incentive contract. If $e - a < \hat{b}$, then $q(e,\hat{b}) < q(e)$, because the expected reelection probability for some signals is now zero. In this case, the expected reelection probability can be directly written as

$$q(e,\hat{b}) = \int_{\hat{b}}^{e+a} p(b)f(b-e)db. \tag{3.16}$$

The utility for the politician under the dual mechanism is denoted by $U^A(e,\hat{b})$ and is given by

$$U^A(e,\hat{b}) = q(e,\hat{b})W_2 - ce^2$$

We now explore the consequences of the incentive contract. First, we examine how effort levels under the IC are affected by reelection threshold contracts. In a next step, we derive the optimal incentive contract. Then, we characterize the conditions under which the incentive contract strictly improves welfare.

Proposition 3.3
The incentive contract weakly increases the effort levels chosen under the incentive constraint.

Proof of proposition 3.3:
First, we rewrite the maximization problem of the politician under the hierarchy of incentive contracts and elections as

$$\max_e \{U^A(e,\hat{b})\}; \quad e \in [0; \max[\bar{b}+a, \hat{b}+a]]$$

As we know, three cases can occur. The lower corner solution remains the same with $e = 0$, but the upper corner solution changes into

$$e = \hat{b} + a$$

for $\hat{b} > \bar{b}$. Hence, the effort level in the upper solution is higher with an incentive contract, or remains the same for $\hat{b} \leq \bar{b}$.

Regarding the interior solutions, the politician chooses his effort level according to the new incentive constraint as

$$e = \arg\max\{q(e,\hat{b})W_2 - ce^2\},$$

which yields the following effort level in the first order condition

$$e^{int}(\hat{b}) = \frac{\partial q(e,\hat{b})}{\partial e}\frac{W_2}{2c}.$$

This can be written as

$$e^{int}(\hat{b}) = \left[\frac{\partial q(e)}{\partial e} - \frac{\partial\left[\int_{e-a}^{\hat{b}} p(b)f(b-e)db\right]}{\partial e}\right]\frac{W_2}{2c}.$$

Without an incentive contract the interior solutions were

$$e^{int} = \frac{\partial q(e)}{\partial e}\frac{W_2}{2c}.$$

Because of

$$\frac{\partial\left[\int_{e-a}^{\hat{b}} p(b)f(b-e)db\right]}{\partial e} < 0,$$

the interior solutions are larger under the incentive contract if $q(e,\hat{b}) < q(e)$, otherwise the effort level remains the same in both scenarios.

■

The proposition indicates that the incentive contract increases the upper corner solution and the interior solutions if an adequate threshold signal is stipulated. In the upper corner solution, the effort level is raised by choosing a threshold signal $\hat{b} > \bar{b}$. In this case the effort level yielding sure reelection is $e = \hat{b} + a$. For the interior solutions, the effort level can be increased by choosing a threshold signal $\hat{b}$ for which $q(e,\hat{b}) < q(e)$. In this case the cut-off of the reelection probability in the presence of incentive contracts increases marginal reelection chances and thus the marginal utility from exerting effort. Note that this does not imply that the chosen effort increases under an incentive contract. For instance if $\hat{b}$ is very high, the effort could jump down from an interior solution to zero. However, since a court can always set $\hat{b} = 0$, a decrease in effort due to reelection threshold contracts can always be avoided.

We now examine what threshold signal $\hat{b}$ should be required by the court in order to obtain a second-best solution. We denote the possible corner and interior solutions under the incentive contract by $e^j(\hat{b})$, $j = 1, ..., k$.[9] Let $e^*(\hat{b})$ be the solution of the politician's maximization problem, i.e., the global maximum

$$e^*(\hat{b}) = \arg\max\{U^A(e^j(\hat{b}), \hat{b})\}. \tag{3.17}$$

Note that $e^*(-a)$ is equal to the effort level e^* chosen when only the reelection mechanism is at work. We state

Proposition 3.4

The court chooses the threshold signal $\hat{b}^*$ as

$$\hat{b}^* = \arg\max\{e^*(\hat{b})\} \quad s.t. \quad U^A(e^*(\hat{b}^*), \hat{b}^*) \geq 0.$$

Proof of proposition 3.4:

The optimal threshold signal $\hat{b}^*$ should be chosen to maximize the effort level e and thus to maximize the benefits for the public.

$e^*(\hat{b})$ is the effort level that the politician chooses subject to the threshold signal $\hat{b}$. Hence, $e^*(\hat{b})$ has to be maximized over $\hat{b}$. The participation constraint $U^A(e^*(\hat{b}^*), \hat{b}^*) \geq$

[9]We assume that there is a finite number of interior solutions.

0 has to be satisfied, because otherwise the politician would not seek reelection.

■

In the next proposition, we establish a sufficient condition for the dual mechanism to strictly improve welfare.

Proposition 3.5

(i) If $U^A(e^*(-a)) = 0$, *then* $e^*(\hat{b}^*) = e^*(-a)$;

(ii) If $U^A(e^*(-a)) > 0$ *and* $e^*(-a) = e^{int}(-a)$, *then* $e^*(\hat{b}^*) > e^*(-a)$.

Proof: see appendix B.

In the next step we explore whether the dual mechanism improves social welfare if the politician has chosen one of the corner solutions under the reelection mechanism alone.

Proposition 3.6

Suppose $U^A(e^*(-a)) > 0$. *Then*

(a) $e^*(\hat{b}^*) > e^*(-a)$ *if* $e^*(-a) = 0$ *and* $p(a)f(a) - \int_{-a+\xi}^{a} p(\epsilon)f'(\epsilon)d\epsilon \geq 0$;

(b) $e^*(\hat{b}^*) > e^*(-a)$ *if* $e^*(-a) = \bar{b}+a$ *and* $p(a)f(a)W_2 - \int_{-a+\xi}^{a} p(\bar{b}+a+\epsilon)f'(\epsilon)d\epsilon W_2 - 2c(\bar{b}+a) \geq 0$.

Proof: see appendix B.

In the proofs we show that the dual mechanism strictly improves social welfare if $U^A(e^*(-a)) > 0$ and $e^*(-a)$ is an interior solution. Under certain conditions, the dual mechanism also improves social welfare if $e^*(-a)$ is one of the corner solutions and $U^A(e^*(-a)) > 0$. The reasoning runs as follows: We first show that $U^A(e^*(-a)) > 0$ is a necessary condition for the PC to be satisfied in a solution $e^*(\hat{b}) > e^*(-a)$. Further we show that it is always possible to set a threshold signal $\hat{b}$ for which $q(e^*(-a), \hat{b}) < q(e^*(-a), -a)$ and the politician does not choose an effort $e^*(\hat{b}) < e^*(-a)$. Then, as we recall from proposition 3.3, the effort in the interior solution is increased because of the increasing marginal utility. Thus, if $e^*(-a) = e^{int}(-a)$, social welfare is strictly improved for $U^A(e^*(-a)) > 0$. Regarding the corner solutions, the effort can only be increased through the dual mechanism if the marginal gain of reelection chances outweighs the marginal increase in costs.

In the following, we give conditions under which the welfare improvement through the dual mechanism is significant.

Obviously, social welfare is maximal if the first-best effort level can be reached. This is possible if the threshold signal can be set as $\hat{b} = e^{FB} - a \geq \bar{b}$ and the politician chooses the upper corner solution.

Regarding the interior solutions, social welfare can always be strictly improved. Note that the reelection threshold contract can improve the effort in the interior solution in two ways: First, as we have seen in proposition 3.3, the effort can be continuously increased; second, the incentive contract can induce a jump from one solution to another. To illustrate the latter case, suppose there are two interior solutions $e^1(-a)$ and $e^2(-a)$ with $e^1(-a) < e^2(-a)$ and $U^A(e^1(-a)) > U^A(e^2(-a))$, but the utility difference is small. Then, there is the possibility that the dual mechanism changes the utility in such a way that $U^A(e^2(\hat{b})) > U^A(e^1(\hat{b}))$ and thus the politician will choose the higher effort level. We now discuss how a continuous rise of $\hat{b}$ yields a strong increase in the effort level. Therefore, we undertake a comparison between the efforts chosen in the interior solution under the dual mechanism and under the reelection mechanism alone. Under the dual mechanism $e^{int}(\hat{b})$ is chosen as

$$e^{int}(\hat{b}) = \frac{\partial \left(\int_{e-a}^{e+a} p(b) f(b-e) db - \int_{e-a}^{\hat{b}} p(b) f(b-e) db \right)}{\partial e} \frac{W_2}{2c} \tag{3.18}$$

As shown in the proof of proposition 3.3, the difference between the efforts lies in the second term. Clearly, the influence of the reelection threshold contract is larger, the higher the influence of the second term is in comparison to the first, i.e., the smaller the marginal reelection probability was under the reelection mechanism alone.

In the next section, we give an example of how the dual mechanism works.

3.6 Example

We illustrate the working of the dual mechanism of elections and incentive contracts with a simple example. We assume that the politician's effort is perfectly observable by the public and thus

$$b = e.$$

As before the first-best solution is given by

$$e = \sqrt{\frac{W_2}{c}}.$$

Further, we assume the reelection mechanism $p(b)$ to be

$$p(b) = \begin{cases} 0 & \text{for } \ b \leq \underline{b}, \\ \gamma + \phi b & \text{for } \ \underline{b} \leq b \leq \bar{b}, \\ 1 & \text{for } \ b \geq \bar{b}, \end{cases}$$

with $\bar{b} \leq e^{FB}$ and $\underline{b} \geq 0$ and $\gamma + \phi \bar{b} = 1$.

Because the politician's effort is perfectly observable, $p(b)$ denotes the probability that the politician will be reelected if he exerts effort e and thus $q(e) = p(b)$. The politician's incentive constraint implies that the politician chooses the effort that maximizes his utility and is given as

$$e = \arg\max\{q(e)W_2 - ce^2\}.$$

The participation constraint is satisfied if

$$q(e)W_2 - ce^2 \geq 0.$$

According to the incentive constraint, three possible solutions can occur:

(i) $e = 0$ (lower corner solution),

(ii) $e = \bar{b}$ (upper corner solution),

(iii) $e^{int} = \phi \frac{W_2}{2c}$ (interior solution).

The effort levels $e = 0$ and $e = \bar{b}$ are the lower and the upper corner solutions. The politician does not exert an effort level higher than $\bar{b}$ because of $q(e) = 1$ for all $b \geq \bar{b}$. Thus, with the effort $\bar{b}$ reelection is sure. The interior solution e^{int} climbs in the gradient of the reelection probability, ϕ, in the utility of holding office in period 2, W_2, and declines in the costs of exerting the effort.

Because of

$$\frac{\partial^2 U^A}{\partial e^2} = \frac{\partial^2((\gamma + \phi b)W_2 - ce^2)}{\partial e^2} = -2c < 0,$$

only one utility maximum exists; it is given through the interior solution. The upper corner solution $e = \bar{b}$ is only chosen for $e^{int} \geq \bar{b}$. Further, the lower corner solution

$e = 0$ is chosen if the PC is not satisfied for any effort higher than $e = 0$. In all other cases, the politician chooses e^{int}. Obviously, as ϕ increases, the probability rises that $e^{int} \geq \bar{b}$ and that the politician will choose effort $\bar{b}$.

We now introduce a reelection threshold contract.

A court announces a threshold signal $\hat{b}$, which the politician has to reach if he wants to stand for reelection. Then, the politician's reelection probability changes to

$$q(e, \hat{b}) = \begin{cases} 0 & \text{for } \; b \leq \max[\underline{b}, \hat{b}], \\ \gamma + \phi b & \text{for } \; \max[\underline{b}, \hat{b}] \leq b \leq \bar{b}, \\ 1 & \text{for } \; b \geq \max[\bar{b}, \hat{b}]. \end{cases}$$

The politician chooses his efforts according to the modified incentive constraint, which now amounts to

$$e = \arg\max\{q(e, \hat{b})W_2 - ce^2\}.$$

The possible solutions, i.e. the possible utility maxima are given as

(i) $e = 0$ (lower corner solution),

(ii) $e = \max\{\bar{b}, \hat{b}\}$ (upper corner solution),

(iii) $e^{int}(\hat{b}) = \max\{\phi \frac{W_2}{2c}, \hat{b}\}$ (interior solution).

The lower corner solution remains the same as before. The upper corner solution can be either $e = \hat{b}$ or $e = \bar{b}$. In the former case, the politician must exert a higher effort to ensure reelection. The interior solution changes into $e = \hat{b}$ for $\hat{b} > \phi W_2/2c$, because the politician would not get reelected by exerting an effort smaller than $\hat{b}$. We have shown that only one utility maximum exists and thus $e = \hat{b}$ in this case is a second-best solution if the utility from exerting $\hat{b}$ is weakly larger than zero and thus the PC is satisfied. We use $e^*(\hat{b})$ to denote the global utility maximum and hence the effort that the politician chooses under the incentive contract.

To derive the optimal threshold signal $\hat{b}^*$ we must ensure that $\hat{b}^*$ maximizes the chosen effort under the IC and that the PC is satisfied.

Thus, the optimal signal $\hat{b}^*$ is chosen as

$$\hat{b}^* = \arg\max\{e^*(\hat{b})\} \quad s.t. \quad U^A(e^*(\hat{b}^*), \hat{b}^*) \geq 0.$$

Obviously, $\hat{b}^* = e^{FB}$ is the solution. The politician will not choose an effort level smaller than e^{FB}, because then he would not be reelected. The participation constraint is satisfied because $U^A(e^{FB}, e^{FB}) = 0$. According to our tie-breaking rule, the politician chooses e^{FB} and not $e = 0$.

In this example, the incentive contract always leads to the first-best solution. It is thus welfare-improving if the politician chooses the interior solution under the reelection mechanism alone, or if $\bar{b} < e^{FB}$ and the politician chooses the upper corner solution. There are two reasons for this result: First, the benefit signal is not noisy. The public and the court observe the benefit signal perfectly and thus the reelection mechanism has the best chance of working. Furthermore, the PC is always satisfied under e^{FB} when there is no noise that could diminish expected reelection probability. Second, the assumption $\bar{b} \leq e^{FB}$ is necessary because otherwise the reelection probability under the first-best effort level is smaller than one and the PC would not be satisfied. In this case, the optimal threshold signal would be the signal which fulfills $U^A(e^*(\hat{b}^*), \hat{b}^*) = 0$.

The incentive contract works as follows: By giving the politician a threshold that he has to reach if he wants to stand for reelection, the court can force the politician to exert a higher effort than he would exert without the threshold. If the benefit signal is not noisy, the first-best effort level always can be reached.

3.7 Determination of Incentive Contracts

In this section, we explore what happens if the politicians themselves can determine the threshold signal $\hat{b}$. We assume that there is a campaign stage before the first period in which two political candidates denoted by i, j offer threshold signals $\hat{b}_i$, $\hat{b}_j$ to the public which they are willing to accept as incentive contracts for their reelection bids.

The competences of the politicians i, j measured by c_i, c_j are assumed to be known to the voters. The offered threshold signals $\hat{b}_i$, $\hat{b}_j$ are associated with effort levels $e_i^*(\hat{b}_i)$, $e_j^*(\hat{b}_j)$ which the politicians i, j would exert in office. Because of our complete information assumption the voters can derive these effort levels by observing $\hat{b}_i$, $\hat{b}_j$.[10] $\hat{b}_i^*$, $\hat{b}_j^*$ denote the threshold signals which the independent court would require from the politicians i, j for them to have the right to stand for reelection. They are associated

[10]Note that the choice of the effort and also the first-best effort levels depend on the competence of the politician.

with the efforts $e_i^*(\hat{b}_i^*)$, $e_j^*(\hat{b}_j^*)$.

The voters observe the threshold offers and cast their votes. We assume that each politician is elected with a probability of 1/2, if $e_i^*(\hat{b}_i) = e_j^*(\hat{b}_j)$ and $c_i = c_j$. If $c_i > c_j$ and $e_i^*(\hat{b}_i) = e_j^*(\hat{b}_j)$ we assume as a tie-breaking rule that politician j is elected with probability 1.[11] If $e_i^*(\hat{b}_i) > e_j^*(\hat{b}_j)$ then politician i is elected with probability 1.

The structure of the game is summarized as follows:

Stage 1: Two politicians denoted by i, j with competences c_i, c_j offer threshold signals $\hat{b}_i$, $\hat{b}_j$ to the public which they are willing to accept as incentive contracts for their reelection bids.

Stage 2: The voters observe the threshold offers and make their election decisions.

Stage 3: The elected politician exerts his effort on task T.

Stage 4: The benefit from the politician's activity is realized. The public observes the benefit signal b. If $b < \hat{b}_i$, $\hat{b}_j$ respectively, the politician leaves office and does not stand for reelection. If $b \geq \hat{b}_i$, $\hat{b}_j$ respectively, the politician stands for reelection and reelection takes place.

We now look for sub-game perfect equilibria of the campaigning game.

Proposition 3.7

(i) If $c_i = c_j$, there exists a unique equilibrium in which both politicians offer the threshold signals $\hat{b}_i^* = \hat{b}_j^*$.

(ii) If $c_i > c_j$, there exists a unique equilibrium in which politician i offers the threshold signal $\hat{b}_i^*$ and politician j offers the threshold signal $\hat{b}_j^o$ with

$$\hat{b}_j^o = \arg\max_{\hat{b}_j} U^A(e_j^*(\hat{b}_j), \hat{b}_j, c_j) \quad s.t.\ e_j^*(\hat{b}_j^o) \geq e_i^*(\hat{b}_i^*).$$

Proof of proposition 3.7:

First, note that

$$U^A(e_i^*(\hat{b}_i^*), \hat{b}_i^*, c_i), U^A(e_j^*(\hat{b}_j^*), \hat{b}_j^*, c_j) \geq 0$$

since the PC is satisfied if the politicians offer the threshold signals $\hat{b}_i^*$, $\hat{b}_j^*$.

[11] This tie-breaking rule is not crucial and allows us to avoid the ϵ-framework in characterizing the equilibria.

(i) Suppose $c_i = c_j$.

Threshold signal offers $\hat{b}_i^* = \hat{b}_j^*$ are an equilibrium, because a downward deviation by a politician would yield a zero election probability for him.

Threshold signal offers $\hat{b}_i = \hat{b}_j < \hat{b}_i^* = \hat{b}_j^*$ and $\hat{b}_i = \hat{b}_j > \hat{b}_i^* = \hat{b}_j^*$ cannot be an equilibrium. They would induce efforts $e_i^*(\hat{b}_i) = e_j^*(\hat{b}_j) < e_i^*(\hat{b}_i^*) = e_j^*(\hat{b}_j^*)$ as $e_i^*(\hat{b}_i^*) = e_j^*(\hat{b}_j^*)$ is the highest effort level which can be implemented under the PC. A deviation by politician i to a threshold signal corresponding to an infinitesimally higher effort would yield an election probability of one and thus a higher utility for politician i.

Finally, threshold signal offers $\hat{b}_i < \hat{b}_j \leq \hat{b}_j^*$ cannot be an equilibrium either, because politician i could raise his expected utility by choosing a signal $\hat{b}_i = \hat{b}_j$ which would give him a positive election probability.

(ii) Suppose $c_i > c_j$.

We show that threshold offers $\hat{b}_i^*$ with a corresponding effort level $e_i^*(\hat{b}_i^*)$ and $\hat{b}_j^o$ with

$$\hat{b}_j^o = \arg\max_{\hat{b}_j} U^A(e_j^*(\hat{b}_j), \hat{b}_j, c_j) \quad s.t.\ e_j^*(\hat{b}_j^o) \geq e_i^*(\hat{b}_i^*)$$

are an equilibrium. First note that $U^A(e_j^*(\hat{b}_j^o), \hat{b}_j^o, c_j) \geq 0$ since by choosing $\hat{b}_j^o = \hat{b}_j^*$ $U^A(e_j^*(\hat{b}_j^*), \hat{b}_j^*, c_j) \geq 0$. The politician j will not be elected if he deviates to a threshold signal corresponding to $e_j^*(\hat{b}_j) < e_i^*(\hat{b}_i^*)$. Thus he chooses the threshold signal which maximizes his utility under the constraint $e_j^*(\hat{b}_j) \geq e_i^*(\hat{b}_i^*)$. Politician i does not deviate either since he cannot offer a higher utility for voters by selecting other thresholds.

The rest of the proof follows the lines of the proof of (i) and is therefore omitted here.

■

In the proof we have shown that the politicians offer the optimal incentive contracts if they have the same competence. If politician j has a higher competence than politician i, then politician j offers at least a threshold signal $\hat{b}_j$ which yields $e_j^*(\hat{b}_j) = e_i^*(\hat{b}_i^*)$.

Thus, he will be elected with certainty. However, different competences of politicians yield inefficiencies in the determination of incentive contracts in the sense that the more competent politician obtains a rent which depends on the size of the competence differential.

The inefficiency increases if the election probability also depends on other factors like the appearance or the communication skills of the competing politicians. Then, a politician who has a high election probability because of these factors has more leeway to choose his incentive contract offer. Thus, the self-determination of incentive contracts is promising if the campaigning is very competitive and problem solving competences are influencing voting behavior.

3.8 Conclusion

Our analysis suggests that thresholds to reelection could be a viable supplementary mechanism to improve democratic procedures. The reelection threshold contracts suggested in this chapter promise efficiency gains and there are no obvious practical considerations which would be detrimental to the actual use in politics.

In the next chapter we extend the analysis of reelection threshold contracts.

Chapter 4

Reelection Threshold Contracts with Heterogeneous Voters

4.1 Introduction

In this chapter we incorporate reelection threshold contracts in a political game with heterogeneous voters and unknown policy preferences of the candidates.

We suggest that reelection threshold contracts which the political candidates must accept upon election could alleviate inefficiencies caused by the combination of uncertainty about policy preferences of candidates, voter heterogeneity and multi-factor voting. The reelection threshold contracts weakly increase social welfare from an ex ante point of view. An incentive contract stipulates a policy space. If the incumbent decides on a policy outside of this policy space he loses his right to stand for reelection. However, if he chooses a policy inside the policy space the normal reelection mechanism takes place. The political candidates are allowed to offer the contracts themselves during the campaign. Thus, there is no institution which could impose its own preferences or the preferences of some group of the society on the design of the incentive contract.

We develop our argument by considering a political game with two candidates. The candidates are policy-motivated and additionally have some private utility from holding office. The ideal point of a candidate is unknown to the voters and the other candidate. The median voter is decisive. Once elected a candidate decides on his policy in the first term which is perfectly observable. After the first term, the reelection decision is made.

We first consider the case in which only elections are used. There exists a fully separating equilibrium which is not socially optimal. Since a deviation from the median voter's preferred policy is not punished heavily the politician has an incentive to indulge in his own preferences.

In the next step we introduce reelection threshold contracts. The contracts are designed as follows. The candidates announce a policy range during the campaign for the first term. If the elected candidate does not choose a policy in the announced range he loses his right to stand for reelection and a new candidate enters the game.

We show that there exists pooling of reelection threshold contract announcements with the following characteristics. The competition for office induces the candidates to offer incentive contracts which weakly increase the expected utility of the median voter. In contrast there exists a fully separating equilibrium when candidates are elected and decide on policies. If the incentive contract strictly increases social welfare we note the following effects. The chosen policy of politicians who match the contract moves closer to the median voter's ideal point than under the election mechanism. However, for some candidates matching the incentive contract is too costly. These candidates will act according to their own preferences once in office. This means that they choose a policy which is further away from the median voter's ideal point than it would be the case without incentive contracts. Thus, from an ex ante point of view social welfare is weakly increased but from an ex post point of view the introduction of an incentive contract may lead to inefficiencies.

The contract presented in this chapter is very similar to the one presented in the previous chapter as the latter stipulates a benefit level which a politician must reach in order to stand for reelection. The key differences of this chapter are heterogeneous preferences of voters and asymmetric information regarding preferences of candidates. Moreover, we show which incentive contracts are offered during a campaign.

The chapter is organized as follows: In section 4.2 we outline the model. In section 4.3 we derive the equilibrium without an incentive contract. In section 4.4 we introduce incentive contracts and develop the resulting equilibrium. In section 4.5 we perform a welfare comparison. Section 4.6 presents our conclusions.

4.2 The Model

4.2.1 Basic Assumptions

We consider a political game with two candidates. The structure of the game is as follows:

First period:

- Two political candidates compete for office. The candidate who obtains a majority of votes is elected.
- The elected candidate takes office and decides on his policy in the first term.

Second period:

- The next election takes place in which the incumbent competes for a second term against the loser in the first round. Voters cast their reelection decisions. The elected candidate takes office.

There is a continuous one-dimensional policy space $\mathcal{P} = \mathbb{R}$. An element $p \in \mathcal{P}$ is a policy. In each period the elected candidate decides on a policy p, where the policy chosen in the first period is denoted by p^1 and the policy chosen in the second period is denoted by p^2 respectively. Voter i has the ideal point x_i in $\mathcal{P}$ where $p = x_i$ is the most preferred policy of voter i. Preferences of the voters are assumed to be single-peaked and thus the distribution of the ideal points of the voters is irrelevant. Only the median voter matters. The median voter's ideal point is denoted by x_ν. Suppose for example p represents a decision about tax-financed transfers that redistribute from rich to poor, pension programs or decisions about unemployment insurance.

4.2.2 The Candidates

There are two political candidates denoted by j and k, $j \neq k$. They have ideal points x_j and x_k representing the candidate's most preferred policy outcome. The candidate's ideal point is private information. The voters and the other candidate consider x_j to be distributed according to the density function

$$f_j(x_j) \text{ on } [\underline{x}_j, \bar{x}_j],\ f_j(x_j) > 0\ \forall\, x_j \in [\underline{x}_j, \bar{x}_j] \text{ and } f_j(x_j) = 0\ \forall\, x_j \notin [\underline{x}_j, \bar{x}_j]. \tag{4.1}$$

Accordingly, x_k is distributed with density function

$$f_k(x_k) \text{ on } [\underline{x}_k, \bar{x}_k],\; f_k(x_k) > 0 \;\; \forall\, x_k \in [\underline{x}_k, \bar{x}_k] \text{ and } f_k(x_k) = 0 \;\; \forall\, x_k \notin [\underline{x}_k, \bar{x}_k]. \tag{4.2}$$

We assume $|x_\nu - \bar{x}_j| = |x_\nu - \underline{x}_k|$ and $|x_\nu - \underline{x}_j| = |x_\nu - \bar{x}_k|$. Furthermore, we assume that $\bar{x}_j \leq x_\nu$ and $\underline{x}_k \geq x_\nu$. Thus, x_j is on the left of the median voter's ideal point and x_k is on the right of the median voter's ideal point. Furthermore, we assume that

$$f_j(x_j) = f_k(x_k) \text{ for } |\bar{x}_j - \underline{x}_j| = |\bar{x}_k - \underline{x}_k|.$$

The information assumption can be interpreted as follows: Suppose there are two parties, one of which has members on the right of the median voter and the other has members on the left of the median voter. Each party has a candidate in the election race. However, the public only knows the party membership of the candidate and not his personal preferences.[1]

The two candidates compete for office. Without loss of generality, we assume that candidate j is elected for the first term. Once in office candidate j decides on a policy denoted by $p_j^1 \in \mathcal{P}$ which is perfectly observable by the voters and the other candidate. At the end of the first term, the incumbent j stands for reelection. He competes against the candidate $k \neq j$ who was the loser in the first round. Then either candidate j or candidate k is elected in the second term and takes office. They implement policies p_j^2 or p_k^2, respectively. As the second term is the last term of the model, we immediately conclude that in any potential equilibrium $p_j^2 = x_j$ and $p_k^2 = x_k$, because there is no reelection decision which could induce an elected politician to move away from his ideal point. Therefore, in order to simplify matters we work directly with $p_j^2 = x_j$ and $p_k^2 = x_k$.

4.2.3 The Utility of the Voters

Voters are assumed to have quadratic per period utility functions

$$u_i(p) = -(p - x_i)^2. \tag{4.3}$$

[1] One could argue that the campaign race yields further information about the preferences of the candidates. Then, $f_j(x_j)$ and $f_k(x_k)$ represents the information about personal preferences yielded during the campaign race together with the information of the party membership of the candidate.

Thus, in each period, the utility of the voter i decreases the more the implemented policy p diverges from his ideal point x_i. The overall utility of a voter is given as

$$V_i(p) = u_i(p^1) + u_i(p^2) = -(p^1 - x_i)^2 - (p^2 - x_i)^2. \tag{4.4}$$

We assume that there is no discounting.

The election decision of the voters in the first period is based on their expected utility:

$$E(V_i(p)) = E(-(p^1 - x_i)^2) + E(-(p^2 - x_i)^2).$$

The election decision of the voters in the second period is based on $E(-(p^2 - x_i)^2)$ as then the utility of the first period is sunk. As preferences are single-peaked, we can concentrate on the decision of the median voter which determines the vote outcome. Since we have labelled the winning candidate in the first period by j we have[2]

$$E(V_\nu(p_j)) \geq E(V_\nu(p_k)).$$

After the first term, the voters cast their reelection decisions. They have observed p_j^1 and can therefore update their expectations regarding x_j and the associated variance which, in turn, determines whether they reelect the incumbent. We work with a linear specification and assume that from the perspective of the first period the reelection chances of the elected candidate j can be summarized by a continuous probability function

$$q\left(E(x_j|p_j^1), \sigma^2(x_j|p_j^1)\right) = a + bE(x_j|p_j^1) - c\sigma^2(x_j|p_j^1) \tag{4.5}$$

with $a, b, c > 0$. The reelection chances are common knowledge among candidates and voters at the beginning of the first period. $E(x_j|p_j^1)$ denotes the expected value of the ideal point of the incumbent j and thus the expectations about his second-term policy after the first-term policy p_j^1 has been observed. $\sigma^2(x_j|p_j^1)$ is the associated variance of the ideal points x_j given p_j^1. The factor a summarizes the influence of $E(x_k)$ and $\sigma^2(x_k)$ on the reelection chances of candidate j. b and c denote the sensitivity of the reelection probability to the expected ideal point and the corresponding variance of an incumbent and are held constant. Thus, $q\big(E(x_j|p_j^1), \sigma^2(x_j|p_j^1)\big)$ is the probability that the incumbent j is reelected when the voters have formed expectations $E(x_j|p_j^1)$ and the associated variance is given as $\sigma^2(x_j|p_j^1)$. We assume $q\big(E(x_j|p_j^1) = \underline{x}_j, \sigma^2(x_j, p_j^1)\big) > 0$

[2] As a tie-breaking rule we assume that the candidate j is elected in the case where the median voter is indifferent.

and thus even incumbents with expected ideal points $\underline{x}_j$ have a positive reelection probability. Furthermore, we assume $q\big(E(x_j|p_j^1) = \bar{x}_j, \sigma^2(x_j, p_j^1)\big) < 1$ and thus even candidates with expected ideal points close to the median voter are not reelected with certainty. The reelection probability of the incumbent is monotonically decreasing in the distance of the expected ideal point of the incumbent from x_ν and in σ^2.

The randomness of future reelection can be interpreted as follows: from the perspective of the first period, the election at the beginning of the second period can be affected by many other factors than the implemented policy and the expected ideal point of a politician. For instance, preferences of voters may shift, which induces noise at the reelection stage. Also, some voters may make their reelection decision dependent on factors such as leadership and communication skills of the incumbent or on economic circumstances independent of current policies. Therefore, the reelection is uncertain for the elected candidate j when he decides on his policy.

4.2.4 The Utility of the Candidates

The utility of the candidates consists of two components: they have policy preferences as the voters do and additionally they draw utility from holding office. Then, from the perspective of the first period, the expected utility of the elected candidate j from implementing the policy p_j^1 is given by

$$\begin{aligned} U^j(p_j^1) = u_j(p_j^1) + W + q\left(E(x_j|p_j^1), \sigma^2(x_j|p_j^1)\right)[u_j(x_j) + W] \\ + \left[1 - q\left(E(x_j|p_j^1), \sigma^2(x_j|p_j^1)\right)\right] E(u_j(x_k)). \end{aligned} \tag{4.6}$$

The utility function consists of multiple components which are explained in the following. $u_j(p)$ represents the political preferences of the incumbent j in each period and is given as

$$u_j(p) = -(p - x_j)^2. \tag{4.7}$$

This utility component is identical to the utility function of a voter.

Second, W represents the private utility of holding the office. This can be interpreted as utility from the wage payments the incumbent receives or from any non-monetary benefits of being in power. $q\left(E(x_j|p_j^1), \sigma^2(x_j|p_j^1)\right)[u_j(x_j) + W]$ represents the expected utility of holding office in the second term and $\left(1 - q\left(E(x_j|p_j^1), \sigma^2(x_j|p_j^1)\right)\right) E(u_j(x_k))$ is the expected utility of losing the election.

As $u_j(x_j) = 0$, the candidate's expected utility can be rewritten as

$$U^j(p_j^1) = u_j(p_j{}^1) + W + q\left(E(x_j|p_j^1), \sigma^2(x_j|p_j^1)\right)[W - E(u_j(x_k))] + E(u_j(x_k)). \quad (4.8)$$

Regarding the participation constraint (PC) of the politician we assume that an elected candidate always has a higher utility from implementing his ideal point in the first term than from renouncing office. Therefore, we can neglect the PC in the following.[3]

In the first term, the incumbent j implements a policy p_j^1 which maximizes his utility. The incentive constraint (IC) faced by the candidates is:

$$\begin{aligned} p_j^1 = \arg\max\nolimits_{p_j^1} \{ & u_j(p_j^1) + W + \\ & q\left(E(x_j|p_j^1), \sigma^2(x_j|p_j^1)\right)[W - E(u_j(x_k))] + E(u_j(x_k))\}. \end{aligned} \quad (4.9)$$

In summary, the structure of the game is as follows:

First period:

- Two political candidates j and k compete for office. They have ideal points x_j, x_k, which are private knowledge to the candidates. The voters and the other candidate consider x_j to be distributed according to the density function $f_j(x_j)$ on $[\underline{x}_j, \bar{x}_j]$ and x_k to be distributed according to the density function $f_k(x_k)$ on $[\underline{x}_k, \bar{x}_k]$.
- The elected candidate j takes office and decides on his policy p_j^1 in the first term, which is perfectly observable by the voters.

Second period:

- A new election takes place in which the incumbent competes for a second term against the candidate who lost in the first round. Voters cast their reelection decisions. The elected candidate takes office.

The game is illustrated in figure 4.1.

In the following, we show the equilibrium under the election mechanism. We only describe the separating equilibrium. This is likely to give the election mechanism the best chance to motivate politicians.

[3]For simplicity of presentation we normalize the outside option of the elected candidate to zero. Then a sufficient condition for neglecting the PC is $W + E(u_j(x_k)) > 2E(u_j(x_j))$. Then, the candidate's utility from implementing his ideal point and not being reelected is higher than his utility from being a citizen even under another candidate j. Thus, no candidate has an incentive to renounce office and allow another candidate of his party to take office.

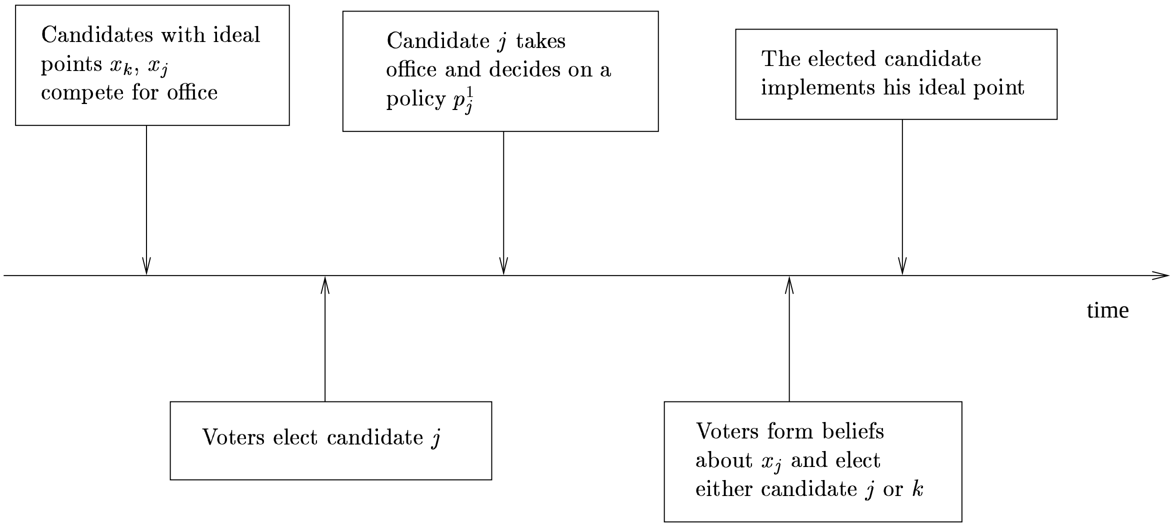

Figure 4.1: Structure of the Game

4.3 Equilibrium Without an Incentive Contract

In this section, we show that there exists a fully separating equilibrium of the game. We first state

Lemma 4.1

In any separating equilibrium it holds that a candidate j with type $\underline{x}_j$ chooses the policy $p_j^1(\underline{x}_j) = \underline{x}_j$.

Proof of lemma 4.1:

Suppose all candidates separate themselves in equilibrium. Then the voters can derive the types of the candidates exactly and the reelection probability of a candidate j of type x_j is given as $q\big(E(x_j|p_j^1) = x_j, \sigma_j^2(x_j|p_j^1) = 0\big) = a + bx_j$. The only reason for a candidate j to choose a policy different from his ideal point is to separate himself from the candidates with lower ideal points and thus to signal his type. Suppose now a candidate j is of type $\underline{x}_j$. As his type is the lowest possible there is no candidate who wants to imitate him and thus it is the best strategy for him to choose $p_j^1 = \underline{x}_j$.

■

For the derivation of the equilibria a particular type of a differential equation is involved. To keep the exposition of the equilibria as simple as possible we present here this one-dimensional differential equation

$$Y^2(z)Y'(z) + (h - eY'(z))Y(z) + gY'(z) - hz = 0$$

and denote it by **DE1** where $z \in (-\infty, +\infty)$. This is a non-linear first-order differential equation. The solution associated with particular initial conditions of **DE1** will play a decisive role in our equilibria and is denoted by **L(DE1)**.

We now show the separating equilibrium of the game which we denote by **ELSEP** and state

Proposition 4.1

*Suppose that **DE1** has a strictly increasing solution in* $[\underline{z} = \underline{x}_j, \bar{z} = p_j^{1*}(\bar{x}_j)]$ *for* h, g *and* e *as specified below. Then there exists a fully separating equilibrium (**ELSEP**) of the game which is given as follows:*

In the first term, the candidate j *chooses the policy* $p_j^{1*}(x_j)$ *determined implicitly by*

$$p_j^{1*}(x_j) = x_j + b\frac{\partial E^*(x_j|p_j^{1*})}{\partial p_j^{1*}}\frac{(W - E(u_j(x_k)))}{2}.$$

The second-period equilibrium belief about the position of the incumbent j *after* p_j^1 *has been implemented is given as the solution* ***L(DE1)***^{el} *of the differential equation **DE1** with* $Y(z) = E^*(x_j|p_j^1)$, $z = p_j^1$, $h = 2/b$, $e = 2E(x_k)$, $g = W + E(x_k^2)$ *and initial condition* $E(x_j|p_j^1 = \underline{x}_j) = \underline{x}_j$.

The expectations about x_k *are given as*

$$E(x_k) = \int_{\underline{x}_k}^{\bar{x}_k} x_k f_k(x_k) dx_k.$$

The out-of-equilibrium beliefs are given as

$$E(x_j|p_j^1) = \begin{cases} \bar{x}_j & \text{for } p_j^1 > p_j^{1*}(\bar{x}_j), \\ \underline{x}_j & \text{for } p_j^1 < p_j^{1*}(\underline{x}_j). \end{cases}$$

Proof: see appendix C.

The equilibrium can be interpreted as follows: In the first term the candidate j chooses his optimal policy p_j^{1*} according to

$$p_j^{1*}(x_j) = x_j + b\frac{\partial E^*(x_j|p_j^{1*})}{\partial p_j^{1*}}\frac{(W - E(u_j(x_k)))}{2}.$$

The term consists of two parts. The first part is the ideal point of the candidate j. The second part consists of three independent factors: the sensitivity of the expected reelection probability with regard to the beliefs about future policies, b, multiplied by the sensitivity of the beliefs about future policies with regard to the policy choice of the candidate today multiplied by the expected utility difference of candidate j when he holds office himself or when candidate k holds office. Note that ${p_j^1}^* > x_j$ as $b > 0$ and $\partial E^*(x_j|p_j^1)/\partial p_j^1 > 0$. Thus, the reelection mechanism gives the candidate j incentives to move towards the median voter's position.

The candidate has to signal his type by choosing a policy which is closer to the median voter than his ideal point because otherwise a lower type candidate would imitate his policy. Because reelection chances, and thus the expected future utility of the candidate j increase if the voters believe a high ideal point, the candidate j faces a trade-off between implementing his ideal point x_j and higher reelection chances. Thus, he moves from his ideal point closer to the median voter. Directionally, the deviation is the higher the more sensitive the expected reelection probability is regarding to $E^*(x_j|p_j^1)$, the more sensitive the beliefs are regarding to p_j^1 and the higher the expected utility difference $W - E(u_j(x_k))$ is, i.e., the higher W is and the more extreme the expected ideal point of the candidate k is and the higher its associated variance.[4] In the second term, the candidates implement their ideal points and thus $p_j^2 = x_j$ and $p_k^2 = x_k$ because there is no reelection which could induce the candidates to move away from their position. Note that the existence of the equilibrium depends on a monotonicity condition on $\mathbf{L(DE1)}^{el}$.[5]

Furthermore, we state

Corollary 4.1

The expectations about the policies before the election in the first term are given by

$$E(p_j^1) = \int_{\underline{x}_j}^{\bar{x}_j} {p_j^1}^*(x_j) f_j(x_j) dx_j$$

[4] Note that the candidate j would implement his ideal point x_j if b were equal to zero and thus if the expected reelection probability was independent of the chosen policy. Then he had no additional utility in terms of increasing reelection probability from moving away from his ideal point towards the median voter.

[5] **DE1** seemingly cannot be solved analytically. However, one can show that Taylor-approximations yield solutions which are strictly increasing on certain intervals.

and

$$E(p_k^1) = \int_{\underline{x}_k}^{\bar{x}_k} p_k^{1*}(x_k) f_k(x_k) dx_k.$$

4.4 Equilibrium With an Incentive Contract

In this section, we explore the equilibrium if the candidates offer incentive contracts during the campaign before the first term and must sign them upon election.[6] An incentive contract is designed as follows: During the campaign, the candidates announce policy spaces $[\hat{p}_j, \bar{p}_j]$ and $[\underline{p}_k, \hat{p}_k]$. Once elected the candidate j has to sign the following contract: If his policy choice in office $p_j^{1^{inc}}$ does not lie in the announced policy space and thus, $p_j^{1^{inc}} \notin [\hat{p}_j, \bar{p}_j]$, then he is not allowed to stand for reelection. If $p_j^{1^{inc}} \in [\hat{p}_j, \bar{p}_j]$, the incumbent j is allowed to stand for reelection and the reelection takes place.[7]

Note that incentive contracts which do not allow policy choices close to the median voter's ideal point would lower the expected utility of the median voter and thus the election chances of the candidate. Thus, it is optimal for the candidates to offer incentive contracts including the median voter's ideal point x_ν.[8] Hence, without loss of generality we assume that the candidates announce policy spaces $[\hat{p}_j, x_\nu]$ and $[x_\nu, \hat{p}_k]$. Furthermore, we can assume $\hat{p}_j \geq \underline{x}_j$ as no candidate will choose a policy $p_j^1 < \underline{x}_j$ as this would never increase his reelection chances. Again, for notational convenience, we assume that the candidate j wins the election.

If the incumbent j is not allowed to stand for reelection, the candidate k and a new candidate denoted by C with ideal point x_C compete for office in period 2. x_C is unknown to the voters. We assume that x_C is distributed with $f_C(x_C) = f_j(x_j)$ on $[\underline{x}_j, \bar{x}_j]$. Thus, the new candidate C has exactly the same characteristics as candidate j. This can be interpreted as follows: As the incumbent j is not allowed to stand for reelection, his party enters the campaign race with a new candidate. From the perspective of the first period, we assume that the candidate C is elected with expected probability $\widetilde{q}(E(x_C), \sigma^2(x_C))$. For tractability, we assume $\widetilde{q}(E(x_C), \sigma^2(x_C)) =$

[6] Also in this section we concentrate on equilibria which are separating in the policy choices.

[7] Note that announcing $[\hat{p}_j, \bar{p}_j]$ without consequences would be a simple cheap talk stage and we would obtain the same equilibrium as in the last section.

[8] We assume that ideal points of candidates diverge sufficiently from the median voter's position x_ν such that all equilibrium policies are either on the right hand side or on the left hand side of the median voter.

$q\left(E(x_C),\sigma^2(x_C)\right) = a + bE(x_C) - c\sigma^2(x_C)$. Note that again a candidate who is elected in the second period will implement his ideal point as the game ends there.

The voters' expectations about the first-term policies are given as $E(p_j^{1^{inc}}|[\hat{p}_j, x_\nu])$ and $E(p_k^{1^{inc}}|[x_\nu, \hat{p}_k])$. For simplicity of presentation, we denote $E(p_j^{1^{inc}}|[\hat{p}_j, x_\nu])$ by $E(p_j^{1^{inc}}|\hat{p}_j)$ and $E(p_k^{1^{inc}}|[x_\nu, \hat{p}_k])$ by $E(p_k^{1^{inc}}|\hat{p}_k)$.

The expected utility of the candidate j given an incentive contract $[\hat{p}_j, x_\nu]$ and policy choice $p_j^{1^{inc}}$ amounts to

$$U^j(p_j^{1^{inc}}) = \begin{cases} u_j(p_j^{1^{inc}}) + W + q\big(E(x_j|p_j^{1^{inc}}), \sigma^2(x_j|p_j^{1^{inc}})\big) \cdot \\ [W - E(u_j(x_k))] + E(u_j(x_k)) & \text{for } \; p_j^{1^{inc}} \in [\hat{p}_j, x_\nu], \\ u_j(p_j^{1^{inc}}) + W + q\left(E(x_C), \sigma^2(x_C)\right) \cdot \\ [E(u_j(x_C)) - E(u_j(x_k))] + E(u_j(x_k)) & \text{for } \; p_j^{1^{inc}} \notin [\hat{p}_j, x_\nu]. \end{cases}$$

If candidate j has the right to stand for reelection and thus if $p_j^{1^{inc}} \in [\hat{p}_j, x_\nu]$, his utility function is identical to that in the scenario without an incentive contract. If he is not allowed to stand for reelection, his expected utility of the second period consists of the weighted utility of being a citizen under candidate C or k, respectively.

The game is summarized as follows:

First period:

- Two political candidates j and k compete for office. They have ideal points x_j and x_k, which are private information of the candidates. The candidates announce incentive contracts $[\hat{p}_j, x_\nu]$ and $[x_\nu, \hat{p}_k]$ during the campaign with the following content: If and only if $p_j^{1^{inc}} \in [\hat{p}_j, x_\nu]$, the candidate is allowed to stand for reelection. The voters make their election decision.
- The candidate j is elected. He decides on a policy $p_j^{1^{inc}}$, which is perfectly observable by the voters.

Second period:

- At the end of the first term, it is decided whether the incumbent j has the right to stand for reelection. If $p_j^{1\,inc} \notin [\hat{p}_j, x_\nu]$, the incumbent j leaves office and a new candidate C with ideal point x_C and $f_C(x_C) = f_j(x_j)$ on $[\underline{x}_j, \bar{x}_j]$ competes for office with candidate k. If $p_j^{1\,inc} \in [\hat{p}_j, x_\nu]$, then the incumbent j stands for reelection and the reelection mechanism takes place. The elected candidate enters office for the second term.

We illustrate the game in figure 4.2.

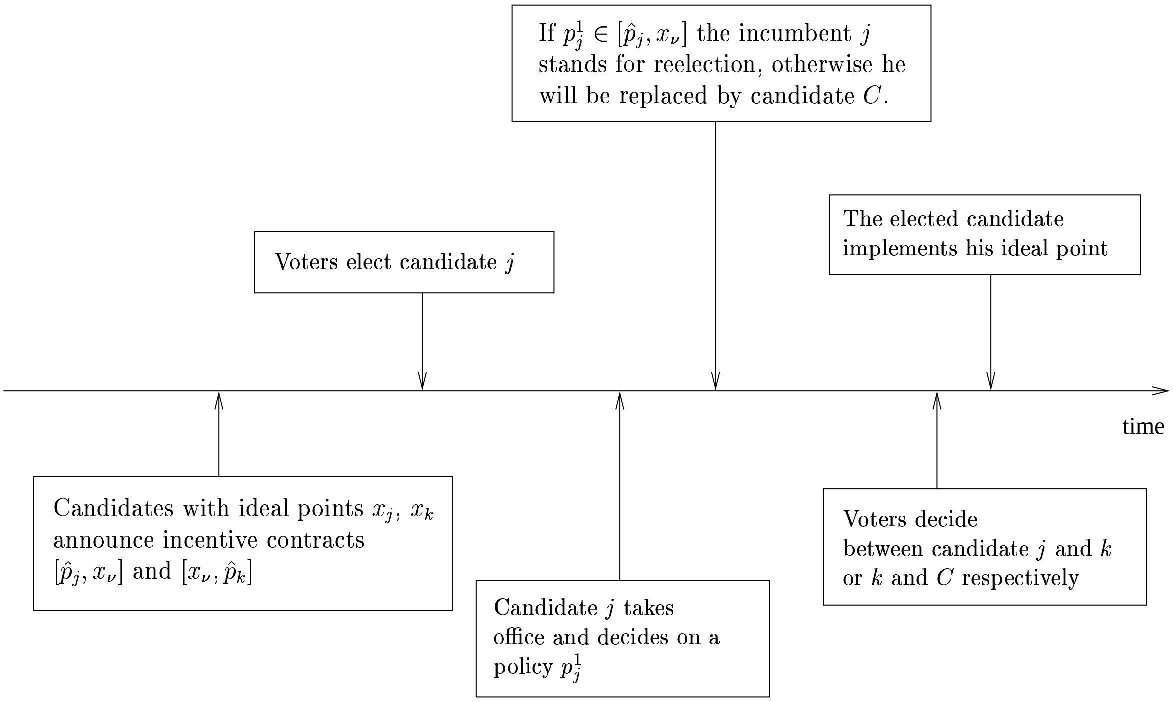

Figure 4.2: Structure of the Game

In order to simplify the presentation we denote by **GAME/ANN** the subgame starting with the policy choice of candidate j in the first period and by **ANN** the incentive contract announcement stage. We proceed as follows. We divide the analysis into two steps: We first derive the separating equilibrium in **GAME/ANN** given that there is pooling in **ANN** in which each type of candidate j announces a given policy space $[\hat{p}_j, x_\nu]$ and each type of candidate k announces a given policy space $[x_\nu, \hat{p}_k]$. In the next step we derive the equilibrium announcement.

We denote the separating equilibrium in **GAME/ANN** by **INCSEP** and state

Proposition 4.2

*Suppose there is pooling in **ANN** and all types of candidate j had announced the incentive contract $[\hat{p}_j, x_\nu]$. Suppose further that **DE1** has a solution which is strictly increasing on $[\underline{z} = x_j^{crit}(\hat{p}_j), \bar{z} = p_j^{1^{inc}}(\bar{x}_j)]$ for g, h and e as specified below.*

*Then there exists an equilibrium (**INCSEP**) in which, for any announced policy space $[\hat{p}_j, x_\nu]$, the policy of the candidate j is given as*

$$p_j^{1^{inc}}(\hat{p}_j) = \begin{cases} \bar{p}_j^1(x_j) & \text{for } x_j \in [x_j^{crit}(\hat{p}_j), \bar{x}_j], \\ x_j & \text{for } x_j \in [\underline{x}_j, x_j^{crit}(\hat{p}_j)] \end{cases}$$

with $\bar{p}_j^1(x_j)$ determined by

$$\bar{p}_j^1(x_j) = x_j + b\frac{\partial E^*(x_j|\bar{p}_j^1)}{\partial \bar{p}_j^1}\frac{(W - E(u_j(x_k)))}{2}.$$

$x_j^{crit}(\hat{p}_j)$ is given as

$$x_j^{crit}(\hat{p}_j) = \arg_{x_j}\left\{-(\hat{p}_j - x_j)^2 + (a + bx_j)(W - E(u_j(x_k))) \right. \\ \left. -(a + bE(x_C) - c\sigma^2(x_C))(E(u_j(x_C)) - E(u_j(x_k))) = 0\right\}.$$

$x_k^{crit}(\hat{p}_k)$ is defined accordingly.

The voters' expectations about the policies in the first term are given by

$$E(p_j^{1^{inc}}|\hat{p}_j) = \int_{\underline{x}_j}^{x_j^{crit}(\hat{p}_j)} x_j f_j(x_j) dx_j + \int_{x_j^{crit}(\hat{p}_j)}^{\bar{x}_j} \bar{p}_j^1(x_j) f_j(x_j) dx_j$$

and

$$E(p_k^{1^{inc}}|\hat{p}_k) = \int_{\underline{x}_k}^{x_k^{crit}(\hat{p}_k)} \bar{p}_k^1(x_k) f_k(x_k) dx_k + \int_{x_k^{crit}(\hat{p}_k)}^{\bar{x}_k} x_k f_k(x_k) dx_k.$$

The second-period equilibrium beliefs about the ideal point of incumbent j are given by

$$E^*(x_j|p_j^{1^{inc}}) = \begin{cases} x_j = p_j^{1^{inc}} & \text{for } p_j^{1^{inc}} \in [\underline{x}_j, \hat{p}_j], \\ \boldsymbol{L(DE1)}^{inc} & \text{for } p_j^{1^{inc}} \in [\hat{p}_j, \bar{p}_j^1(\bar{x}_j)] \end{cases}$$

*with $\boldsymbol{L(DE1)}^{inc}$ as the solution of the differential equation **DE1** with $Y(z) = E^*(x_j|\bar{p}_j^1)$, $z = \bar{p}_j^1$, $h = 2/b$, $e = 2E(x_k)$, $g = W + E(x_k^2)$ and initial condition $E(x_j|\hat{p}_j) = x_j^{crit}(\hat{p}_j)$.*

The expectations in the second period about the ideal points of the candidate k and candidate C are given as

$$E(x_k) = \int_{\underline{x}_k}^{\bar{x}_k} x_k f_k(x_k) dx_k$$

and

$$E(x_C) = \int_{\underline{x}_C}^{\bar{x}_C} x_C f_C(x_C) dx_C.$$

The out-of-equilibrium beliefs are given by

$$E(x_j|p_j^{1\,inc}) = \begin{cases} \bar{x}_j & \text{for } p_j^{1\,inc} > p_j^{1\,inc}(\bar{x}_j), \\ \underline{x}_j & \text{for } p_j^{1\,inc} < p_j^{1\,inc}(\underline{x}_j). \end{cases}$$

The proof is given in the appendix C.

In the proof we have shown that given there is pooling in **ANN** and the candidate j had offered an incentive contract $[\hat{p}_j, x_\nu]$, there exists a fully separating equilibrium in **GAME/ANN**. Each candidate j with $x_j > x_j^{crit}(\hat{p}_j)$ will implement a unique policy $\bar{p}_j^1 > \hat{p}_j$ and each candidate j with $x_j \leq x_j^{crit}(\hat{p}_j)$ will implement his ideal point.

The intuition runs as follows:

Given the incentive contract $[\hat{p}_j, x_\nu]$, candidate j has either the possibility to match the incentive contract and to stand for reelection or not to match the incentive contract. Candidate j implements his ideal point x_j if matching the incentive contract is too costly for him. This is the case when the required policy choice is too far away from his own ideal point. If the incentive contract is not matched candidate j is no longer concerned about his reelection and thus has no incentive to move away from his ideal point. Thus, he acts according to his own political preferences and chooses $p_j^{1\,inc} = x_j$. However, if the ideal point of the candidate j passes a certain threshold $x_j^{crit}(\hat{p}_j)$, then he would like to match the incentive contract. In this case the expected reelection chances and the associated increase in expected utility from office in the second period outweigh the costs from matching the incentive contract and moving away from the ideal point. Candidates j with $x_j > x_j^{crit}(\hat{p}_j)$ separate themselves through policy choices $\bar{p}_j^1$. $\bar{p}_j^1$ is determined by the implicit equation

$$\bar{p}_j^1(x_j) = x_j + b\frac{\partial E^*(x_j|\bar{p}_j^1)}{\partial \bar{p}_j^1}\frac{(W - E(u_j(x_k)))}{2}.$$

$\bar{p}_j^1$ has the same form and thus the same characteristics as the chosen policy under the election mechanism, i.e. there is a deviation from the ideal point of the candidate j towards the median voter's preferred policy and this deviation tends to be the higher the higher b and W are and the more sensitive the beliefs are with regard to the chosen policy. The only difference lies in the belief function which is different as the initial conditions are different.

The second-period equilibrium belief about the ideal point of candidate j $E^*(x_j|p_j^{1^{inc}})$ is based on the observed policy in the first term and the offered incentive contract. Two cases can occur: The candidate could implement a policy $p_j^{1^{inc}} > \hat{p}_j$. In this case, he has implemented $\bar{p}_j^1(x_j)$ and the belief is given as the reversal function of $\bar{p}_j^1$. If a candidate does not match the incentive contract then $E^*(x_j|p_j^{1^{inc}}) = p_j^{1^{inc}}$ as the candidate has no incentives to leave his ideal point.

Note that for $\hat{p}_j = \underline{x}_j$, the incentive contract yields the same result as the election mechanism as $\hat{p}_j = \underline{x}_j$ does not restrict policy choices.

We now explore which incentive contracts are offered by the candidates in **ANN**. Let $E^{INCSEP}(V_\nu(p_j^{1^{inc}}, p^{2^{inc}}|\hat{p}_j))$ denote the expected equilibrium utility of the median voter associated with the election of candidate j if there is pooling in **ANN** and **INCSEP** is played in **GAME/ANN**. $E^{INCSEP}(V_\nu(p_k^{1^{inc}}, p^{2^{inc}}|\hat{p}_k))$ is defined accordingly. We state

Proposition 4.3

Given the equilibrium ***INCSEP*** *is played in* ***GAME/ANN*** *and* ***L(DE1)***^{inc} *is strictly increasing on* $[\underline{z} = x_j^{crit}(\hat{p}_j^*), \bar{z} = p_j^{1^{inc}}(\bar{x}_j)]$, *there exists pooling in* ***ANN*** *(i.e. pooling in* ***ANN*** *and* ***INCSEP*** *are together an equilibrium of the overall game). Each type of candidate j announces $\hat{p}_j$ given as*

$$\hat{p}_j^* = \arg_{p_j \in [\underline{x}_j, x_\nu]} \left\{ E^{INCSEP}\left(V_\nu(p_j^{1^{inc}}, p^{2^{inc}}|\hat{p}_j)\right) \geq E^{INCSEP}\left(V_\nu(p_k^{1^{inc}}, p^{2^{inc}}|\hat{p}_k^*)\right) \right\}.$$

Each type of candidate k announces $\hat{p}_k$ as

$$\hat{p}_k^* = \arg \max_{p_k \in [x_\nu, \bar{x}_k]} \left\{ E^{INCSEP}\left(V_\nu(p_k^{1^{inc}}, p^{2^{inc}}|\hat{p}_k)\right) \right\}.$$

Candidate j wins the election.

Out-of-equilibrium beliefs for the candidate j fulfill

$$E\left(V_\nu(p_j^{1^{inc}}, p^{2^{inc}}|\hat{p}_j')\right) < E^{INCSEP}\left(V_\nu(p_k^{1^{inc}}, p^{2^{inc}}|\hat{p}_k^*)\right)$$

for $\hat{p}_j' \neq \hat{p}_j^*$.

Out-of-equilibrium beliefs for the candidate k fulfill

$$E\left(V_\nu(p_k^{1^{inc}}, p^{2^{inc}}|\hat{p}_k')\right) < E^{INCSEP}\left(V_\nu(p_k^{1^{inc}}, p^{2^{inc}}|\hat{p}_k^*)\right)$$

for $\hat{p}_k' \neq \hat{p}_k^*$.

Proof of proposition 4.3:

Suppose there is pooling in **ANN**, i.e. each type of candidate j announces the same $\hat{p}_j$ and each type of candidate k announces the same $\hat{p}_k$, respectively. Suppose furthermore the equilibrium **INCSEP** exists and is played in **GAME/ANN**.

Given that each type of candidate k offers

$$\hat{p}_k^* = \arg \max_{\hat{p}_k \in [x_\nu, \bar{x}_k]} \left\{ E^{INCSEP} \left(V_\nu(p_k^{1^{inc}}, p^{2^{inc}} | \hat{p}_k) \right) \right\}$$

each type of candidate j chooses

$$\hat{p}_j^* = \arg_{p_j \in [\underline{x}_j, x_\nu]} \left\{ E^{INCSEP} \left(V_\nu(p_j^{1^{inc}}, p^{2^{inc}} | \hat{p}_j) \right) \geq E^{INCSEP} \left(V_\nu(p_k^{1^{inc}}, p^{2^{inc}} | \hat{p}_k^*) \right) \right\}$$

as best response to ensure election.[9]

$\hat{p}_k^*$ in turn is a best response to $\hat{p}_j^*$ because there is no other incentive contract offer with which the candidate k could win the election because of our distribution assumptions.

Out-of-equilibrium beliefs for candidate k must fulfill

$$E \left(V_\nu(p_k^{1^{inc}}, p^{2^{inc}} | \hat{p}_k') \right) < E^{INCSEP} \left(V_\nu(p_k^{1^{inc}}, p^{2^{inc}} | \hat{p}_k^*) \right)$$

for $\hat{p}_k' \neq \hat{p}_k^*$. Then there is no profitable deviation for candidate k.

The out-of-equilibrium beliefs are plausible: Suppose one type of candidate k offers $\hat{p}_k'$ to signal a type with which he could win the election. If the public believed this, then all other types of candidate k would also announce $\hat{p}_k'$ and imitate this type. This in turn would lead to an expected utility for the median voter which is smaller than $E^{INCSEP}(V_\nu(p_k^{1^{inc}}, p^{2^{inc}} | \hat{p}_k^*))$.

Out-of-equilibrium beliefs for candidate j must fulfill

$$E \left(V_\nu(p_j^{1^{inc}}, p^{2^{inc}} | p_j') \right) < E^{INCSEP} \left(V_\nu(p_k^{1^{inc}}, p^{2^{inc}} | \hat{p}_k^*) \right)$$

for $\hat{p}_j' \neq \hat{p}_j^*$. Then there is no profitable deviation for the candidate j because he loses the election for any other policy announcement.

We note that $\hat{p}_j^*$ is unique because the types of the candidates k and j have distribution functions such that the median voter in expected terms is indifferent between the candidates. Thus, there exists only one $\hat{p}_j$ which can ensure $E^{INCSEP}(V_\nu(p_j^{1^{inc}}, p^{2^{inc}} | \hat{p}_j)) = E^{INCSEP}(V_\nu(p_k^{1^{inc}}, p^{2^{inc}} | \hat{p}_k^*))$.

[9] The election of candidate j is guaranteed because of our tie-breaking assumption.

Finally, as there is pooling in **ANN** and $\mathbf{L(DE1)}^{inc}$ is strictly increasing on $[\underline{z} = x_j^{crit}(\hat{p}_j^*), \bar{z} = p_j^{1^{inc}}(\bar{x}_j)]$ the equilibrium **INCSEP** exists.

■

In the proof we have shown that there exists pooling in **ANN**. Candidate j offers an incentive contract which guarantees the median voter the same expected **INCSEP**-equilibrium utility as that offered by voting for candidate k. Thus, $\hat{p}_j^*$ is chosen to ensure the election.

In equilibrium candidate k chooses his incentive contract announcement in order to maximize the expected utility of the median voter from voting for candidate k. The offered incentive contracts are thus given as

$$\hat{p}_k^* = \arg \max_{p_k \in [x_\nu, \bar{x}_k]} \left\{ E^{INCSEP}\left(V_\nu(p_k^{1^{inc}}, p^{2^{inc}} | \hat{p}_k) \right) \right\}$$

and

$$\hat{p}_j^* = \arg_{p_j \in [\underline{x}_j, x_\nu]} \left\{ E^{INCSEP}\left(V_\nu(p_j^{1^{inc}}, p^{2^{inc}} | \hat{p}_j) \right) \geq E^{INCSEP}\left(V_\nu(p_k^{1^{inc}}, p^{2^{inc}} | \hat{p}_k^*) \right) \right\}.$$

There remains one problem. The Bayesian equilibrium notions do not place restrictions on out-of-equilibrium beliefs and thus we should check whether the out-of-equilibrium beliefs on candidate j are plausible. However, to apply any refinement on the beliefs it would be necessary to identify the equilibrium continuation given any announcement $\hat{p}_j'$. This is beyond the scope of this chapter. However, note that any announcement $\hat{p}_j' > \hat{p}_j^*$ is not equilibrium dominated for candidates j with types $x_j < x_j^{crit}(\hat{p}_j^*)$ as they will not match the incentive contract in either case.

Furthermore, we can rule out that certain other equilibria exist. There does not exist pooling at another incentive contract offer as then the candidate j would lose the election. There also cannot exist fully separating at least when $-(x_\nu - \underline{x}_j)^2 < -(x_\nu - \underline{x}_k)^2$. There would be some types of candidate j who would lose the election if there was fully separating. These types of candidates would always imitate the announcement of a winning candidate as the imitation is then beneficial. Thus, there cannot be fully separating in **ANN**. The line of reasoning is similar when a subset of types of candidates pool at a particular incentive contract and other types pool at another contract. There always would exist some types of candidate j who would lose the election and therefore would imitate winning candidates, again maybe except for the case that the candidate j had an enormous comparative advantage.

In the next section we perform a welfare comparison between the equilibrium under the election mechanism alone and the equilibrium under the hierarchy of an incentive contract and elections.

4.5 Welfare Comparison

In this section we perform a welfare comparison between the equilibrium **ELSEP** and the equilibrium consisting of pooling in **ANN** and **INCSEP**. Let $E^{EL}(V_\nu(p_j^1, p^2))$ be the expected utility of the median voter in equilibrium **ELSEP** and $E^{INCSEP}(V_\nu(p_j^{1^{inc}}, p^{2^{inc}}|\hat{p}_j^*))$ be the expected equilibrium utility of the median voter if there is pooling in **ANN** and **INCSEP** in **GAME/ANN**. Furthermore, let $E^{EL}(u_\nu(p_j^1))$ be the expected first-period utility of the median voter in the equilibrium **ELSEP** and $E^{INCSEP}(u_\nu(p_j^{1^{inc}}|\hat{p}_j^*))$ be the expected first-period utility of the median voter in the equilibrium consisting of pooling in **ANN** and **INCSEP**, respectively.

We state

Proposition 4.4

The introduction of an incentive contract weakly increases social welfare.

Proof of proposition 4.4:

In order to show that the introduction of an incentive contract weakly increases social welfare it is sufficient to show that an announcement $\hat{p}_j$ with $E^{INCSEP}(V_\nu(p_j^{1^{inc}}, p^{2^{inc}}|\hat{p}_j))$ $< E^{EL}(V_\nu(p_j^1, p^2))$ is not an equilibrium announcement as derived in proposition 4.3.

All our arguments are based on the assumption that there is pooling in **ANN**. We first note that $\hat{p}_j = \underline{x}_j$ implies $E^{INCSEP}(V_\nu(p_j^{1^{inc}}, p^{2^{inc}}|\hat{p}_j)) = E^{EL}(V_\nu(p_j^1, p^2))$ and similarly $\hat{p}_k = \bar{x}_k$ implies $E^{INCSEP}(V_\nu(p_k^{1^{inc}}, p^{2^{inc}}|\hat{p}_k)) = E^{EL}(V_\nu(p_k^1, p^2))$. In these cases the incentive contract does not impose any restrictions on the policy choice of the politician once in office.

Furthermore, note that $E^{EL}(V_\nu(p_j^1, p^2)) = E^{EL}(V_\nu(p_k^1, p^2))$ due to our information assumptions.

Suppose now candidate j offers $\hat{p}'_j$ with $E^{INCSEP}(V_\nu(p_j^{1^{inc}}, p^{2^{inc}}|\hat{p}'_j)) < E^{EL}(V_\nu(p_j^1, p^2))$. This can be no equilibrium announcement. Given the candidate k announces $\hat{p}_k^*$ the candidate j would lose the election.

■

We continue with a description of the conditions under which the introduction of an incentive contract strictly increases social welfare. We state

Proposition 4.5
The expected social welfare is strictly increased through the introduction of an incentive contract if

$$\int_{\underline{x}_j}^{x_j^{crit}(\hat{p}_j^*)} f_j(x_j)dx_j q\left(E(x_C), \sigma^2(x_C)\right) E(u_\nu(x_C)) - \int_{\underline{x}_j}^{x_j^{crit}(\hat{p}_j^*)} f_j(x_j)q(x_j)u(x_j)dx_j$$
$$> E^{EL}(u_\nu(p_j^1)) - E^{INCSEP}(u_\nu(p_j^{1^{inc}}|\hat{p}_j^*)).$$

The proof is given in the appendix C.

This condition reflects two consequences of the introduction of an incentive contract. First, the incentive contract changes the expected utility of the median voter in the first period as it changes the policy chosen by candidate j. This leads to a higher expected first-period utility of the median voter if $E^{INCSEP}(u_\nu(p_j^{1^{inc}}|\hat{p}_j^*)) > E^{EL}(u_\nu(p_j^1))$.

Second, in the second period there are two countervailing effects of the introduction of an incentive contract: The first effect is that with an incentive contract a pool of "bad" candidates, i.e. candidates with an ideal point far away from the median voter's ideal point cannot have office a second time. Candidates with $x_j \in [\underline{x}_j, x_j^{crit}(\hat{p}_j^*)]$ are renounced to stand for reelection because they did not match the incentive contract. Thus, the pool of candidates which stand for reelection is better than in equilibrium **ELSEP**. On the other hand, if the incumbent j must leave office, a new candidate enters the game whose expected ideal point is closer to the median voter's preferences but the variance connected with his position is higher. The question regarding the second period is therefore: does the median voter prefer a candidate with closer expected ideal point but high variance to an incumbent with a further but known ideal point?

Thus, whether the incentive contract strictly increases social welfare depends on the parameter constellation.

Thus, there is a potential drawback of the introduction of an incentive contract. We have shown that the incentive contract weakly increases social welfare from an ex ante point of view. From an ex post point of view it is possible that the candidate j implements his ideal point x_j instead of a more moderate policy. This is the case if the incentive contract imposes too strong constraints on the policy chosen by candidate j causing him to no longer want to match his contract. Thus, under an incentive contract social welfare is weakly increased from an ex ante point of view, but may decrease the ex post welfare of voters.

4.6 Conclusion

Our analysis in this chapter suggests that introducing incentive contracts for politicians improves democratic procedures from an ex ante point of view. However, from an ex post point of view, some problems may arise as the elected candidate does not always invest in matching his incentive contract and then decides on a policy according to his own preferences as he does not care about reelection anymore.

In the next chapter we analyze whether reelection threshold contracts are suitable to increase the information efficiency of a democracy.

Chapter 5

Reelection Threshold Contracts and the Information Efficiency of a Democracy

5.1 Introduction

One of the main causes of inefficiencies in democracies is the lack of credibility of announcements made during a campaign. Since the candidates are not bound to fulfill their campaign promises, the credibility of these promises is often in question. This may cause friction costs. Consider an outstanding reform for which an adequate reform procedure has yet to be identified. A political candidate could announce a law during the campaign with which he intends to introduce the reform. However, the candidate is in no way committed to pass this law. Upon election he could easily implement another law, favoring for example a certain clientele. Moreover, during the campaign information acquisition for an adequate reform procedure may incur the candidate costs which he would rather like to spend for campaign purposes. However, a credible law announcement might be beneficial, because the public could prepare itself for the reform and hence there would be less friction costs.

In this chapter we first examine the credibility of law announcements made during a campaign when the election mechanism is at work. Second we introduce a reelection threshold contract which binds the candidates to their law announcements. We show that social welfare can be increased for some parameter constellations.

We develop our argument by considering a campaign model with two candidates. Once in office the elected candidate is faced with the implementation of a reform project, which requires passing a new law that is a priori unknown. The candidates have the possibility to acquire information about this law before the election. The search is costly.

During the campaign the candidates can make law announcements for the implementation of the reform project, which are not verifiable. Entrepreneurs decide whether or not to base their investment decision on these law announcements. If they invest based on a law announcement and the candidate has gathered information, i.e. the law announcement is appropriate, the development of the country is favorable.

First, it will be shown that under the election mechanism a candidate will invest in the information acquisition if the costs of this information are compensated by a sufficient increase of the reelection probability. Furthermore, the probability that the candidate has acquired the information must be high enough so that entrepreneurs will base their investment decisions on the announced law.

Second, we introduce an incentive contract which requires that a candidate has to announce a law during the campaign. If the candidate fails to implement the announced law, he will lose the right to stand for reelection. The introduction of the incentive contract has two effects. First, we show that information acquisition by the candidates and thus also the credibility of their law announcements is substantially increased as the incentive contract punishes other behavior. However, the whole reform project may be jeopardized if the candidate announced a law which is not enforceable as then a candidate does not concern for reelection. The parameter constellation dictates which effect will outweigh the other.

We identify two benchmarks: first, the incentive contract decreases the expected social welfare if the law announcement has no bearing on investment decisions. Second, the incentive contract increases social welfare if the candidate accumulates information in all cases. The law announcement is then credible.

This chapter is related to the model by Alesina (1988), who shows that in a repeated electoral game with low enough discount rates and infinite time horizon, reputation may lead politicians to deliver on their promises. In a second model, Alesina and Spear (1988) address this issue in an overlapping generations model of politicians, following the work of Crémer (1986). In this model an elected politician in his last term has an incentive to stick to his campaign promises due to party pressure.

Another cause for campaign promises being credible is signaling. Campaign promises are used as signals for a candidate's type. Harrington (1993) presents a model where a policy-motivated candidate is unsure about the policy preferences of the electorate. This candidate may be better off to announce his true preferences. In another model (Harrington (1992)) he shows that if the support of the electorate is crucial not only in getting elected but also in carrying out policy this strengthens the credibility of campaign promises.

The chapter is organized as follows. In section 5.2 we outline the model. In section 5.3 we derive the equilibria under the election mechanism. In section 5.4 we develop the equilibria if an incentive contract is added. In section 5.5 we indicate the welfare implications. Section 5.6 concludes.

5.2 The Model

We consider a two-period model with two political candidates $i, j \in \{A, B\}$. There is a public project denoted by P faced by the elected candidate in the first term. The elected candidate can undertake the project or maintain the status quo (ST). The decision is denoted by X with $X \in \{P, ST\}$. The implementation of the project in the first term will incur a cost C for the politician and requires passing a new law.

There is a continuous one-dimensional law space $\mathcal{M} = \mathbb{R}$. An element $p \in \mathcal{M}$ is a law. Once in office, a candidate j can choose a law p, which we denote by p_j. We assume that both candidates are constrained in their choice of a law by the ideological position of their parties or by commitments to lobbies. In particular, we assume that candidate A can only choose a law p_A in the subspace or interval $[\underline{p}_A, \bar{p}_A]$, $\bar{p}_A > \underline{p}_A$. Similarly, candidate B can only choose a law p_B in the subspace $[\underline{p}_B, \bar{p}_B]$, $\bar{p}_B > \underline{p}_B$. We assume $\bar{p}_A \leq \underline{p}_B$ and thus there is no intersection.

Each of these subspaces contains a law p_j^* with which the project P can be implemented successfully. However, the appropriate law p_j^* is unknown to the candidates before the election date. They only have some background information θ about p_j^*, which they share with the whole society. This can be interpreted as follows: The elected candidate faces a problem, for example, the reform of the health care system. The necessary reform law is unknown a priori. The candidate and the public have only a vague knowledge about it. This vague knowledge ("background information"), for instance, may be "more excess" or "more competition between the insurances". In addition to a feasible design of the law, the candidates have to take into account the ideological preferences of their parties or their commitment to lobbies. Thus, there will always be design differences of the law and no two candidates will adopt the same law. For an example take the Rürup and the Herzog commission in Germany which in 2003 both gathered information about an appropriate design of the health care reform. The Rürup commission was appointed by the SPD an the Herzog commission by the CDU/CSU.

The candidates have the possibility to make announcements α_j during the campaign. $\alpha_j \in \{\alpha_j^\theta, \alpha_j^{p_j}\}$ with

$$\alpha_j = \begin{cases} \emptyset \cup \theta = \alpha_j^\theta, \\ p_j \cup \theta = \alpha_j^{p_j}. \end{cases} \tag{5.1}$$

Thus, either a candidate only presents the background information θ (in case α_j^θ) or he announces a concrete law p_j, which together with the background information constitutes a complete policy proposal which is equivalent to a law announcement denoted by $\alpha_j^{p_j}$. The law announcement is not verifiable by the voters in the sense that voters could not check whether $\alpha_j^{p_j}$ is the appropriate law announcement.

We assume that a candidate can gather information about p_j^* at costs K_j during the campaign. We denote this case by S for "search". The case where a candidate does not gather information about p_j^* is denoted by NS. We assume that a candidate finds the appropriate law p_j^* with certainty if he invests K_j. If he does not invest K_j he does not find the appropriate law.[1] Furthermore, we assume that once in office the candidate finds p_j^* to lower costs, which are assumed to be zero for simplicity of presentation.[2] We denote the case that a candidate announces $\alpha_j^{p_j} = p_j^* \cup \theta$ by α_j^* and the case that a candidate announces $\alpha_j^{p_j} = p_j \cup \theta$ by α_j^l if $p_j \neq p_j^*$.

The costs K_j depend on the type or competence of the candidate j which cannot be

[1] This can be justified by a random choice in $[\underline{p}_j, \bar{p}_j]$. Then, the probability that $p_j = p_j^*$ is indeed zero.

[2] However, if one wants to model a situation in which one candidate is already incumbent, one should assume that there are also positive costs for him, for example, private effort costs. As long as the costs for information acquisition are lower while a candidate holds office, this has no bearing on the results.

observed by the voters. From the voters' perspective, K_A is distributed with density function $f_A(K_A)$ on $[\underline{K}_A, \bar{K}_A]$, and K_B with density function $f_B(K_B)$ on $[\underline{K}_B, \bar{K}_B]$. The costs K_j reflect a candidate's competency to gather information, where competency needs to be interpreted in a broad sense, including the ability to motivate governmental branches and experts to design a successful law. The competency of the candidates is unknown to the voters, but the probability distribution over the competencies is common knowledge.

A subset Γ of voters, whom we call "entrepreneurs", has to choose optimal economic actions (investments) $e(I)$ before the election takes place. I denotes the information on which the entrepreneurs base their decision with $I = \{\alpha_A, \alpha_B, \theta\}$. Thus, the entrepreneurs either base their decision on one of the announcements or on θ. We assume that if the entrepreneurs base their decision on α_j and $\alpha_j = \alpha_j^{p_j}$ they undertake an investment denoted by $e(\alpha_j^{p_j})$. If they use θ they do not invest which is denoted by $e(\theta)$. We assume that there is no possibility to base the investment on a combination of the two laws.[3] Note that I is choice of the entrepreneurs. The investment decision creates a pay-off $\pi(e(I))$ for the entrepreneurs in the first term of the politician. We assume

$$\pi(e(\alpha_j^*)) > \pi(e(\theta)) > \pi(e(\alpha_j^{\wr})). \tag{5.2}$$

For simplicity of presentation we also assume $\pi(e(\alpha_A^*)) = \pi(e(\alpha_B^*))$ and $\pi(e(\alpha_A^{\wr})) = \pi(e(\alpha_B^{\wr}))$. Thus, the ideological bias of the law has no influence on the pay-off for the entrepreneurs. The pay-off for the entrepreneurs is higher if they base their investment decision on an appropriate law announcement, but the pay-off is lower if they base it on an inappropriate law announcement rather than on θ, i.e. choose to not invest.

For simplicity of presentation, we denote $\pi(e(\alpha_j^*))$ by $\pi(\alpha_j^*)$, $\pi(e(\theta))$ by $\pi(\theta)$ and $\pi(e(\alpha_j^{\wr}))$ by $\pi(\alpha_j^{\wr})$.

Suppose that both candidates j announce laws $\alpha_A^{p_A}$ and $\alpha_B^{p_B}$. Then, if the entrepreneurs do not choose $e(\theta)$, we assume they choose

- $e(\alpha_j^{p_j})$ if the candidate j is elected with certainty and
- $$e = \begin{cases} e(\alpha_A^{p_A}) \text{ with probability } 1/2 \\ e(\alpha_B^{p_B}) \text{ with probability } 1/2 \end{cases}$$

[3]This is certainly true if a specific investment is required.

otherwise.

The performance of the country is given by $Y(X, e(I))$ and thus depends on whether the project is implemented after a candidate has been elected and on the investment choice before the election. We assume

$$Y(P, e(\alpha_j^*)) > Y(P, e(\theta)) > Y(P, e(\alpha_j^l)) > Y(ST, e(\theta)) = Y(ST, e(\alpha_j^{p_j})). \tag{5.3}$$

Thus, higher performance is associated with investment based on the appropriate law announcement.[4],[5]

The utility of the voters is given as

$$U_\nu = kY(X, e(I)) \tag{5.4}$$

with $0 < k \leq 1$ and thus depends on the performance of the country.

Let $E_j(Y)$ denote the expected performance associated with the election of candidate j. We assume that voters are risk-neutral and thus, elect the candidate associated with the higher expected performance. Therefore, if $E_A(Y) > E_B(Y)$ candidate A is elected with certainty. If $E_A(Y) = E_B(Y)$ we assume that each candidate has a probability of $1/2$ of being elected.

An elected candidate has a probability of $q(Y(X, e(I)))$ of being reelected in the second term. For simplicity, we denote $q(Y(X, e(I)))$ by $q(X, e(I))$. $q(X, e(I))$ is equal for both candidates. We assume

$$q(P, e(\alpha_j^*)) > q(P, e(\theta)) > q(P, e(\alpha_j^l)) > q(ST, e(\theta)) = q(ST, e(\alpha_j^{p_j})) = 0 \tag{5.5}$$

and thus that $q(Y(X, e(I)))$ is strictly increasing in $Y(P, e(I))$ and is zero if the candidate does not implement the project.

The fact that the reelection scheme is stochastic can be interpreted in several ways. For instance, while some voters may base their reelection decision exclusively on the

[4]We assume

$$Y(P, e(\alpha_j^*)) - Y(P, e(\theta)) \geq K_j \ \ \forall\, K_j \in [\underline{K}_j, \bar{K}_j],\ j = A, B$$

and thus information acquisition is always socially efficient when the project is undertaken.

[5]Note that the case where the entrepreneurs base their investment on the announced law of the losing candidate is captured in $Y(X, e(\alpha_j^l))$, as the winning candidate cannot implement the law of the losing candidate for political reasons. Furthermore, note that the $Y(ST, e(\alpha_j^{p_j}))$ encompasses also the case $Y(ST, e(\alpha_j^*))$.

past performance of the candidate, others may use other factors for their reelection decision. These factors may include the leadership and communication skills of the incumbent, the perceived competence of a competitor, or on economic circumstances independent of current policies.

The elected candidate is assumed to be motivated by holding the office. His utility once he is elected is given by

$$U(X, e(I)) = W + q(X, e(I))W - c \tag{5.6}$$

with

$$c = \begin{cases} 0 & \text{for } X = ST \\ C & \text{for } X = P. \end{cases}$$

W denotes the utility of holding the office, which could be monetary utility or simply utility from having power. c denotes the costs for undertaking the project which are zero if the project is not undertaken and C if the project is undertaken. For simplicity of presentation, we assume that the discount factor is 1.

We assume

$$q(P, e(I))W - C > q(ST, e(I))W = 0$$

and thus the project is undertaken after the election whenever the candidate has a nonzero reelection probability.

The game is given as follows.

Stage 1: The candidates campaign for office and decide on $\{S, NS\}$. They make an announcement α_j.

Stage 2: The entrepreneurs choose $e(I)$. The voters observe $e(I)$ and make their election decision.

Stage 3: The elected candidate decides on $X \in \{P, ST\}$. $\pi(e(I))$ and Y realize and the reelection takes place.

The derivation of the equilibria under the election mechanism follows.

5.3 The Election Mechanism

We only consider elections and start with the following observation.

Lemma 5.1

In any equilibrium under the election mechanism, an elected politician chooses $X = P$.

Proof of lemma 5.1:

As $q(ST, e(I)) = 0$ and $q(P, e(I))W - C > 0$, the politician always has a higher utility by choosing $X = P$.

■

In what follows we neglect the option ST since it will never be chosen under the election mechanism. We denote by $\text{prob}(\alpha_j^{p_j} = \alpha_j^*)$ the beliefs of the voters that a politician announces the appropriate law. We now give the necessary conditions for the information acquisition of a candidate under the election mechanism.

Lemma 5.2

In any equilibrium under the election mechanism the following conditions have to be necessarily fulfilled in order that a candidate j gathers information:[6]

(a) $e(I) = e(\alpha_j^{p_j})$ *and thus* $E(\pi(\alpha_j^{p_j})) \geq E(\pi(\theta))$ *and*

(b) $E_j(Y(P, e(\alpha_j^{p_j}))) \geq E_j(Y(P, e(\theta)))$.

This is equivalent to the condition

$$prob(\alpha_j^{p_j} = \alpha_j^*) \geq \max\left\{\frac{\pi(\theta) - \pi(\alpha_j^l)}{\pi(\alpha_j^*) - \pi(\alpha_j^l)}, \frac{Y(P, e(\theta)) - Y(P, e(\alpha_j^l))}{Y(P, e(\alpha_j^*)) - Y(P, e(\alpha_j^l))}\right\}.$$

Proof of lemma 5.2:

For information acquisition of a candidate j the two conditions (a) and (b) have to be fulfilled:

(a) $e(I) = e(\alpha_j^{p_j})$ and thus $E(\pi(\alpha_j^{p_j})) \geq E(\pi(\theta))$ and

[6] The search for information is probabilistic. However, we will neglect this in our terminology throughout this chapter.

(b) $E_j(Y(X, e(\alpha_j^{p_j}))) \geq E_j(Y(X, e(\theta)))$.

The condition (a) means that the entrepreneurs are willing to choose $e(\alpha_j^{p_j})$. This must be fulfilled, otherwise the information acquisition has no effects. In addition, the condition (b) must be fulfilled, otherwise the candidate has a higher election probability by announcing α_j^{θ}.

The condition (a) is fulfilled if

$$\text{prob}(\alpha_j^{p_j} = \alpha_j^*)\pi(\alpha_j^*) + (1 - \text{prob}(\alpha_j^{p_j} = \alpha_j^*))\pi(\alpha_j^l) \geq \pi(\theta).$$

Then the entrepreneurs' expected gain from investment under $\alpha_j^{p_j}$ is higher than the gain incurred by not investing. The condition can be easily transformed into

$$\text{prob}(\alpha_j^{p_j} = \alpha_j^*) \geq \frac{\pi(\theta) - \pi(\alpha_j^l)}{\pi(\alpha_j^*) - \pi(\alpha_j^l)}.$$

When this condition is not fulfilled, the entrepreneurs will not select $e(\alpha_j^{p_j})$ and the candidate does not benefit in announcing an appropriate law and acquiring the necessary information.

Additionally, the condition (b) is fulfilled if

$$\text{prob}(\alpha_j^{p_j} = \alpha_j^*)Y(P, e(\alpha_j^*)) + (1 - \text{prob}(\alpha_j^{p_j} = \alpha_j^*))Y(P, e(\alpha_j^l)) \geq Y(P, e(\theta))$$

what can be transformed into

$$\text{prob}(\alpha_j^{p_j} = \alpha_j^*) \geq \frac{Y(P, e(\theta)) - Y(P, e(\alpha_j^l))}{Y(P, e(\alpha_j^*)) - Y(P, e(\alpha_j^l))}.$$

Thus, both conditions are fulfilled if

$$\text{prob}(\alpha_j^{p_j} = \alpha_j^*) \geq \max\left\{\frac{\pi(\theta) - \pi(\alpha_j^l)}{\pi(\alpha_j^*) - \pi(\alpha_j^l)}, \frac{Y(P, e(\theta)) - Y(P, e(\alpha_j^l))}{Y(P, e(\alpha_j^*)) - Y(P, e(\alpha_j^l))}\right\}.$$

■

The condition (a) in lemma 5.2 means that the entrepreneurs are willing to select $e(\alpha_j^{p_j})$ and thus to invest based on a law announcement. This must be fulfilled, otherwise the information acquisition has no effect. Additionally, the condition (b) must be fulfilled otherwise the candidate has a higher election probability by announcing α_j^{θ}.

The two necessary conditions can be summarized as:

$$\text{prob}(\alpha_j^{p_j} = \alpha_j^*) \geq \max\left\{\frac{\pi(\theta) - \pi(\alpha_j^{\wr})}{\pi(\alpha_j^*) - \pi(\alpha_j^{\wr})}, \frac{Y(P, e(\theta)) - Y(P, e(\alpha_j^{\wr}))}{Y(P, e(\alpha_j^*)) - Y(P, e(\alpha_j^{\wr}))}\right\}.$$

In what follows this condition is expressed as

$$\text{prob}(\alpha_j^{p_j} = \alpha_j^*) \geq \max\left\{\Delta\pi(\alpha_j^*, \alpha_j^{\wr}, \theta), \Delta Y(\alpha_j^*, \alpha_j^{\wr}, \theta)\right\}$$

where

$$\Delta\pi(\alpha_j^*, \alpha_j^{\wr}, \theta) = \frac{\pi(\theta) - \pi(\alpha_j^{\wr})}{\pi(\alpha_j^*) - \pi(\alpha_j^{\wr})}$$

and

$$\Delta Y(\alpha_j^*, \alpha_j^{\wr}, \theta) = \frac{Y(P, e(\theta)) - Y(P, e(\alpha_j^{\wr}))}{Y(P, e(\alpha_j^*)) - Y(P, e(\alpha_j^{\wr}))}.$$

We state

Proposition 5.1

Suppose

$$F_A([q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^{\wr}))]W) \geq \max\left\{\Delta\pi(\alpha_A^*, \alpha_A^{\wr}, \theta), \Delta Y(\alpha_A^*, \alpha_A^{\wr}, \theta)\right\}.$$

*Then there exists an equilibrium (**AS**) in which*

$$prob^*(\alpha_A^{p_A} = \alpha_A^*) = F_A([q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^{\wr}))]W)$$

and

$$prob^*(\alpha_B^{p_B} = \alpha_B^*) = 0.$$

The candidate A announces $\alpha_A^{p_A}$. The entrepreneurs choose $e(\alpha_A^{p_A})$. The candidate B does not gather information. The candidate A gathers information if

$$[q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^{\wr}))]W \geq K_A.$$

The candidate A is elected with certainty. The expected performance of the country is given as

$$E_A^{AS}(Y) = Y(P, e(\alpha_A^{\wr})) + F_A([q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^{\wr}))]W)[Y(P, e(\alpha_A^*)) - Y(P, e(\alpha_A^{\wr}))].$$

Proof: see appendix D.

The intuition of proposition 5.1 is as follows.

The beliefs of the voters together with the assumption of the proposition imply that candidate A is elected with certainty whenever he announces a particular law $\alpha_A^{p_A}$. Thus, he will announce a law. Candidate B will not gather information because the voters believe that his law announcement is not appropriate.

The candidate A will gather information as long as

$$[q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^l))]W \geq K_A$$

and thus as long as the increase of his expected future utility due to a higher expected reelection probability is greater than the costs for information acquisition. Thus, the only incentive for candidate A to gather information is the increase in his expected reelection probability through efficiency gains in the society. These efficiency gains must be significantly to outweigh the costs of the information acquisition. Otherwise the candidate A announces $\alpha_A^{p_A} = \alpha_A^l$.

Given the probability distribution of K_A voters' beliefs are correct what establishes the equilibrium. The expected performance of the country denoted by $E_A^{AS}(Y)$ is given as

$$E_A^{AS}(Y) = Y(P, e(\alpha_A^l)) + F_A([q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^l))]W)[Y(P, e(\alpha_A^*)) - Y(P, e(\alpha_A^l))].$$

Following a very similar argument there exists a second equilibrium in which candidate B is the elected candidate.

Proposition 5.2

Suppose

$$F_B([q(P, e(\alpha_B^*)) - q(P, e(\alpha_B^l))]W) \geq \max\left\{\Delta\pi(\alpha_B^*, \alpha_B^l, \theta), \Delta Y(\alpha_B^*, \alpha_B^l, \theta)\right\}.$$

*Then there exists an equilibrium (**BS**) in which*

$$prob^*(\alpha_B^{p_B} = \alpha_B^*) = F_B([q(P, e(\alpha_B^*)) - q(P, e(\alpha_B^l))]W)$$

and

$$prob^*(\alpha_A^{p_A} = \alpha_A^*) = 0.$$

The candidate B announces $\alpha_B^{p_B}$. The entrepreneurs choose $e(\alpha_B^{p_B})$. The candidate A does not gather information. Candidate B gathers information if

$$[q(P, e(\alpha_B^*)) - q(P, e(\alpha_B^l))]W \geq K_B.$$

Candidate B is elected with certainty. The expected performance of the country is given as

$$E_B^{BS}(Y) = Y(P, e(\alpha_B^l)) + F_B([q(P, e(\alpha_B^*)) - q(P, e(\alpha_B^l))]W)[Y(P, e(\alpha_B^*)) - Y(P, e(\alpha_B^l))].$$

The proof follows the lines of the proof of proposition 5.1 and is therefore omitted.

The model also allows for knife-edge equilibria.

Proposition 5.3
Suppose

$$F_A(\frac{1}{2}[q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^l))]W) = F_B(\frac{1}{2}[q(P, e(\alpha_B^*)) - q(P, e(\alpha_B^l))]W)$$

and

$$F_j(\frac{1}{2}[q(P, e(\alpha_j^*)) - q(P, e(\alpha_j^l))]W) \geq \max\left\{\Delta\pi(\alpha_j^*, \alpha_j^l, \theta), \Delta Y(\alpha_j^*, \alpha_j^l, \theta)\right\}.$$

*Then there exists an equilibrium (**ABS**) in which*

$$prob^*(\alpha_j^{p_j} = \alpha_j^*) = F_j(\frac{1}{2}[q(P, e(\alpha_j^*)) - q(P, e(\alpha_j^l))]W)$$

for $j = A, B$.

The candidate j, $j = A, B$, announces $\alpha_j^{p_j}$. The candidate j gathers information if

$$\frac{1}{2}[q(P, e(\alpha_j^*)) - q(P, e(\alpha_j^l))]W \geq K_j.$$

The entrepreneurs' selection of the law announcement determines which candidate is elected. The expected performance of the country is given as

$$E_j^{ABS}(Y) = Y(P, e(\alpha_j^l)) + F_j(\frac{1}{2}[q(P, e(\alpha_j^*)) - q(P, e(\alpha_j^l))]W)[Y(P, e(\alpha_j^*)) - Y(P, e(\alpha_j^l))].$$

Proof: see appendix D.

The intuition of proposition 5.3 is as follows:

The beliefs of the voters together with the assumptions of the proposition imply that the entrepreneurs choose to invest and that both candidates are elected with a priori probability 1/2 if they announce $\alpha_j^{p_j}$. They are not elected if they announce α_j^{θ}. Thus, candidate j announces $\alpha_j^{p_j}$. The elected candidate is the one on whose law announcement the entrepreneurs based their investment decision. Suppose the entrepreneurs have chosen $e(\alpha_A^{p_A})$. Then $E_A^{ABS}(Y) > E_B^{ABS}(Y)$ and candidate A is elected with certainty. Since the entrepreneurs have a probability of $1/2$ of selecting a given law, each candidate has a probability of $1/2$ of being elected. Candidate j, $j = A, B$, gathers information as long as

$$\frac{1}{2}[q(P, e(\alpha_j^*)) - q(P, e(\alpha_j^l))]W \geq K_j.$$

Thus, the probability that a candidate has invested in information-acquisition is given as $F_j(\frac{1}{2}[q(P, e(\alpha_j^*)) - q(P, e(\alpha_j^l))]W)$.

Note that the probability that a candidate gathers information is less than in the case where one candidate is elected with certainty. The expected gain in future utility through information acquisition is less due to the lower election probability. Thus, the uncertainty in the electoral outcome decreases the incentive for a candidate to acquire information.[7]

The expected performance in the equilibrium **ABS** is given by

$$E_j^{ABS}(Y) = Y(P, e(\alpha_j^l)) + F_j(\frac{1}{2}[q(P, e(\alpha_j^*)) - q(P, e(\alpha_j^l))]W)[Y(P, e(\alpha_j^*)) - Y(P, e(\alpha_j^l))].$$

There may also exist no-trust equilibria, which we denote by **NSE**.

Proposition 5.4

*There exists an equilibrium (**NSE**) in which*

$$prob^*(\alpha_j^{p_j} = \alpha_j^*) = 0$$

for $j = A, B$.

No candidate will gather information. The expected performance of the country is given as $E_j^{NSE}(Y) = Y(P, e(\theta))$.

Each candidate has a probability of $1/2$ of being elected.

The proposition 5.4 follows from the following observation. Suppose the voters believe

$$\text{prob}(\alpha_j^{p_j} = \alpha_j^*) = 0$$

for $j = A, B$.

[7] The probability that a candidate gathers information would be higher if there exists only one law p_j^* that both candidates find with certainty if they invest K_j. Then there exists the possibility that both candidates announce the same $\alpha_j^{p_j}$. In this case the entrepreneurs would choose $e(\alpha_j^{p_j})$.

Then $E_j^{NSE}(Y) = Y(P, e(\theta))$ for $j = A, B$ and the entrepreneurs choose not to invest. Thus, there is no incentive for a candidate to gather information which means that the beliefs are correct. Thus, both candidates do not gather information and each candidate has a probability of 1/2 of being elected. This equilibrium always exists.

In the next section we look at the equilibria when an incentive contract is present.

5.4 Equilibria with an Incentive Contract

An incentive contract is designed as follows: During the campaign candidate j is forced to announce $\alpha_j^{p_j}$ and thus to announce a complete policy proposal. He must sign the following contract: If he gets elected and if he does not fulfill his law announcement he will lose the right to stand for reelection. If, however, $\alpha_j^{p_j} = \alpha_j^*$ the candidate has the right to stand for reelection.

The structure of the game is given as follows:

Stage 1: The candidates campaign for office and decide on $\{S, NS\}$. Each candidate has to announce $\alpha_j^{p_j}$.

Stage 2: The entrepreneurs choose $e(I)$. The voters observe $e(I)$ and make their election decision.

Stage 3: The elected candidate decides on $X \in \{ST, P\}$; $\pi(e(I))$ and $Y(X, e(I))$ realize.

Stage 4: If $\alpha_j^{p_j} = \alpha_j^*$, the incumbent has the right to stand for reelection and the election proceeds in normal manner. If $\alpha_j^{p_j} = \alpha_j^{\wr}$, he does not have the right to stand for reelection.

We examine the equilibria of the game. In any equilibrium the following must hold.

Lemma 5.3

In any equilibrium under the incentive contract an elected candidate j chooses

$$X = \begin{cases} P \textit{ with } prob^*(\alpha_j^{p_j} = \alpha_j^*) \\ ST \textit{ with } 1{-}prob^*(\alpha_j^{p_j} = \alpha_j^*) \end{cases}$$

Proof: see appendix D.

If an incumbent announced $\alpha_j^{p_j} = \alpha_j^l$ he won't implement the project once in office. $X = ST$ strictly dominates $X = P$ since the costs for undertaking the project are strictly positive and the candidate cannot be reelected.

Furthermore, we state that in the case where an incentive contract is present, the possibility of a no trust equilibrium does not exist.

Proposition 5.5
There exists no equilibrium with search probability zero for both candidates under the incentive contract.

Proof: see appendix D.

The intuition behind proposition 5.5 is as follows.

Given an incentive contract the candidates always have incentives to gather information even if the entrepreneurs choose $e(\theta)$ because a politician does not have the right to stand for reelection if he announced α_j^l.

We will now expose the equilibria of the game.

Proposition 5.6
(i) Suppose

$$F_A(q(P, e(\alpha_A^*))W - C) \geq \Delta\pi(\alpha_A^*, \alpha_A^l, \theta).$$

Then there exists an equilibrium ($\boldsymbol{ASI}^{inc}$) with beliefs of the voters

$$prob^*(\alpha_A^{p_A} = \alpha_A^*) = F_A(q(P, e(\alpha_A^*))W - C)$$

and

$$prob^*(\alpha_B^{p_B} = \alpha_B^*) = 0.$$

Candidate A gathers information if

$$q(P, e(\alpha_A^*)))W - C \geq K_A.$$

The entrepreneurs choose $e(\alpha_A^{p_A})$. Candidate B does not gather information.

Candidate A is elected with certainty and the expected performance of the country is given as

$$E_A^{ASI^{inc}}(Y) = Y(ST, e(\alpha_A^l)) + F_A(q(P, e(\alpha_A^*))W - C)[Y(P, e(\alpha_A^*)) - Y(ST, e(\alpha_A^l))].$$

(ii) Suppose

$$F_A(q(P, e(\alpha_A^*))W - C) < \Delta\pi(\alpha_A^*, \alpha_A^l, \theta).$$

*Then there exists an equilibrium (**ASNI**^{inc}) with beliefs of the voters*

$$prob^*(\alpha_A^{p_A} = \alpha_A^*) = F_A(q(P, e(\theta))W - C)$$

and

$$prob^*(\alpha_B^{p_B} = \alpha_B^*) = 0.$$

Candidate A gathers information if

$$q(P, e(\theta)))W - C \geq K_A.$$

The entrepreneurs choose $e(\theta)$. The candidate B does not gather information.

Candidate A is elected with certainty and the expected performance of the country is given as

$$E_A^{ASNI^{inc}}(Y) = Y(ST, e(\theta)) + F_A(q(P, e(\theta))W - C)[Y(P, e(\theta)) - Y(ST, e(\theta))].$$

Proof: see appendix D.

The intuition for proposition 5.6 is as follows.

Given the beliefs and the assumptions in both parts of proposition 5.6, i.e. in (i) and (ii) candidate A is elected with certainty because it is believed that the candidate B does not gather information and thus will not implement the project once in office.

In (i) the entrepreneurs choose $e(\alpha_A^{p_A})$, as their expected gain from investing is greater than $\pi(\theta)$. In (ii) they select $e(\theta)$ as not investing yields a higher expected pay-off. However, in both cases candidate A has an incentive to gather information. Since candidate A does not have the right to stand for reelection upon announcing α_j^l, he will always gather information as long as the incurred cost do not exceed the expected utility of holding office. Thus, with an incentive contract, information acquisition depends only indirectly on the investment decision of the entrepreneurs as the expected reelection probability and thus the expected utility of a candidate gets smaller if they choose $e(\theta)$.Under the election mechanism it was a necessary condition for information acquisition of a candidate that the entrepreneurs select investment upon the announced law.

Following a very similar argument there exist equilibria in which the candidate B is the elected candidate. We denote these equilibria by $\mathbf{BSI}^{inc}$ and $\mathbf{BSNI}^{inc}$. They are identical to those described in proposition 5.6 up to relabelling.

The incentive contract scenario also allows for knife-edge-equilibria.

Proposition 5.7

(i) Suppose

$$F_j(\frac{1}{2}q(P,e(\alpha_j^*))W - \frac{1}{2}C) \geq \Delta\pi(\alpha_j^*, \alpha_j^\wr, \theta)$$

and

$$F_A(\frac{1}{2}q(P,e(\alpha_A^*))W - \frac{1}{2}C) = F_B(\frac{1}{2}q(P,e(\alpha_B^*))W - \frac{1}{2}C).$$

Then there exists an equilibrium ($\boldsymbol{ABSI}^{inc}$) with beliefs of the voters

$$prob^*(\alpha_j^{p_j} = \alpha_j^*) = F_j(\frac{1}{2}q(P,e(\alpha_j^*))W - \frac{1}{2}C)$$

for $j = A, B$.

The candidate j, $j = A, B$, gathers information if

$$\frac{1}{2}q(P,e(\alpha_j^*)))W - \frac{1}{2}C \geq K_j.$$

The entrepreneurs' selection of the law announcement determines which candidate is elected.

$$E_j^{ABSI^{inc}}(Y) = Y(ST,e(\alpha_j^\wr)) + F_j(\frac{1}{2}q(P,e(\alpha_j^*))W - \frac{1}{2}C)[Y(P,e(\alpha_j^*)) - Y(ST,e(\alpha_j^\wr))]$$

(ii) Suppose

$$F_j(\frac{1}{2}q(P,e(\alpha_j^*))W - \frac{1}{2}C) < \Delta\pi(\alpha_j^*, \alpha_j^\wr, \theta)$$

and

$$F_A(\frac{1}{2}q(P,e(\theta))W - \frac{1}{2}C) = F_B(\frac{1}{2}q(P,e(\theta))W - \frac{1}{2}C).$$

Then there exists an equilibrium ($\boldsymbol{ABSNI}^{inc}$) with beliefs of the voters

$$prob^*(\alpha_j^{p_j} = \alpha_j^*) = F_j(\frac{1}{2}q(P,e(\theta))W - \frac{1}{2}C)$$

for $j = A, B$.

The candidate j, $j = A, B$ gathers information if

$$\frac{1}{2}q(P,e(\theta)))W - \frac{1}{2}C \geq K_j.$$

Each candidate has a probability of $1/2$ *of being elected.*

The expected performance of the country is given as

$$E_j^{ABSNI^{inc}}(Y) = Y(ST, e(\theta)) + F_j(\frac{1}{2}q(P, e(\theta))W - \frac{1}{2}C)[Y(P, e(\theta)) - Y(ST, e(\theta))].$$

Proof: see appendix D.

The intuition for proposition 5.7 is similar to the intuition for proposition 5.6. However, both candidates are elected with a priori probability $1/2$ which again lowers the incentives for information acquisition.

In the next section we provide a welfare comparison of the two scenarios.

5.5 Welfare Comparison

To perform a welfare comparison, we assume that in both scenarios the equilibrium which provides the highest expected performance of the country, i.e. the highest $E_j(Y)$, is selected.[8]

Without loss of generality, we assume throughout this section that

$$F_A([q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^l))]W) > F_B([q(P, e(\alpha_B^*)) - q(P, e(\alpha_B^l))]W)$$

and

$$F_A(q(P, e(\alpha_A^*))W - C) > F_B(q(P, e(\alpha_B^*))W - C)$$

and

$$F_A(q(P, e(\theta))W - C) > F_B(q(P, e(\theta))W - C).$$

We now characterize the equilibria which yield the highest expected performance of a country for each parameter constellation.

Lemma 5.4

(i) ***Election Mechanism***

For

$$F_A([q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^l))]W) \geq \max\left\{\Delta\pi(\alpha_A^*, \alpha_A^l, \theta), \Delta Y(\alpha_A^*, \alpha_A^l, \theta)\right\}$$

[8]This is a natural selection criterion based on forward induction reasoning since entrepreneurs make the first observable move.

*the equilibrium **AS** is the equilibrium with the highest expected performance.*

For

$$F_A([q(P,e(\alpha_A^*)) - q(P,e(\alpha_A^{\wr}))]W) < \max\left\{\Delta\pi(\alpha_A^*,\alpha_A^{\wr},\theta), \Delta Y(\alpha_A^*,\alpha_A^{\wr},\theta)\right\}$$

*the equilibrium **NSE** is the equilibrium with the highest expected performance.*

(ii) ***Incentive Contract***

For

$$F_A(q(P,e(\alpha_A^*))W - C) \geq \Delta\pi(\alpha_A^*,\alpha_A^{\wr},\theta)$$

*the equilibrium **ASI**^{inc} is the equilibrium with the highest expected performance.*

For

$$F_A(q(P,e(\alpha_A^*))W - C) < \Delta\pi(\alpha_A^*,\alpha_A^{\wr},\theta)$$

*the equilibrium **ASNI**^{inc} is the equilibrium with the highest expected performance.*

Proof: see appendix D.

In the proof we identified with a comparison between the equilibria the ones with the highest expected performances for each parameter constellation. It is shown that the equilibria in which only one candidate gathers information and is elected with certainty yield a higher expected performance than the equilibria in which both candidates gather information and are elected with a priori probability 1/2. This is due to the fact that uncertainty about the election outcome decreases the incentive to acquire information. Furthermore, the equilibria in which candidate A is elected with certainty yield a higher expected performance than those in which candidate B is elected with certainty, since we assumed candidate A to have more incentives to acquire information. Thus, the equilibrium **AS** yields the highest expected performance under the election mechanism and the equilibrium **ASI**^{inc} yields the highest expected performance under the incentive contract. If **AS** does not exist, the equilibrium **NSE** is that with the highest expected performance under the election mechanism. The equilibrium **ASNI**^{inc} yields the highest expected performance in the incentive contract scenario if **ASI**^{inc} does not exist.

We now provide a welfare comparison of the election mechanism and the incentive contract scenario. Note that we use the selection criterion that the equilibrium with the highest expected performance will be played.

Proposition 5.8

(i) For

$$F_A([q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^\wr))]W) \geq \max\left\{\Delta\pi(\alpha_A^*, \alpha_A^\wr, \theta), \Delta Y(\alpha_A^*, \alpha_A^\wr, \theta)\right\},$$

social welfare increases through the introduction of an incentive contract if and only if

$$F_A(q(P, e(\alpha_A^*))W - C) > \frac{Y(P, e(\alpha_A^\wr)) - Y(ST, e(\alpha_A^\wr))}{Y(P, e(\alpha_A^*)) - Y(ST, e(\alpha_A^\wr))}$$
$$+F_A([q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^\wr))]W)\frac{Y(P, e(\alpha_A^*)) - Y(P, e(\alpha_A^\wr))}{Y(P, e(\alpha_A^*)) - Y(ST, e(\alpha_A^\wr))}.$$

(ii) For

$$F_A([q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^\wr))]W) < \max\left\{\Delta\pi(\alpha_A^*, \alpha_A^\wr, \theta), \Delta Y(\alpha_A^*, \alpha_A^\wr, \theta)\right\},$$

and

$$F_A(q(P, e(\alpha_A^*))W - C) \geq \Delta\pi(\alpha_A^*, \alpha_A^\wr, \theta),$$

social welfare increases through the introduction of an incentive contract if

$$F_A(q(P, e(\alpha_A^*))W - C) > \frac{Y(P, e(\theta)) - Y(ST, e(\alpha_A^\wr))}{Y(P, e(\alpha_A^*)) - Y(ST, e(\alpha_A^\wr))}.$$

(iii) For

$$F_A(q(P, e(\alpha_A^*))W - C) < \Delta\pi(\alpha_A^*, \alpha_A^\wr, \theta),$$

the introduction of an incentive contract decreases social welfare.

Proof: see appendix D.

In the proof of proposition 5.8 we compare the expected performance of a country under the election mechanism and under an incentive contract for each parameter constellation. We first look at the cases (i) and (ii). In order to increase social welfare the probability that a politician faced with an incentive contract will announce the appropriate law for the reform project must be greater than a critical threshold value.

The threshold values depend on the parameters which identify which equilibrium is chosen under the incentive contract and under the election mechanism. We now give a qualitative comparison of the equilibria. The equilibria with the highest expected performances are **AS** under the election mechanism and $\mathbf{ASI}^{inc}$ under the incentive contract. They share an important characteristic. Namely, only the candidate A gathers information and the entrepreneurs base their decisions on $\alpha_A^{p_A}$.

Note that the equilibrium $\mathbf{ASI}^{inc}$ can be sustained for a larger parameter range than the equilibrium **AS**.[9] In $\mathbf{ASI}^{inc}$ the candidates have more incentives to gather information because having information is much more important than under the election mechanism. There are two positive effects. First, even if under the election mechanism the equilibrium **AS** is chosen (case (i)), the probability that the candidate announces an appropriate law increases. Second, there exists the case that $\mathbf{ASI}^{inc}$ is chosen under an incentive contract and **NSE** is chosen under the election mechanism (case (ii)).

However, there is a potential drawback of the incentive contract. Even if $\mathbf{ASI}^{inc}$ is chosen under the incentive contract the candidate will not implement the reform project if there was no information acquisition before election since, in this case, he cannot fulfill the contract. If he had not signed the contract, he would implement the reform project because reelection chances remain.

Thus, to increase social welfare, the benefits of higher information acquisition must outweigh the potential negative effect of not implementing the project. These two effects determine whether social welfare is decreased or increased with the introduction of an incentive contract.

The incentive contract decreases social welfare if the equilibrium $\mathbf{ASNI}^{inc}$ is selected (case (iii)). When the equilibrium $\mathbf{ASNI}^{inc}$ yields the highest expected performance under the incentive contract the equilibrium **NSE** is selected under the election mechanism. Although there is information acquisition in the equilibrium $\mathbf{ASNI}^{inc}$, it has no effect on the performance of the country as the entrepreneurs choose $e(\theta)$. There is no benefit in having more information but the threat that the project is not implemented still exists.

[9]The assumption C close to zero has no influence on this result. Note that for a large C the parameter range also broadens. Compared to the election mechanism the utility of the candidates from information acquisition remains the same and only the utility from not gathering information declines.

In contrast, we state

Corollary 5.1

For

$$F_A(q(P, e(\alpha_A^*))W - C) = 1$$

the introduction of an incentive contract weakly increases social welfare.

Proof: see appendix D.

For

$$F_A(q(P, e(\alpha_A^*))W - C) = 1,$$

the introduction of an incentive contract weakly increases social welfare. In this case, all types of candidate A gather information and the risk that the project will not be implemented no longer exists.

The conditions under which it is likely that the introduction of an incentive contract will increase social welfare follow.

Corollary 5.2

The introduction of an incentive contract is more likely to increase social welfare if

- *the utility of holding the office,* W*, is high,*
- $q(P, e(\alpha_j^*))$ *is high,*
- $q(P, e(\alpha_j^l))$ *is high,*
- $\pi(\alpha_j^*)$ *is significantly greater than* $\pi(\theta)$*,*
- $Y(P, e(\alpha_j^*))$ *is significantly greater than* $Y(P, e(\theta))$*.*

Corollary 5.2 results from the following observations. The probability that the candidate with an incentive contract announces an appropriate law increases in the expected utility from information acquisition and thus in W and $q(P, e(\alpha_j^*))$. Furthermore, to increase social welfare, the probability that the candidate with an incentive contract announces an appropriate law should be significantly greater than the probability that the law announcement is appropriate under the election mechanism. This is true if $q(P, e(\alpha_j^l))$ is not too small. Suppose, however, $q(P, e(\alpha_j^l))$ is close to zero. Then the effects of announcing a law which is not appropriate would be nearly the same as in the case with an incentive contract. Announcing an inappropriate law then is also punished heavily under the election mechanism.

Furthermore, social welfare is likely to increase under an incentive contract if the entrepreneurs' choice $e(\alpha_j^*)$ leads to a considerable improvement in performance. This is the case when $Y(P, e(\alpha_j^*))$ is significantly greater than $Y(P, e(\theta))$. Finally the entrepreneurs are more inclined to choose $e(\alpha_j^*)$ if $\pi(\alpha_j^*)$ is significantly greater than $\pi(\theta)$.

Thus, the cases in which social welfare can be increased through the introduction of an incentive contract can be easily identified.

5.6 Conclusion

The introduction of a reelection threshold contract will increase the amount of information acquisition during electoral campaigns. However, it has the negative effect that a reform project may not be implemented if the elected candidate cannot adhere to the contract. The cases in which this is likely to happen can be easily identified. There is a further argument that the negative effect of incentive contracts might be of less importance. The possibility that an elected candidate does not implement the reform may be avoided by punishing this behavior. If his utility by implementing the project is greater than his utility with a punishment, also an incumbent who announced an inappropriate law will implement the project. Furthermore, one could argue that not implementing a beneficial reform could cause the politician a loss of social prestige.

Chapter 6

Conclusions

The thesis suggests that incentive contracts in politics can help to enhance the accountability of politicians. Moreover, the introduction of incentive contracts might also alleviate growing public indifference to elections and politics. The proposal may be perceived as provocative, but we believe that politicians should consider it as a means of improving the functioning of democracies and the welfare of people.

The current analysis, however, can only be a starting point. Numerous issues call for ongoing research. Some of them are addressed in the following.

First, there should be exploration of the issues that qualify for inclusion in an incentive contract and the measures that should be used for the incentive contract. In some cases, for example in the case of unemployment, this is fairly obvious because the incentive contract can be based on the average unemployment rate. But here too, a definition problem remains since unemployment rates are defined in many different ways. Hence, there is a need to agree upon definitions that cannot be changed and manipulated once they have been adopted. Moreover, whereas issues such as unemployment or crime can be quantified with sufficient precision, this is not the case for other issues, such as reforms in health care or the judicial system. Therefore, in significant areas of political activity performance cannot be measured with any real degree of precision. This may make it difficult to find appropriate threshold values that the politician has to reach in order to have the right to stand for reelection.

Second, who should have the right to declare the issues that should or can be included in the incentive contract? One possibility is that politicians are completely free to offer incentive contracts during the campaign. However, it would also be possible that an independent institution declares the issues that should be included in incentive contracts offered by politicians. Furthermore, the public could vote on these issues. Finding out which of these alternatives is preferable would be another fruitful line of research.

Third, to enforce the incentive contracts an institution has to be designed. This institution should have the right to cancel or renegotiate the incentive contracts in the case of exceptional events. It might be a court or a commission, but its specific organization, the associated incentive structure, and ways of ensuring that there is no possibility of manipulation are all open issues.

Fourth, there might be a case for a renegotiation clause in the incentive contract, as many pressing issues during a politician's term may be unforseeable or insufficiently forseeable when the politician takes over office. Examples are Iraq's invasion of Kuwait that George Bush was confronted by in his term as president of the USA, or the flood in Germany 2002. In these cases, the issues were unforeseeable and it would have been difficult or impossible to write an incentive contract on the basis of these events. Thus, one might wonder whether a reelection threshold contract as proposed in this thesis may lead to an under-investment of effort on newly emerging issues, because they are not relevant for the right to stand for reelection. It is possible that we need the introduction of a clause to the effect that the contract will be cancelled or renegotiated in the case of extra-ordinary events such as war or a natural catastrophe.

Another research issue is whether and under what circumstances the politicians are willing to impose the incentive contracts upon themselves. One could argue that once one politician offers an incentive contract to increase his election chances the competing politicians in turn will also have to offer incentive contracts in order to maintain their election chances. However, this needs to be clarified further, as the willingness of politicians to impose self-constraints is a necessary precondition for the introduction of incentive contracts in politics.

A completely open research question is who the incentive contracts should apply to. In democracies, there is a complex formation of power between politicians and their parties and/or between the competing parties themselves. Then the question arises as to who will offer the incentive contract - the party or the future members of the government? As parties in general are big voter organizations, one should not exclude them from elections once one member of them has failed to fulfill his contract. But this in turn may give rise to new difficulties, as there might be conflicts between the party and the politicians due to diverging incentives. One could for example imagine a situation where the politician in office would like to implement some unpopular reforms in order to honor his contract, but the party fears for its share of votes and thus restrains the politician from undertaking the reform. Moreover, in some democratic systems, parties are forced to build coalitions or are controlled to some extent by the opposition parties, as in Germany with the Bundesrat. In these cases, the question of who is accountable for governmental affairs is even more intriguing. The possibilities for using incentive contracts in this complex structure of power have yet to be explored.

Furthermore, the literature has identified a number of inefficiencies in the political system that go beyond the current investigation (see e.g., the surveys and contributions by Buchanan and Tullock (1965), Mueller (1989), Stiglitz (1989), Persson and Tabellini (1990), Bernholz and Breyer (1993), Dixit (1995), Drazen (2000), Persson and Tabellini (2000), and Gersbach and Haller (2001)). How the dual mechanism can be applied for these kind of inefficiencies would be another interesting avenue for research.

The actual reach of the dual mechanism can only be judged after these issues have been explored in detail. Nevertheless, we believe that these lines of research can also lead to a satisfying result, and that incentive contracts in politics can be a viable supplement for democracies.

Appendix A

Proofs for Chapter 2

Proof of proposition 2.3:

If the politician chooses the first-best effort levels e_1^* and e_2^*, his participation constraint is only satisfied with a reelection probability of one. Hence, if the politician chooses the corner solution, the optimal threshold reelection scheme must implement the first-best effort levels e_1^* and e_2^*. According to proposition 2.2 it is sufficient to set $\hat{e}_2 = e_2^*$ and to choose the required threshold signal $\hat{b}_1$ such that

$$e_1^* = \hat{b}_1 + a,$$

which requires that

$$\hat{b}_1 = b_1^* = e_1^* - a.$$

The utility of the politician is zero.

First-best can be implemented if IC and PC are satisfied under the reelection scheme $p^*(b_1, e_2)$ and the effort levels e_1^* and e_2^*. Since the PC is fulfilled by construction, we have to check the IC. The politician should have no incentive to deviate to the interior solution or to the solution $e_1 = 0,\ e_2 = 0$ under the threshold scheme $p^*(b_1, e_2)$.

The politician will never choose $e_1 = 0$, $e_2 = 0$, because his utility under this solution is zero, which is equal to the utility under the first-best solution. According to our tie-breaking rule in the case of indifference, the politician will not select $e_1 = 0$, $e_2 = 0$.[1]

The politician will deviate to the interior solution if

$$0 = U^A(b_1^*, e_1^*, e_2^*) < U^A(b_1^*, e_1^{int}, e_2^*).$$

[1] As we will see, the politician will never choose effort levels $e_1 = 0$, $e_2 = 0$. There is always a threshold reelection scheme which yields positive levels of efforts and zero utility for the politician.

This condition is satisfied if

$$(1 - F(b_1^* - e_1^{int}))W_2 - (c_1 e_1^{int})^2 - (c_2 e_2^*)^2 > 0.$$

Inserting

$$b_1^* = e_1^* - a = \frac{\sqrt{W_2 - (c_2 e_2^*)^2}}{c_1} - a$$

and e_1^{int} yields

$$(2a - \frac{\sqrt{W_2 - (c_2 e_2^*)^2}}{c_1} + (\frac{1}{4ac_1^2} W_2))W_2 - 2a(c_1 \frac{W_2}{4ac_1^2})^2 - 2a(c_2 e_2^*)^2 > 0,$$

which yields

$$a^2 - a\frac{W_2}{2c_1\sqrt{W_2 - (c_2 e_2^*)^2}} + \frac{(W_2)^2}{16c_1^2(W_2 - (c_2 e_2^*)^2)} > 0.$$

The function equals zero for

$$\bar{a} = \frac{W_2}{4c_1\sqrt{W_2 - (c_2 e_2^*)^2}}.$$

For $a < \bar{a}$, $e_1^{int} > e_1^{FB}$ and thus the PC is not satisfied if the politician deviates to e_1^{int}. Therefore, the politician deviates only for $a > \bar{a}$. Thus, for $a > \bar{a}$, the first-best solution cannot be implemented.

■

Proof of proposition 2.4:

The proof proceeds in two steps. First, we derive the optimal threshold reelection scheme within the class of schemes that lead to the interior solution. Second, we show that no other threshold reelection scheme yields higher utility for the public.

We claim that when the interior solution is the optimal choice of the politician, the optimal threshold reelection scheme is

$$p^o(b_1, e_2) = \begin{cases} 1 & \text{if } b_1 \geq b_1^o = \frac{W_2}{4ac_1^2} - a \text{ and } e_2 \geq e_2^o = \frac{\sqrt{W_2 - \left(\frac{1}{4ac_1}W_2\right)^2}}{c_2}, \\ 0 & \text{otherwise.} \end{cases}$$

Under this reelection scheme, the politician chooses his effort level e_1 as e_1^{int} according to proposition 2.2. Within the bounds $-a \leq \hat{b}_1 - e_1 \leq a$, $\hat{b}_1$ can be freely chosen without affecting e_1^{int}. Therefore it is optimal to choose the signal such that the reelection probability under e_1^{int} is one, because this increases the expected utility of the politician and allows voters to choose a higher value of $\hat{e}_2$. The optimal signal is

$$\hat{b}_1 = b_1^o = e_1^{int} - a = \frac{1}{4ac_1^2} W_2 - a.$$

Any signal $b_1 > b_1^o$ would lead to a reelection probability smaller than one and thus decrease the agent's utility without inducing a higher effort level e_1, which makes it more difficult to fulfill the PC.

Under the restriction of the participation constraint, the required effort level $\hat{e}_2$ can be chosen as

$$\hat{e}_2 = e_2^o = \frac{\sqrt{W_2 - \left(\frac{1}{4ac_1} W_2\right)^2}}{c_2}.$$

The constraint $e_2^o \geq 0$ requires

$$a \geq \frac{\sqrt{W_2}}{4c_1},$$

which is always satisfied for $a > \bar{a}$. The utility of the politician is zero.

In the second step, we show that no other threshold scheme can implement a higher utility for voters.

The only alternative is a threshold scheme which leads to a corner solution. A solution superior to $e_1^o = e_1^{int}$, e_2^o would require an effort level e_1, which is higher than e_1^o because for $a > \bar{a}$, e_1^o is too small in comparison to the first-best solution. Suppose a threshold scheme can implement an effort level $e_1 = e_1^o + \epsilon$ for some $\epsilon > 0$ under the corner solution. This would require a benefit signal $b_1 = b_1^o + \epsilon$. The reelection probability would be equal to one and the effort level $\hat{e}_2$ is given by the PC as [2]

$$\hat{e_2} = \widetilde{e_2} = \frac{\sqrt{W_2 - (c_1(e_1^o + \epsilon))^2}}{c_2}.$$

The utility of the politician would be zero. The utility of the public would be increased because $U^P(e_1^o + \epsilon, \widetilde{e}_2) > U^P(e_1^o, e_2^o)$.

Next we check the IC. A necessary condition is

$$U^A(b_1^o + \epsilon, e_1^o + \epsilon, \widetilde{e}_2) > U^A(b_1^o + \epsilon, e_1^o, \widetilde{e}_2),$$

[2]The argument holds for any effort level e_2 which satisfies but may not exhaust the PC.

or

$$0 > U^A(b_1^o + \epsilon, e_1^o, \widetilde{e_2}),$$

which implies

$$\left(1 - \frac{b_1^o + \epsilon - e_1^o + a}{2a}\right) W_2 - (c_1 e_1^o)^2 - (c_2 \widetilde{e_2})^2 < 0.$$

Inserting $b_1^o = e_1^o - a$, we get

$$\left(1 - \frac{\epsilon}{2a}\right) W_2 - (c_1 e_1^o)^2 - (c_2 \widetilde{e_2})^2 < 0.$$

Inserting $\widetilde{e_2}$ yields

$$c_1^2 \epsilon^2 + 2c_1^2 \epsilon e_1^o - \frac{W_2 \epsilon}{2a} < 0,$$

and with

$$\frac{\epsilon W_2}{2a} = 2c_1^2 \epsilon e_1^o$$

we obtain the condition:

$$c_1^2 \epsilon^2 < 0.$$

Therefore, the IC is not fulfilled and the politician will always deviate, which completes the proof.

■

Appendix B

Proofs for Chapter 3

Proof of proposition 3.5:

Proof of (i):

Suppose $U^A(e^*(-a)) = 0$. $e^*(-a)$ maximizes the utility under the reelection mechanism alone and thus

$$U^A(e^*(-a)) \geq U^A(e) \quad \forall e,$$

and because of our tie-breaking rule

$$U^A(e^*(-a)) > U^A(e) \quad \text{for } e > e^*(-a).$$

Then, if $e^*(\hat{b}) > e^*(-a)$, the PC would be violated and the optimal threshold signal is set as $\hat{b}^* = -a$.

Proof of (ii):

Since costs and $q(e, \hat{b})$ are continuous in e and $\hat{b}$ respectively, there exist $\delta > 0$ and $\xi > 0$ sufficiently small that $U^A(e^*(-a)+\delta, -a+\xi) \geq 0$. Thus, in principle it is possible to satisfy the PC if effort and the threshold signal are marginally increased.

We proceed in two steps. In a first step we show that for $U^A(e^*(-a)) > 0$ there always exist threshold signals $\hat{b}$ with $q(e^*(-a), \hat{b}) < q(e^*(-a), -a)$ for which the politician does not choose a solution smaller than $e^*(-a)$. Then we show that the effort in the interior solution can always be enlarged if $U^A(e^*(-a)) > 0$.

We first show that for $U^A(e^*(-a)) > 0$, there are always threshold signals $\hat{b}$ for which the politician does not choose an effort level $e < e^*(-a)$ under the dual mechanism.

The solution $e^*(-a)$ satisfies $U^A(e^*(-a)) \geq U^A(e)$ for all e and thus

$$\int_{e^*(-a)-a}^{e^*(-a)+a} p(b)f(b-e)dbW_2 - c(e^*(-a))^2 \geq \int_{e-a}^{e+a} p(b)f(b-e)dbW_2 - ce^2 \quad \text{for } e^*(-a) \neq e.$$

Then, for the threshold signal $\hat{b} = e^*(-a) - a$ and for $e < e^*(-a)$:

$$\int_{e^*(-a)-a}^{e^*(-a)+a} p(b)f(b-e)dbW_2 - c(e^*(-a))^2 > \int_{e^*(-a)-a}^{e+a} p(b)f(b-e)dbW_2 - ce^2,$$

because the introduction of an incentive contract diminishes expected reelection probability and thus the utility for a given effort level. Thus, threshold signals $\hat{b} = e^*(-a) - a + \xi$ with ξ sufficiently small exist, such that for $e < e^*(-a)$

$$\int_{e^*(-a)-a+\xi}^{e^*(-a)+a} p(b)f(b-e)dbW_2 - c(e^*(-a))^2 \geq \int_{e^*(-a)-a+\xi}^{e+a} p(b)f(b-e)dbW_2 - ce^2.$$

Thus there exist threshold signals with $q(e^*(-a), \hat{b}) < q(e^*(-a))$ for which the politician does not choose an effort smaller than $e^*(-a)$.

Suppose $e^*(-a) = e^{int}(-a)$. For sufficiently small ξ, the politician will again choose the same interior solution. Then, the effort is increased for a threshold signal $\hat{b} = e^*(-a) - a + \xi$ because of proposition 3.3, which implies that the cut-off of the reelection probability through the incentive contract increases marginal utility of the politician from exerting effort.

■

Proof of proposition 3.6:

We first show (a).

Suppose $e^*(-a) = 0$. Then, the effort can be enlarged if for threshold signals $\hat{b} = -a+\xi$, $\xi > 0$ and an effort level $\delta > 0$

$$U^A(0, -a + \xi) \leq U^A(\delta, -a + \xi).$$

The condition can be rewritten as

$$\int_{-a+\xi}^{a} p(b)f(b)dbW_2 \leq \int_{-a+\xi}^{\delta+a} p(b)f(b-\delta)dbW_2 - c\delta^2.$$

Thus, we obtain

$$\int_{a}^{\delta+a} p(b)f(b-\delta)dbW_2 + \int_{-a+\xi}^{a} p(b)[f(b-\delta) - f(b)]dbW_2 - c\delta^2 \geq 0.$$

This is equivalent to

$$\int_{a-\delta}^{a} p(\delta+\epsilon)f(\epsilon)d\epsilon W_2 + \int_{-a+\xi-\delta}^{a-\delta} p(\delta+\epsilon)[f(\epsilon)-f(\epsilon+\delta)]d\epsilon W_2 - c\delta^2 \geq 0.$$

By taking the derivatives at $\delta = 0$ we obtain a sufficient condition as

$$p(a)f(a) - \int_{-a+\xi}^{a} p(\epsilon)f'(\epsilon)d\epsilon \geq 0.$$

We next prove (b).

Suppose $e^*(-a) = \bar{b} + a$. Then, the effort can be enlarged if for threshold signals $\hat{b} = e^*(-a) - a + \xi$, $\xi > 0$ and an effort level $e^*(\hat{b}) = e^*(-a) + \delta$, $\delta > 0$

$$U^A(\bar{b}+a, e^*(-a)-a+\xi) \leq U^A(\bar{b}+a+\delta, e^*(-a)-a+\xi).$$

The condition can be rewritten as

$$\int_{\bar{b}+\xi}^{\bar{b}+2a} p(b)f(b-(\bar{b}+a))dbW_2 - c(\bar{b}+a)^2 \leq \int_{\bar{b}+\xi}^{\bar{b}+\delta+2a} p(b)f(b-(\bar{b}+a+\delta))dbW_2 - c(\bar{b}+a+\delta)^2.$$

Thus we obtain

$$\int_{\bar{b}+2a}^{\bar{b}+\delta+2a} p(b)f(b-(\bar{b}+a+\delta))dbW_2 + \int_{\bar{b}+\xi}^{\bar{b}+2a} p(b)[f(b-(\bar{b}+a+\delta)) - f(b-(\bar{b}+a))]dbW_2$$
$$-c(\bar{b}+a+\delta)^2 + c(\bar{b}+a)^2 \geq 0.$$

This is equivalent to

$$\int_{a-\delta}^{a} p(\bar{b}+a+\delta+\epsilon)f(\epsilon)d\epsilon W_2 + \int_{\bar{b}+\xi-(\bar{b}+a+\delta)}^{\bar{b}+2a-(\bar{b}+a+\delta)} p(\bar{b}+a+\delta+\epsilon)[f(\epsilon)-f(\epsilon+\delta)]d\epsilon W_2$$
$$-c(\bar{b}+a+\delta)^2 + c(\bar{b}+a)^2 \geq 0.$$

By taking derivatives at $\delta = 0$, a sufficient condition is

$$p(a)f(a)W_2 - \int_{\xi-a}^{a} p(\bar{b}+a+\epsilon)f'(\epsilon)d\epsilon W_2 - 2c(\bar{b}+a) \geq 0.$$

■

Appendix C

Proofs for Chapter 4

Proof of proposition 4.1:

In a fully separating equilibrium $\sigma^2(x_j|p_j^1) = 0 \;\; \forall \, p_j^1$ must hold. Assuming a separating equilibrium, we can thus write

$$q\left(E(x_j|p_j^1), \sigma^2(x_j|p_j^1)\right) = q\left(E(x_j|p_j^1), \sigma^2(x_j|p_j^1) = 0\right) = a + bE(x_j|p_j^1).$$

Given a belief function $E^*(x_j|p_j^1)$ candidate j chooses

$$p_j^1 = \arg\max_{p_j^1} \{u_j(p_j^1) + W +$$
$$q\left(E^*(x_j|p_j^1)]\right)[W - E(u_j(x_k))] + E(u_j(x_k))\}.$$

Simple derivations yield the first order condition

$$-2(p_j^1 - x_j) + b\frac{\partial E^*(x_j|p_j^1)}{\partial p_j^1}(W - E(u_j(x_k))) = 0$$

and thus the chosen policy p_j^{1*} is implicitly determined by

$$p_j^{1*}(x_j) = x_j + \frac{\partial E^*(x_j|p_j^{1*})}{\partial p_j^{1*}}\frac{b(W - E(u_j(x_k)))}{2}.$$

Rewriting this equation yields

$$p_j^1(x_j) = x_j + \frac{b}{2}\frac{\partial E^*(x_j|p_j^1)}{\partial p_j^1}\left(W + x_j^2 - 2E(x_k)x_j + E(x_k^2))\right)$$

which can be transformed into

$$\frac{b}{2}\frac{\partial E^*(x_j|p_j^1)}{\partial p_j^1}x_j^2 + \left(1 - b\frac{\partial E^*(x_j|p_j^1)}{\partial p_j^1}E(x_k)\right)x_j$$
$$+\frac{b}{2}\frac{\partial E^*(x_j|p_j^1)}{\partial p_j^1}\left(W + E(x_k^2)\right) - p_j^1 = 0.$$

We obtain the equation

$$x_j^2 \frac{\partial E^*(x_j|p_j^1)}{\partial p_j^1} + \left(\frac{2}{b} - 2E(x_k)\frac{\partial E^*(x_j|p_j^1)}{\partial p_j^1}\right) x_j$$
$$+ \left(W + E(x_k^2)\right) \frac{\partial E^*(x_j|p_j^1)}{\partial p_j^1} - \frac{2}{b} p_j^1 = 0.$$

In order that strategy and beliefs constitute a fully separating equilibrium it must be $x_j = E(x_j|p_j^1)$ and thus

$$\left(E^*(x_j|p_j^1)\right)^2 \frac{\partial E^*(x_j|p_j^1)}{\partial p_j^1} + \left(\frac{2}{b} - 2E(x_k)\frac{\partial E^*(x_j|p_j^1)}{\partial p_j^1}\right) E^*(x_j|p_j^1)$$
$$+ \left(W + E(x_k^2)\right) \frac{\partial E^*(x_j|p_j^1)}{\partial p_j^1} - \frac{2}{b} p_j^1 = 0.$$

Thus, the belief function is the solution of the differential equation **DE1** with $Y(z) = E^*(x_j|p_j^1)$, $z = p_j^1$, $h = 2/b$, $e = 2E(x_k)$ and $g = W + E(x_k^2)$. The initial condition is $E(x_j|p_j^1 = \underline{x}_j) = \underline{x}_j$ as the candidate with type $\underline{x}_j$ according to lemma 4.1 will choose $p_j^1(\underline{x}_j) = \underline{x}_j$.

We denote this solution by $\mathbf{L(DE1)}^{el}$. If $\mathbf{L(DE1)}^{el}$ is strictly increasing in p_j^1 on $[\underline{x}_j, p_j^{1*}(\bar{x}_j)]$, the equilibrium exists.

The expectations about the losing candidate's ideal point after the election has taken place are given as

$$E(x_k) = \int_{\underline{x}_k}^{\bar{x}_k} x_k f_k(x_k) dx_k$$

as no further information about candidate k's type is revealed.

As the voters can derive the incumbent's ideal point x_j from the optimally chosen policy p_j^{1*}, $\sigma^2(x_j|p_j^1) = 0$ is satisfied.

We specify the out-of-equilibrium beliefs as follows

$$E(x_j|p_j^1) = \begin{cases} \bar{x}_j & \text{for } p_j^1 > p_j^{1*}(\bar{x}_j), \\ \underline{x}_j & \text{for } p_j^1 < p_j^{1*}(\underline{x}_j). \end{cases}$$

Thus, the public believes $E(x_j|p_j^1) = \bar{x}_j$ if a candidate chooses a policy which is higher than the maximal equilibrium strategy $p_j^{1*}(\bar{x}_j)$ and $E(x_j|p_j^1) = \underline{x}_j$ if the candidate chooses a policy lower than $p_j^{1*}(\underline{x}_j)$.

■

Proof of proposition 4.2:

Suppose there is pooling in **ANN** and each type of candidate j has announced the same policy space $[\hat{p}_j, x_\nu]$. Given the announced policy space $[\hat{p}_j, x_\nu]$ the elected candidate j chooses his policy $p_j^{1^{inc}}$ according to the IC.

Note that two cases can occur

1. Candidate j chooses a policy $p_j^{1^{inc}} \in [\hat{p}_j, x_\nu]$ and thus matches his incentive contract.
2. Candidate j chooses a policy $p_j^{1^{inc}} \notin [\hat{p}_j, x_\nu]$ and thus does not match his incentive contract.

We assume for the moment that the sets of candidates who match and who do not match the incentive contract are non-empty.

It is obvious that for $p_j^{1^{inc}} \notin [\hat{p}_j, x_\nu]$ it is utility maximizing for candidate j to choose $p_j^{1^{inc}} = x_j$, because he cannot be reelected.

Since both sets of candidates (matching and not matching) are assumed to be non-empty this is equivalent to the existence of a critical ideal point $x_j^{crit}(\hat{p}_j) \in [\underline{x}_j, \bar{x}_j]$ for which $U^j(\hat{p}_j) = U^j(x_j^{crit})$, i.e. this type of candidate is indifferent between matching and not matching the contract. Suppose the equilibrium **INCSEP** is fully separating with respect to policy choices. $x_j^{crit}(\hat{p}_j)$ is given as

$$\begin{aligned} x_j^{crit}(\hat{p}_j) = \arg_{x_j} \{&-(\hat{p}_j - x_j)^2 + (a + bx_j)\left[W - E(u_j(x_k))\right] \\ &- (a + bE(x_C) - c\sigma^2(x_C))\left[E(u_j(x_C)) - E(u_j(x_k))\right] = 0\} . \end{aligned} \tag{C.1}$$

We assume $x_j^{crit}(\hat{p}_j)$ to be unique on $[\underline{x}_j, \bar{x}_j]$.[1]

Furthermore, given that a candidate matches the contract and thus $p_j^{1^{inc}} \geq \hat{p}_j$, candidate j chooses $p_j^{1^{inc}}$ according to the incentive constraint as

$$p_j^{1^{inc}} = \arg\max_{p_j^{1^{inc}}} \left\{ u_j(p_j^{1^{inc}}) + W + \left(a + bE(x_j|p_j^{1^{inc}})\right)\left[W - E(u_j(x_k))\right] + E(u_j(x_k)) \right\} .$$

Simple derivation yields that the chosen policy $\bar{p}_j^1$ is implicitly determined by

$$\bar{p}_j^1 = x_j + \frac{b}{2}\frac{\partial E(x_j|\bar{p}_j^1)}{\partial \bar{p}_j^1}(W - E(u_j(x_k))).$$

[1]A necessary condition is $\partial(U^j(\hat{p}_j) - U^j(x_j))/\partial x_j > 0$ for $x_j < \hat{p}_j$. This condition can be transformed in a condition based only on exogenous variables.

As is shown in the proof of proposition 4.1, beliefs are given as the solution of

$$\left(E^*(x_j|\bar{p}_j^1)\right)^2 \frac{\partial E^*(x_j|\bar{p}_j^1)}{\partial \bar{p}_j^1} + \left(\frac{2}{b} - 2E(x_k)\frac{\partial E^*(x_j|\bar{p}_j^1)}{\partial \bar{p}_j^1}\right) E^*(x_j|\bar{p}_j^1) + \left(W + E(x_k^2)\right) \frac{\partial E^*(x_j|\bar{p}_j^1)}{\partial \bar{p}_j^1} - \frac{2}{b}\bar{p}_j^1 = 0$$

and thus as the solution of the differential equation **DE1** with $Y(z) = E^*(x_j|\bar{p}_j^1)$, $z = \bar{p}_j^1$, $h = 2/b$, $e = 2E(x_k)$ and $g = W + E(x_k^2)$. The initial condition is given as $E(x_j|\hat{p}_j) = x_j^{crit}(\hat{p}_j)$, as this condition must be satisfied in equilibrium. We denote this solution by $\mathbf{L(DE1)}^{inc}$.

Then there exists an equilibrium in which the policy of candidate j is given as

$$p_j^{1^{inc}}(\hat{p}_j) = \begin{cases} \bar{p}_j^1(x_j) & \text{for } x_j \in [x_j^{crit}(\hat{p}_j), \bar{x}_j], \\ x_j & \text{for } x_j \in [\underline{x}_j, x_j^{crit}(\hat{p}_j)]. \end{cases}$$

Hence, the voters' expectations about the policies in the first term are given by

$$E(p_j^{1^{inc}}|\hat{p}_j) = \int_{\underline{x}_j}^{x_j^{crit}(\hat{p}_j)} x_j f_j(x_j) dx_j + \int_{x_j^{crit}(\hat{p}_j)}^{\bar{x}_j} \bar{p}_j^1(x_j) f_j(x_j) dx_j$$

and

$$E(p_k^{1^{inc}}|\hat{p}_k) = \int_{\underline{x}_k}^{x_k^{crit}(\hat{p}_k)} \bar{p}_k^1(x_k) f_k(x_k) dx_k + \int_{x_k^{crit}(\hat{p}_k)}^{\bar{x}_k} x_k f_k(x_k) dx_k.$$

The second-period equilibrium beliefs about the ideal points of the incumbent j are given as

$$E^*(x_j|p_j^{1^{inc}}) = \begin{cases} x_j = p_j^{1^{inc}} & \text{for } p_j^{1^{inc}} \in [\underline{x}_j, \hat{p}_j], \\ \mathbf{L(DE1)}^{inc} & \text{for } p_j^{1^{inc}} \in [\hat{p}_j, \bar{p}_j^1(\bar{x}_j)] \end{cases}$$

with $Y(z) = E^*(x_j|\bar{p}_j^1)$, $z = \bar{p}_j^1$, $h = 2/b$, $e = 2E(x_k)$, $g = W + E(x_k^2)$ and initial condition $E(x_j|\hat{p}_j) = x_j^{crit}(\hat{p}_j)$.

The equilibrium exists if $\mathbf{L(DE1)}^{inc}$ is strictly increasing on $[x_j^{crit}(\hat{p}_j), p_j^{1^{inc}}(\bar{x}_j)]$.

The expected values of the ideal points of candidate k and candidate C are given as

$$E(x_k) = \int_{\underline{x}_k}^{\bar{x}_k} x_k f_k(x_k) dx_k$$

and

$$E(x_C) = \int_{\underline{x}_C}^{\bar{x}_C} x_C f_C(x_C) dx_C.$$

The out-of-equilibrium beliefs are given by

$$E(x_j|p_j^{1^{inc}}) = \begin{cases} \bar{x}_j & \text{for } p_j^{1^{inc}} > p_j^{1^{inc}}(\bar{x}_j) \\ \underline{x}_j & \text{for } p_j^{1^{inc}} < p_j^{1^{inc}}(\underline{x}_j) \end{cases}$$

for the same reasons as those given in the proof of proposition 4.1.

In cases where the solution of (C.1) yields $x_j^{crit} < \underline{x}_j$ we must define $x_j^{crit} = \underline{x}_j$. We can then apply a similar line of logic in this case.

■

Proof of proposition 4.5:

In order to perform the welfare comparison we compare $E^{EL}(V_\nu(p_j^1, p^2))$ with $E^{INCSEP}(V_\nu(p_j^{1^{inc}}, p^{2^{inc}}|\hat{p}_j^*))$.

$E^{EL}(V_\nu(p_j^1, p^2))$ is given by

$$E^{EL}(V_\nu(p_j^1, p^2)) = E^{EL}(u_\nu(p_j^1)) + \int_{\underline{x}_j}^{\bar{x}_j} f_j(x_j)\Big(q(x_j)\Big(u_\nu(x_j) - E(u_\nu(x_k))\Big) + E(u_\nu(x_k))\Big)dx_j.$$

$E^{INCSEP}(V_\nu(p_j^{1^{inc}}, p^{2^{inc}}|\hat{p}_j^*))$ is given by

$$E^{INCSEP}(V_\nu(p_j^{1^{inc}}, p^{2^{inc}}|\hat{p}_j^*)) = E^{INCSEP}(u_\nu(p_j^{1^{inc}}|\hat{p}_j^*)) + \int_{\underline{x}_j}^{x_j^{crit}(\hat{p}_j^*)} f_j(x_j)\Big(q\left(E(x_C), \sigma^2(x_C)\right)\Big[E(u_\nu(x_C)) - E(u_\nu(x_k))\Big] + E(u_\nu(x_k))\Big)dx_j + \int_{x_j^{crit}(\hat{p}_j^*)}^{\bar{x}_j} f_j(x_j)\Big(q(x_j)\Big[u_\nu(x_j) - E(u_\nu(x_k))\Big] + E(u_\nu(x_k))\Big)dx_j.$$

Then, $E^{INCSEP}(V_\nu(p_j^{1^{inc}}, p^{2^{inc}}|\hat{p}_j)) > E^{EL}(V_\nu(p_j^1, p^2))$ if

$$E^{INCSEP}(u_\nu(p_j^{1^{inc}}|\hat{p}_j^*)) + \int_{\underline{x}_j}^{x_j^{crit}(\hat{p}_j^*)} f_j(x_j)dx_j\Big[q\left(E(x_C), \sigma^2(x_C)\right)\left(E(u_\nu(x_C)) - E(u_\nu(x_k))\right)\Big] + \int_{x_j^{crit}(\hat{p}_j^*)}^{\bar{x}_j} f_j(x_j)\Big(q(x_j)\big(u_\nu(x_j) - E(u_\nu(x_k))\big)\Big)dx_j + E(u_\nu(x_k)) >$$
$$E^{EL}(u_\nu(p_j^1)) + \int_{\underline{x}_j}^{\bar{x}_j} f_j(x_j)q(x_j)\Big(u_\nu(x_j) - E(u_\nu(x_k))\Big)dx_j + E(u_\nu(x_k)).$$

This can be transformed into

$$E^{INCSEP}(u_\nu(p_j^{1^{inc}}|\hat{p}_j^*))+$$
$$\int_{\underline{x}_j}^{x_j^{crit}(\hat{p}_j^*)} f_j(x_j)dx_j\Big(q\left(E(x_C),\sigma^2(x_C)\right)\Big[E(u_\nu(x_C))-E(u_\nu(x_k))\Big]\Big)-$$
$$\int_{\underline{x}_j}^{x_j^{crit}(\hat{p}_j^*)} f_j(x_j)\Big[q(x_j)\Big(u_\nu(x_j)-E(u_\nu(x_k))\Big)\Big]dx_j - E^{EL}(u_\nu(p_j^1))>0.$$

which finally can be rewritten as

$$\int_{\underline{x}_j}^{x_j^{crit}(\hat{p}_j^*)} f_j(x_j)dx_j\Big[q\left(E(x_C),\sigma^2(x_C)\right)E(u_\nu(x_C))\Big] - \int_{\underline{x}_j}^{x_j^{crit}(\hat{p}_j^*)} f_j(x_j)q(x_j)(u_\nu(x_j))dx_j >$$
$$E^{EL}(u_\nu(p_j^1)) - E^{INCSEP}(u_\nu(p_j^{1^{inc}}|\hat{p}_j^*)).$$

■

Appendix D

Proofs for Chapter 5

Proof of proposition 5.1:

We start from the beliefs of the voters

$$\text{prob}(\alpha_A^{p_A} = \alpha_A^*) = F_A([q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^{\wr}))]W)$$

and

$$\text{prob}(\alpha_B^{p_B} = \alpha_B^*) = 0.$$

Suppose candidate A makes a law announcement $\alpha_A^{p_A}$.

The assumption of the proposition

$$F_A([q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^{\wr}))]W) \geq \max\left\{\Delta\pi(\alpha_A^*, \alpha_A^{\wr}, \theta), \Delta Y(\alpha_A^*, \alpha_A^{\wr}, \theta)\right\}$$

together with the beliefs imply according to lemma 5.2 that the entrepreneurs choose $e(\alpha_A^{p_A})$ which generates an expected performance associated with the election of candidate A of

$$E_A^{AS}(Y) = Y(P, e(\alpha_A^{\wr})) + F_A([q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^{\wr}))]W)[Y(P, e(\alpha_A^*)) - Y(P, e(\alpha_A^{\wr}))].$$

Suppose now candidate B makes a law announcement $\alpha_B^{p_B}$. The beliefs imply according to lemma 5.2 that the entrepreneurs choose $e(\theta)$ if candidate B is elected. Thus, the expected performance associated with the election of candidate B is given as

$$E_B^{AS}(Y) = Y(P, e(\theta)).$$

As

$$F_A([q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^{\wr}))]W) \geq \Delta Y(\alpha_A^*, \alpha_A^{\wr}, \theta)$$

$E_A^{AS}(Y) > E_B^{AS}(Y)$ holds and thus candidate A is elected with certainty if he announces $\alpha_A^{p_A}$.

If candidate A announces α_A^{θ} the expected performance associated with the election of candidate A is given as $E_A(Y) = Y(P, e(\theta))$. Then $E_A(Y) = E_B^{AS}(Y)$ and each candidate would be elected with a probability of $1/2$. Thus, candidate A announces $\alpha_A^{p_A}$.

As his election is certain, the candidate A gathers information if

$$[q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^l))]W \geq K_A$$

and thus if the expected gain in future utility due to an increase of the expected re-election probability through announcing the law is higher than the costs of information acquisition.

Thus, the probability that candidate A will gather information is given by

$$F_A([q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^l))]W).$$

As a law announcement of candidate B is not believed to be appropriate, he will not gather information. Thus, the beliefs of the voters are correct.

$E_A^{AS}(Y)$ is given as

$$E_A^{AS}(Y) = Y(P, e(\alpha_A^l)) + F_A([q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^l))]W)[Y(P, e(\alpha_A^*)) - Y(P, e(\alpha_A^l))].$$

■

Proof of proposition 5.3:

We start from the beliefs of the voters

$$\text{prob}(\alpha_j^{p_j} = \alpha_j^*) = F_j(\frac{1}{2}[q(P, e(\alpha_j^*)) - q(P, e(\alpha_j^l))]W)$$

for $j = A, B$.

Suppose now both candidates make a law announcement $\alpha_j^{p_j}$.

The assumptions of the proposition

$$F_A(\frac{1}{2}[q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^l))]W) = F_B(\frac{1}{2}[q(P, e(\alpha_B^*)) - q(P, e(\alpha_B^l))]W)$$

and

$$F_j(\frac{1}{2}[q(P, e(\alpha_j^*)) - q(P, e(\alpha_j^\wr))]W) \geq \max\left\{\Delta\pi(\alpha_j^*, \alpha_j^\wr, \theta), \Delta Y(\alpha_j^*, \alpha_j^\wr, \theta)\right\}$$

together with the beliefs imply that each candidate is elected with a priori probability 1/2 as $E_A^{ABS}(Y) = E_B^{ABS}(Y)$ and that the entrepreneurs choose to invest. If a candidate announces α_j^θ, then he has zero election probability. Thus, announcing α_j^θ is no profitable deviation and both candidates announce $\alpha_j^{p_j}$.

As both candidates have a priori the same election probability, the entrepreneurs choose, according to our assumptions, with probability 1/2 $e(\alpha_A^{p_A})$ and with probability 1/2 $e(\alpha_B^{p_B})$.

The candidate whose law was selected by the entrepreneurs in their investment decision, (assume it to be candidate A) is elected. $E_A^{ABS}(Y)$ is given by

$$E_A^{ABS}(Y) = Y(P, e(\alpha_A^\wr)) + F_A(\frac{1}{2}[q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^\wr))]W)[Y(P, e(\alpha_A^*)) - Y(P, e(\alpha_A^\wr))]$$

if the entrepreneurs have selected $e(\alpha_A^{p_A})$ which is bigger than[1]

$$E_B^{ABS}(Y) = Y(P, e(\alpha_B^\wr)).$$

Then candidate j, $j = A, B$, gathers information if

$$\frac{1}{2}[q(P, e(\alpha_j^*)) - q(P, e(\alpha_j^\wr))]W \geq K_j$$

and thus if the expected gain in future utility due to an increased expected reelection probability through announcing the appropriate law is higher than the costs of information acquisition.

Thus, the probability that $\alpha_j^{p_j} = \alpha_j^*$ is given by

$$\text{prob}(\frac{1}{2}[q(P, e(\alpha_j^*)) - q(P, e(\alpha_j^\wr))]W \geq K_j) = F_j(\frac{1}{2}[q(P, e(\alpha_j^*)) - q(P, e(\alpha_j^\wr))]W)$$

for $j = A, B$. Thus, the beliefs of the voters are correct.

■

[1]This is the case because the candidate B cannot implement $\alpha_A^{p_A}$.

Proof of lemma 5.3:

Note that for $\alpha_j^{p_j} = \alpha_j^l$ an elected candidate j does not have the right to stand for reelection. This means that incumbents who announced α_j^l will not implement the project and thus choose $X = ST$ because $0 < C$.

Thus,[2]

$$X = \begin{cases} P \text{ with } \text{prob}^*(\alpha_j^{p_j} = \alpha_j^*), \\ ST \text{ with } 1-\text{prob}^*(\alpha_j^{p_j} = \alpha_j^*). \end{cases}$$

■

Proof of proposition 5.5:

Suppose there exists an equilibrium with search probability zero for both candidates. In such an equilibrium beliefs must fulfill $\text{prob}(\alpha_j^{p_j} = \alpha_j^*) = 0$ for $j = A, B$ and the entrepreneurs choose $e(\theta)$ as $0 < \Delta\pi(\alpha_j^*, \alpha_j^l, \theta)$.

However, a candidate gathers information as long as his expected utility from holding the office in the second period is bigger than the sum of the costs for information acquisition and for undertaking the project, as he does not have the right to stand for reelection when $\alpha_j^{p_j} = \alpha_j^l$. Hence the search probability is positive for at least one of the candidates and we obtain a contradiction.

■

Proof of proposition 5.6:

(i) We start from the beliefs of the voters

$$\text{prob}(\alpha_A^{p_A} = \alpha_A^*) = F_A(q(P, e(\alpha_A^*))W - C)$$

and

$$\text{prob}(\alpha_B^{p_B} = \alpha_B^*) = 0.$$

The assumption of (i)

$$F_A(q(P, e(\alpha_A^*))W - C) \geq \Delta\pi(\alpha_A^*, \alpha_A^l, \theta)$$

[2] The probability that an elected candidate has announced the appropriate law is equivalent to the equilibrium beliefs.

together with the beliefs imply according to lemma 5.2 that the entrepreneurs choose $e(\alpha_A^{p_A})$ if candidate A is elected. Recall that a candidate j, $j = A, B$, who announced $\alpha_j^{\wr}$ will choose $X = ST$ once in office. Then

$$E_A^{ASI^{inc}}(Y) = Y(ST, e(\alpha_A^{\wr})) + F_A(q(P, e(\alpha_A^*))W - C)[Y(P, e(\alpha_A^*)) - Y(ST, e(\alpha_A^{\wr}))].$$

The beliefs also imply that the entrepreneurs choose $e(\theta)$ if candidate B is elected. Furthermore, it is believed that candidate B does not implement the reform project once in office. Thus, $E_B^{ASI^{inc}}$ is given by

$$E_B^{ASI^{inc}}(Y) = Y(ST, e(\theta)).$$

Thus, candidate A is elected with certainty. He gathers information as long as

$$q(P, e(\alpha_A^*)))W - C \geq K_A$$

and thus as long as the expected utility from holding the office in the second period is higher than the sum of the costs for information acquisition and the costs for implementing the project. This is the case, because the candidate has no right to stand for reelection if he did not gather information.

The probability that $\alpha_A^{p_A} = \alpha_A^*$ is then given by $F_A(q(P, e(\alpha_A^*))W - C)$. The candidate B will not gather information as he is not elected. Thus beliefs are correct.

(ii) For the proof of (ii) we start from beliefs of the voters

$$\text{prob}(\alpha_A^{p_A} = \alpha_A^*) = F_A(q(P, e(\theta))W - C)$$

and

$$\text{prob}(\alpha_B^{p_B} = \alpha_B^*) = 0.$$

The assumption of (ii),

$$F_A(q(P, e(\alpha_A^*))W - C) < \Delta\pi(\alpha_A^*, \alpha_A^{\wr}, \theta)$$

together with the beliefs imply that the entrepreneurs choose $e(\theta)$ if candidate A is elected as well as if candidate B is elected. The expected performance of the country associated with the election of candidate A is given as

$$E_A^{ASNI^{inc}}(Y) = Y(ST, e(\theta)) + F_A(q(P, e(\theta))W - C)[Y(P, e(\theta)) - Y(ST, e(\theta))]$$

and the expected performance of the country associated with the election of candidate B is given as

$$E_B^{ASNI^{inc}}(Y) = Y(ST, e(\theta))$$

due to a similar line of reasoning as in the proof of (i). Thus, candidate A is elected with certainty. The candidate A will search for information as long as

$$q(P, e(\theta)))W - C \geq K_A$$

because if he announces $\alpha_A^{\wr}$ he does not have the right to stand for reelection. The candidate B will not gather information following the logic of the proof of (i). Thus, the beliefs of the voters are correct.

■

Proof of proposition 5.7:

(i) We start from beliefs of the voters

$$\text{prob}(\alpha_j^{p_j} = \alpha_j^*) = F_j(\frac{1}{2}q(P, e(\alpha_j^*))W - \frac{1}{2}C)$$

for $j = A, B$.

The assumptions of the proposition

$$F_j(\frac{1}{2}q(P, e(\alpha_j^*))W - \frac{1}{2}C) \geq \Delta\pi(\alpha_j^*, \alpha_j^{\wr}, \theta)$$

and

$$F_A(\frac{1}{2}q(P, e(\alpha_A^*))W - \frac{1}{2}C) = F_B(\frac{1}{2}q(P, e(\alpha_B^*))W - \frac{1}{2}C)$$

together with the beliefs imply $E_A^{ABSI^{inc}}(Y) = E_B^{ABSI^{inc}}(Y)$, which yields an a priori election probability of $1/2$ for each candidate. Thus, a candidate j, $j = A, B$ gathers information if

$$\frac{1}{2}q(P, e(\alpha_j^*)))W - \frac{1}{2}C \geq K_j$$

and thus voters' beliefs are correct.

The entrepreneurs choose with probability 1/2 $e(\alpha_A^{p_A})$ and with probability 1/2 $e(\alpha_B^{p_B})$. The voters elect the candidate whose announcement was used for the investment decision of entrepreneurs due to the same reasons as described in the proof of proposition 5.3.

Thus,

$$E_j^{ABSI^{inc}}(Y) = Y(ST, e(\alpha_j^{\wr})) + F_j(\frac{1}{2}q(P, e(\alpha_j^*))W - \frac{1}{2}C)[Y(P, e(\alpha_j^*)) - Y(ST, e(\alpha_j^{\wr}))].$$

(ii) For the proof of (ii) we start from beliefs of the voters

$$\text{prob}(\alpha_j^{p_j} = \alpha_j^*) = F_j(\frac{1}{2}q(P, e(\theta))W - \frac{1}{2}C)$$

for $j = A, B$.

The assumptions of the proposition

$$F_j(\frac{1}{2}q(P, e(\alpha_j^*))W - \frac{1}{2}C) < \Delta\pi(\alpha_j^*, \alpha_j^{\wr}, \theta)$$

and

$$F_A(\frac{1}{2}q(P, e(\theta))W - \frac{1}{2}C) = F_B(\frac{1}{2}q(P, e(\theta))W - \frac{1}{2}C)$$

together with the beliefs imply that the entrepreneurs choose $e(\theta)$. The candidate j, $j = A, B$, will gather information as long as $\frac{1}{2}q(P, e(\theta))W - \frac{1}{2}C \geq K_j$ due to a similar line of logic as in the proof of proposition 5.6 (ii). Thus, voters' beliefs are correct.

Then

$$E_j^{ABSNI^{inc}}(Y) = Y(ST, e(\theta)) + F_j(\frac{1}{2}q(P, e(\theta))W - \frac{1}{2}C)[Y(P, e(\theta)) - Y(ST, e(\theta))]$$

for $j = A, B$ and each candidate is elected with probability 1/2.

■

Proof of lemma 5.4:

In the proof we compare the existence conditions and expected performances of the equilibria under the election mechanism and under the incentive contract respectively. We will show that the equilibrium **AS** yields the highest expected performance under the election mechanism. If **AS** does not exist the equilibrium **NSE** yields the highest expected performance. Following this we show that the equilibrium **ASI**^{inc} yields the highest expected performance under the incentive contract. If **ASI**^{inc} does not exist **ASNI**^{inc} yields the highest expected performance.

(i) **Election Mechanism**

We compare the existence condition and the expected performance of the equilibrium **AS** with the existence conditions and expected performances of the other equilibria under the election mechanism.

The equilibrium **AS** exists if

$$F_A([q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^{\wr}))]W) \geq \max\left\{\Delta\pi(\alpha_A^*, \alpha_A^{\wr}, \theta), \Delta Y(\alpha_A^*, \alpha_A^{\wr}, \theta)\right\}.$$

It yields an expected performance of

$$E_A^{AS}(Y) = Y(P, e(\alpha_A^{\wr})) + F_A([q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^{\wr}))]W)[Y(P, e(\alpha_A^*)) - Y(P, e(\alpha_A^{\wr}))].$$

Comparison **AS** vs **BS**

The equilibrium **BS** exists if

$$F_B([q(P, e(\alpha_B^*)) - q(P, e(\alpha_B^{\wr}))]W) \geq \max\left\{\Delta\pi(\alpha_B^*, \alpha_B^{\wr}, \theta), \Delta Y(\alpha_B^*, \alpha_B^{\wr}, \theta)\right\}$$

and it yields an expected performance of

$$E_B^{BS}(Y) = Y(P, e(\alpha_B^{\wr})) + F_B([q(P, e(\alpha_B^*)) - q(P, e(\alpha_B^{\wr}))]W)[Y(P, e(\alpha_B^*)) - Y(P, e(\alpha_B^{\wr}))].$$

Because of our assumption

$$F_A([q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^{\wr}))]W) > F_B([q(P, e(\alpha_B^*)) - q(P, e(\alpha_B^{\wr}))]W)$$

AS always exists if **BS** exists and has a higher expected performance.

Comparison **AS** vs **ABS**

The equilibrium **ABS** exists if

$$F_A(\frac{1}{2}[q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^{\wr}))]W) = F_B(\frac{1}{2}[q(P, e(\alpha_B^*)) - q(P, e(\alpha_B^{\wr}))]W)$$

and

$$F_j(\frac{1}{2}[q(P, e(\alpha_j^*)) - q(P, e(\alpha_j^{\wr}))]W) \geq \max\left\{\Delta\pi(\alpha_j^*, \alpha_j^{\wr}, \theta), \Delta Y(P, \alpha_j^*, \alpha_j^{\wr}, \theta)\right\}.$$

It yields an expected performance of

$$E_j^{ABS}(Y) = Y(P, e(\alpha_j^{\wr})) + F_j([q(P, e(\alpha_j^*)) - q(P, e(\alpha_j^{\wr}))]W)[Y(P, e(\alpha_j^*)) - Y(P, e(\alpha_j^{\wr}))].$$

Because of

$$F_A([q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^{\wr}))]W) > F_A(\frac{1}{2}[q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^{\wr}))]W)$$

AS always exists if **ABS** exists and has a higher expected performance.

Comparison **AS** vs **NSE**

The equilibrium **NSE** always exists and yields an expected performance of

$$E_j^{NSE}(Y) = Y(P, e(\theta)).$$

This is smaller than the expected performance under **AS**. Thus, **AS** dominates **NSE**, if it exists.

However, suppose that

$$F_A([q(P, e(\alpha_A^*)) - q(P, e(\alpha_A^{\wr}))]W) < \max\left\{\Delta\pi(\alpha_A^*, \alpha_A^{\wr}, \theta), \Delta Y(\alpha_A^*, \alpha_A^{\wr}, \theta)\right\}.$$

Then **AS** does not exist and thus also the equilibria **BS** and **ABS** do not exist as we can see from the comparison of the existence conditions. Then **NSE** is the only remaining equilibrium and yields the highest expected performance.

(ii) **Incentive Contract**

We compare the existence condition and the expected performance of the equilibrium **ASI**^{inc} with the existence conditions and expected performances of the other equilibria under an incentive contract.

For

$$F_A(q(P,e(\alpha_A^*))W - C) \geq \Delta\pi(\alpha_A^*, \alpha_A^l, \theta)$$

the equilibrium $\mathbf{ASI}^{inc}$ exists. It generates an expected performance of

$$E_A^{ASI^{inc}}(Y) = Y(ST, e(\alpha_A^l)) + F_A(q(P,e(\alpha_A^*))W - C)\left[Y(P,e(\alpha_A^*)) - Y(ST, e(\alpha_A^l))\right].$$

Comparison $\mathbf{ASI}^{inc}$ vs $\mathbf{BSI}^{inc}$

The equilibrium $\mathbf{BSI}^{inc}$ exists if

$$F_B(q(P,e(\alpha_B^*))W - C) \geq \Delta\pi(\alpha_B^*, \alpha_B^l, \theta).$$

It yields an expected performance of

$$E_B^{BSI^{inc}}(Y) = Y(ST, e(\alpha_B^l)) + F_B(q(P,e(\alpha_B^*))W - C)\left[Y(P,e(\alpha_B^*)) - Y(ST, e(\alpha_B^l))\right].$$

Because of our assumption

$$F_A(q(P,e(\alpha_A^*))W - C) > F_B(q(P,e(\alpha_B^*))W - C),$$

$\mathbf{ASI}^{inc}$ always exists if $\mathbf{BSI}^{inc}$ exists and yields a higher expected performance.

Comparison $\mathbf{ASI}^{inc}$ vs $\mathbf{ABSI}^{inc}$

The equilibrium $\mathbf{ABSI}^{inc}$ exists if

$$F_j(\frac{1}{2}q(P,e(\alpha_j^*))W - \frac{1}{2}C) > \Delta\pi(\alpha_j^*, \alpha_j^l, \theta)$$

and

$$F_A(\frac{1}{2}q(P,e(\alpha_A^*))W - \frac{1}{2}C) = F_B(\frac{1}{2}q(P,e(\alpha_B^*))W - \frac{1}{2}C).$$

It yields an expected performance of

$$E_j^{ABSI^{inc}}(Y) = Y(ST, e(\alpha_j^l)) + F_j(\frac{1}{2}q(P,e(\alpha_j^*))W - \frac{1}{2}C)\left[Y(P,e(\alpha_j^*)) - Y(ST, e(\alpha_j^l))\right].$$

Because

$$F_A(q(P,e(\alpha_A^*))W - C) > F_A(\frac{1}{2}q(P,e(\alpha_A^*))W - \frac{1}{2}C)$$

$\mathbf{ASI}^{inc}$ always exists if $\mathbf{ABSI}^{inc}$ exists and yields a higher expected performance.

<u>Comparison $\mathbf{ASI}^{inc}$ vs $\mathbf{BSNI}^{inc}$</u>

The equilibrium $\mathbf{BSNI}^{inc}$ exists if

$$F_B(q(P, e(\alpha_B^*))W - C) < \Delta\pi(\alpha_B^*, \alpha_B^{\wr}, \theta)$$

and yields an expected performance of

$$E_B^{BSNI^{inc}}(Y) = Y(ST, e(\theta)) + F_B(q(P, e(\theta))W - C)\left[Y(P, e(\theta)) - Y(ST, e(\theta))\right].$$

$\mathbf{ASI}^{inc}$ and $\mathbf{BSNI}^{inc}$ can possibly coexist as the existence conditions may have an intersection. However, $E_B^{BSNI^{inc}}(Y)$ is smaller than $E_A^{ASI^{inc}}(Y)$ as

$$Y(ST, e(\theta)) = Y(ST, e(\alpha_A^{\wr})),$$

$$Y(P, e(\alpha_A^*)) > Y(P, e(\theta))$$

and

$$F_A(q(P, e(\alpha_A^*))W - C) > F_B(q(P, e(\theta))W - C).$$

<u>Comparison $\mathbf{ASI}^{inc}$ vs $\mathbf{ABSNI}^{inc}$</u>

The equilibrium $\mathbf{ABSNI}^{inc}$ exists if

$$F_j(\frac{1}{2}q(P, e(\alpha_j^*))W - \frac{1}{2}C) < \Delta\pi(\alpha_j^*, \alpha_j^{\wr}, \theta)$$

and

$$F_A(\frac{1}{2}q(P, e(\theta))W - \frac{1}{2}C) = F_B(\frac{1}{2}q(P, e(\theta))W - \frac{1}{2}C)$$

and yields an expected performance of

$$E_j^{ABSNI^{inc}}(Y) = Y(ST, e(\theta)) + F_j(\frac{1}{2}q(P, e(\theta))W - \frac{1}{2}C)\left[Y(P, e(\theta)) - Y(ST, e(\theta))\right].$$

$\mathbf{ASI}^{inc}$ and $\mathbf{ABSNI}^{inc}$ can possibly coexist. However, $E_j^{ABSNI^{inc}}(Y) < E_A^{ASI^{inc}}(Y)$ as

$$Y(ST, e(\theta)) = Y(ST, e(\alpha_A^{\wr})),$$

$$Y(P, e(\alpha_A^*)) > Y(P, e(\theta))$$

and

$$F_A(q(P, e(\alpha_A^*))W - C) > F_A(\frac{1}{2}q(P, e(\theta))W - \frac{1}{2}C).$$

Thus, the equilibrium $\mathbf{ASI}^{inc}$ dominates all other equilibria in terms of expected performance.

However, for $F_A(q(P, e(\alpha_A^*))W - C) < \Delta\pi(\alpha_A^*, \alpha_A^\wr, \theta)$ the equilibrium $\mathbf{ASI}^{inc}$ does not exist. We will now show that in this case the equilibrium $\mathbf{ASNI}^{inc}$ yields the highest expected performance.

First note that if $\mathbf{ASI}^{inc}$ does not exist then also the equilibria $\mathbf{BSI}^{inc}$ and $\mathbf{ABSI}^{inc}$ do not exist. Thus, we have to compare the equilibria $\mathbf{ASNI}^{inc}$, $\mathbf{BSNI}^{inc}$, and $\mathbf{ABSNI}^{inc}$.

The equilibrium $\mathbf{ASNI}^{inc}$ exists if

$$F_A(q(P, e(\alpha_A^*))W - C) < \Delta\pi(\alpha_A^*, \alpha_A^\wr, \theta)$$

and yields an expected economic performance of

$$E_A^{ASNI^{inc}}(Y) = Y(ST, e(\theta)) + F_A(q(P, e(\theta))W - C)[Y(P, e(\theta)) - Y(ST, e(\theta))].$$

Comparison $\mathbf{ASNI}^{inc}$ vs $\mathbf{BSNI}^{inc}$

The equilibrium $\mathbf{BSNI}^{inc}$ exists if

$$F_B(q(P, e(\alpha_B^*))W - C) < \Delta\pi(\alpha_B^*, \alpha_B^\wr, \theta)$$

and yields an expected performance of

$$E_B^{BSNI^{inc}}(Y) = Y(ST, e(\theta)) + F_B(q(P, e(\theta))W - C)\left[Y(P, e(\theta)) - Y(ST, e(\theta))\right].$$

$\mathbf{ASNI}^{inc}$ and $\mathbf{BSNI}^{inc}$ can possibly coexist. However, $E_A^{ASNI^{inc}}(Y) > E_B^{BSNI^{inc}}(Y)$ as

$$F_A(q(P, e(\theta))W - C) > F_B(q(P, e(\theta))W - C).$$

Comparison $\mathbf{ASNI}^{inc}$ vs $\mathbf{ABSNI}^{inc}$

The equilibrium $\mathbf{ABSNI}^{inc}$ exists if

$$F_j(\frac{1}{2}q(P, e(\alpha_j^*))W - \frac{1}{2}C) < \Delta\pi(\alpha_j^*, \alpha_j^\wr, \theta)$$

and

$$F_A(\frac{1}{2}q(P, e(\theta))W - \frac{1}{2}C) = F_B(\frac{1}{2}q(P, e(\theta))W - \frac{1}{2}C)$$

and yields an expected performance of

$$E_j^{ABSNI^{inc}}(Y) = Y(ST, e(\theta)) + F_j(\frac{1}{2}q(P, e(\theta))W - \frac{1}{2}C)\left[Y(P, e(\theta)) - Y(ST, e(\theta))\right].$$

$\mathbf{ASNI}^{inc}$ and $\mathbf{ABSNI}^{inc}$ can possibly coexist. However, $E_j^{ASNI^{inc}}(Y) > E_A^{ABSNI^{inc}}(Y)$ as

$$F_A(q(P, e(\theta))W - C) > F_A(\frac{1}{2}q(P, e(\theta))W - \frac{1}{2}C).$$

Thus, the equilibrium $\mathbf{ASNI}^{inc}$ dominates the equilibria $\mathbf{BSNI}^{inc}$ and $\mathbf{ABSNI}^{inc}$. $\mathbf{ASNI}^{inc}$ always exists if $\mathbf{ASI}^{inc}$ does not exist and is thus the equilibrium which yields the highest expected performance if $\mathbf{ASI}^{inc}$ does not exist.

■

Proof of proposition 5.8:

(i) Suppose

$$F_A([q(P,e(\alpha_A^*)) - q(P,e(\alpha_A^\wr))]W) \geq \max\left\{\Delta\pi(\alpha_A^*,\alpha_A^\wr,\theta), \Delta Y(\alpha_A^*,\alpha_A^\wr,\theta)\right\}.$$

Thus, under the election mechanism the equilibrium **AS** is selected. Under the incentive contract the equilibrium $\mathbf{ASI}^{inc}$ is chosen because

$$\begin{aligned} F_A([q(P,e(\alpha_A^*))]W - C) &\geq F_A([q(P,e(\alpha_A^*)) - q(P,e(\alpha_A^\wr))]W) \\ &\geq \max\left\{\Delta\pi(\alpha_A^*,\alpha_A^\wr,\theta), \Delta Y(\alpha_A^*,\alpha_A^\wr,\theta)\right\} \end{aligned}$$

and hence we have

$$F_A([q(P,e(\alpha_A^*))]W - C) \geq \Delta\pi(\alpha_A^*,\alpha_A^\wr,\theta)$$

which is the assumption of $\mathbf{ASI}^{inc}$.

Social welfare increases upon the introduction of an incentive contract if $E_A^{ASI^{inc}}(Y)$ $> E_A^{AS}(Y)$ and thus if and only if

$$\begin{aligned} &Y(ST,e(\alpha_A^\wr)) + F_A([q(P,e(\alpha_A^*))]W - C)[Y(P,e(\alpha_A^*)) - Y(ST,e(\alpha_A^\wr))] \\ &> Y(P,e(\alpha_A^\wr)) + F_A([q(P,e(\alpha_A^*)) - q(P,e(\alpha_A^\wr))]W)[Y(P,e(\alpha_A^*)) - Y(P,e(\alpha_A^\wr))]. \end{aligned}$$

This condition is equivalent to

$$\begin{aligned} F_A([q(P,e(\alpha_A^*))]W - C) &> \frac{Y(P,e(\alpha_A^\wr)) - Y(ST,e(\alpha_A^\wr))}{Y(P,e(\alpha_A^*)) - Y(ST,e(\alpha_A^\wr))} + \\ F_A([q(P,e(\alpha_A^*)) - q(P,e(\alpha_A^\wr))]W)&\frac{Y(P,e(\alpha_A^*)) - Y(P,e(\alpha_A^\wr))}{Y(P,e(\alpha_A^*)) - Y(ST,e(\alpha_A^\wr))}. \end{aligned}$$

which establishes point (i).

(ii) If

$$F_A([q(P,e(\alpha_A^*)) - q(P,e(\alpha_A^{\wr}))]W) < \max\left\{\Delta\pi(\alpha_A^*,\alpha_A^{\wr},\theta), \Delta Y(\alpha_A^*,\alpha_A^{\wr},\theta)\right\},$$

and

$$F_A([q(P,e(\alpha_A^*))]W - C) \geq \Delta\pi(\alpha_A^*,\alpha_A^{\wr},\theta)$$

then under the election mechanism the equilibrium **NSE** is chosen and under the incentive contract the equilibrium $\mathbf{ASI}^{inc}$ is chosen. Thus, the introduction of an incentive contract increases social welfare if $E_A^{ASI^{inc}}(Y) > E_j^{NSE}(Y)$ and thus if and only if

$$Y(ST,e(\alpha_A^{\wr})) + F_A([q(P,e(\alpha_A^*))]W - C)[Y(P,e(\alpha_A^*)) - Y(ST,e(\alpha_A^{\wr}))] > Y(P,e(\theta))$$

what is equivalent to

$$F_A([q(P,e(\alpha_A^*))]W - C) > \frac{Y(P,e(\theta)) - Y(ST,e(\alpha_A^{\wr}))}{Y(P,e(\alpha_A^*)) - Y(ST,e(\alpha_A^{\wr}))}.$$

(iii) If

$$F_A([q(P,e(\alpha_A^*))]W - C) < \Delta\pi(\alpha_A^*,\alpha_A^{\wr},\theta)$$

then also

$$F_A([q(P,e(\alpha_A^*)) - q(P,e(\alpha_A^{\wr}))]W) < \max\left\{\Delta\pi(\alpha_A^*,\alpha_A^{\wr},\theta), \Delta Y(\alpha_A^*,\alpha_A^{\wr},\theta)\right\}$$

because

$$F_A([q(P,e(\alpha_A^*))]W - C) > F_A([q(P,e(\alpha_A^*)) - q(P,e(\alpha_A^{\wr}))]W).$$

Then under the election mechanism the equilibrium **NSE** is chosen and under the incentive contract the equilibrium $\mathbf{ASNI}^{inc}$ is chosen. Suppose that the introduction of an incentive contract increases social welfare, i.e. $E_A^{ASNI^{inc}}(Y) > E_j^{NSE}(Y)$ and thus

$$Y(ST,e(\theta)) + F_A([q(P,e(\theta))]W - C)[Y(P,e(\theta)) - Y(ST,e(\theta))] > Y(P,e(\theta)).$$

This is equivalent to

$$(1 - F_A([q(P,e(\theta))]W - C))Y(ST,e(\theta)) > (1 - F_A([q(P,e(\theta))]W - C))Y(P,e(\theta)),$$

which can be reduced to

$$Y(ST,e(\theta)) > Y(P,e(\theta)).$$

This case contradicts our assumptions and thus social welfare never increases.

■

Proof of corollary 5.1:
If $F_A([q(P, e(\alpha_A^*))]W - C) = 1$, then the equilibrium $\mathbf{ASI}^{inc}$ is chosen under the incentive contract because

$$1 \geq \Delta\pi(\alpha_A^*, \alpha_A^l, \theta)$$

is always satisfied as $\pi(\alpha_A^*) > \pi(\theta)$ per assumption. All types of candidate A gather information. Then $E_A^{ASI^{inc}}(Y) = Y(P, e(\alpha_A^*))$ which is the best possible performance. Thus, social welfare weakly increases through the introduction of an incentive contract.

■

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