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Abstract

Like many common-pool resources, the Lake Victoria fisheries are characterized by poor compliance with production input regulations that are intended to reduce overexploitation. To explore the use of input subsidies to increase compliance, we determine the subsidy level required to induce demand for legal fishing nets, thereby compensating fishermen for loss of productivity net of enforcement risk. Our study additionally tests the subsidy-enhancing effect of a norm-nudge. A new multiple price list mechanism for eliciting revealed willingness to pay for multiple units of a production input is developed, adapted to the demands of a challenging field setting, and implemented with 462 fishermen at 20 landings sites on the Tanzanian lakeshore. Consistent with the high prevalence of illegal fishing gear at our sites, we find a zero median demand for legal net panels at local market prices. The subsidy required to shift median demand to at least one legal net panel is a 21% discount. Norm-nudging generates no policy-relevant enhancement of the subsidy.

JEL Classification: C93, D04, H23, Q28
Keywords: compliance; natural resource management; subsidies

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1 Introduction

Common-pool resource use in developing countries is notoriously difficult to govern. Conventional policy instruments such as input restrictions and harvesting quotas are often ineffective due to low enforcement power and corruption (Ostrom, 2008). In the absence of effective regulation, the "Tragedy of the Commons" (Hardin, 1968) takes effect. For the sake of individual benefits, resource users employ unsustainable and often illegal practices that drive systems towards overexploitation and confront policy makers with the task of finding alternatives. An example for a natural resource system with mounting pressures on the resource stock and ineffective formal regulations is Lake Victoria in East Africa, the second largest freshwater lake in the world. While population growth, pollution, and climate change continue to exert stress onto the ecosystem, existing policies have been unsuccessful in reducing illegal fishing practices (Eggert and Lokina, 2010; Etiegni et al., 2017). Co-management solutions are undermined by issues of corruption (Nunan et al., 2018) and strict enforcement methods such as the sporadic burning of illegal fishing nets fail to increase compliance (Kolding et al., 2014; Obiero et al., 2015; Cepić and Nunan, 2017).

To inform alternative policies that can induce compliance in the absence of strong enforcement capacity, we study the subsidization of legal inputs to the main economic activity of natural resource users. In particular, we run a field intervention in the Lake Victoria fisheries in Tanzania and test the effect of subsidies on the demand for legal fishing nets. We pursue two main research objectives. First, we study the baseline willingness to pay (WTP) for fishing nets that comply with formal regulations. Through a comparison of fishermen's WTP with the local market price we can approximate (i) whether demand is consistent with a high prevalence for illegal nets in the status quo and (ii) what is the discount necessary for widespread demand of legal nets. Second, we study whether a so-called "norm-nudge", *i.e.*, a non-price related intervention that provides information on the (desirable) behavior of peers (see Farrow et al., 2017; Bergquist et al., 2019, for recent reviews) is able to increase the cost-effectiveness of the subsidy. Thereby, we make a first attempt to implement findings from lab-in-the-field experiments with fishermen at Lake Victoria that showcase the effectiveness of norm-nudges for increasing cooperation in a social dilemma (see Diekert et al., 2021; Diekert and Eymess, 2021).

The Lake Victoria fisheries are in need for management approaches that can ensure sustainable resource use in the long-term without neglecting the economic importance of short-term resource exploitation (Aura et al., 2020). Official regulations intend to achieve this goal. As an example, we focus on a regulation that limits the mesh size of fishing nets in Lake Victoria's "dagaa" fishery to reconcile the profitability of fishing with the protection of the juvenile stock. Given the strategic incentives in this multi-national fishery and/or limited state capacity, this mesh size regulation is poorly enforced and commonly violated (Eggert and Lokina, 2010). The frame survey by the Lake Victoria Fisheries Organization (LFVO) highlights the widespread use of illegal nets in the dagaa fishery. In 2016, more than 90% of all nets violate the mesh size regulation indicating that for the vast majority of fishermen, the productivity gains of illegal gear outweigh the cost of enforcement risk. Based on the premise that community participation increases compliance (Ostrom, 1990), so-called Beach Management Units (BMU) were established around the lake to monitor and enforce state regulations at the landing site level. But for multiple reasons, BMUs are ineffective. Regulations are perceived as illegitimate and corruption as well as close kinship ties prevent BMU representatives from punishing non-compliant community members (Nunan et al., 2018; Etiegni et al., 2017). Instead, regulators resort to strict but sporadic enforcement, raiding fishing communities to confiscate and burn illegal gear. These measures have failed to deter non-compliance but further aggravated the perceived inadequacy of the enforcement system (Cepić and Nunan, 2017; Nunan et al., 2018) For a sustained increase in compliance, alternative policies are necessary.

One such alternative are input subsidies, an approach that is broadly applied in agricultural development. To promote agricultural growth in general or respond to draughts in particular, fertilizer subsidies induce land use intensification and can thereby reduce both poverty and food shortages (Morris, 2007; Jayne and Rashid, 2013). Their use is motivated through the need to correct market failures such as credit constraints or missing market access as well as the benefits of accelerating the exposure to new technologies such that farmers can experience learning effects and ultimately adopt more efficient production inputs (Holden, 2019).

We propose a novel use of input subsidies as a policy instrument to reduce non-compliance. By subsidizing legal production inputs, the policy is designed to drive their illegal counterparts out of the market. The intervention works as a bargain between regulator and resource users, in which the subsidy compensates for the productivity loss of switching from illegal to legal inputs. In turn, benefits are generated in terms of a decrease in costly enforcement measures and more sustainable resource use. While regulators would eventually aim for widespread replacement of illegal inputs, we focus on the first hurdle that any potential subsidization policy needs to pass: are subsidies an effective and efficient instrument to increase the demand for legal production inputs?

The cost-effectiveness of a subsidization policy is among the primary criteria for regulators to assess its feasibility. Policy-makers would look for additional non-price related mechanisms that given a fixed budget can increase take-up, or given a fixed take-up rate can decrease the necessary budget. A popular non-price related intervention are norm-nudges. By providing information about the behavior or opinion of others, norm nudges have been successful in promoting a variety of desirable consumer behavior such as recycling (Schultz, 1999) or reducing water consumption (Ferraro and Price, 2013; Brent et al., 2015). Recent experimental studies show that norm-nudges can also be used as a mechanism to induce cooperation in a social dilemma, both with western laboratory participants (Fehr and Schurtenberger, 2018) and with fishermen from Lake

Victoria participating in a lab-in-the-field experiment (Diekert et al., 2021; Diekert and Eymess, 2021). To provide evidence beyond the experimental test-bed, we study whether a norm-nudge can increase the effectiveness of a subsidy program by either increasing the demand for legal production inputs or by decreasing the subsidy necessary for widespread demand.

To study the effect of input subsidies on demand for legal nets in our field intervention, we develop a novel elicitation method for the revealed WTP that is incentive compatible, fits a setup with multiple units, and is adapted to a challenging field environment. Because fishermen at Lake Victoria tie several panels together to form a larger net (see Figure A-2 in the Appendix), we allow participants to purchase up to four panels in our intervention. Also, the method is adapted to the low overall literacy in our sample at Lake Victoria, a situation in which it is particularly challenging to ensurer comprehension (Burchardi et al., 2021). Further, the method is able to identify plausible zero demand, *i.e.*, we can categorize participants by whether they are on the market for new production inputs at the time of the intervention. We offer legal net panels to 462 fishermen at Lake Victoria, collecting a total of 247 observations with plausible non-zero demand at the highest discount offered. Prices per panel range from approx. a 35% discount to a 25% premium compared to the local market price. By offering net panels at increasing discounts, we are able to study the demand for legal nets at market price and the subsidy necessary for widespread purchases.

Our study makes three contributions. First, we demonstrate the use of input subsidies for a novel purpose: increasing the demand for legal production inputs in natural resource use. Second, we successfully apply our newly developed procedure in the challenging field setting at Lake Victoria and thereby gain important methodological insights for empirical research on the evaluation of market-based instruments that work through consumer preferences (Berry et al., 2020; Cole et al., 2020). Third, our results have novel policy implications for the management of common-pool resources like the fisheries at

Lake Victoria. In particular, we find a zero median demand for legal net panels above and at the average reported market price. Only about 20% of participants in the sample buy at least one panel when no discount is offered. Our results on a zero median demand for legal nets at market price are consistent with a high prevalence of illegal fishing gear in our sample. The majority of fishermen appear to prefer nets with illegal mesh size. To shift median demand to a minimum of one legal panel, a 21% discount is necessary indicating that demand for legal nets is conditional on a substantial discount. Moreover, the norm-nudge treatment does not increase demand. While the necessary discount to induce positive demand is about 3 percentage points lower than in the control group, the difference is not significant. Results imply that a policy intervention that subsidizes legal production inputs to increase compliance can work but needs sizeable financial resources.

2 The Dagaa Fishery at Lake Victoria

2.1 Background

The harvest of *silver cyprinid*, locally referred to as "dagaa", is the largest fishery by catch volume and the second largest fishery by economic value at Lake Victoria (Kolding et al., 2014). It provides a livelihood to thousands of fishermen and their families and is an essential part of food security for several million residents in the three riparian countries Kenya, Tanzania, and Uganda. To catch dagaa, fishermen use the seine netting method. For sein netting, the typical fishing crew vertically connects three or four net panels to form a larger net used (ca. 100 meter long and 15 meter deep) to catch schools of dagaa that are lured to the surface by kerosene lamps at night.

Among the measures to foster sustainability in the dagaa fishery at the Tanzanian lakeside is a governmental regulation that limits the mesh size of seine nets to 8 millimeters.[1] However, according to the frame survey by the LVFO in 2017, nets with a mesh size of 6 millimeters or lower dominate the market by a large margin: more than 90% of all nets have a mesh size below the 8 millimeter regulation. The use of these illegal nets increases revenue by capturing smaller and immature fish (Wanink, 1999) but thereby jeopardizes the sustainability of the fishery. Especially when used in conjunction with other unsustainable or even outlawed practices such as fishing in nearshore or breeding areas, juvenile catch rates of dagaa and the other two commercially fished species Nile Perch and Tilapia increase drastically (Njiru et al., 2014; Mangeni-Sande et al., 2019). Given that many fishermen use vessels that can only access inshore areas, the adoption of nets with a larger mesh size would reduce concerns of overfishing (Ojwang et al., 2014).

2.2 Net Panels and their Market Characteristics

Two types of net panels dominate the legal market for the dagaa fishery at Lake Victoria (*i.e.*, nets with a mesh size $\geq$ 8mm): locally produced "Kenyan" nets and Asian import products referred to as "Japanese" nets.[2] The two types differ with respect to durability and price. Japanese nets, made from a higher-quality UV-resistant filament, typically last two or three years before they have to be replaced. The going market price for these nets is around TZS 190,000 per panel (US $82.6). Kenyan panels, made from lower-quality material, start to show deterioration after one month of use and are hand-fixed by the fishing crews until they need to be fully replaced after around six months. New

[1]The Tanzanian fisheries regulation of 2009 specifies that a person shall not possess, use, or cause any other person to use a dagaa fishnet of mesh size less than eight millimetres in any fresh water body (The United Republic of Tanzania, 2009). In an attempt to harmonize resource conservation and the need for exploitation for economic benefits, the 2009 regulation repeals a 2005 regulation that limited the use of nets for dagaa fishing to 10 mm. The LVFO, a transnational institution for the conservation and management of Lake Victoria's resources, recommends a mesh size of 8 millimeters and above (LVFO, 2016b,a), a recent change from the 10mm recommendation that the LVFO supported before 2016.

[2]The geographical denominators attached to the products do not necessarily coincide with the country of production. "Kenyan" refers to nets that are locally produced and sold. "Japanese" refers to high-quality imports, mostly from China. For an impression of a seine net used for dagaa fishing, see Appendix Figure A-2.

"Kenyan" nets cost around TZS 60,000 per panel (US \$26.1). The market for illegal seine nets (*i.e.*, nets with a mesh size < 8mm) is different. Only Kenyan nets are available at a mesh size below 8 mm. For a relevant policy recommendation with respect to a legal net subsidy program at Lake Victoria, we therefore consider legal Kenyan 8 mm net panels in our study (hereafter, we omit the "Kenyan").

At a one-time subsidization offer (like in our intervention), one should expect to encounter three types of demand for new net panels: (i) temporarily positive demand, (ii) temporarily zero demand, and (iii) structurally zero demand. The durability of net panels of about six months leads to regular but infrequent demand for new production inputs. This frequency of demand is likely to depend on the size of the gear owner's fishing operation. To give an example: an owner operating one vessel would need to purchase around four new net panels every six months or one panel every six weeks but a considerably larger fleet of six vessels would generate demand of 24 panels every half year or about one panel per week. Conditional on the date of an owner's last panel purchase, demand at the time of the subsidization offer will therefore be positive or zero. It is important to note that the purchase of reserve net panels may be limited due to liquidity constraints or be inefficient due to high storage costs. That is, net panels require costly indoor storage space as they are bulky goods that deteriorate over time from UV radiation (Al-Oufi et al., 2004) and prolonged storage in itself is costly due to the threat of theft (Nunan et al., 2018).

Note that temporarily zero demand can only occur with a one-time intervention. A policy that offers subsidies over a longer time frame would eventually be able to target all gear owners in case their demand is not structurally zero. Such structurally zero demand for legal Kenyan nets will however arise if gear owners strictly prefer higher quality "Japanese" nets or if gear owners strictly prefer nets with an illegal mesh size. Gear owners with an structural zero demand are not the population of interest for our proposed policy intervention.

3 Theory

In this section, we sketch a very simple theoretical model of the situation that a dagaa fisher/firm faces.

Let n be the number of net panels that a firm deploys. The firm's production function f is increasing in n, but at a decreasing rate (such that $f'(n) > 0$ and $f''(n) < 0$). Further, let p be the market price for dagaa and w be the factor price per net panel. We assume that the firm is a price taker on the factor market, and that both the output market and the market for net panels are competitive. A profit-maximizing firm then chooses n to maximize its profit function (1), and the firm's demand for net panels $n(p, w)$ is defined by the corresponding first-order condition (2).

$$\pi(n) = pf(n) - wn \tag{1}$$

$$\pi'(n) = pf'(n) - w = 0 \tag{2}$$

Demand for net panels increases in the output price p and decreases in the factor price w. Differentiating (2) with respect to p and w, respectively, we get

$$\frac{\delta n(p, w,)}{\delta p} = -\frac{f'(n(p, w))}{f''(n(p, w))} > 0 \qquad \text{and} \qquad \frac{\delta n(p, w,)}{\delta w} = \frac{1}{pf''(n(p, w))} < 0.$$

Net panels come in two varieties. There are net panels with small mesh sizes, n_s (with mesh size <8mm), and net panels with large mesh sizes, n_l (with mesh size ≥8mm). Using a net with a small size yields a productivity advantage: For a fish stock x (a given number of individual fish with a given distribution of fish sizes in the water), a net with smaller mesh size will retain more fish. That is, we have $f'(n_s; x) > f'(n_l; x)$.

There is a negative externality of choosing nets with small meshes because these nets deplete the fish stock more effectively. As there is open-access to the lake and there are many firms, we assume that firms are myopic and do not account for the effect of their own harvest on the fish stock.[3] Nevertheless, we assume that the firms understand that the fish stock would be larger if all (or most) firms were to choose a large mesh size. After all, that is the rationale of the regulation that makes small mesh sizes illegal.

Because small mesh sizes are illegal, firms have to account for the potential fine, in addition to the productivity differential, when choosing small over large net sizes. That is, they have to assess the probability ρ of having to pay a fine F when being caught using small nets. For simplicity, we assume that the expected fine, ρF is linearly increasing in the number of small panels that the firm uses.

We can express the difference in factor prices between nets with small and large mesh sizes, $w_s - w_l$, by equation (3). When the productivity gain from using a small mesh size outweighs the expected fine, we should not observe a positive demand for nets with large mesh sizes.

$$w_s - w_l \;=\; p[f'(n_s;x) - f'(n_l;x)] - \rho F \tag{3}$$

In other words, equation (3) gives the absolute value of the subsidy that is necessary to induce a firm to buy a net with legal mesh size. The subsidy must compensate the firm for the productivity loss net of the expected fine.

Equation (3) offers three comparative statics (testable implications of the model), that are spelled out below (under the mild additional assumption that $f''(n_s;x) = f''(n_l;x)$, which simplifies the algebra a lot). First, the subsidy should be lower the higher is the expected fine. Second, the effect of a higher output price is ambiguous: Because $f'(n_s;x) > f'(n_l;x)$ we have $\frac{\mathrm{d}n_s}{\mathrm{d}p} > \frac{\mathrm{d}n_l}{\mathrm{d}p}$, which together with $f'' < 0$ leads to two

[3] Although we do not model the dynamics of this common production factor explicitly, we highlight that the “race to fish” along the size dimension will not be constrained even if there were management by conventional harvest quotas (Diekert, 2012). Property rights would need to be fully delineated to achieve the first-best (Costello and Deacon, 2007). This means that conventional harvest quotas (that limit *how much* fish a fisher can catch) must be accompanied by gear regulations (limiting *which sizes* of fish a fisher can catch, see Stoeven et al., 2021).

countervailing effects. Third, the effect of a larger perceived fish stock, x, which may be induced by the norm nudge that could shift fishers' expectations about the median mesh size in the lake, depends on whether $\frac{\partial^2 f(n_s,x)}{\partial n_s \partial x} > \frac{\partial^2 f(n_l,x)}{\partial n_l \partial x}$ or not.[4] That is, does a larger stock increase the marginal productivity of a net with small mesh size more than the marginal productivity of a net with large mesh size? Given the S-shaped selectivity pattern of seine gear which essentially retains all fish above a certain size and no fish below a certain size, which is determined by the mesh size (in simple words, small fish can escape, large fish cannot), it is reasonable to presume that the marginal productivity of a net with small mesh size is larger than the marginal productivity of a net with large mesh size. If a norm-nudge induces firms to expect a higher fish stock, we would therefore expect it to work to increase the size of the subsidy that is necessary to make firms shift to using legal gears.

$$\frac{\mathrm{d}[w_s - w_l]}{\mathrm{d}\rho F} = -1$$

$$\frac{\mathrm{d}[w_s - w_l]}{\mathrm{d}p} = [f'(n_s; x) - f'(n_l; x)] + pf'' \left(\frac{\mathrm{d}n_s}{\mathrm{d}p} - \frac{\mathrm{d}n_l}{\mathrm{d}p} \right)$$

$$\frac{\mathrm{d}[w_s - w_l]}{\mathrm{d}x} = pf'' \left(\frac{\mathrm{d}n_s}{\mathrm{d}x} - \frac{\mathrm{d}n_l}{\mathrm{d}x} \right) + \frac{\partial^2 f(n_s, x)}{\partial n_s \partial x} - \frac{\partial^2 f(n_l, x)}{\partial n_s \partial x} = p \left(\frac{\partial^2 f(n_s, x)}{\partial n_s \partial x} - \frac{\partial^2 f(n_l, x)}{\partial n_l \partial x} \right)$$

4 Methods

To study the valuation of legal net panels, we design a novel elicitation method for revealed WTP for multiple units. We adapt existing mechanism (see Kagel and Levin (2011) for a review on auctions and Berry et al. (2020) as well as Cole et al. (2020) for recent examples of evaluation mechanisms in the field) to the specific needs of our

[4] In the derivation of $\frac{\mathrm{d}[w_s - w_l]}{\mathrm{d}x}$ we have made use of the fact that $\frac{\mathrm{d}n}{\mathrm{d}x} = \frac{\frac{\partial^2 f(n,x)}{\partial n \partial x}}{\frac{\partial^2 f(n,x)}{\partial n^2}}$ and that $\frac{\partial^2 f(n,x)}{\partial n^2} = \frac{\partial^2 f(n,x)}{\partial n^2}$.

challenging environment at Lake Victoria. First, since gear owners in our sample are likely to have demand for several panels, we adjust a multiple price list (MPL) to fit a setup with multiple units (muMPL). Second, instead of converging on a precise WTP through repeated price range adjustments, we use a discrete set of prices that is evaluated relative to a market price. This is closer to a real market environment, enables the implementation of the method in a workshop setting without the need to assist respondents individually, and facilitates comprehension in a low literacy environment (de Meza et al., 2013). Third, we combine the muMPL with an incentive compatible Becker-deGroot-Marschak (BDM) type of bid allocation to obtain true valuations.

4.1 The muMPL Mechanism

The muMPL mechanism has three steps: (i) participants privately state their demand for net panels at seven discrete prices and a maximum number of four net panels offered at each price, (ii) one of the seven prices is randomly drawn as the offer price for all participants in the workshop, (iii) one participant at a time is randomly chosen and the number of units that are indicated for purchase at the offer price are sold. The price list is a binding agreement to purchase the net panels in case the participant is allocated any units in step (iii).

Before the WTP elicitation in step (i), we ask participants for the price of a legal net panel that they usually pay at the market. The average of all reported market prices within a workshop is then publicly announced in order to anchor all participants on the same market valuation. Additionally, the average market price is useful to control for different prices at different landing sites and to evaluate the demand for legal nets in terms of the discount offered.

The WTP is elicited with an order sheet, see Appendix Figure A-1. The order sheet gathers several points of data. First, it gives a discrete price list that starts at TZS 39,000 for one net panel and continues in steps of TZS 6,000 in ascending order with the last price at TZS 75,000. Considering an average reported market price around TZS 60,000, prices on the list range from a discount of 35% per panel to a price premium of 25%. Next to each price, participants are asked to state the number of panels that they are willing to purchase at each given price with a maximum number of four panels offered. For orientation, the total cost that a participant would need to pay is displayed below each choice. Participants are instructed to give consistent answers, *i.e.*, that the number of panels indicated for purchase should not increase with an increasing price per unit.

After participants fill out the price list and seal it in an envelope, the offer price is publicly and randomly drawn for all participants in the workshop. The offer price is drawn from all seven prices that are part of the order sheet's price list. Afterwards, nets are allocated in public. One envelope is randomly drawn from all price list valuations and the number of net panels that are indicated for purchase at the offer price are sold to the respective participant. Then another envelope is drawn and the procedure is iterated until all items are sold or all order sheets have been drawn.

4.2 The Norm-Nudge

The norm-nudge is a descriptive social information message that is verbally provided to all participants in the workshop immediately before their WTP is elicited, *i.e.*, before the order sheet is filled out. We use the following message:

"You are not the first landing site we visit for a workshop. We visit many communities around the Lake. At other landing sites, many fishermen support sustainable fishing by purchasing 8mm net panels."

By leveraging a comparison, the message is designed to affect participants' belief about what is common observable behavior. The message is carefully phrased as to avoid uncertainties about both the reference group and the normative implications of the described target behavior(Bicchieri and Dimant, 2019). That is, descriptive norm-nudges may fail or backfire if the reference group of the information message is not relevant (Bicchieri, 2017; Diekert et al., 2021) or when it is unclear whether the target behavior is desirable also from a normative standpoint, *i.e.*, whether it is perceived as the right thing to do (Bicchieri et al., 2019). Therefore, we use a message that explicitly refers to peer behavior (fishermen at other landing sites) and support the message with a normative statement, the desirability with respect to sustainable resource use. Moreover, do not name a specific price in order to avoid anchoring demand. Thereby, we limit self-serving belief formation (Dana et al., 2007) as we make it more difficult for participants to rationalize that the applicability of the social information is subject to personal budget constraints.

5 Data

We first describe the implementation of the muMPL procedure in the Lake Victoria region. Then, we provide evidence on both temporarily and structurally zero demand at the highest discount offered and present characteristics of all participants with non-zero demand.

5.1 Implementation

The muMPL valuation procedure was implemented with 462 fishermen in a workshop setting at 20 different landing sites in the Lake Victoria region, Tanzania. Data was collected in October and November 2021. The workshops were led by researchers from the Tanzanian Fisheries Research Institute and explicitly framed as an intervention to support sustainable fishing. The norm-nudge treatment was randomized across workshops. Participants were sampled from all boat and gear owners in the dagaa fishery that were potentially interested to acquire new net panels. For every two participants we made one net panel available for purchase such that the unit to participant ratio was kept constant. Workshop attendance varied between 18 and 24 participants. Each participant could, at most, acquire four panels.

The elicitation procedure and the norm-nudge treatment was implemented as described in section 4. Beforehand, informed consent was obtained and a detailed explanation of the procedure's rules was given. In particular, it was highlighted that all valuations during the workshop are made under the agreement that, if selected, the participant would have to purchase the number of units indicated at the respective offer price. To increase the understanding of the evaluation method and to showcase the binding purchase agreement, a training procedure was conducted. That is, before fishermen could acquire net panels, soda bottles (at a two to one ratio of units to participants) were made available for purchase. The valuation and purchase of these soda bottles followed the exact same procedure and thereby served as a low stakes practice environment for the valuation of net panels. The workshop concluded with a survey on demographic and fishery related characteristics.

5.2 Zero Demand

Based on the rationale discussed in section 2.2, we find evidence for both structurally and temporarily zero demand in our sample. For a comparison of the sub-samples with positive and zero demand in our data, see Table 1. The comparison highlights important differences between the sub-samples. Those with zero demand are significantly more likely to have only purchased Japanese quality nets during their last panel purchase, indicating structural reasons for low demand with a low interest in locally produced nets. A logit model on an indicator variable for non-zero demand supports this conjecture, see Appendix Table A-2. Also, participants with zero demand in our sample own fewer panels and go on fewer fishing trips per week. The patterns are suggestive of temporarily zero demand as smaller fishing operations need to replace panels less frequently and are

Table 1: Participant characteristics with mean comparison tests between samples with positive and zero demand.

	Positive demand			Zero demand			
	N	mean	sd	N	mean	sd	adj. p
Age	227	42.3	8.8	205	42.0	9.3	1.00
Female	227	0.1	0.3	205	0.0	0.2	0.12
Number of boats owned	225	2.6	2.4	205	2.5	2.2	1.00
Number of panels owned	227	9.6	4.6	203	7.2	5.0	0.00
Panel market price	247	59,661	5,372	215	62,106	5,763	0.00
Current price of dagaa (5L bucket)	227	9,769	4,036	205	8,801	3,439	0.04
Trips per week	227	4.4	2.3	204	4.0	1.5	0.10
Mean income (last 20 trips)	199	131,415	88,959	182	120,440	83,353	0.65
Last purchase (only Japanese)	247	0.3	0.4	215	0.5	0.5	0.00

Notes: Comparison of characteristics between participants with non-zero demand ($N = 247$) and participants with zero demand ($N = 215$), even at the highest discount offered. Prices and income are reported in TZS. All displayed test statistics are mean-comparison t-tests with adjusted p-values.

therefore more likely to have zero demand during a one-time intervention. Lastly, a higher reported price for inputs (panel market price) and a lower reported price for outputs (current price for a 5 liter bucket of dagaa) of the production process suggest that some zero demand may be driven by liquidity constraints.

Only the $N = 247$ boat and gear owners with temporarily positive demand at the lowest price are the population of interest for informing the effectiveness and efficiency of our intervention. Those with structurally or temporarily zero demand are dropped from the analysis throughout our study.

5.3 Participant Characteristics

For more detailed participant characteristics of the 247 participants with positive demand at the highest discount, see Table 2. In the table, we also report results of a mean comparison t-test between control and norm-nudge treatment group for each observable.

Participants in our sample are, on average, 42 years old and predominantly male. The average fishermen owns between two and three fishing vessels and just under ten net panels, indicating that boats are operated with an average of three to four panels. The average reported market price for each panel is around TZS 60,000 with the lowest

Table 2: Participant characteristics (positive demand) with mean comparison tests between norm-nudge treatment and baseline.

		Treatment			Baseline		
	N	mean	sd	N	mean	sd	p
Age	103	41.4	9.52	124	43.01	8.18	0.19
Female	103	0.08	0.27	124	0.11	0.32	0.37
Number of boats owned	102	2.69	2.23	123	2.59	2.59	0.75
Number of panels owned	103	9.94	4.45	124	9.25	4.73	0.26
Panel market price	108	59,862	5,673	139	59,504	5,141	0.61
Current price of dagaa (5L bucket)	103	9,312	3,489	124	10,149	4,418	0.11
Trips per week	103	3.97	1.09	124	4.79	2.96	0.01
Mean income (last 20 trips)	89	146,635	93,576	110	119,100	83,449	0.03
Last purchase (only Japanese)	108	0.24	0.43	139	0.29	0.45	0.41

Notes: Comparison of characteristics for all participants with positive demand between treatment ($N=109$) and baseline group ($N=138$). Prices and income are reported in TZS. All displayed test statistics (p) are mean-comparison t-tests.

and highest reports at TZS 48,000 and TZS 75,000, respectively. The reported market price is an important point of comparison for the price list when studying the discount necessary to induce demand for legal net panels. Fishermen sell dagaa at an average price of just under TZS 10,000 per five liter bucket and go on four to five fishing trips each week. The reported average income per trip across the last 20 fishing trips is around TZS 130,000. About 25% of the sample report to have purchased only Japanese nets during their last net panel purchase.

Most participant characteristics are balanced between baseline and treatment group. We only observe differences with respect to the number of trips per week and average income from the last 20 trips. That is, participants in the treatment group go on less trips per week and report a higher average income during their last 20 trips, suggesting that they land a higher average catch volume per trip. We control for these characteristics during our analysis.

6 Hypotheses

In line with our pre-registered hypotheses, we aim to address two research objectives: (i) determine the WTP for legal net panels and (ii) test the effectiveness of a social norm-nudge in increasing the WTP for legal net panels.

We introduce the following notation: Let $\bar{p}_w$ be the average market price for a legal net panel as elicited from all participants in workshop w and $q(p)$ be the number of panels q demanded at price p. As our main outcome variable of interest, we consider the median demand $\tilde{q}(p)$ at price p. Finally, let T denote the treatment, with T_{BL} as the baseline and T_{SI} as the norm-nudge intervention.

6.1 Baseline WTP for Legal Nets

As our first research objective, we determine the baseline WTP for legal net panels offered during the workshop. Illegal nets dominate the market indicating that the productivity gain of a lower mesh size outweighs the risk of enforcement through confiscation. Despite the fact that fishermen appear to prefer illegal nets, we do not expect a zero demand for legal panels. We expect that fisherman with a preference for illegal nets have an indifference point between the two mesh sizes at a sufficiently low price for the legal net. That is, illegal (< 8 mm) and legal (≥ 8 mm) nets can be considered imperfect substitutes. In this case, fishermen would value legal nets at a significantly lower price compared to what they would pay at the market. We formulate our hypothesis accordingly.

Hypothesis 1 *At the local market price, the median demand for a legal net panel is zero.*

$$E[\tilde{q}(p = \bar{p}_w)|T_{BL}] = 0 \tag{4}$$

In other words, we expect that there is a need for subsidization such that the majority of fishermen decide to purchase nets with a legal mesh size. As the average reported market price w is not necessarily part of the given price list, there is no guarantee that $\tilde{q}(\bar{p}_w)$ is directly observed. Yet, Hypothesis 1 implies that the median demand should also be zero for any price that is larger than the local market price, *i.e.*, when $p > \bar{p}_w$. We will test Hypothesis 1 by aggregating the actual discounts offered to the individual participant in ranges of 10% and then examining the 95% confidence interval of the median demand in the ranges above and below a 0% discount. Given that Hypothesis 1 holds, we study the discount necessary to shift median demand to at least one net panel.

6.2 The Effect of a Norm-Nudge

As our second research objective, we test the effectiveness of a norm-nudge as introduced in section 4.2. The intervention is designed to increase the demand of legal nets through social comparison and thereby make the subsidy program more cost-effective. By highlighting that the use of legal nets is common practice among peers (at other landing sites), and that it serves the purpose of sustainable resource use, the intervention provides a clue about the social expectation of purchasing legal nets and may therefore increase the WTP. At the same time, the message provides information on the prevalence of larger mesh sizes. Consequently, participants may expect decrease pressure on the fish stock and higher stock sizes in the future. Those with a strict preference for own payoff maximization may view this as an opportunity to increase their own harvest. In this case, the continued use of lower mesh sizes would be a rational response (see also section 3).

While the overall effect is theoretically ambiguous, we expect that the positive effect dominates empirically. This is both based on the fact that Tanzania is traditionally a conformist society (Bond and Smith, 1996) and based on previous successful use of norm-nudges in lab-in-the-field experiments at Lake Victoria (Diekert et al., 2021; Diekert and

Eymess, 2021). We therefore formulate a directed hypothesis:

Hypothesis 2 *At each price, there are more net panels demanded with a norm-nudge than without a norm-nudge.*

$$E[q(p)|T_{BL}] \leq E[q(p)|T_{SI}] \tag{5}$$

In other words, the demand curve for seine net panels with a norm-nudge dominates the demand curve without a norm-nudge. To test Hypothesis 2, we conduct a Kolmogorov–Smirnov test on the equality of the probability distributions in T_{BL} and T_{SI}. Furthermore, we study the cost-effectiveness of the norm-nudge by testing for a difference in the discount needed to shift median demand to at least one net panel between baseline and treatment group.

7 Results

We first analyze the baseline willingness to pay for legal net panels both in terms of demand at the different prices offered and in terms of the discount necessary for demanding at least one net panel (section 7.1). Then, we shift our attention to the effect of the norm-nudge intervention (section 7.2). Throughout, we only consider the $N = 247$ participants with positive demand at the lowest price.

7.1 WTP for Legal Nets

The left graph in Figure 1 plots the average number of panels demanded at the seven different points of the price list, differentiated by baseline and treatment group. At all three points above the market price average (above ca. TZS 60,000, see Table 2), demand is close to zero. Below market price, demand increases with each decrease in the offered price and peaks at the lowest price of TZS 39,000 where just over two panels are demanded on average. We observe no evidence of hoarding at the lowest price, suggesting that participants did not purchase the maximum number of nets in order to resell them.

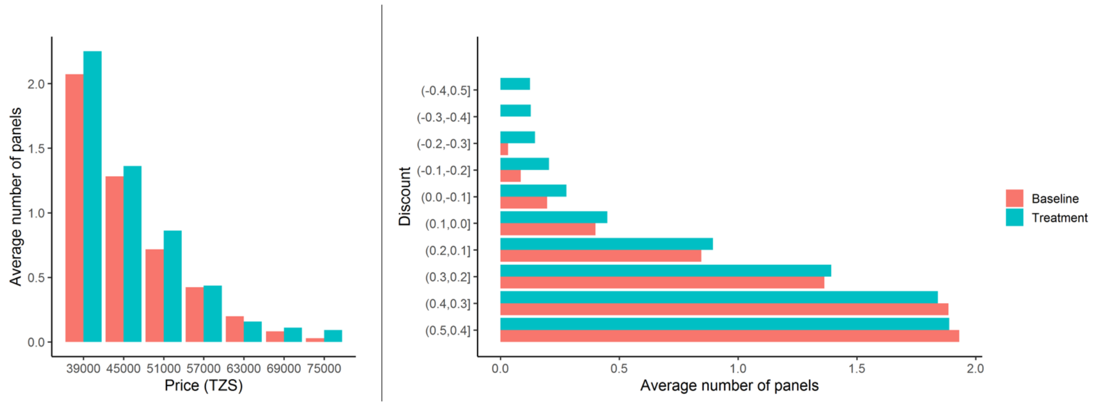

Figure 1: Average number of panels demanded at all offered price points (left plot) and in terms of the different discounts offered (in ranges of 10%) compared to the average reported market price (right plot). The graphs are split by baseline and treatment group (combined $N = 247$).

The right graph in Figure 1 plots the data with respect to the discount offered.[5] Since the reported market price differs between workshops, the point of comparison to determine the discount offered at each point on the price list varies accordingly. The graph aggregates these observations in discount ranges of 10 percentage points, extending from what is a 40 to 50 percent price premium (the negative discount range) down to a 40 to 50 percent discount. At any price premium and at the price ranges adjacent to the reported market price (discounts and premiums below 10%), average demand is low and participants demand, on average, less than 0.5 net panels. Only at discounts above 20%, participants have a mean demand of more than one panel. The median demand in all discount ranges below a 20 percent discount is zero. To test Hypothesis 1, we examine

[5]The data on the average reported market price is adjusted for outliers. That is, we dropped the 5% lowest and 5% highest values. All dropped values and other missing co-variates in our econometric models are imputed with the average value as per the elicitation of other participants following the multivariate imputation by chained equations method by Van Buuren and Groothuis-Oudshoorn (2011). Appropriate controls and clustering of the errors are implemented in all econometric models.

the 95% confidence interval of median demand in the range directly above to the market price (up to a 10% premium) and in the range directly below market price (up to a 10% discount), see Appendix Table A-1 for summary statistics in all discount ranges. In both ranges adjacent to the market price, the 95% confidence of median demand interval does not include any positive demand. At market price, median demand is zero. We therefore accept Hypothesis 1.

Our descriptive results suggest that widespread demand of legal net panels in our sample is reliant on a subsidy. In the following, we focus on the discount necessary to induce positive demand. In other words, what is the highest price at which a participant demands at least one net panel? Figure 2 plots the distribution of the discount at which a participant shifts from a zero to a positive demand by baseline and treatment group. The majority of participants in our sample need a substantial discount. That is, more than 25% of the baseline sample exhibit positive demand only after at least a 30% discount is offered and for another 25%, a discount of at least 20% is necessary. Only every fifth participant has a positive demand around the average reported market price (less than 10% discount). To shift median demand to at least one net panel in the baseline, a 22% discount is necessary.

A linear regression of several observables (including all unbalanced characteristics between baseline and treatment group, see Table 2) on the discount necessary for positive demand, highlights additional features of the valuations for legal nets in our sample. Strikingly, we find that younger fishermen have a significantly higher WTP for legal nets. For each additional year of age, a further discount of, on average, 0.5% is necessary for fishermen to demand at least one net panel. Also, fishermen with a higher number of boats owned exhibit a lower need for subsidies.

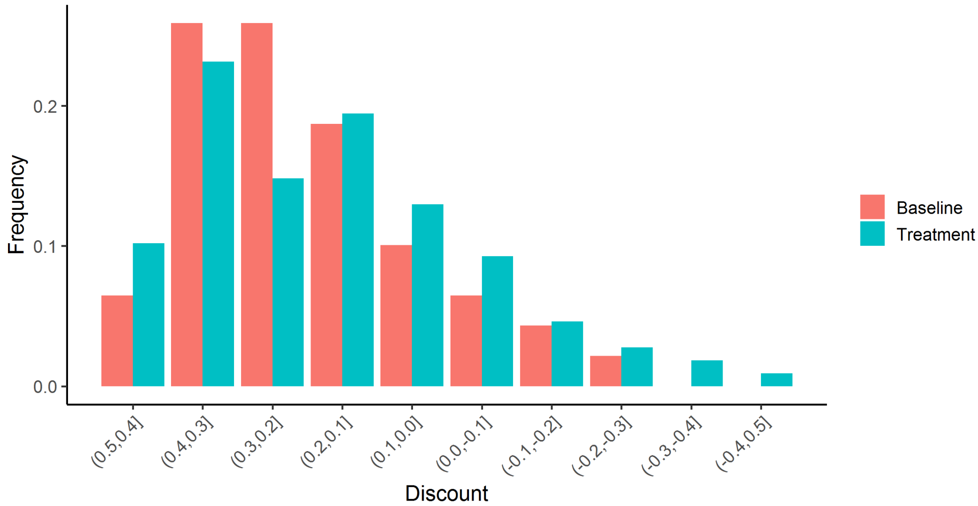

Figure 2: Distribution of discount at which at least one net panel is demanded, split by baseline and treatment group.

7.2 The Effect of a Norm-Nudge

Figure 1 compares baseline and norm-nudge treatment groups for both the demand at the different prices and the corresponding discount compared to the average reported market price. While descriptive results suggest that there is a slightly higher demand for legal panels at almost every price, a Kolmogorov-Smirnov test on the equality of the probability distributions rejects a difference ($p = 0.99$).

Again, we shift our focus to the lowest discount at which a participant demands at least one net panel. The distribution of the minimum discount necessary to induce positive demand (see Figure 2) with a norm-nudge compared to the baseline is slightly shifted to the right, indicating that, on average, a lower discount is sufficient in the treatment group. In fact, with the norm-nudge we observe a few participants that have a demand for net panels even at considerable price premiums above 20%. The discount necessary to shift median demand decreases from 22% in the baseline to 19% in the treatment group, an insignificant difference with $p = 0.306$ in a one-sided equality-of-medians test. The absence of a treatment effect is supported by the OLS regression on

Table 3: OLS model. Dependent variable: Discount necessary for demanding at least one net panel.

	Coefficient	std. err.	p-value
Norm-nudge treatment	-0.030	0.046	0.517
Female	0.019	0.038	0.614
Age	0.005	0.001	0.001
Number of panels owned	-0.002	0.002	0.274
Current price of dagaa	0.000	0.000	0.089
Trips per week	-0.007	0.005	0.148
Mean income (last 20 trips)	0.000	0.000	0.057
Number of boats owned	-0.006	0.003	0.068
Last purchase (only Japanese)	-0.004	0.026	0.885
N	247		
R^2	0.088		

Notes: The table reports OLS estimates on the discount necessary for the demand of at least one net panel. Standard errors are clustered at the landing site level. Missing data points for all covariates are imputed following the multivariate imputation by chained equations method by Van Buuren and Groothuis-Oudshoorn (2011).

the discount necessary for demanding at least one net panel, see Table 3. While the model estimates that the norm-nudge leads to a decrease of necessary subsidies by 3 percentage points, the effect is not significant. Thus, we reject Hypothesis 2.

7.3 Estimating Factor Demand and Price Elasticity

Since participants are able to demand up to four net panels at any given price, we can also study participants' demand curves in the offered price range. Similar to Corrigan et al. (2009), we use a random effects Poisson model to estimate demand and the elasticity of demand to a decrease in prices, or in our case, to an increase in the discount offered relative to the average reported market price.

The aggregate demand curve from the Poisson estimation is shown in Figure 3.[6] The model substantiates our finding of very low demand at prices below a 10% discount and indicates that demand increases substantially for discount levels above 20%. To quantify the relationship between discount and demand, we use the estimation to derive the price

[6]For regression results of the random effects Poisson model, see Appendix Table A-3.

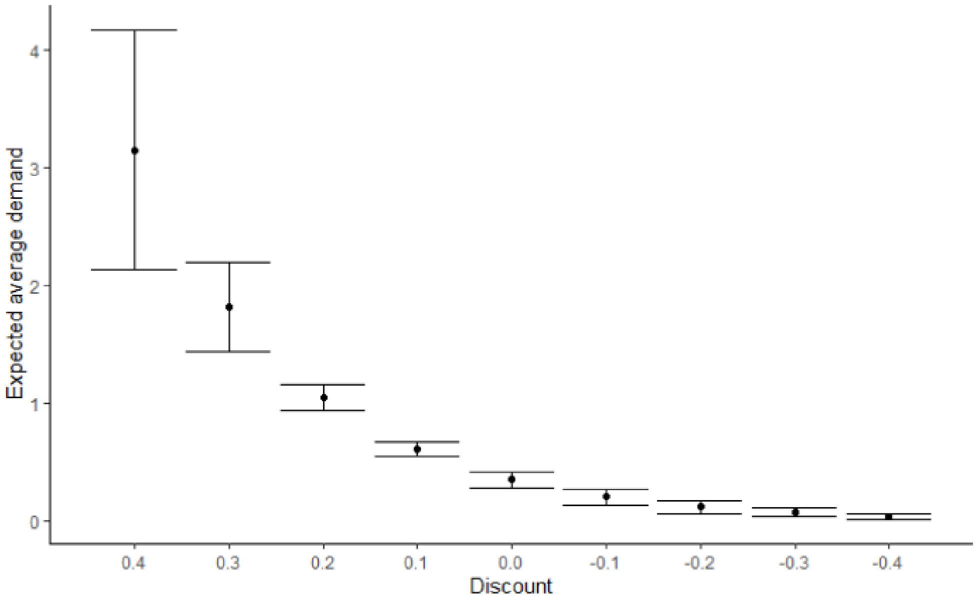

Figure 3: Net panel demand at different discount levels estimated using a random effects Poisson regression.

Table 4: Demand elasticity at different discount levels

Discount	Elasticity	95% Coef. Interval	
10%	0.55	-0.68	1.78
20%	1.1	-0.13	2.33
30%	1.65	0.42	2.88
40%	2.2	0.97	3.43

Notes: The table reports the price elasticity as derived from a random effects Poisson regression. Elasticity values are positive due to their interpretation with respect to the discount level.

elasticity. We interpret the elasticity in terms of an increasing discount (decreasing price) offered relative to the market price, see Table 4 for the elasticity at positive discounts. The model implies that at a 10% discount, demand is still inelastic but is elastic (an elasticity > 1) at discounts above 18.2%. Note that at larger discounts the elasticity increases indicating that participants become less price sensitive as the price for net panels decreases relative to the market price.

8 Discussion

When natural resource systems are not effectively regulated, resource users may resort to unsustainable and often illegal extraction practices. To avoid overexploitation, alternatives to ultimately ineffective enforcement policies are necessary. We study the subsidization of legal inputs to the main economic activity of fishermen at Lake Victoria and thereby inform how policies can induce compliance in the absence of strong enforcement capacity. With a field intervention and a novel elicitation method of the WTP for multiple items, we offer legal fishing nets at increasing discounts and are therefore able to show low demand for legal nets at market price and identify the subsidy necessary for widespread purchases. Additionally, we find that our norm-nudge does not increase the cost-effectiveness of a subsidy program.

The results from our field intervention are consistent with widespread illegal gear use in the Lake Victoria fisheries. At the going market price of a legal fishing net, only 20% of fishermen with temporarily positive demand in our sample are willing to purchase at least one net, indicating that the majority appears to prefer nets with an illegal mesh size. Widespread demand of legal nets is only observed when a substantial discount is offered. That is, a 21% discount is necessary to shift median demand to at least one net panel. The take-up of legal nets in our study implies that a subsidy program that targets the main economic activity can work but needs substantial capital investment. For example, a campaign that pushes at least half of the more than 10,000 illegal nets documented by LVFO's 2016 frame survey out of the market, would need a yearly budget of about US $240,000.[7] Our elasticity estimates suggest that a budget increase with the purpose of increasing the subsidy level will lead to less price-sensitive consumer demand, thereby accelerating take-up.

[7] This back-of-the-envelope calculation is made under a competitive market assumption in which no small number of net manufacturers or distributors can pocket a large share of the funds due to their market power. We assumes a panel durability of six months, four panels used per net, and a 21% discount at a market price of TZS 60,000 valued at TZS 2,300 per US $1.

The provision of a norm-nudge has no detectable effect on the WTP for legal net panels in our workshop intervention. Thus, the results from lab-in-the-field experiments by Diekert et al. (2021) and Diekert and Eymess (2021) who document that fishermen at Lake Victoria increase cooperative choices in a prisoner's dilemma by around 15 percentage points do not carry over to our study. Also because a field intervention is less geared towards the identification of a treatment effect, we observe a much smaller, albeit insignificant effect size of three percentage points (ca. 13%). This is closer to the effect sizes found in considerably larger norm-nudge field interventions by *e.g.*, Allcott (2011) who finds a 2% reduction in home energy use or by Brent et al. (2015) who document a 5% reduction in water consumption. To pick up on such a small effect, a markedly larger intervention is necessary.

Our study showcases that the first step of a subsidy program to combat illegal resource use, *i.e.*, the increase in demand of legal production inputs, is feasible. It is reasonable to assume that the fishermen that purchased legal net panels during the workshop will end up using them on the lake. So while inducing widespread demand is possible, our study does not yet address the other steps a successful and sustainable policy would need to cover. In particular, future research should investigate (i) whether illegal nets are effectively displaced, (ii) whether the adoption of legal nets has an effect on the resource stock through changes in harvesting efforts, and (iii) whether fishermen return to using illegal nets once the acquired legal nets wear out.

In the process of working out the details of both the conceptualization and implementation of a subsidy program to increase compliance, we believe it prudent to consider the lessons learned from decades of research on subsidies for agricultural development (Morris, 2007). Among others, those include the formulation of clear exit strategies and the avoidance of rent-seeking behavior and funding leakages (Holden and Lunduka, 2013; Jayne and Rashid, 2013). Especially for ecosystems that are shared across countries, exemplified by the Lake Victoria fisheries, a comprehensive approach is crucial. Here, transnational institutions such as the Lake Victoria Fisheries Organization may function as a platform for the harmonization of nationally or regionally implemented programs.

Finally, our study offers a methodological contribution to the literature on eliciting the revealed WTP for multiple instead of single units that is furthermore adapted for the use in developing countries. The procedure can be applied to a workshop setting where several participants reveal their WTP simultaneously, without the need for individual assistance. We avoid the complexity of a multi-unit auction by combining a multiple price list approach with the option for varying unit demand at discrete price intervals and a BDM type of bid allocation (De Groote et al., 2011; Berry et al., 2020; Burchardi et al., 2021). While BDM type mechanisms elicit true valuations, they are generally sensitive to the price range offered and can induce inconsistencies due to their lottery aspect, especially in a low literacy environment (Bohm et al., 1997; Cole et al., 2020). We alleviate these concerns by (i) providing an additional known reference point (the market price) during WTP elicitation and (ii) using a low-stakes practice environment that resolved comprehension problems before any valuations of interest were elicited. We recommend the use of the our approach in similar contexts.

9 Conclusion

The unhindered and sometimes illegal exploitation of natural resources is cause for concern for both regulators and local communities of resource users. In settings where conventional top-down control and enforcement approaches as well as co-management structures fail to deter non-compliance, the search for effective policies continues. In an attempt to inform alternatives, our study demonstrates the feasibility of a subsidy program in increasing the demand for legal production inputs. We view our findings as a first step towards a comprehensive understanding of subsidy programs as a tool to stimulate sustainable resource extraction by making illegal inputs to the production process unprofitable. While such policy interventions need sizeable financial resources, they can be key in ensuring sustainable resource use in the long-term without neglecting the economic importance of resource exploitation in the short-term.

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Appendix

A-1 Additional Results

Table A-1 reports summary statistics (number of observations, median, mean, and the 95% confidence interval of the median) for the demand in the different discount and price premium ranges offered in the sample of participants with positive demand at the lowest price (baseline and treatment groups are pooled). We find zero median and zero mean demand in the discount ranges below a 20% discount. Also, the 95% confidence interval for any discount below 10% does not include positive demand. For the few observations with a discount above 40%, median demand is at two panels. Demand at any price above a 20% price premium is negligible.

Table A-1: Median, with 95% confidence interval, and mean demand for net panels in different discount and price premium ranges.

	N	median	mean	Median: 95% CI
50% – 40% discount	56	2	1.91	(1, 2)
40% – 30% discount	201	1	1.87	(1, 2)
30% – 20% discount	234	1	1.38	(1, 1)
20% – 10% discount	257	0	0.87	(0, 1)
10% – 0% discount	253	0	0.42	(0, 0)
0% – 10% premium	209	0	0.23	(0, 0)
10% – 20% premium	223	0	0.14	(0, 0)
20% – 30% premium	175	0	0.09	(0, 0)
30% – 40% premium	88	0	0.06	(0, 0)
40% – 50% premium	21	0	0.05	(0, 0)

Notes: Confidence Intervals are calculated using the Binomial Interpolation method of Mood and Graybill (1963).

Table A-2 reports results from a non-linear regression with an indicator variable for whether a participant has positive demand at the lowest price as the dependent variable. The model consider all 462 participants and is interpreted as a hurdle model for positive demand. We find that female participants are more likely to have positive demand at the lowest price. Also, boat owners with smaller enterprises (number of boats owned) and those that appear to prefer “Japanese” quality nets (proxied by whether they only bough Japanese quality during their last net panel purchase) are less likely to pass the hurdle for positive demand.

Table A-2: Logit model - Dependent variable: Dummy for Non-zero demand

	Coefficient		**std. err.**	**P-value**
Treatment (Dummy)	-0.548		0.353	0.120
Female	0.943	*	0.429	0.028
Age	0.014		0.014	0.294
Number Panels Owned	0.049		0.040	0.214
Current Price of dagaa	0.000	.	0.000	0.086
Trips per Week	0.095		0.071	0.177
Price Local Panel	0.000	*	0.000	0.016
Mean Income (last 20 trips)	0.000		0.000	0.110
Number of Boats Owned	0.095	*	0.047	0.044
Buying Only ”Japanase” Nets	-0.784	*	0.317	0.013
Constant	1.992		1.961	0.310
Number of obs	462			
Wald chi2(10)	85.52			
Prob > chi2	0			
Pseudo R2	0.1166			
Clustered Errors	Yes			
p-values key:				
***: 0.001; **: 0.01; *: 0.5; . : 0.1				

We follow Corrigan et al. (2009) to estimate the participants demand for multiple items within the range of prices participants confronted. We use a random effects Poisson regression that relies on the assumption that individual specific effects are not correlated with the prices participants face. In this regression, we use all the information relative to the number of panels that were demanded by each individual (with a positive demand for panels) at each price.

$$Pr(q_{ij} = m) = \frac{e^{-\lambda}\lambda_{ij}^{m}}{m!} \tag{6}$$

$$\lambda_{ij} = exp(\beta_0 + \beta_1 \,\text{discount} + u_i) \tag{7}$$

The advantage of this procedure is the possibility of calculating the demand elasticity at different price discounts. Under this Poisson model, $E(q_{ij}) = \lambda_{ij}$, and the elasticity is defined as (see (Corrigan et al., 2009)):

$$\hat{\eta} = \frac{\delta E(q_{ij})}{\delta\,\text{discount}} \frac{\text{discount}}{E(q_{ij})} = \hat{\beta}_1 \,\text{discount} \tag{8}$$

See the table A-3 for the regression results.

Table A-3: Random effects Poisson model. Dependent variable: individual demand at the discount relative to the market price.

	Coefficient		std. err.	P-value
Discount	5.601	***	0.316	0.000
Treatment (dummy)	0.111		0.294	0.706
Female	-0.196		0.192	0.309
Age	-0.015	*	0.007	0.030
Number Panels Owned	0.027	*	0.014	0.049
Current Price of dagaa	0.000		0.000	0.692
Trips per week	0.026	.	0.015	0.093
Mean Income (last 20 trips)	0.000		0.000	0.591
Number Boats Owned	0.062	*	0.027	0.023
Buying Japanese Panels	-0.067		0.118	0.569
Constant	-0.560		0.505	0.267
Number of Observations			246	
Wald Chi Sq.			1389.090	
Prob > Chi Sq.			0.000	
Clustered Errors			Yes	
p-values key:				
***: 0.001; **: 0.01; *: 0.5; . : 0.1				

A-2 Net Panel Order Sheet

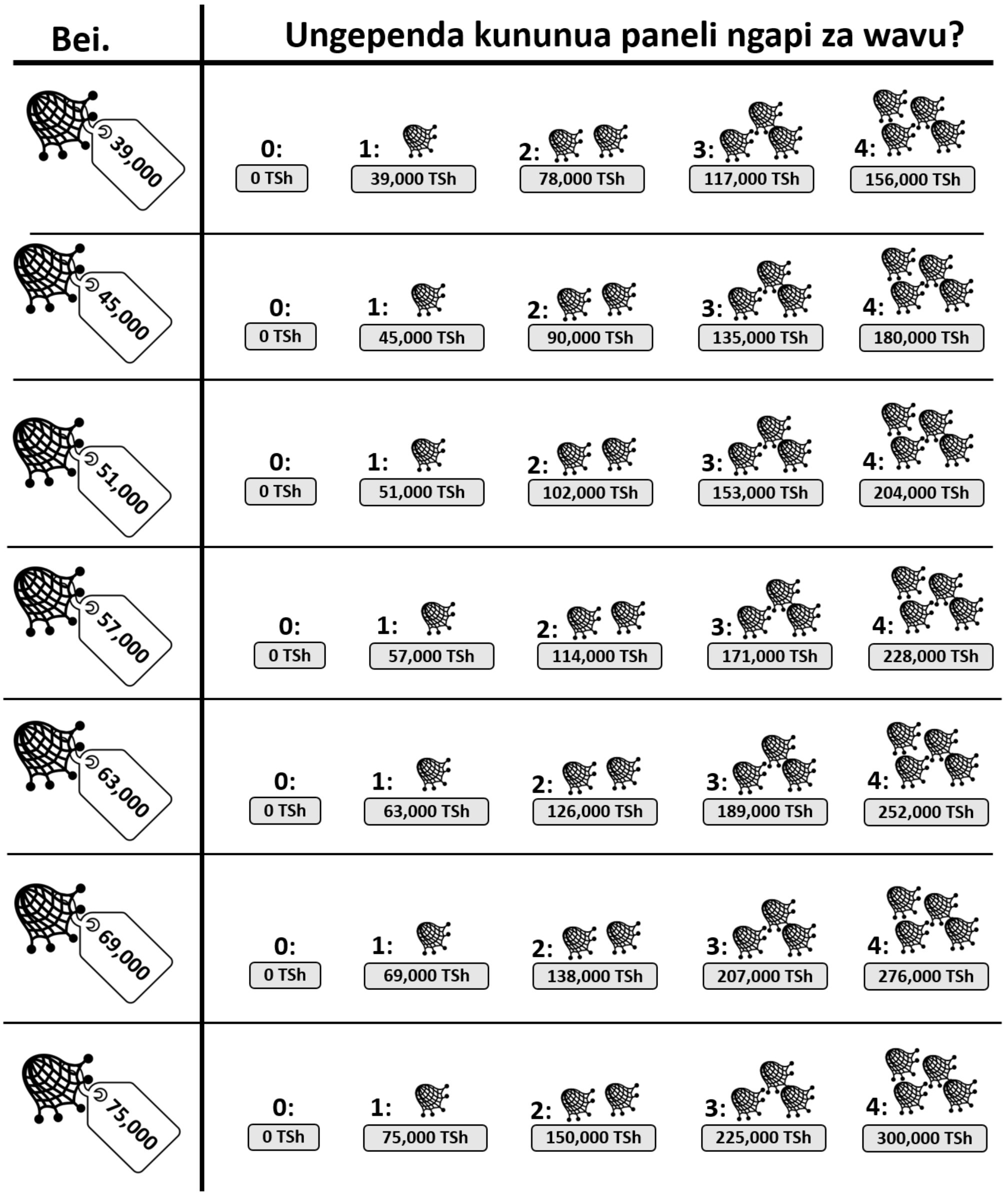

Figure A-1: Net panel order sheet with seven discrete price options in ascending order and four units offered at each price. The column titles are translated to "Price" and "How many net panels would you like to buy?"

A-3 Net Panels

Figure A-2 gives an impression of how a seine net for dagaa fishing looks like. While the net is quite deteriorated (see the numerous holes throughout the mesh), the photograph showcases that a net is composed of several connected panels.

Figure A-2: Dagaa drying under the sun, over a net composed of several connected panels. Source: Author's own photograph, Tanzania, 2021.