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Analysis

Too poor to be green consumers? A field experiment on revealed preferences for firewood in rural Guatemala

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ABSTRACT

The paper reports on a field experiment that investigates whether households in Guatemala are willing to surrender a small material gain in order to buy legal rather than illegal firewood. Given the ineffectiveness of command-and-control policies to curb the problem of illegal logging in Guatemala, the experiment assesses the potential viability of market-oriented solutions. Local consumers in developing countries are generally believed to be too poor to pay a premium for green/ethical products. Therefore, little information has been gathered on willingness-to-pay (WTP) for such products and its determinants in non-affluent consumer markets. While our experiment on firewood consumption in central Guatemala only implies a weak and indirect test of WTP for green products, the results indicate that it is premature, if not unwarranted, to assume that the poor are not ready to make pro-ethical choices in the marketplace. Moreover, we find that information on the legal procedures for firewood extraction significantly affects consumer choice between legal and illegal firewood.

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1. Introduction

1.1. Background

A very considerable proportion of the firewood used for household consumption in rural Guatemala—where it remains the main source of energy for cooking and heating—is extracted in violation of legal requirements (Castañeda and Sandoval, 2008). Policy responses to deal with this problem are difficult to implement in Guatemala because of the persistence of institutional constraints (e.g. inefficient bureaucracy¹ and lack of political will). However, the efficacy of command-and-control policies may be reinforced if these are complemented with market-oriented instruments, by which we mean measures that tap into the ethical and environmental concerns of the final consumer.

However, the rapidly growing body of literature on consumer willingness-to-pay for products associated with more sustainable resource exploitation sends out a pessimistic message regarding the market potential for ‘green’ (which in our case overlaps with ‘legal’ or ‘ethical’) products in a country like Guatemala. As stated by Fisher et al. (2005: 11), “studies have shown that markets for certified forest products in developed countries are relatively limited, and that the prospects for

reaping a premium can be poor. [...] We can only suspect that such prospects are even poorer in developing countries”. The assumption underlying this statement is that consumers from a developing country cannot afford to care about the ethical profile of their consumption. This reasoning is in line with Maslow’s well-known hierarchy-of-needs (Maslow, 1970 [1954]), in which the need to act in accordance with one’s ethical beliefs is a so-called ‘higher-order’ need. While these assumptions are plausible, their empirical validity has barely been under scrutiny.

Bonsu and Zwick (2007) conclude that Ghanaian consumers exhibit lower levels of ethics compared with Western counterparts, which suggests that ethical markets are not very likely to prosper in this country. Goswami (2008) found that only a small segment of consumers—wealthier liberal professionals—is positively motivated to preferentially buy eco-labeled clothing in India, supporting the proposition that only few (richer) consumers in developing countries may be ready to pay a premium for green products. Nonetheless, Mohamed and Ibrahim (2007) found that 32% of their sample of Malaysian consumers would be willing to pay a premium for environmentally certified wood products and that the average premium for this subgroup would amount to a sizeable 14.4%. In this study, however, the willingness to pay an ethical premium is estimated through elicitation, i.e., based on *stated* preferences, which may differ considerably from actual market behaviour.

The presence of biases in willingness-to-pay (WTP) estimates generated by stated preference methods is well-documented for both private goods (Werthenbroch and Skiera, 2002; Ding et al., 2005; Urama and Hodge, 2006) and public goods (Johansson-Stenman and Svedsäter, 2003; Schläpfer et al., 2004). The magnitude of the hypothetical bias

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¹ A cross-country survey by the World Bank (2006) on the ease of dealing with licences ranks Guatemala among the most cumbersome in this respect (165th out of 175 countries surveyed).

problem in studies on ethical consumer behaviour is clearly demonstrated by De Pelsmacker et al. (2005), who conducted a conjoint analysis among a sample of Belgian consumers to estimate WTP for Fair-trade coffee. While 10% of the respondents state that they are willing to pay the actual price premium of 27%, the actual market share of Fair-trade coffee does not exceed 1%.

Given the bias problem of stated preferences techniques, WTP studies have started to adopt a number of *revealed* preference methods, often using experimental methodologies (Didier and Lucie, 2008). The common denominator of these experimental studies is that consumers have an incentive to reveal their “true” WTP, because decisions made during the experiment have real consequences in terms of individual gains and losses. The ideal experiment consists in manipulating the price differential between alternative products in the actual marketplace and, subsequently, monitoring changes in their respective sales. This strategy has been applied, for instance, to measure WTP for eco-labeled plywood products in a large American store (Anderson and Hansen, 2004a). In the case of rural Guatemala, however, the near absence of legal firewood in the market precludes such an approach. Instead, we recreate a choice situation experimentally.

The analysis of WTP has traditionally been framed within modern economic choice theory, which presumes that market behaviour responds to the will to maximize the agent's individual satisfaction or utility. The utility function is usually formalized as $u(x, b, z, s)$, where x_1, \dots, x_N are commodities, b_1, \dots, b_N are attributes of such commodities, z is a numeraire and s is a vector of consumer's characteristics (such as age, education, level of information, etc.). This basic notion may be extended to a random utility model when components unobservable to the investigator are incorporated into the function. Unobserved variables may include consumer's features or attributes of the commodities. The utility function would then be $u(x, b, z, s, \varepsilon)$, where ε is a set of fixed constants or functions for the consumer but a random variable with a joint density function for the investigator (Hanemann, 1984). The theory assumes that the consumer chooses a bundle of commodities (x, z) so as to maximize u , given a budget constraint. Criticisms on the validity of this core assumption have been voiced since long, not only because it is considered a narrow oversimplification of motivations driving consumer behaviour but also due to its tautological and non-falsifiable nature, since—according to critics—it is impossible to conceive an observational phenomenon that contradicts it (Katona, 1958). According to Nixon (2006), in addition to its logical shortcomings, by adopting a consequentialist ethic of maximizing individual satisfaction, modern economic choice theory lacks the ability to provide useful insights when alternative ethical stands are at stake in consumption behaviour. Instead, choice theories alternative to the neoclassical stream of thought are usually based on the assumption that “choice may reflect a compromise among a variety of considerations of which personal welfare may be just one” (Sen, 1977). These alternative theoretical approaches are very appealing for analyzing ethical and green consumption since the individual benefits from pro-environmental/ethical consumption behaviour at best materialize in the long run—and may in fact never be realized—while the cost tend to be incurred immediately (McCarthy and Shrum, 2001), which is at odds with the presumption of individual utility maximization.

At least two types of studies dealing with the behaviour of “green” consumers may be identified in the literature. The first type tackles the relationship between consumers' behaviour, values, knowledge, attitudes and demographic variables (Loureiro and McCluskey, 2002; Abdul-Muhmin 2006; Chan et al., 2008; Basu and Hicks, 2008). A second type consists of studies that have developed comprehensive theoretical frameworks for explaining the determinants of behaviour (Stern, 2000; Buenstorf and Cordes, 2008). The main insight from this broad literature is that the decision process in green/ethical consumption is very complex (Moisander, 2007). Following McFadden (1986), for the present paper we adopt an input–output scheme as a model for consumer decisions, where as inputs there are external factors (historical and socioeconomic effects), information, product

attributes and market constraints (budget, availability) and market choices as output. Our main concern, however, is the role of information in choice decisions regarding ethical/green attributes of a product (firewood). Though the empirical evidence on the relationship between information and consumer's propensity to actually buy ‘green’ products is mixed (Anderson and Hansen, 2004b; Aguilar and Vlosky, 2007), we pay special attention to the role of information since this is an area where policy interventions are more feasible (campaigns for awareness raising, for instance).

Furthermore, we control for a number of socioeconomic variables (e.g., gender, age, ethnicity and religion) through a multivariate analysis. As independent variables we have chosen factors that a) were possible to evaluate through a short questionnaire and b) have been found to influence environmental preferences by previous studies. For example, Virden and Walker (1999) report a significant influence of gender and ethnicity on environmental preferences among a sample of Americans. Based on an extensive review, Zelezny et al. (2000) conclude that women show stronger environmental attitudes and behaviours than men, both across different countries and age ranges. Atran et al. (2002) and Stocks et al. (2007) found significant differences in the management of common-pool natural resources between different ethnic groups in Guatemala and Nicaragua, respectively. Lowry (1998) shows that religious affiliation is related to membership in environmental groups, while Owen and Videras (2007) found that some types of beliefs stimulate pro-environment behaviours and attitudes, even after controlling for religious affiliation. We also expect age to influence environmental preferences in the locality where we conducted the research, since younger generations have probably been more exposed to environmental awareness campaigns. We also control for the effect of the relative importance of energy sources at the household level (gas and firewood), since we expect individuals from households with a higher degree of dependence on gas to be less sensitive to trade-offs in the amount of firewood that they will gain/lose in the experiment.

1.2. Firewood extraction and commercialization in Tecpán, Guatemala

The firewood commercialized in Tecpán, where the experiment has been conducted, is extracted from the area itself, either from the Municipal Park of Tecpán, a forested area that was declared a national park in 2000, or other nearby forest resources that do not hold a protected status. In the latter case, felling trees for firewood requires either a concession (common property) or license (privately owned trees) from the National Forest Management Institute (INAB, by its acronym in Spanish). Deposit warehouses are the most popular outlets for firewood. Several of them operate in Tecpán (despite the fact that there is only one according to the official business register). Households in the Municipality's rural communities are being served by itinerant vendors who use pick-up trucks for distribution.

In order to be granted permission for firewood extraction, the law prescribes the following actions: i) draw up an inventory of forestry resources as well as a short- or medium term management plan, ii) hire an expert to supervise logging operations, iii) secure a deposit or other type of guarantee for the execution of the management plan, iv) pay a 10% tax on the value of wood to be extracted, and v) comply with re-planting requirements. INAB has officially 60 days to decide on awarding the requested concession or license, but according to actors in the logging chain this may sometimes take up to 3–4 months. Extractions of small quantities of wood for family consumption (subsistence use) are exempted from the above requirements and the procedure for permission (which is given by the Municipality) in this case takes only 15 days to complete. This simplified procedure still constitutes an obstacle for subsistence consumption, as documented by Wittman and Geisle (2005). Another exception concerns extractions from areas that are located within urban perimeters, which requires permission from municipal authorities rather than from

INAB, provided the exploitation does not exceed 10 m³. When extraction sites are located within protected areas, a different law applies that stipulates stricter requirements for a license, which should be obtained from the National Council of Protected Areas (CONAP for its Spanish acronym).

In addition to the permission for extraction, commercial transportation of firewood requires official dispatch notes. Roadside inspections of these notes by the Division for Nature Protection of the Civil Police (DIPRONA for its Spanish acronym) render the transport stage the most risky one of the entire illegal logging chain, where drivers try to minimize the risk of a stiff penalty by operating at night or in the weekends when inspections are rare, by falsifying or re-utilizing dispatch notes, and through bribing DIPRONA officials. Once the logs have reached the deposits or the market, their origin is difficult to trace for final consumers.

The remainder of the paper is structured as follows. Section 2 introduces the experiment, which we believe is novel in its set-up, and describes the pool of participants. Section 3 presents and discusses the experimental results. These are contrasted with the outputs from the contingent valuation exercise that was performed prior to the experiment. Finally, Section 4 summarizes the main contribution of the paper.

2. Methodology and characteristics of the sample

2.1. Experimental design

The experiment was set up in a number of strategic places in and around the town of Tecpán, which is located on Guatemala's central high plateau and belongs to the Department of Chimaltenango.² The Tecpán Municipality's poverty rate is substantially higher than the national average: 70% against 56% countrywide (INE, 2006). Members of the research team, including a number of locally recruited assistants, fluent in the *K'acqchikel* language, randomly approached passers-by and invited them to participate. Apart from being a resident of the Tecpán Municipality, participation was conditional on experience in purchasing firewood for one's household. This excluded 1) households using only gas, 2) households obtaining firewood solely through non-commercial channels, such as through own collection efforts, and 3) members of firewood purchasing households without experience in making firewood purchases. Before entering into the choice experiment, a short set of survey questions was administered to each participant, including some questions on the legal requirements that apply to the exploitation of forest resources.

At the end of the survey, we conducted an estimation of willingness-to-pay for legal firewood, by means of combining open and increasing bidding questions. Namely, we asked respondents how much was the maximum amount they were willing to pay for x quantity of firewood (which was shown to them without any mention to legality/environmental performance). Then we asked whether the respondent was willing to pay more if we ensure him/her that the firewood fulfilled all the requirements to be "legal" and therefore its good environmental performance was granted. If the answer was positive, we increased the initially stated amount by 20% and asked whether the respondent would be willing to pay such amount. We repeated the increasing bidding until the respondent was not anymore willing to pay the requested amount. If the subject was not familiar with the procedure to obtain legal firewood, the person in charge of administering the survey provided the necessary information to her/him before starting the contingent valuation exercise. Upon completion of the face-to-face survey and the contingent valuation, the subjects directly proceeded to the choice experiment, which was conducted in a nearby spot. The experimenter was a different person than the one administering the survey in order to

reduce participants' potential need to show consistency with their stated WTP.³ After having received instructions from the experimenter, participants carried out the choice task described below.

Each individual was presented with two bundles of firewood that differed from each other in terms of legality as well as in the number of logs they contained. The first bundle contained a number of 8 logs, each approximately 50 cm long and tied together with a cord, which was presented to the participants as illegal, by indicating to them that we had asked the seller to show any documents that could prove the lawfulness of the logs, but that the seller had been unable to provide such evidence. The quantity of firewood in this bundle is roughly equivalent to that consumed by a four-member household in a day. Alongside this bundle, a second one with a fewer number of logs was presented. This smaller bundle was presented as legal by telling participants that the seller's permission had been thoroughly checked and had proven legitimate. In support of this claim, a copy of an official dispatch note, allegedly obtained from this seller, was depicted on a poster behind the legal bundle. If participants choose the smaller bundle, this is taken to imply that they are willing to surrender resources following a preference for legally sourced firewood. The difference in logs between the illegal and legal bundle will be indicated by c and the monetary equivalent of this cost of choosing legal by C (in *Quetzales*) in the remainder of the paper.

In reality, the logs of the two bundles were obtained from one and the same seller, even from the same truck load, to minimize the difference in intrinsic characteristics of the logs, such as their degree of humidity, which is an important purchase criterion due to the fact that it determines burning efficiency and smoke generation. Efforts were made to secure that the legal status and the amount of logs were the dominant, if not the only, differences between the two bundles in the perception of participants. While in fact we did not solicit any documents from our seller to know whether the truck load was of legal origin, participants did not seem to entertain doubts about the difference in legal status between the objects of choice presented to them.

The link between (il)legality and environmental (un)sustainability was visualized for the subjects by placing the illegal bundle in front of a poster depicting a photo of a barren deforested area, while a poster showing an area with a healthy forest cover formed the background of the legal alternative. Additionally, participants were told that the firewood had been extracted from an area within the Municipality itself. The pictures were shown just to visualize the association between legality and good environmental performance of firewood extraction. We assume that there exists a strong association between both, since in the current Guatemalan regulatory framework compliance with legal provisions is the formal way to ensure sustainable extraction of firewood. Moreover, recent data confirm that illegal harvesting of firewood is the main cause of deforestation in the Tecpán area (Castañeda and Sandoval, 2008).

The participants were asked to choose their preferred bundle, which they could take home, allegedly as a reward for their cooperation in the survey. No cash endowments were handed out, nor was there any mention of prices. The extra cost of legal firewood was implicit in the quantity offered, i.e., by setting $c > 0$. We set $c = \{2, 3, 4\}$, resulting in legal bundles of 6, 5 and 4 logs, respectively. Each participant was presented a trade-off involving one of these cost levels. Hence, the effect of varying c was measured across individuals rather than through a within-subject design.

The value per unit of illegal logs of the size and quality used in the experiment is approximately 0.50 *Quetzales*, according to information from respondents in the survey and market observation, which means the illegal bundle of 8 logs is worth around 4 *Quetzales* (1 US\$ PPP).

³ Still, cognitive dissonance theory predicts effects from the contingent valuation exercise on the choice experiment. See Johansson-Stenman and Svedsäter (2003) for an elaborate discussion on potential biases related to the sequence of stated and revealed preference methods.

² The experiment was carried out in October 2006.

The implicit monetary cost of choosing legal (in *Quetzales*) in the three treatments then becomes: $C \approx \{1.00, 1.50, 2.00\}$. Despite the fact that the value of the prizes offered in the experiment may seem rather small, it should be kept in mind that the amount of firewood involved was around the daily need of an average family, and therefore respondents took the experiment very seriously.

Our experiment involved a windfall gain for participants, which may have affected their decisions compared to a situation where they would have paid out with cash from their own pockets. The presumed upward bias in WTP estimates that this feature may generate has its theoretical underpinning in *Kahneman and Tversky's (1979)* seminal work on reference-dependent preferences. One of their main behavioural findings is that “losses loom larger than gains” when it comes to changes in welfare. Individuals are more eager to avert a loss than to induce a gain of the same magnitude. In the terminology of *Kahneman and Tversky's* prospect theory, the value function for losses is steeper than for gains. An alternative interpretation of the same bias concerns the observation that people tend to spend unanticipated gains more easily than anticipated ones, as documented in *Arkes et al. (1994)*.

2.2. Sample characteristics

In total, 218 individuals participated in the experiment, of which 82.6% female. This lop-sided gender ratio in the participant pool reflects the fact that the experiment was conducted on a market day, which led to the interception of many female shoppers. Urban dwellers are also over-represented in our sample. Despite attempts to redress urban bias by sending out a mobile team to conduct the experiment in several rural communities, close to two-thirds of the participants are residents of the urban centre of Tecpán, although some neighborhoods where participants were recruited would more accurately be described as peri-urban. According to official statistics, urban dwellers only account for 30% of the total population in the Tecpán Municipality. Urban bias also shows up in the lower percentage of individuals of indigenous origin in our sample (80%) compared to that in the general population (92%), given that *ladino* (mestizo) households are likely to be concentrated in the Municipality's more urbanized parts.

Concerning the income level of the households represented in the sample, our criteria for participation have likely trimmed both tails of the income distribution. The exclusion of households relying purely on gas and those relying solely on own firewood collection has probably eliminated the wealthiest and the poorest households. The economic welfare level of the participants has been measured subjectively in the form of an income evaluation question, similar to the one introduced by *Van Praag (1968)*, where respondents rated their household's economic situation on a ladder scale from 'good' to 'bad' when compared to others in the community. Apart from the difficulties in obtaining reliable estimates of household's current income levels through a street interview, subjective measures of economic welfare are arguably more appropriate in the case of a choice experiment, where subjects might act on how they *perceive* their own economic situation rather than on their actual—objectively measured—income level. As *Lokshin et al. (2006)* point out, “characteristics as anticipation of future shocks, household's perception of income security, perception about changes in the household's needs over the lifecycle, [and] the relativity component of household welfare, are reflected in the subjective measures of well-being, but omitted from the objective measures”. In addition, empirical studies comparing subjective and objective income measures at the macro level, such as *Ravallion and Lokshin (2002)*, tend to find a highly significant positive correlation between both. About 4 out of every 10 participants reported that their household's economic situation is more favorable than that of the average household in the community, whereas 1 in 10 rated their economic situation as distinctly worse and thereby as precarious.

Self-rated economic welfare only exhibits a weak positive correlation with educational status. This may be due to the fact that the education profile of the participants is generally weak. Some 38% never attended school and an additional 8% dropped out before completing primary education. Only 15% of the sample has a secondary education degree. Despite this low degree of variation in schooling outcomes, we analyze whether the 46% that did not finish primary school behaved differently in the experiment from those who did. Additionally, participants' religious affiliation will be included as an explanatory variable in the analysis. About half the subjects (51%) identified themselves in the survey as catholic, while the other half (49%) expressed adherence to a protestant church.

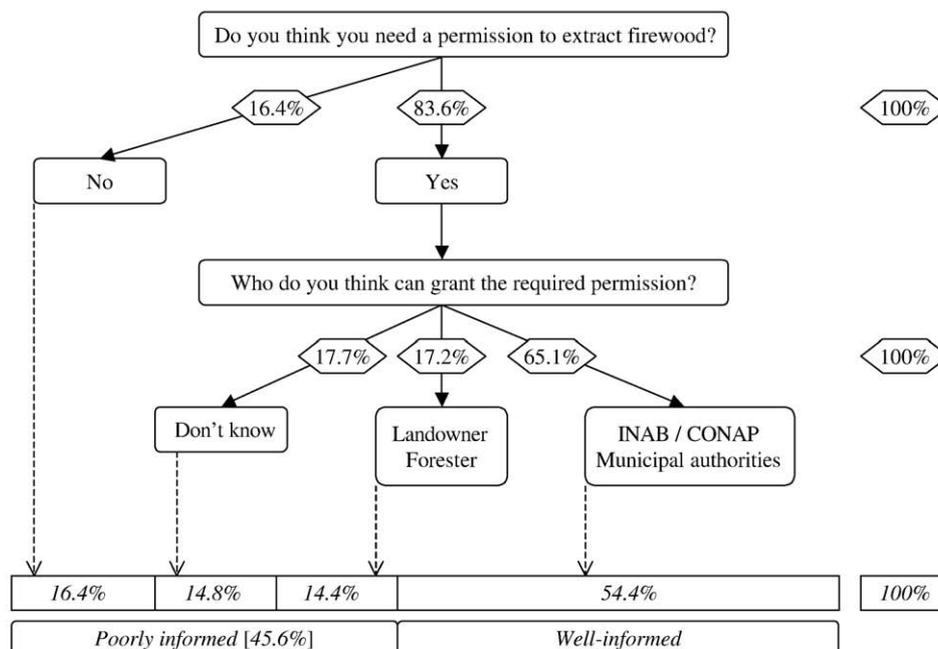


Fig. 1. Classification of participants according to information on extraction permits (n=218).

Table 1
Share of participants choosing legal firewood ($n=218$)

		Cost of choosing legal in experiment			All treatments
		$c=2$ [25%] $C \approx 1.00$	$c=3$ [37.5%] $C \approx 1.50$	$c=4$ [50%] $C \approx 2.00$	
All participants		0.72 (21/29)	0.57 (58/102)	0.32 (28/87)	0.49 (107/218)
Economic situation(self-rated)	Favourable	0.83 (5/6)	0.60 (15/25)	0.38 (8/21)	0.54 (28/52)
	Average	0.79 (15/19)	0.59 (38/64)	0.31 (17/54)	0.51 (70/137)
	Precarious	0.25 (1/4)	0.38 (5/13)	0.25 (3/12)	0.31 (9/29)

The degree of information among subjects was elicited through a nested question, asking people first whether they thought one needed a permission to extract firewood, and, provided they answered affirmatively, we then posed the question what actor or institution they believed is authorized to grant such permission. The results are presented in Fig. 1.

Interestingly, 16.4% was not aware of any legal requirements to fell trees for commercial or subsistence use, while an additional 14.8% recognized the need for a license, but had no clue as to what authorities to apply to for obtaining the same. Both categories are considered 'poorly informed' on the legality issue. This qualification also applies to another group of respondents, i.e., those who provided an incorrect answer to the question regarding who can grant a logging permission. Over 15% of the respondents mistakenly believed it is the private landowner who is in charge of issuing permission to extract firewood from his property.

As visualized at the bottom of Fig. 1, those who were poorly informed (the three above-mentioned groups sum up to 45.6% of the sample) will be separated in the analysis from the remaining 54.4% who were able to answer the questions correctly. This latter group of well-informed subjects either mentioned INAB, CONAP or municipal authorities as the appropriate agent to turn to for a license. Given the legal stipulations reviewed in the Introduction section, each of these answers is correct, depending on the status and location of the area from which resources are extracted.

The average household consists of six members, which typically consumes one *carga* of firewood per week (80 logs of approximately 50 cm of length). While logs are preferred, some poorer households buy sticks and branches, as these can be obtained at a lower price. About 90% of the surveyed households buy all firewood through the marketplace, whereas the remaining 10% also gathers firewood

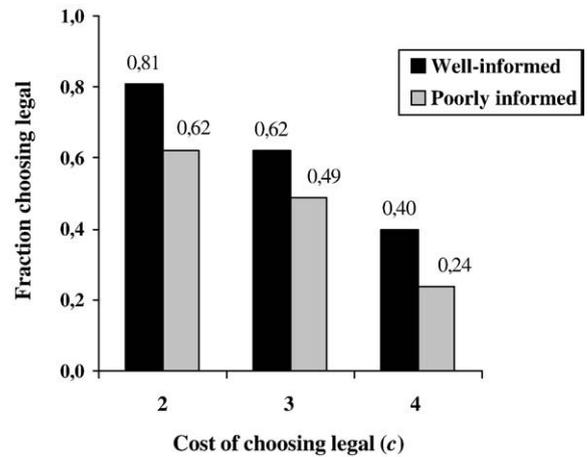


Fig. 2. Effect of information on choice for legal firewood in experiment ($n=218$).

directly from nearby forests or plantations, often without permission from the landowners. However, the latter group of households still strongly depends on the marketplace for obtaining firewood.

3. Results and discussion

Before presenting the results of the multivariate analysis—which includes controls for a set of individual and household characteristics—we first briefly review the results from a simple cross-tabulation for those variables in which we take particular interest. The variable to be explained is the share of individuals choosing the legal bundle of firewood in the experiment, which serves as a proxy for people's willingness-to-pay for legal firewood. We expect this fraction to be negatively correlated with the cost of the trade-off between legal and illegal firewood and positively correlated with both the relative economic situation of the household and the individual's degree of information on regulations for extracting firewood.

3.1. Univariate analysis

Table 1 shows the fraction 'choosing legal' at different cost levels, both for the whole sample as well as broken down by participants' self-rated economic situation. Considering first the total sample, it appears that an increase in the cost markedly reduces the fraction that takes home legal firewood. While this share is as high as 0.72 at $c=2$, only 32% is still prepared to do so when the cost has doubled to $c=4$. Across all treatments, close to half the participants (49%) choose legal and even at

Table 2
Logistic regression: probability of choosing legal bundle of firewood in experiment ($n=209$)

Variable	Parameter estimate	Odds ratio estimate	Wald chi-square	p-value
GENDER (dummy; 0= male; 1= female)	-0.25	0.78	0.32	0.573
RELIGION (dummy; 0= catholic; 1= protestant)	-0.52	0.59	2.16	0.142
ETHNIC (dummy; 0= indigenous; 1= ladino)	0.89	2.45	1.44	0.231
STOVE (dummy; 0= open fire; 1= stove)	0.44	1.56	2.02	0.156
EDUCATION (dummy; 0= no education degree; 1= primary completed)	0.43	1.54	1.45	0.229
AGE (in categories)	-0.84***	0.43	13.23	<0.001
ECONOMIC WELFARE (self-evaluation on a three-step ladder)	1.09***	2.98	12.18	<0.001
QCONS (quantity consumed, standardized to <i>carga</i> /week)	0.83***	2.29	8.01	0.005
GAS (dummy; 0= no; 1= yes)	3.23***	25.36	16.39	<0.001
Interaction GAS QCONS	-1.46***	0.23	7.20	0.007
COST OF CHOOSING LEGAL (experimental treatments; $c=\{2, 3, 4\}$)	-3.14***	0.04	18.55	<0.001
INFORMATION (dummy; 0= poorly informed; 1= well-informed)	1.22***	3.40	8.87	0.003
Interaction INFORMATION ETHNIC	-1.95**	0.14	4.45	0.035
Nagelkerke $R^2=0.47$ (McFadden $R^2=0.33$)				
$\chi^2=89.9$ ($p<0.001$)				

*** and ** indicate statistical significance at 1 and 5%, respectively.

high cost this fraction is non-negligible. The results are thus clearly inconsistent with the ‘zero premium’ assumption for low-income communities. When broken down by categories of relative economic situation of households, the univariate picture suggests that the propensity to choose legal is positively correlated with this variable. This holds true for each cost level, although the differences between the ‘favorable’ and ‘average’ groups are small compared to the gap with those who rate their economic situation as ‘precarious’. Still, at least 25% of the participants who identify themselves as belonging to this latter category—and likely earning an income close to the extreme poverty line—picked up the legal bundle in the treatments. The groups reporting ‘favorable’ and ‘average’ economic conditions neatly follow the observed trend of declining fractions when c increases. Such a trend cannot be discerned for those self-stated as economically worse-off, but this may be due to the limited size of this category in absolute terms ($n=29$).

The clustered bar graph in Fig. 2 depicts the relative frequencies of ‘choosing legal’ when we distinguish between those participants who are poorly informed and those who are well-informed about logging permissions.

In line with expectations, members of the well-informed group show a higher propensity to choose legal than their poorly informed counterparts, regardless of the cost involved. The relative frequencies are on average 16 percentage points apart. At $c=2$, for example, 40% chooses legal in the well-informed group against only 24% in the group with poor information on logging permissions. Hence, this result suggests that information on legal requirements increases people’s propensity to substitute illegal for legal firewood, even if some firewood has to be given up in the process.

The following sub-section presents the outputs from a logistic regression performed to test the robustness of the above results when a set of control variables are taken into consideration.

3.2. Multivariate analysis

Table 2 summarizes the results of the logistic regression. Due to missing values, nine participants could not be included. As can be observed in the table, the participant’s gender, religious affiliation (catholic or protestant), ethnic origin (indigenous or *ladino*), and the way they cook food (open fire or stove) have little explanatory power. The same holds for education, which fails to turn up as a significant predictor of behaviour in the experiment. These results are not in line with the literature cited in the Introduction section, which report a noteworthy effect of these variables on environmental preferences or performance. Nevertheless, the role of these factors in determining environmental behaviour may be expected to vary according to the experimental situation, cultural settings and the type of environmental preferences concerned. Our results suggest that generalizations about these relationships are tricky.

By contrast, the respondent’s age appears to be an important determinant, where the younger generation demonstrates a higher propensity to make a trade-off in favor of the legal option than older participants. Other significant determinants are the quantity of firewood consumed by the household and whether a household fulfils part of its energy needs with gas alongside firewood. First, the proclivity of participants to choose the legal bundle increases with the amount of firewood consumption. Members of gas-consuming households are also more likely to pick the legal bundle of firewood up in the experiment. This effect weakens for those households who, despite their use of natural gas, still heavily rely on firewood, as shown by the significance and negative sign of the interaction term of the quantity consumed variable (QCONS) and the dummy variable for gas-using households (GAS). Members from households consuming large quantities of firewood may be less sensitive to the trade-off they face in the experiment, since the cost of choosing legal is relatively low when compared to their total expenditure on firewood. Gas-consum-

ing households may be less sensitive to implicit price differentials in firewood due to the possibility of substitution.

If we recall the observed tendencies in the univariate analysis, it can now be concluded from Table 2 that these are robust to the addition of the above-mentioned control variables. The cost level c enters negatively with a reliability of over 99%. The regression results also clearly bear out the importance of a household’s economic situation. Self-rated economic situation has a positive sign and is highly significant ($p<0.001$). The better the relative economic situation of the household, the higher is the willingness to surrender resources for legal firewood.

Finally, the separation of the poorly informed from the well-informed participants adds significant explanatory power to the model. The positive sign of the information dummy confirms that being informed on the requirements regarding the extraction of firewood increases the likelihood to ‘choose legal’. Given the insignificance of education in the model, we did not incorrectly pick up a positive effect from more general knowledge (generated from schooling) in Fig. 2. In fact, education levels are only weakly correlated with this very specific type of information on logging permissions ($\rho=0.16$). Interestingly, the positive effect of being well-informed on one’s choice in the experiment applies to the group of participants of indigenous origin only. Interaction of the information variable with the dummy variable for *ladinos* results in a significant offsetting effect. Given the small absolute number of *ladinos* in the sample ($n=44$), we are hesitant to conclude that information on legality does not affect the ethical trade-off of non-indigenous individuals for some socio-cultural reason, since we cannot exclude the possibility of this being an artefact in the data. The ratio estimate in the third column of Table 2 indicates that, among the indigenous majority, well-informed individuals are 3.4 times more likely to ‘choose legal’ than their poorly informed counterparts. Over the whole sample, the effect is slightly weaker, but still significant at the 5% level. Interacting the information dummy with other independent variables did not reveal other groups that are relatively (in)sensitive to information on logging permissions. As stated in the Introduction section, empirical studies on relationship between environmental information and green/ethical market behaviour have shed mixed results. Our research may be then positioned among the ones finding a positive relation (Fraj and Martinez, 2007).

3.3. Theoretical implications of results

From the point of view of conventional economic choice theory, the outputs of our choice experiment would be interpreted as the result of the maximization of consumer’s satisfaction, according to consumer’s preferences, which are reflected in a marginal rate of substitution between illegal and legal firewood. We consider such an interpretation to be deprived of substantive content, however (Sanchez-Cuenca, 2008). Sen (1977) clearly identified the flaws of the utility maximization logic: “If you are observed to choose x rejecting y , you are declared to have a preference for x over y . Your personal utility is defined as simply a numerical representation of this preference, assigning a higher utility to a preferred alternative. With this set of definitions you can hardly escape maximizing your own utility, except through inconsistency”. Contrary to the assumption of utility maximization, we argue that when the agent chooses the bundle with the lower amount of firewood, she or he is selecting an option that will improve some kind of delusive social welfare at the expense of her/his own short-run level of utility. We believe that choosing the legal bundle can hardly be interpreted as a case of instrumental reciprocity (Sobel, 2005) or sympathy, the latter understood as a case in which concern for others directly affects one’s own welfare. Therefore, we argue that sacrificing firewood in our experiment should be interpreted as a case of “commitment” or “self-imposed choice constraints” (Sen, 1977, 1997; Broussolle, 2005), which refer to the proposition that the accountability and obligation to others may take the form of restrictions on choice.

The social psychology literature coins this type of individual behaviour as “social norm activation” (morally appropriate behaviour). That is, a felt obligation to select a particular choice may stem from compliance with perceived other-expectations (Ek and Söderholm, 2008). Building on this notion, the term “citizen consumer” has been adopted, to refer to “someone who acts beyond her own interest as a consumer and takes responsibility for wider concerns beyond the individual level” (Freestone and McGoldrick, 2008). In the same line of reasoning, the concept of “consumer moral consciousness” has been coined to stress the relationship between consumers’ acts and the level of awareness of ethical implications of one’s consumption patterns (McGregor, 2006).

Self-imposed choice constraints may be a matter of moral consciousness, but may also be caused by the aspiration to please experimenters or peers, as a generic act to support a good cause (warm glow), or it may be related to cultural habits. Unfortunately, our methodological setting does not allow us to isolate participants’ exact motivations. Independently of the motivation, it is very remarkable that such a high proportion of our sample is willing to bear a sizable and real sacrifice in the consumption of a good that has immediate and important use in the household.

The fact that the self-stated economically worse-off among our sample is also to some extent willing to bear costs in the pursuit of ethical/green consumption makes the case for self-imposed choice constraints even stronger, and challenges the conventional assumption that “in developing countries short-term biophysical needs may take precedence over long-term sustainability” (Gowdy and Mayumi, 2001) or the conjecture that green/ethical consumption is the result of a post-modern lifestyle (Haanpää, 2007). The proposition that environmental concerns are a luxury of the rich has been well contested by several ecological economists (Gadgil and Guha, 1995; Duffield et al., 1998; Berkes et al., 2000; Martinez-Alier, 2005). We think our paper contributes to this stream of literature by means of testing consumption preferences of the rural poor with a novel methodological approach. However, as discussed in the following subsection, our findings also suggest that the poor may be more willing to bear “in kind” than cash sacrifices when facing trade-offs in choice decisions. We deal with this issue below.

3.4. Stated vs. revealed preferences

In the contingent valuation elicitation, 73% of the sample declared a positive willingness to pay an ethical/green premium on legal over illegal firewood. Over the entire sample, the average price premium in favor of legal firewood equaled 21% over the base price for a bundle of five logs of illegal firewood. An interesting asymmetry comes to the surface when stated and revealed preferences of individual respondents are compared. Whereas 36.1% of those who selected legal firewood in the choice experiment did not declare a WTP high enough to justify such a choice (at least for the particular trade-off that was presented to them), only 3.3% of those making the opposite choice (those preferring the illegal option) should not have done so according to their statements in the contingent valuation exercise. This asymmetry suggests that ethical motives came out stronger in the choice experiment than in contingent valuation, which is contrary to expectations, as one would believe that taking out the hypothetical character would result in a higher propensity to choose the ethical/green choice. In fact, the rationale for applying revealed preference methods is to correct for the conjectured upward bias on WTP in hypothetical settings.

We should be cautious, however, in drawing conclusions and proposing interpretations. Apart from the bias introduced by the windfall character of the experiment, we have to bear in mind that the experimental results are conditioned by the fact that decisions were made in relation to firewood endowment rather than actual purchase with cash. A trade-off in terms of firewood endowment may entail a lower marginal utility loss for participants due to the embodiment of its value in a particular commodity. Although participants could in

principle resell the firewood to extract its cash value after the experiment, some transaction costs would have to be borne. The relative salience of a monetary (rather than material) cost in the contingent valuation could have dampened the enthusiasm for legal firewood. In connection to this, it should also be pointed out that the choice experiment involved a ‘one-shot’ decision. The fact that people were willing to accept to bear the cost of a given endowment once, does not guarantee that one would be prepared to do so in case of repeated choice. The contingent valuation question may have evoked a more structural rather than an incidental situation in the participants’ minds.

The difficulty of pinpointing participants’ exact perceptions and motivations in both the contingent valuation and the choice experiment pre-empts an unambiguous interpretation of the higher observed support for legal firewood in our experimental set-up than one would expect based on earlier WTP declarations. Our results indicate that field experiments may shed new light on the complex relationship between stated and revealed preferences and that simplistic assumptions for predicting consumers’ behaviour should be avoided. The extent to which stated and revealed preferences are dependent on the vehicle by which the sacrifice takes place (windfall, material endowment, cash expenditure, etc.) requires further research. Also, the hypothesis that the poor are more willing to bear material (in kind) than cash sacrifices could be tested in future experiments.

4. Concluding remarks

It is commonly assumed that the bulk of consumers in developing countries are “too poor to be green” (Martinez-Alier, 1995) or, in more specific terms, too poor to express their ethical/environmental concerns in the marketplace. Our experiment conveys a rather different picture. The fraction of our sample that is willing to substitute illegal for legal firewood is far from negligible, despite the costs involved. Even though we cannot conclude that a local market for “certified” legal firewood would be viable, there seems ample scope for awareness raising as a policy intervention. A necessary condition for any consumer campaign to be successful, however, is that consumers are able to distinguish between legal and illegal firewood in the marketplace.

References

- Abdul-Muhmin, A., 2006. Explaining consumers’ willingness to be environmentally friendly. *International Journal of Consumer Studies* 31, 237–247.
- Aguilar, F.X., Vlosky, R.P., 2007. Consumer willingness to pay price premiums for environmentally certified wood products in the US. *Forest Policy and Economics* 9 (8), 1100–1112.
- Anderson, R.C., Hansen, E.N., 2004a. Determining consumer preferences for ecolabeled forest products: an experimental approach. *Journal of Forestry* 102 (4), 28–32.
- Anderson, R.C., Hansen, E.N., 2004b. The impact of environmental certification on preferences for wood furniture: a conjoint analysis approach. *Forest Products Journal* 54 (3), 42–50.
- Arkes, H.R., Joyner, C.A., Pezzo, M.V., Nash, J.G., Siegel-Jacobs, K., Stone, E., 1994. The psychology of windfall gains. *Organizational Behavior and Human Decision Processes* 59 (3), 331–347.
- Atran, S., Medin, D., Ross, N., Lynch, E., Vapnarsky, V., Ucan Ek, E., Coley, J., Timura, C., Baran, M., 2002. Folkeology, cultural epidemiology and the spirit of the commons. *Current Anthropology* 43 (3), 421–450.
- Basu, A., Hicks, R., 2008. Label performance and the willingness to pay for Fair Trade coffee: a cross-national perspective. *International Journal of Consumer Studies* 32, 470–478.
- Berkes, F., Colding, J., Folke, C., 2000. Rediscovery of traditional ecological knowledge as adaptive management. *Ecological Applications* 10 (5), 1251–1262.
- Bonsu, S., Zwick, D., 2007. Exploring consumer ethics in Ghana, West Africa. *International Journal of Consumer Studies* 31, 648–655.
- Broussolle, D., 2005. Internal consistency of choice, Sen and the spirit of revealed preferences: a behaviorist approach. *Journal of Socio-Economics* 34, 605–620.
- Buenstorf, G., Cordes, C., 2008. Can sustainable consumption be learned? A model of cultural evolution. *Ecological Economics* 67, 646–657.
- Castañeda, J.P., Sandoval, C., 2008. Rastreando la cadena de la tala no controlada: El caso de Tecpán y San Juan Sacatepéquez en Guatemala. Paper presented at the 8th National Forestry Conference, Guatemala.
- Chan, R., Wong, Y.H., Leung, T.K.P., 2008. Applying ethical concepts to the study of “green” consumer behavior: an analysis of Chinese consumers’ intentions to bring their own shopping bags. *Journal of Business Ethics* 79, 469–481.

- De Pelsmacker, P., Driesen, L., Rayp, G., 2005. Do consumers care about ethics?: willingness to pay for fair-trade coffee. *Journal of Consumer Affairs* 39 (2), 363–385.
- Didier, T., Lucie, S., 2008. Measuring consumer's willingness to pay for organic and Fair Trade products. *International Journal of Consumer Studies* 32, 479–490.
- Ding, M., Grewal, R., Liechty, J., 2005. Incentive-aligned conjoint analysis. *Journal of Marketing Research* 42 (1), 67–82.
- Duffield, C., Gardner, J.S., Berkes, F., Singh, R.B., 1998. Local knowledge in the assessment of resources sustainability: case studies in Himachal Pradesh, India, and British Columbia, Canada. *Mountain Research and Development* 18 (1), 35–49.
- Ek, K., Söderholm, P., 2008. Norms and economic motivation in the Swedish green electricity market. *Ecological Economics* 68, 169–182.
- Fisher, C., Aguilar, F., Jawahar, P., Sedjo, R., 2005. Forest certification: toward common standards? RFF Discussion Paper no. 05-10. Resources for the Future, Washington. available online at [<http://www.rff.org/Documents/RFF-DP-05-10.pdf>].
- Fraj, E., Martinez, E., 2007. Ecological consumer behaviour: an empirical analysis. *International Journal of Consumer Studies* 31, 26–33.
- Freestone, O., McGoldrick, P., 2008. Motivations of the ethical consumer. *Journal of Business Ethics* 79, 445–467.
- Gadgil, M., Guha, R., 1995. *Ecology and Equity: The Use and Abuse of Nature in Contemporary India*. Penguin Books, New Delhi.
- Goswami, P., 2008. Is the urban Indian consumer ready for clothing with eco-labels? *International Journal of Consumer Studies* 32, 438–446.
- Gowdy, J., Mayumi, K., 2001. Reformulating the foundations of consumer choice theory and environmental valuation. *Ecological Economics* 39, 223–237.
- Hanemann, M., 1984. Discrete/continuous models of consumer demand. *Econometrica* 52 (3), 541–561.
- Haanpää, L., 2007. Consumers' green commitment: indication of a postmodern lifestyle? *International Journal of Consumer Studies* 31, 478–486.
- INE, Instituto Nacional de Estadística de Guatemala, 2006. *Mapas de pobreza en Guatemala al 2002*. Serviprensa, Guatemala.
- Johansson-Stenman, O., Svedsäter, H., 2003. Self image and choice experiments: hypothetical and actual willingness to pay. Working Papers in Economics no. 94. Department of Economics, Göteborg University.
- Kahneman, D., Tversky, A., 1979. Prospect theory: an analysis of decision under risk. *Econometrica* 47 (2), 263–292.
- Katona, G., 1958. Rational behavior and economic behavior. *Psychological Review* 60, 307–318.
- Lokshin, M., Umupathi, N., Paternostro, S., 2006. Robustness of subjective welfare analysis in a poor developing country: Madagascar 2001. *Journal of Development Studies* 42 (4), 559–591.
- Loureiro, M., McCluskey, J.J., 2002. Will consumers pay a premium for eco-labeled apples? *Journal of Consumer Affairs* 36 (2), 203–219.
- Lowry, R., 1998. Religion and the demand for membership in environmental citizen groups. *Public Choice* 94, 223–240.
- Martinez-Alier, J., 1995. The environment as a luxury good or "too poor to be green"? *Ecological Economics* 13 (1), 1–10.
- Martinez-Alier, J., 2005. *The Environmentalism of the Poor: A Study of Ecological Conflicts and Valuation*. Oxford University Press, New Delhi.
- Maslow, A.H., 1970 [1954]. *Motivation and Personality*. Harper & Row, New York.
- McCarthy, J., Shrum, L.J., 2001. The influence of individualism, collectivism, and locus of control on environmental beliefs and behavior. *Journal of Public Policy & Marketing* 20 (1), 93–104.
- McFadden, D., 1986. The choice theory approach to market research. *Marketing Science* 5 (4), 275–297.
- McGregor, S., 2006. Understanding consumers' moral consciousness. *International Journal of Consumer Studies* 30, 164–178.
- Mohamed, S., Ibrahim, M.L., 2007. Preliminary study on willingness to pay for environmentally certified wood products among consumers in Malaysia. *Journal of Applied Sciences* 7, 1339–1342.
- Moisander, J., 2007. Motivational complexity of green consumerism. *International Journal of Consumer Studies* 31, 404–409.
- Nixon, M., 2006. Satisfaction for whom? Freedom for what? Theology and the economic theory of the consumer. *Journal of Business Ethics* 70, 39–60.
- Owen, A., Videras, J., 2007. Culture and public goods: the case of religion and the voluntary provision of environmental quality. *Journal of Environmental Economics and Management* 54, 162–180.
- Ravallion, M., Lokshin, M., 2002. Self-rated economic welfare in Russia. *European Economic Review* 46 (8), 1453–1473.
- Sanchez-Cuenca, I., 2008. A preference for selfish preferences: the problem of motivations in rational choice political sciences. *Philosophy of the Social Sciences* 38 (30), 361–378.
- Schläpfer, F., Roschewitz, A., Hanley, N., 2004. Validation of stated preferences for public goods: a comparison of contingent valuation survey response and voting behaviour. *Ecological Economics* 51 (1–2), 1–16.
- Sen, A., 1977. Rational fools: a critique of the behavioral foundations of economic theory. *Philosophy and Public Affairs* 6 (4), 317–344.
- Sen, A., 1997. Maximization and the act of choice. *Econometrica* 65 (4), 745–779.
- Sobel, J., 2005. Interdependent preferences and reciprocity. *Journal of Economic Literature* 43 (2), 392–436.
- Stern, P., 2000. Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues* 56 (3), 407–424.
- Stocks, A., McMahan, B., Taber, P., 2007. Indigenous, colonist, and government impacts on Nicaragua's Bosawas Reserve. *Conservation Biology* 21 (6), 1495–1505.
- Urama, K., Hodge, I., 2006. Are stated preferences convergent with revealed preferences? empirical evidence from Nigeria. *Ecological Economics* 59, 24–37.
- Van Praag, B.M.S., 1968. *Individual Welfare Functions and Consumer Behavior*. North-Holland, Amsterdam.
- Viriden, R., Walker, B., 1999. Ethnic/racial and gender variations among meanings given to, and preferences for, the natural environment. *Leisure Sciences* 21, 219–239.
- Wertenbroch, K., Skiera, B., 2002. Measuring consumers' willingness to pay at the point of purchase. *Journal of Marketing Research* 39, 228–241.
- Wittman, H., Geisler, C., 2005. Negotiating locality: decentralization and communal forest management in the Guatemalan Highlands. *Human Organization* 64 (1), 62–74.
- World Bank, 2006. *Doing Business 2007: How to Reform*. World Bank, Washington DC.
- Zelezny, L., Chua, P.P., Aldrich, C., 2000. Elaborating on gender differences in environmentalism. *Journal of Social Issues* 56 (3), 443–457.