Title:
The Effect of Marketing Messages, Liquidity Constraints, and Household Bargaining on Willingness to Pay for a Nontraditional Cookstove

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Theresa Beltramo, David I. Levine, Garrick Blalock

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Abstract: Lack of product information, liquidity constraints, and women's limited intrahousehold bargaining power can all slow adoption of new technologies that primarily benefit women and children in poor nations. One such technology, an improved cookstove, can replace inefficient traditional biomass cookstoves that cause significant environmental degradation and some four millions deaths a year. This experiment conducted in rural Uganda estimates willingness to pay for cookstove technologies using Vickrey second-price auctions. Using a randomized controlled trial we first test whether marketing messages which address specific information barriers increase willingness to pay. Second, a within-subjects comparison tests the effect of time payments on willingness to pay. To assess intrahousehold decision-making a correlational study examines the effect of being female, indicators of intra-household decision making, and earning a stable income on willingness to pay. Information campaigns have no large effect on willingness to pay. Neither marketing message- 'the stove can improve health' or 'the stove can save time and money'- consistently increased willingness to pay. We find evidence that consumers in rural Uganda are liquidity constrained. Including time payments raised willingness to pay for a nontraditional cookstove by 41%. Each additional asset owned increased willingness to pay by 10%. Having a stable income increased willingness to pay by 8-10% for both men and women participants, though no effect on willingness to pay is observed of having a stable income for married women. There is a large negative effect on willingness to pay if participant is female- on average men are willing to pay 21-23% more than women. Efforts to increase willingness to pay for nontraditional cookstoves which improve health and abate environmental harm may be more successful by designing and disseminating nontraditional cookstoves with features valued more highly by men and addressing liquidity constraints, instead of repeating marketing messages related to the cookstoves' health and private economic benefits.

Cover Letter

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Dear Editors,

Enclosed is "The effect of marketing messages, liquidity constraints, and household bargaining on willingness to pay for a nontraditional cookstove," with David I. Levine and Garrick Blalock.

The article has been accepted and presented at the recent 2013 *Symposium on Economic Experiments in Developing Countries* (SEEDAC) and has been written specifically to combine the experimental approach with economic theory. The paper presents a theoretical model of the role of information & consumer demand, liquidity constraints and present bias on willingness to pay for a nontraditional cookstove.

The article finds very strong evidence that gender, liquidity constraints and/or present bias limit willingness to pay for a new product in rural Uganda. Though there is no evidence that poor information mitigated by credible information on the product's attributes through effective marketing messaging has any effect on willingness to pay. These results have first-order importance in thinking about product design, efficient subsidies, and barriers to adopting technologies ranging from new fertilizers to condoms.

Our study exemplifies the fact that, for all of its benefits, technology alone often cannot solve problems. Investments in life-improving technologies, such as cookstoves and water filters, must be accompanied by continued research in the factors that influence human adoption and use of those technologies.

Sincerely yours,
Theresa Beltramo
Theresa Beltramo

***Title Page (with Full Author Details)**

Title: The effect of marketing messages, liquidity constraints, and household bargaining on willingness to pay for a nontraditional cookstove

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Highlights

- We estimate willingness to pay for cookstove technologies using Vickrey second-price auctions.
- Vickrey second price auction experiments have poor predictive validity of actual purchase behavior.
- There is no consistent evidence that information on product attributes improved willingness to pay.
- Adding time payments significantly increases willingness to pay.
- Being female has large negative effects on willingness to pay.

The effect of marketing messages, liquidity constraints, and household bargaining on willingness to pay for a nontraditional cookstove

Authors: Theresa Beltramo, David Levine and Garrick Blalock*

Abstract

Lack of product information, liquidity constraints, and women's limited intrahousehold bargaining power can all slow adoption of new technologies that primarily benefit women and children in poor nations. One such technology, an improved cookstove, can replace inefficient traditional biomass cookstoves that cause significant environmental degradation and some four millions deaths a year. This experiment conducted in rural Uganda estimates willingness to pay for cookstove technologies using Vickrey second-price auctions. Using a randomized controlled trial we first test whether marketing messages which address specific information barriers increase willingness to pay. Second, a within-subjects comparison tests the effect of time payments on willingness to pay. To assess intrahousehold decision-making a correlational study examines the effect of being female, indicators of intra-household decision making, and earning a stable income on willingness to pay. Information campaigns have no large effect on willingness to pay. Neither marketing message- 'the stove can improve health' or 'the stove can save time and money'- consistently increased willingness to pay. We find evidence that consumers in rural Uganda are liquidity constrained. Including time payments raised willingness to pay for a nontraditional cookstove by 41%. Each additional asset owned increased willingness to pay by 10%. Having a stable income increased willingness to pay by 8-10% for both men and women participants, though no effect on willingness to pay is observed of having a stable income for married women. There is a large negative effect on willingness to pay if participant is female- on average men are willing to pay 21-23% more than women. Efforts to increase willingness to pay for nontraditional cookstoves which improve health and abate environmental harm may be more successful by designing and disseminating nontraditional cookstoves with features valued more highly by men and addressing liquidity constraints, instead of repeating marketing messages related to the cookstoves' health and private economic benefits.

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1. Introduction

From water filters to bednets and from fertilizer to efficient cookstoves, poor people around the globe frequently do not purchase goods that agronomists, epidemiologists and engineers claim would be beneficial at market prices. In many cases, the products do not meet consumers' needs. In other cases, a variety of barriers impede efficient product adoption. This article examines three familiar barriers that impede take-up of cost effective products for poor consumers: poor households may lack information on the benefits and durability of the stoves ((Feder and Slade 1984; Conley and Udry 2001; Giné and Yang 2009), may be liquidity- or credit-constrained (Giné, Townsend, and Vickery 2008; Cole et al. 2012; Tarozzi et al. 2011), or may not share equally decision making for durable goods which primarily benefit women (Ashraf 2009; Meredith et al. 2012; Miller and Mobarak 2013).

Traditional cookstoves are inefficient, harnessing only 5–15% of biomass energy (Khan et al. 1995 in Mobarak et al. 2012). As a result, they cause significant environmental degradation and loss of life. According to the recent *Global Burden of Disease* report, household air pollution accounts for an estimated 4 million deaths a year globally (Lim et al. 2012). Traditional cookstoves also contribute to global warming (Bailis et al. 2007).[1]

Nontraditional cookstoves, depending on quality and construction, have the potential to significantly reduce household air pollution and thus improve the health of women cooks and her accompanying children. Further, nontraditional cookstoves can significantly reduce fuel use, which in the case of consumption of biomass such as charcoal or wood, will reduce the burden on the environment and can slow deforestation and/or desertification. Fuel savings will decrease household expenditure on fuel and/or reduce time spent collecting fuel. Additional benefits to consumers of nontraditional cookstoves include pots and pans require less cleaning, cooks' clothes remain cleaner, and the women find the nontraditional cookstove aspirational, as it is both modern and works more efficiently (Beltramo and Levine 2013).

Despite these benefits, past stove projects have frequently provided sizeable subsidies, particularly to poor rural consumers. One frequently cited reason for subsidization is that men have a low valuation of saved time of household members (mainly women and children) and hence an unwillingness of consumers to pay market prices for a nontraditional cookstove to replace a *free* three-stone fire (Rollinde 2009; Mobarak et al. 2012). Additional research posits that end-users are not yet concerned enough by household air pollution or global warming to change their cooking habits (Rollinde 2009). In a related experiment, Miller and Mobarak (2013) test willingness to pay for nontraditional cookstoves in Bangladesh. They find that when offered a variety of cookstoves, women prefer the more expensive health-improving cookstoves, but lack the financial resources to pay for it.

In some contexts, subsidies can play an important role in adoption of welfare-improving technologies for poor consumers (Cohen and Dupas 2010). Though, the huge gap in demand for subsidies and supply of relatively scarce development dollars provides an opportunity to identify products and market-driven

[1] Incomplete combustion releases heat-trapping pollutants, including methane and black carbon, which have a greater global warming impact than carbon dioxide does per unit of carbon emitted (Bond, Venkataraman, and Masera 2004; Ramanathan and Carmichael 2008).

models of consumer adoption to sustainably increase adoption of welfare-improving products by poor consumers. Products with a positive price can screen out consumers who place low value on the product, but will accept when the price is zero or negligible (Oster 1995). Understanding what affects poor rural consumer's willingness to pay for welfare-improving technologies can motivate the private sector to expand product lines and deepen markets for the poor. As a result, a goal of this research is to help stove producers sell nontraditional cookstoves at market prices. Critical to a market based strategy for poor consumers is to understand what motivates their purchase decision of a new durable goods.

Our experiment tests three potential factors affecting willingness to pay. First, we conducted a randomized controlled trial using a crossed (or orthogonal) method to test whether two marketing messages increase willingness to pay for a nontraditional cookstove. Second, using a within-subjects comparison, we test the effect of time payments on willingness to pay. Third, motivated by a model of intrahousehold decision-making, we conduct a correlational study to test the effect of being female, indicators of intra-household decision making, and earning a stable income on willingness to pay.

Neither marketing message—'the stove can improve health' or 'the stove can save time and money'—consistently increased willingness to pay. We find evidence that consumers in rural Uganda are liquidity and or credit constrained. Including time payments raised willingness to pay for a nontraditional cookstove by 41% ($p<0.01$), each additional asset owned increased willingness to pay by 10% in both auctions ($p<0.01$), and having a stable income increased willingness to pay by 10% for the pay within a week auction and 8% for the time payment auction ($p<0.05$). Further, substantial differences in willingness to pay are observed across gender. Women have willingness to pay that is 23-21% less than men ($p<0.01$). And despite the 8-10% increase observed in having a stable income for the wider sample, no effect on willingness to pay is observed for married women with a stable income.

Consistent with other literature, we find no consistent evidence that marketing messages related to the cookstoves' health leads to an increase in willingness to pay. Efforts to increase willingness to pay for nontraditional cookstoves which improve health and abate environmental harm may be more successful by addressing liquidity constraints and by designing and disseminating nontraditional cookstoves with features valued more highly by men.

Only a few studies to date, particularly, for nontraditional cookstoves, attempt to understand what motivates poor consumers' willingness to pay and decision to purchase, new technologies. Most existing studies do so by using qualitative approaches and nonexperimental evidence (Mobarak et al. 2012). With the launch of several major international efforts to disseminate cleaner cookstoves—including the United Nations Foundation's Global Alliance for Clean Cookstoves (to coordinate cookstove dissemination efforts across more than a dozen US government agencies), European and local government and private sector donors—the need for rigorous research on the demand for new varieties of cookstoves and effective distribution strategies has become more urgent (Mobarak et al. 2012). This research contributes to the understanding of what drives poor consumer's demand which can help stove producers and distributers increase profits and, in turn, contribute to a sustainable market driven solution necessary for the mass distribution and adoption of nontraditional cookstoves. These results are relevant for other similar welfare and/or health-improving new technologies-such as fertilizer or

improved water and sanitation- which private producers typically consider as too difficult to sell to the poor due to their limited purchasing power.

2. Economic theory and literature review

Measuring Revealed Willingness to Pay with Second Price Auctions

Two main methods exist—revealed and stated preferences—for measuring willingness to pay in experimental settings. We utilize a revealed preference method, which refers to the observation of preferences revealed by market transactions, such as auctions.

The auction mechanism, particularly the Vickrey second-price auction, is frequently used to elicit willingness to pay in many disciplines of economics due to its theoretical demand-revealing properties (Shogren et al. 1994; Vickrey 1961). In a Vickrey second-price auction, participants submit sealed bids for a product, and the highest bidder wins the auction and pays the second-highest bid.

Although the second-price auction has several theoretical advantages over other auction mechanisms, these benefits may not exist in practice if bidders do not perceive that truthful bidding is optimal. Experimental research has found mixed results. Some have found no evidence against truthful bidding (Johannesson, Liljas, and O'Conor 1997). Others have found bids in second-price auctions may take considerable time to converge to their theoretically predicted value (Coppinger, Smith, and Titus 1980) or do not converge to this "true" value at all (Lusk et al. 2001; Kagel and Levin 1993). Participants may not necessarily realize (even when told) that their incentive is to bid their true maximum willingness to pay (Lusk et al. 2001). Or, experimental evidence may diverge from theoretical predictions because auction bidding processes do not naturally mimic consumers' decision making processes in normal retail settings (Hoffman et al. 1993). Contrary to the practically unrestricted supply of goods in retail settings, bidders in auctions compete with one another for a limited stock. Under practical circumstances, bids in auctions might therefore not only depend on respondents' true valuations of the good but also on the subject's response goal of ensuring that he or she places the winning bid (Noussair, Robin, and Ruffieux 2004; Wertenbroch and Skiera 2002). This kind of gambling behavior consequently may limit the validity of auctions under practical conditions. To verify the predictive validity of the second-price auctions we compare predicted demand from the auction with purchases by a separate set of consumers offered a posted price.

Evidence of barriers to adoption of durable goods

These experiments test familiar barriers that have been demonstrated by economic experiments in the field to impede take-up and willingness to pay of cost effective products similar to nontraditional cookstoves. Poor households may lack information on the benefits and durability of the stoves (Feder and Slade 1984; Conley and Udry 2001; Giné and Yang 2009), may be liquidity- or credit-constrained (Giné, Townsend, and Vickery 2008; Cole et al. 2012; Tarozzi et al. 2011), or may have intrahousehold externalities which lower willingness to pay for products whose primary beneficiaries are women and children (Ashraf 2009; Meredith et al. 2012; Miller and Mobarak 2013). Purchase decisions and willingness to pay for clean cookstoves depend on individual consumer qualities which we assess

through techniques of market segmentation, particularly demographic criteria including gender, education, family size, livelihoods; psychographic criteria including social class, or wealth; and by the occasion—event conditions when product sold and attitudes towards product (Cleveland, Papadopoulos, and Laroche 2011; Kucukemiroglu, Harcar, and Spillan 2007; Arnould, Price, and Zinkhan, 2004; Faz and Breloff 2012).

The role of information & consumer demand: Lack of information can be a significant barrier in willingness to pay. To outline the effect of the lack of information in the context of willingness to pay for nontraditional cookstoves, we use the following model.

Assume an infinitely-lived consumer has income y each period. She has to purchase Q units of energy each period to run her traditional cookstove (with the price of energy normalized to unity) and she receives utility from non-energy consumption c_t. She can borrow or save with a gross rate of return $R = 1+r > 1$, and her subjective discount rate is δ (< 1).

The consumer maximizes the present value of utility

$$\sum_{t=0}^{\infty} u(c_t)\delta^t,$$

subject to a lifetime budget constraint that the present value of consumption is not more than her income:

$$\sum_{t=0}^{\infty}(Q + c_t)/R^t = \sum_{t=0}^{\infty} y_t/R^t.$$

Without loss of generality normalize her utility without the cookstove, $u(y\text{-}Q)$, as zero. Assume an improved cooking technology comes on the market that increases the combustion efficiency thereby lowering the fuel needed and exposure to household air pollution. The new appliance costs P in the first period and uses φQ of energy each period until the appliance dies, with $0 < \varphi < 1$. The appliance has a per-period exponential death rate ψ, with $0 < \psi < 1$, and upon the appliance's death, the consumer can return to her old technology at zero cost.

With perfect capital markets the consumer's willingness to pay for the new appliance is the expected present value of lower spending on energy during the lifetime of the appliance:

$$p^* \leq \sum_{t=0}^{\infty}((1-\varphi)Q(1-\psi)^t)/R^t = (1-\varphi)QR/(R+\psi-1) \qquad (1)$$

Call the critical price p^*, which defines the efficient willingness to pay (we assume indifferent consumers purchase the appliance). As expected, willingness to pay is higher if the appliance is very efficient (low φ), the household uses a lot of energy (high Q), the appliance usually lasts a long time (low ψ), and if other investment opportunities are poor (low R).

However consider the market imperfection that the consumer lacks information on product benefits or doubts the firm's claims about energy savings. Assume the consumer is unsure of energy savings and

discounts the firm's true claim by a factor $\gamma < 1$. The consumer continues to purchase if price is below the present value of expected savings, but those savings are now discounted by γ. Thus, the highest willingness to pay with uncertain savings is:

$$p^{us} = \gamma\, p^{*}.$$

Now assume the consumer is offered credible information on the product's energy savings through effective marketing messaging. As a result, assume the consumer's beliefs align with the product's true savings (that is, energy use falls to φQ) and $\gamma=1$, or those calculated in equation (1).

As a result, economic theory shows it is plausible that if marketing messages address the obstacle of imperfect product information, products will be adopted efficiently. Complementarily, some economic field experiments find information-based campaigns can lead to large behavior change. Research in Bangladesh finds if a household has information that their well water contains arsenic, the probability that the household changes to another well within one year is increased by 0.37 (Madajewicz et al. 2007).

Yet, other information-based campaigns for similar health and welfare creating products lead to small or no behavior change. Evidence from an experiment on household point-of-use (POU) water treatment technologies finds little impact on demand by information campaigns (Albert, Luoto, and Levine 2010; Luo et al. 2012).

To complicate the picture further, economic field experiments have particularly mixed results in using health messages to increase willingness to pay for health improving products, similar to nontraditional cookstoves. Recent experiments find evidence of strong price sensitivity for health products by poor consumers (Ashraf 2009; Cohen and Dupas 2010; Dupas 2009). One of the few quantitative experiments on measuring willingness to pay for nontraditional cookstoves tests underlying preferences of consumers in Bangladesh for nontraditional cookstove technologies (Mobarak et al. 2012). Among all characteristics, the ability of nontraditional cookstoves to reduce fuel costs is the most valued characteristic- 47%. The next most-valued attributes are the ability to reduce cooking time (21%) and to accommodate a wider variety of biomass fuels (14%). Notably, health and environmental concerns are far down the list of motivations for purchasing non-traditional cookstoves- only 9% of respondents answered that reducing or eliminating household smoke is what they value most about nontraditional cookstoves (Mobarak et al. 2012). Household budgetary concerns (not limited to cookstove price) appear to dominate any health concerns associated with smoke from nontraditional cookstoves.

In another experiment colleagues hypothesize that poor investments in preventative health products could be caused by households lacking health information and risks that could be mitigated by such products. They test the role of health messages in four experiments in Kenya, Guatemala, India, and Uganda and find that information alone has no impact on the ultimate purchase decision despite clear evidence that the informational script substantially increased knowledge related to the preventative health intervention (Meredith et al. 2012). Instead, they find price is by far the most important predictor of purchase. As a result, there is strong evidence from economic field experiments suggesting that the 'Saves time and money' message is more likely to increase willingness to pay than the nontraditional

cookstove 'Improves health' message. The mixed outcomes of experimental research to date provides no clear signal what to expect on how information and marketing messages affect consumer decisions, especially in poor nations.

Effect of liquidity or credit constraints and present-bias on demand for products: Evidence exists that many consumers in poor nations face liquidity or credit constraints and are present biased and thus find it difficult to come up with the entire purchase price of a durable good in one lump sum (Banerjee 2003; Mullainathan and Eldar 2011). We model an extreme version of liquidity constraints in which a liquidity-constrained consumer can neither save nor borrow. Thus, each period the consumer consumes her income after buying energy and perhaps an appliance. The lifetime utility without the new appliance is the value of income minus energy costs:

$$\sum_{t=0}^{\infty} u(y-Q)\delta^t.$$

A liquidity-constrained consumer is unable to purchase the appliance when her period's disposable income is less than the price charged to liquidity-constrained consumers, p^{lc} (that is, if $y - \varphi Q < p^{lc}$). If the appliance is potentially affordable (that is, $p^{lc} + \varphi Q < y$), then a buyer's initial-period consumption declines by the entire price:

$$c_0 = y - \varphi Q - p^{lc}.$$

Assume unbiased expectations of the appliance's savings and that the appliance never dies (i.e., $\gamma = 1$ and $\psi = \psi' = 0$). Then the liquidity-constrained consumer buys the new appliance if expected lifetime utility with the new appliance is greater than without it, with her initial period consumption equal to $y - \varphi Q - p$:

$$u(y-\varphi Q-p) + \sum_{t=1}^{\infty} u(y-\varphi Q)\delta^t > 0 \qquad (2)$$

Or, the initial period disutility of purchasing the appliance must be outweighed by the utility gain when the appliance is saving energy. In most cases willingness to pay is higher without liquidity constraints than with them. For example, if $\delta = 1/R$, a liquidity constraint always decreases demand. Jensen's inequality implies that inequality 2 is not satisfied at the maximum willingness to pay for the unconstrained consumer (p* from equation 1). Intuitively, a lump-sum payment for the appliance reduces utility more than when the consumer could use savings or borrowing to spread out the cost of the appliance.[2]

With present bias the consumer maximizes a slightly different utility function (assuming the β-δ formulation of (Laibson 1997; O'Donoghue and Rabin 1999):

$$u(c_0) + \beta \sum_{t=1}^{\infty} u(c_t)\delta^t$$

[2] An exception holds when the market interest rate is far above the consumer's impatience ($R \gg 1/\delta$) the specification is available upon request.

Here future benefits in period $t > 0$ are discounted not just by δ^t, but also by an extra term β (< 1). A consumer with present bias will purchase the appliance if her expectation of her future utility is positive:

$$u(y - \varphi Q - p) + \beta \sum_{t=1}^{\infty} u(y - \varphi Q)\delta^t(1 - \psi)^t > 0.$$

The implied willingness to pay is always lower than without present bias because β (which is less than unity) multiplies the summation of expected future benefits. Importantly, the disutility of paying future time payments is also discounted by β. Thus, present bias need not reduce willingness to pay using time payments.

Experiments in the field has found strong evidence that time payments raise willingness to pay for nontraditional cookstoves. A related experiment in urban Kampala using a charcoal stove, finds 26% of consumers who were offered four equal time payments- over a month period to pay for their stove- purchase the stove. This is more than a six-fold increase for consumers randomly selected to receive the sales contract without time payments, who purchased the stove 4% of the time (Levine et al. 2013). Further, the same stove used in this intervention- the Envirofit G3300- successfully sold more than 80,000 stoves at a for-profit purchase price of ~US$28 in Southern India where users pay for the stove in time payments of six to eight months (Gomes 2009). But, little formalized research exists how much access to micro-credit increases adoption of nontraditional cookstoves. We therefore hypothesize that a sales offer with time payments will increase willingness to pay and sales, especially for consumers with liquidity and/or credit constraints. If so, by simply addressing these barriers, large markets of poor people previously disregarded by the private sector, may indeed by profitable.

Intrahousehold externalities & consumer demand: Numerous studies provide evidence that women are more likely to invest in children's health than men (Thomas 1990, Duflo 2004). As a result, when selling preventative health products targeting females may be important for adoption. In related research in Southern Ethiopia, colleagues find women are 0.47 times less likely ($p<0.05$) to pay for insect treated bednets in Malaria affected areas than men (Gebresilassie and Mariam 2011). But if women cannot make independent choices, public policy may not be able to exploit gender differences in preferences to promote technology adoption without broader social change.

The 2013 UNDP Human Development Report ranks Uganda 110 in the Gender Inequality Index, and as a low human development country with a relatively high gender inequality value of 0.517 (Malik 2013). Evidence of systematic disadvantages for women in Uganda indicate they will face tighter liquidity constraints and have a smaller overall budget rendering them overall less powerful, and thus we posit that even if they make decisions about large household purchases or earn their own income the effect will be considerably counteracted by gender bias.

In related research in Mexico, colleagues experiment with testing how market segmentation affects unbanked customers access and use of formal financial services (Faz and Breloff 2012). They find regular income is an important driver of savings, supporting our hypotheses participants with a stable income will be less liquidity and credit constrained and should have a positive effect on willingness.

Further, bottom of the pyramid consumers, often confronted with multiple competing needs, may have difficulty prioritizing investment in one welfare improving technology over another. Related research studying women's perceptions of health risks from household air pollution due to cookstoves in Bangladesh finds that while 94% of respondents believe that indoor smoke is more harmful than dust from sweeping, the majority also believe that smoke is less harmful than polluted water (76%) and spoiled food (66%) (Mobarak et al. 2012). Given the experimental evidence and high gender inequality in the local setting, we posit gender, wealth and stable income will have a large effect on willingness to pay.

3. Background

Uganda is one of the poorest nations in the world, the infant mortality rate is 54 per 1000 live births and the literacy rate for 15–24 year olds is 76% (Uganda Bureau of Statistics and ICF International Inc. 2012). The annual gross national income (GNI) per capita is $1,120 purchasing price parity 2012 international US$ (World Bank Group 2013). The main economic activity in the Mbarara region is subsistence farming, particularly agricultural crops including matooke, irish potatoes, and millet, as well as raising livestock. Rural households are on average poorer than urban counterparts and have low rates of electrification- 5%, and simple floors for their homes—81% have floors made of earth or dung (Uganda Bureau of Statistics and ICF International Inc. 2012).

Traditional cooking practices in rural Uganda. The use of solid fuel in rural Uganda is almost universal- 98% of households use solid fuel for cooking, 85% of whom cook with wood (Uganda Bureau of Statistics and ICF International Inc. 2012). In our sample 95% of households report the primary fuel used for cooking is wood, 3% use charcoal, and 2% use wood and charcoal. When asked if they buy and/or collect wood for cooking last week or month- 30% of our households report buying, 85% report collecting wood, and 21% report both buying and collecting wood. Almost all families cook on a traditional three-stone fire, usually located within an enclosed kitchen or cooking hut- 73% of households own exclusively three-stone fires, 12% own charcoal stoves, 11% have built in mud stoves, and 4% report owning another type of stove (Table 3). In a second related study we conducted in neighboring parishes in the Mbarara district where we visited a sub-sample of households' kitchens, 62% of households had totally enclosed kitchens with no windows and 38% had semi-enclosed kitchens with at least one window (Harrell et al. 2013). Poor ventilation and inefficient combustion of traditional cookstoves result in high levels of household air pollution exposure for household cooks and their accompany children- an average of 1018.94 $\mu g/m^3$ over a 24 hour period, prior to receipt of the nontraditional cookstove. This is about thirty times the U.S. Environmental Protection Agency's (EPA's) maximum 24-hour PM2.5 recommended hourly average of 35 $\mu g/m^3$ (Harrell et al. 2013; US EPA 2012). In that same sample, Women and girls are the primary cooks and cook 9 hours in an average 24-hour period (Harrell et al. 2013).

Justification for selection of Mbarara Region. The Mbarara region was chosen because it best fit criteria consistent with testing the product in a rural area. In particular, at the time of the experiment, almost all families cook on a traditional three-stone fire, there is no active nontraditional cookstove intervention nor nontraditional cookstoves for sale in the local markets, it is less than a day's travel from Kampala,

and local leaders indicated that wood is relatively scarce (Beltramo, Harrell, and Levine 2012).[3] Figure 1 provides a map of the parishes and study zone.

4. Methods

After a six month feasibility study which trialed four different stove types, the wood-burning Envirofit G3300 was selected by the community to be used in this experiment (Beltramo, Harrell, and Levine 2012). The Envirofit is a rocket stove, which (when operated correctly) achieves more efficient combustion of fuel and the manufacturer laboratory results cite the Envirofit G3300 reduces fuel consumption by half and household air pollution by 51% compared to a traditional three-stone fire. The manufacturer also reported a product lifespan of 5 years (Beltramo, Harrell, and Levine 2012). Participants in our feasibility stage liked the Envirofit G3300 because it uses little wood, produces little smoke, is portable, lights fast, and the concentrated flame makes the stove both safer and faster in cooking time than a traditional three-stone fire (Beltramo, Harrell, and Levine 2012).

The Centre for Integrated Research and Community Development (CIRCODU), an NGO based in Kampala that specializes in market research related to household energy, acted as the in-country data collection and sales team partner. To mobilize the community to attend our meetings, the initiative worked with the local Community Development Officer, a quasi-governmental official who specializes in mobilizing local communities, and who was charged with recruiting a focal point person in each parish. The focal point person was paid a small fee to spread the word about the upcoming sales meeting and to gather roughly 60 people to a meeting on an agreed upon date.

Based on power calculations and the minimum detectable effect for the experiment testing marketing messages a total of 36 parishes in rural Uganda were selected to participate in the experiment. A parish is an administrative unit that covers a handful of villages and typically has about 5000–6300 residents. This experiment was relatively large and using the most conservative representative population estimate per parish (n=5000), these 36 parishes represent slightly more than half a percentage of the total population of Uganda in 2013 (CIA World Factbook 2013).

As participants arrived to the meeting, they were randomly selected to into four groups which corresponded to one of four marketing messages: (1) on health (2) saves time and money (3) both of the above; and (4) control group with neither messages. The final group engaged in a group discussion on cooking and gave feedback on the new stove while the other groups received their marketing message. Upon arrival each participant took a survey detailing their cooking practices—how many people they cook for, type of stoves owned, fuel used, etc.—, socio-demographic information- age, gender, marital status, employment and income earned, assets owned- including number of mobile phones in household, number of cows owned, if household owns a bicycle, motorcycle, car, TV, radio. In addition to assess intrahousehold bargaining power, participants were asked who in the household usually makes decisions about purchasing major household items. Table 3 details the summary statistics of participants. The meeting next included a live cooking demonstration with the nontraditional stove

[3] Wood is more scarce in some northern parts of Uganda, but those districts proved too far of a distance with poor road infrastructure to work in.

detailing how the stove worked. The participants were then given a description of how the second-price auction worked and given a chance to ask questions. In each parish we ran two second-price auctions for the Envirofit G3300 which differed by sales contract offered. The first auction was a pay within a week auction, which required participants to pay the second-highest bid for the stove within a week of the auction. The second auction includes time payments and required the winner to pay the second-highest bid for the stove in four equal weekly installments. Each of the two auction's winners was required to leave a deposit that same day- a minimum of which was equivalent to ~25% of the price paid, but a larger deposit could be paid at the discretion of the winner. Participants were then separated into the four groups and given the marketing messages. At the end of the marketing messages, each individual participant was separated from the group and given a second survey asking them to bid on each of the two auctions. After revealing the auction outcomes, the sales team collected deposits from the two winning bidders, one for the pay within a week offer and one for the auction with time payments. Finally, participants were invited to taste the meal cooked—matooke and beans—from the nontraditional stove during the demonstration. The pay within a week purchasers then had seven days to bring the rest of their money to the pick-up location and receive their stove. Winners of the time payments auction paid the remaining sum (after the deposit) in four weekly time payments to the focal point person. Over the following months, the focal point person in each parish collected time payments and recorded payment rates, late payment rates, return rates, warranty repair rates, and default rates.

These self-reported survey results may be biased for several reasons. Due to fairness restrictions only one participant per household was allowed to bid in the auctions, though our research team report that frequently participants arrived with family members. For the initial survey, efforts were made to enumerate participants as separate from the group as possible. However due to curiosity of other participants and family structure, some participants were surveyed within earshot of other household and/or community members. Respondents who know others, especially their spouse, are listening may be more likely to indicate that decisions about household purchases are made jointly, even if in practice this is not the case. We are unable to control for this effect as we do not have a consistent measure if a participant is accompanied by other household members.

Overview of marketing messages. A key lesson from the randomized direct mail field experiment of loan offers in South Africa verifies a central premise of psychology—context matters—and suggests that pinning down which effects matter most in particular market settings require systematic field experimentation (Bertrand et al. 2010). As a result, during the six month feasibility stage three messages were designed and tested specifically for the local setting and for the Envirofit G3300 including the nontraditional cookstove can: 1). "improve health" by reducing kitchen level concentrations of household air pollution, 2). "save time and money," and 3. is "aspirational," modern, and an indication of high status.

To determine which two messages were the most effective, the team held six focus groups with a total of 66 participants. In each focus group the order of messages delivered was randomized and at the end of all three messages each participant was asked in private to rank the messages in order of most to least persuasive. Each marketing message contained information in the words of a local woman who had trialed the Envirofit G3300 in her home during the feasibility stage. Each message was presented

using a combination of vivid photos and local women's personal experience with the Envirofit G3300. The team referenced back to each message's photos to ensure that each person remembered each individual message before ranking them. Based on the outcomes of the focus groups, the top ranked marketing message was "improves health," though "saves time and money" was a close second. As a result, these two most popular messages were used in the willingness to pay experiment.

The marketing message related to health includes: "Smoke from the cookfire is poison. It makes you feel light-headed or dizzy, makes you cough, and can cause sore eyes or a sore throat from the smoke. Smoke from cookstoves causes serious diseases including pneumonia and bronchitis. These diseases from cookstove smoke caused as many child deaths in Uganda as malaria" (Appendix 1: Marketing Messages). To increase attention to health effects a shock technique common in many anti-smoking campaigns was used and one of our posters presented a picture of a baby with a cigarette superimposed on its lips. These methods are controversial, but given results that many researchers find health messages a poor motivator for purchase of preventative health products, this vivid representation of the ills of household air pollution was used in an effort to increase effect of the health message.

The marketing message related to saving time and money also focused on being concrete and vivid. During this message an actual physical pile of wood needed to cook an average lunch meal was shown for both the traditional three-stone fire and the Envirofit G3300. In addition, two actual experiences from households who used the Envirofit G3300 during the feasibility stage were included. According to one woman with two children the nontraditional cookstove cut their fuel-gathering time in half and specifically the marketing message detailed the household saved 40 free hours per month and 480 hours per year. Similarly, concrete fuel savings from a family who bought fuel and trialed the nontraditional cookstove was also cited. (Appendix 1: Marketing Messages).

Measures of Barriers

Information: To test the effect of information as a barrier to product adoption we first test if the mean (and median) willingness to pay for the four marketing messages are equal using a joint significance F-test (Table2). In addition, to test if message groups differ in other attributes related to the deposit, # of winners, and by highest bidders. Additional F-tests are run to test the mean (and median) deposit, count (and percentage) of winners by auction type, and count (and percent) of bids above $10US. The $10 threshold is chosen because this purchase price represents the top 10% of the population's bids, for the pay within a week auction.

Next using OLS several regression specifications test if being randomly selected to receive one or both of the marketing messages predicts willingness to pay (Table 4). We posit the willingness to pay of participant *i* under sales offer *s* at meeting *m* is a function of whether the participant receives a specific marketing message *n*:

$$WTP_{ims} = Message_{imn} + FE_{im} + \varepsilon_{ims} \qquad (3)$$

In all specifications control variables or fixed effects (indicated by FE_{im}) include: whether the household collected wood for cooking last week or month, if the household bought wood last week or month, the

number of people who ate lunch yesterday at the household (including a dummy variable for those who do not cook lunch yesterday), and parish fixed effects.

Specification (3) is run with two different subsets of message groupings- (3a) and (3b). The first specification (3a) includes all four original message groups.

$$Message_n = \{No\ Message_1 + Health\ Only_2 + Saves\ Time\ \&\ Money_3 + Both\ Messages_4\} \quad (3a)$$

To test the two main effects next of either receiving one or both messages specification (3b) consolidates the messages into three groups.

$$Message_n = \{No\ Message_1 + Health\ Only\ or\ Both_2 + Saves\ Time\ \&\ Money\ or\ Both_3\} \quad (3b)$$

Results are displayed in Table 4.

Liquidity and Credit Constraints and Present bias: To test if liquidity and credit constraints and or present bias are barriers to willingness to pay, Table 1 presents the result of the single difference between the mean willingness to pay of each auction type. In addition, Tables 4–6, test willingness to pay across both auction types separately. We expect that richer people will be subject to lower budget constraints and buy more of new things, including new stoves. Thus, it is likely those who already have more assets to have a higher propensity to purchase the new stove. This theory implies the willingness to pay of household *i* under sales offer *s* at meeting *m* is:

$$WTP_{ism} = \Sigma_j \gamma_j X_{sjm} + \delta\ wealth_{ism} + \Sigma\ \alpha_m FE_{im} + \text{with } \delta > 0. \quad (4)$$

Wealth is proxied by an asset index index that counts the number of items households report owning- including at least one of each of the items including: mobile phone, cows, a bicycle, motorcycle, car, TV, and radio.

To test how willingness to pay is affected by wealth Table 5 and 6 display the results of the OLS specification (5) where we posit the willingness to pay of participant *i* under sales offer *s* at meeting *m* is:

$$WTP_{ims} = Asset_{ims} + FE_{im} + \varepsilon_{ims} \quad (3)$$

Intrahousehold bargaining power & women's autonomy

To test if women have less power than men in household purchase decisions of nontraditional cookstoves, we measure two dimensions of *woman's power*$_i$. We asked participants: "Who usually makes decisions about purchasing major household items?". And second we proxy woman's power by gender of the participant.

Among the sample of women who are married, we test the effect of those who report making joint household decisions. In total, of the 2297 participants who took the demand response survey 80% are married (n=1823). And, of those married, 15% report that women are the main household decision makers, of which 90% (n=243) are women respondents. (In robustness tests we check if it matters if the husband or wife is reporting who makes decisions.)

We posit that due to the stove having more value to women willingness to pay of household *i* under sales offer *s* at meeting *m* would increase if a married woman makes decisions about purchases for household durable goods. We posit that women due to intrahousehold bargaining power will bid less on the nontraditional cookstove.

Table 5 tests willingness to pay of household *i* under sales offer *s* at meeting *m* is:

$$WTP_{ims} = woman's\ power_{im} + Asset_{im} + FE_{im} + \varepsilon_{ims} \quad (6)$$

We hypothesize that a woman participant who earns a stable cash income will be more likely to have control over household expenditure and may bid higher than those women that do not. To test this hypothesis participants are asked a series of questions related to their income. If they earn income, how are they paid for their work—cash only, cash and in-kind, in-kind only, or not paid? If employed, are they employed by a family member, non-family member, or self-employed? What length of time are participants employed—all year, seasonally, or occasionally? Next, stable income is defined for participants who earn year-round income at least partly in cash. We posit that due to the stove having more value to women willingness to pay should increase if a married woman makes decisions about purchases for household durable goods or if women have their own independent income.(In robustness tests we check if it matters if the respondent is the primary cook.)

To test the effect of the woman's power and stable income on willingness we run OLS regression specification (6) and test separately by auction type indicated by sales offer *s* at meeting *m*. Results are displayed in Table 5.

To see if the stable income hypothesis holds for the wider population including both women and men we test is a participant who earns a stable cash income will be more likely to have control over household expenditure and may bid higher than those who do not. We posit that participants with stable income of household *i* under sales offer *s* at meeting *m* would increase for the pay within the week auction.

$$WTP_{ims} = stable\ cash\ income_{im} + Asset_{im} + FE_{im} + \varepsilon_{ims} \quad (7)$$

Results of specification (7) are presented in Table 6.

5. Results

Descriptive Statistics

Across the 36 parishes 2355 people attended the meetings and 2297 participated in the initial survey (Table 1, Figure 1). Overall 70% of participants are women. Of those who took the survey, 2125 (93%) bid in the pay within a week auction and 2135 (93%) bid in the time payments auction. The main reasons participants gave for not bidding was that some participants came out of curiosity but had no intention of buying a stove. In addition, one household refused to give informed consent and did not take the survey. Failure to bid was uncorrelated with treatment status.

We held two second price auctions in each of the 36 parishes, or a total of 72 auctions. In 20 auctions there was a tie among the winning bids and in this case both winners were given the opportunity to buy the stove. There were 47 stoves purchased in the pay within a week auction and 45 in the time payment auction.

We dropped twenty-eight observations of initial auction winners that refused to pay, as this refusal is evidence they were bidding above their true willingness to pay. Failing to removing these outliers would upwardly bias the means of each auction offer.

Summary statistics

Most participants are female (71%), married (80%), and report earning income (87%, Table 3). The majority of participants report being self-employed (78%), being paid in cash only (64%), and being employed all year round (63%). The participants in this study own relatively few assets. 89% of participants own a radio, 5% own a television, and 2% own a car. 70% of respondents have at least one mobile phone in the household and 29% report owning cows (Table 3). The mean of the basic asset index that counts the number of seven items owned- include at least one mobile phone, a positive number of cows, a bicycle, motorcycle, car, TV, and radio- is 2.5 and the median is 3. The average age of the participant is 49 and 46% of participants are 40 years of age or more (n=1051 participants), while 12% are between the age of 14-24 (2% are 14-19 years of age).

Almost all participants (95%) primarily cook with wood and almost as many (85%) collect wood themselves. At the same time, 30% report buying fuel last week or month. Most households (73%) only have a three-stone fire—73%, while 12% also report owning a charcoal stove, and 11% also own a mud stove. 70% of respondents are the primary household cooks, all of which are female.

When asked “Who usually makes decisions about purchasing major household items?”, among married households 55% respond both wife and husband jointly, 29% husband only, and 15% wife only.

Among female respondents, 68% report earn some cash, but only 35% earn annual income and are paid at least partly in cash, while only 8% are employed by non-family and paid at least partly in cash.

Table 2 reports the average bid by message group. Some socio-demographic and variables related to cooking do differ by message group. To test if the socio-demographic and variables related to cooking jointly predict marketing message group a multinomial logit is run and the F test is not significant, and we conclude the variation among groups is not significant. There is no evidence against appropriate randomization into the four marketing groups.

Results

The demand curve for the two auctions is presented in Figure 2. The mean willingness to pay was $4.86 for the pay within a week auction and $6.83 for time payments.[4] One local stove distributer of the

[4] The official exchange rate from Ugandan Shillings to US $ at the exchange rate of 2515 Uganda Shillings to 1 US $. The exchange rate is the official quarterly exchange rate from the United States Treasury's report, “Exchange Rate for March 31, 2012", available at: http://www.fms.treas.gov/intn.html.

Envirofit G3300, UpEnergy, estimates the retail price in other districts in Uganda was near $19 at the time of this experiment. Only 1.5% of the pay within a week auction and 4.5% of time payments equaled or exceeded that retail price.

Marketing messages have no consistent effect on willingness to pay

Neither marketing message- the stove can improve health or the stove can save time and money- consistently increased willingness to pay. Though, the health message sometimes increased willingness to pay for cash-and-carry payment auctions. Table 2 displays the results of the joint significance F-tests by message group and auction type. There is no statistical difference in mean or median for the auction with time payments by message groups. For the auction with time payments the mean bid for the group which received no message was $6.73, which is slightly lower than the group which received the 'improves health' message ($6.82), the group which received the saves time and money" ($7.17), but slightly higher for the group that received both messages ($6.61). None of these differences approach statistical significance.

For the pay within a week auction, there is a significant effect of the "improves health" message whose mean of 5.50 ($p<0.01$) is larger than the means of the other groups ($F(3,2121)=5.22$, $p<0.01$). The mean bid for the group which received no message is $4.58, is lower than the group which received the 'improves health' message ($5.50, $p<0.01$), and the group which received both messages ($4.88), but slightly higher than the mean bid for the group which received the saves time and money" ($4.47).

The mean deposit shows no effect of marketing messages for both auction types (see Table 2 Column 4's insignificant F-test results: $F(3,43)=0.91$ and $F(3,41)=0.15$). For the pay within a week auction and auction with time payments, there is a positive statistical difference in the mean for the count of winners by auction type- $F(3,2121)=2.32$, $p<0.10$; ($F(3,2131)=2.58$*, $p<0.10$)- showing a significantly larger number of winners who received the "improves health" message. Further, the analysis of variance revealed significant differences by message group for the count of bids above $10. For the pay within a week auction there is a positive statistical difference for the count of bids above 10US$ for the "improves health" ($F(3,2121)=2.32$, $p<.10$) message group and the group which received both messages ($F(3,2121)=8.80$, $p<0.01$). For the auction with time payments, the group which received the "improves health" message has a higher count of bids above 10US$ ($F(3,2131)=1.04$, $p<0.05$).

Turning to regression results, Table 4 column 1 corresponds to the specification (3), where the 4 message groups are kept separate. For the pay within a week auction, the health message only has a statistically significant positive effect on willingness to pay- a 19% increase on the average bid. For the same specification (3) for the auction with time payments, however, there is no statistically significant effect of any message groups on willingness to pay (Table 4 column 3).

For specification (3) which consolidates the main results into three message groups- No message, 'Improves health' or both, and 'Saves time and/or money' or both messages- for the auction with time payments results remain unchanged (Table 4 column 4). For the pay within a week auction, now the group received either "improves health" or both messages has a positive increase on willingness to pay, a 13% increase ($p<0.01$). Table 4, column 5 shows the percent increase of the time payments auction

compared to the pay within a week show a 17% greater effect of health message on pay within a week offer than time payments offer ($p<0.01$). Given this result is not consistently significant, the effect is assumed small relative to other predictors of willingness to pay.

In all specifications control variables including: whether the household collected wood for cooking last week or month, if the household bought wood last week or month, the number of people who ate lunch yesterday at the household, and parish fixed effects have been included. Parish fixed effects are consistently statistically significant at the 1% across all specifications while household bought wood last week is significant for the time payment auction at the 10% level.

Time payments increase willingness to pay substantially

Including time payments resulted in a significant increase in willingness to pay (Table 1). The average bid for the pay within the week auction was 41% lower (mean = 4.86, SD = 4.65) than the bid for the pay within the week auction (mean = 6.83, SD = 6,38). This difference was statistically significant $t(4258)=-11.52$, $p<0.01$).

For the pay within a week auction (n=2125) the average bid was $4.86 (median $3.98) and only 8% bid more than $10 (Table 1 and Figure 2). The mean winning bid for the stove was $15.78 and the average price paid for the second highest bid was $12.87.

For the auction with time payments the average bid was $6.83 (median $4.77) and 16% of participants bid more than $10 for the stove (Table 1 and Figure 2). The average winning bid was $23.03 and average second price paid was $16.78. All differences between the auction types are highly statistically significant.

The average deposit paid was $5.61- or 44% of the total price, notably higher than the minimum bid of 25% of the purchase price necessary to leave. For the pay within a week auction 8.5% returned their stoves after purchase and 4.3% defaulted (that is, they neither returned their stove nor completed payment a week later, Table 1). For the time payment auction, 15.6% returned their stoves and 8.9% defaulted (Table 1).

Women have significantly lower willingness to pay

We next turn to the correlational analyses. Not surprisingly wealth, proxied by the count of seven assets owned, predicts higher willingness to pay. In the pay within a week offer each additional asset owned predicts an increase in willingness to pay of 51 cents or a 10% increase of the average bid ($p<0.01$, Table 6 column 2). Similarly in the auction with time payments each additional asset owned predicts a $0.67 higher bids in the time payments auction, also equivalent to 10% increase of the average bid ($p<0.01$, Table 6 column 4). Notably, wealth effects are stable and positive- 10% increase per asset owned- across both auction types.

The test of *woman's power*$_i$, has different effects when proxied by respondent is female and women participants who report they are the joint decision makers in married households. Among married households, female respondents bid about 23% less than men (-$1.124 $p<0.01$, Table 5) for the pay

within a week auction and 21% less than men for the auction with time payments (-$1.417, p<0.01, Table 5).[5]

The test of *woman's power*$_i$, outlined in specification (6) for the restricted sample of married households only, shows no statistically significant effect for women participants who report they are joint decision makers with their husbands in durable good purchases (Table 5, column 2 for the pay within a week and column 6 for the auction with time payments). A robustness test is conducted to check if it matters if the husband or wife is reporting who makes decisions and there is no observable difference. In addition, we test if the respondent is the primary cook effects willingness to pay. Table 5 column 4 and 8 show the results for the respondent is the primary cook for the two auction types has no effect. Though for this specification in both auction types the coefficient on participant is female is the largest for all four specifications represented in Table 5 corresponding to a 25% drop in willingness to pay for the pay within the week auction (B=-1.236, SE=0.423, p<0.01) and a 21% decrease for the auction with time payments (B=-1.454, SE=0.576, p<0.05).

For the restricted sample of married households only there is a large negative effect on willingness to pay for both auctions for those who report their household did not cook lunch yesterday. For the pay within the week auction if the household did not cook lunch yesterday this lowered the mean bid between 22-23% depending on the specification (Table 5 columns 4 & 2, B=-$0.758 and -$1.136, SE=0.374 and 0.385, p<0.01) and by 8-15% of the mean bid for the auction with time payments (Table 5, columns 8 & 6, B=-$0.567 & -$1.002, SE=0.504 and 0.520, p<0.10).

Table 6 reports that having a stable income (specification 7) has a positive statistically significant effect on both auction types. For the pay within a week auction having a stable income raises the average willingness to pay by 10% (B=0.501, SE=0.207, p<0.05) and for the auction with time payments by 8% of the average bid (B=0.562, SE=0.283, p<0.05). Age has no effect on willingness to pay (Table 6). Similar to all other regressions parish fixed-effects are positive and statistically significant at the 1% level while a dummy variable indicating the household report gathering wood has no effect on either auction (Table 6). The household buys wood does have a positive and statistical effect on willingness to pay for the auction with time payments (p<0.05 or p<0.10 depending on the specification, Table 6 columns 3 & 4 respectively). This result is consistent with our hypothesis that time payments address obstacles to liquidity constraints and that a stable income relaxes liquidity constraints(as in (Faz and Breloff 2012)).

No effect is observed of women with a stable income for the restricted sample of married households in either auction. As the stable income effect is positive and raises willingness to pay 8-10%, but has no effect for women, it is plausible that women have less *ability* to pay than willingness to pay. Results cited above from experiments on preferences and willingness to pay for nontraditional cookstoves in Bangladesh find that women – who bear disproportionate cooking costs – have stronger preference for healthier stoves, but lack the authority to make purchases (Miller and Mobarak 2013). Consistent with this finding, women in our sample own fewer assets and have less stable income than men. Participants report on average that 70% of households own at least one mobile phone, while 54% of women or wives

[5] Men are willing to pay 23(25%) more for the pay within a week auction (auction with time payments) (mean= 5.62, SD=5.98; mean=7.86, SD=7.87) than women (mean=4.55, SD=3.96; mean=6.42; SD=5.62), respectively (Table 1).

of male respondents report owning a mobile phone (Table 3). On average, men disproportionately have report more stable income than women-67% of men surveyed, while 35% of women report a stable income (Table 3). Females also report less household assets - 2.2 on average, versus 2.8 assets reported by men (Table 3). Our findings suggest that if women cannot make independent choices about household resource use and/or lack the ability to pay, public policy may not be able to exploit gender differences in preferences to promote technology adoption without broader social change.

Robustness checks: Do bids reflect true willingness to pay?

While we analyze the bids as measures of true willingness to pay, we know this is not true. First, 28 winning (that is, very high) bidders refused to pay. Second, our qualitative researcher reported that some respondents who knew they would not win bid zero. Third, it is likely that many other bidders used a general bidding heuristic to shade their stated willingness to pay (as in (Guiteras et al. 2013)).

If the second-price auction induces truthful willingness to pay, then it will predict demand with a posted price. There are mixed results from the experimental literature (Coppinger, Smith, and Titus 1980; Hoffman et al. 1993; Lusk et al. 2001; Noussair, Robin, and Ruffieux 2004). To compare how the demand curve from the second price auction (Figure 2) predicts purchases with a posted price, we compared sales offer with a posted price in a second sales study in neighboring villages within Mbarara using the same nontraditional cookstove. The populations are very similar in observable characteristics (Harrell et al. 2013). In ten parishes we offered the same pay within a week sales offer as in our auction experiment.

The auction results suggested that at a stove price of $12, 4% of consumers would buy the stove.[6] We held two sales meetings (n=63 participants) at that price and 35% of participants purchased the stove (t-test of difference in means $p<0.01$).

We then raised the price to $16, where our auction implies 2.25% of participants would purchase the stove. At the price 8 sales meetings with this price, 5% of participants purchased the stove (n=349, t-test of difference in means $p<0.01$).

These findings are not conclusive because the sales meetings for the two studies took place a few months apart and because the parishes with the auctions were not chosen randomly, but were slightly more remote from the main roads (which presumably lowered the ability to pay slightly). At the same time, these results are consistent with other field experiments where many consumers underbid their true valuation. While cautionary, unless the under-bidding is correlated with the experimental treatment, we do not believe it biases our main results.

6. Conclusions

We have three main results:

1. Our randomized trial finds no consistent evidence that information on how the nontraditional stove can improve health or can save time and money improved willingness to pay;

[6] United States Treasury, “Exchange Rate for March 31, 2012", available at: http://www.fms.treas.gov/intn.html.

2. In a within-subject comparison, willingness to pay was 41% higher with time payments than when paying within one week;
3. Our correlational results find that men bid 20% more than women.

It is possible that more vivid or convincing messages about improved health or savings would be effective. Alternatively, messages emphasizing the high status of the new stove or other features of the stove (convenience, safety, etc.), or messages delivered by other sources, might have more impact. Nevertheless, our results suggest that economic barriers are more important than informational barriers.

The large effects of time payments suggest liquidity constraints and/or present bias reduce demand. Thus, broad dissemination of cookstoves (and, presumably other health-related durable goods such as a water filters) will require reducing the transaction costs of collecting payments over time. It is possible that mobile phone payments (see (Luoto and Levine 2014), switching to layaway- where consumers make payments prior to receiving the stove (Guiteras et al. 2013)-, linking with microfinance or others who already collect regular payments, or using a network of local vendors to collect the time payments can reduce transaction costs substantially. More innovation and testing is required to identify effective business models in different settings.

On the one hand, even with time payments only 4.5% of participants bid the market price of $19. This result suggests stoves can only be widely distributed if there are subsidies or substantial reductions in production and distribution costs. On the other hand, in a subsequent experiment, when we combined the time payments with a free trial and had a posted price (not an auction), over half of participants purchased the nontraditional stove for $16 (Levine et al. 2013). Thus, unless transaction costs are very high, it is likely that any subsidy for stoves should be used first to cover the transaction costs of payments made over time before they are used it reduce the purchase price.

The higher willingness to pay of men may be due to low bargaining power of women within the home, or due to other effects (selection of which men attended the meeting, the fact that husbands were often accompanied by wives with whom they could discuss, and so forth). While not definitive, this result suggests the importance of marketing durable products that women use (such as cookstoves) to both husbands and wives. This result is also consistent with the hypothesis that willingness to pay for a nontraditional stove will increase if the new stove includes additional features particularly valuable to men.

For example, we piloted the BioLite HomeStove during the feasibility stage of this study (before the HomeStove came on the market in 2013).[7] In addition to the household air pollution benefits to women cooks and her accompanying children, the BioLite HomeStove has a unique attribute- it generates electricity from incomplete biomass combustion allowing the added benefit of charging mobile phones, and/or using LED lights simultaneously while cooking. Many men in our focus groups were very interested in this stove, largely because it could also charge a mobile phone. The BioLite HomeStove is

[7] The side-fed stove design, which among biomass cookstove designs, is one of the most efficient at reducing household air pollution, reduces carbon monoxide by 91% (laboratory results, see BioLite HomeStove webpage).

currently being sold in Uganda at a price of $40, and at present the stove is on back order. Additional experiments are needed to test how much the option of charging a phone increases willingness to pay for nontraditional cookstoves among men and women respectively. This research provides evidence to successfully market health improving products, like cookstoves, which primarily benefit women (and her accompanying children), product demand will increase if attributes are included which particularly appeal to men.

Our study exemplifies the fact that, for all of its benefits, technology alone often cannot solve problems. Investments in life-improving technologies, such as cookstoves and water filters, must be accompanied by continued research in the factors that influence human adoption and use of those technologies. Our study provides both confirmation of this challenge and hope that it can be overcome.

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Table

Table 1: Overview of outcome by auction type (bids in US $)

General summary statistics	**N**	**%**		
HH's that took Demand Determinant Survey	2297	100.0		
Count of female participation	2297	70.4		
HH's that bid on Pay Within a Week Auction	2125	92.5		
HH's that bid on Time Payment Auction	2135	92.9		
Pay Within a Week Auction Offer	**N**	**Mean**	**S.D.**	**Median**
All bids	2125	4.86	4.65	3.98
Bids by females	1509	4.55	3.96	3.98
Share of bids >$10	2125	8.3%		1
Winning bids	47	15.78	8.56	15.90
Second price paid	47	12.87	5.07	11.93
Deposit paid for stove	47	5.61	4.37	3.98
Stoves returned: percent of stoves sold	47	8.5%		
Defaults: percent of stoves sold	47	4.3%		
Average % of winning bid paid prior to default		35.4%		
Time Payment Auction Offer	**N**	**Mean**	**S.D.**	**Median**
All bids	2135	6.83***	6.38	4.77
Bids by females	1517	6.42***	5.62	3.98
Share of bids >$10	2135	15.7%**		
Winning bids	45	23.03***	14.95	19.88
Second price paid	45	16.78***	6.38	15.90
Deposit paid for stove	45	5.06	2.77	4.77
Stoves returned: percent of stoves sold	45	15.6%		
Defaults: percent of stoves sold	45	8.9%		
Average % of winning bid paid prior to default		24.8%		

Notes: The intention to treat sample or the number of participants on the Master Roster who initially registered upon arrival the day of the meeting is 2,355. The "households (HH's) that took Demand Determinant Survey" and "# female participants" are from the survey entitled "Demand Determinants". The remaining statistics are from the "Bid Record survey". This sample drops twenty-eight observations of initial auction winners who refused to pay the second-highest bid. There were 36 of each auction type. The # of winners >36 due to tie bids. In the event of a tie both bidders were given the opportunity to purchase the stove at the second highest price. Percent of stoves returned and defaults represent percent of total stoves purchased by auction type. All auction bids have been converted from Ugandan Shillings to US $ at the exchange rate of 2515 Uganda Shillings to 1 US $. The exchange rate is the official quarterly exchange rate from the United States Treasury's report, "Exchange Rate for March 31, 2012", available at: http://www.fms.treas.gov/intn.html. As a result, all amounts for Mean, S.D. and Median are in US $.

Significance of t-tests, from difference of means between auction offer types, is denoted by:* at the 10% level ** at the 5% level, and *** at the 1% level.

Table 2: Marketing message and bids for auctions (in US$)

Pay Within a Week Auction Offer							
Marketing message received	**N**	**Mean bid (S.D.)**	**Median bid**	**Mean deposit (S.D.)**	**Median deposit**	**Count and percentage of winners by auction**	**Count and percent of bids above 10US$**
No Message	546	4.58 (4.82)	3.98	6.26 (3.69)	5.96	10 21%	26 5%
Saves Time & Money	513	4.47 (4.14)	3.98	5.14 (5.43)	5.96	7 15%	34 7%
Improves Health	525	5.50*** (5.22)	3.98	6.45 (4.67)	3.98	19** 40%	68*** 13%
Time, Money & Health	541	4.88 (4.28)	3.98	3.87 (3.64)	1.99	11 23%	49*** 9%
Joint F-test	F	(3,2121) =5.22***		(3,43) =0.91		(3,2121) =2.32*	(3,2121) =8.80***
Time Payment Auction Offer							
Marketing message received	**N**	**Mean bid (S.D.)**	**Median bid**	**Mean deposit (S.D.)**	**Median deposit**	**Count and percentage of winners by auction**	**Count and percent of bids above 10US$**
No Message	544	6.73 (6.87)	4.77	5.28 (3.57)	4.97	9 20%	73 14%
Saves Time & Money	535	7.17 (6.38)	5.96	4.76 (2.61)	3.98	20 44%	86 17%
Improves Health	514	6.82 (6.35)	4.77	5.14 (3.61)	3.98	8** 18%	85** 16%
Time, Money & Health	542	6.61 (5.90)	4.77	5.47 (1.30)	5.47	8 18%	92 17%
Joint F-test	F	(3,2131) =0.77		(3,41) =0.15		(3,2131) =2.58*	(3,2131) =1.04**

Notes: from Table 1 are consistent for statistics in this table.
Significance tests: the effect of marketing message relative to the no message group on bid amount, deposit amount, count of winners, and count of individuals bidding more than $10 : *** p<0.01, ** p<0.05, * p<0.10
Joint Significance F-tests: tests if the four market messaging groups are equal: *** p<0.01, ** p<0.05, * p<0.10. For the F-test by message group for the variable Count and percentage of winners above $10 USD , the F statistic is based on the average bid above $10.

Table 3: Summary statistics of household characteristics by message group

	Marketing Message Received				
	No Message	**Saves Time and Money**	**Improves Health**	**Time, Money and Health**	**Total**
Respondent's gender is female	69%	73%	70%	72%	71%
Average age of respondent	39	40	40	39	39
Marital status					
Married (monogamous)**	72%	75%	80%	76%	76%
Widow**	9%	14%	10%	10%	11%
Single (never married)	7%	5%	5%	5%	6%
Married (polygamous)***	6%	4%	1%	5%	4%
Divorced or separated***	6%	2%	4%	4%	4%
Earns income***	96%	83%	78%	92%	87%
How paid					
Cash only***	43%	57%	58%	97%	64%
Cash and in-kind***	55%	42%	41%	3%	35%
In-kind only***	2%	1%	0%	0%	1%
Not paid*	0%	0%	1%	0%	0%
Main employer					
Self-employed***	88%	72%	71%	78%	78%
Non-family member***	10%	11%	13%	21%	14%
Family member***	2%	17%	16%	2%	8%
Length of employment					
All year***	53%	55%	67%	77%	63%
Seasonal***	46%	43%	31%	21%	36%
Occasional	1%	2%	2%	2%	2%
Respondent has annual income & paid partly in cash***	51%	45%	52%	71%	54%
Woman has annual income & paid partly in cash**	30%	31%	30%	50%	35%
Woman employed by non-family & paid partly in cash***	4%	7%	8%	15%	8%
Household own cows	31%	27%	32%	28%	29%
0-5 cows	75%	74%	74%	74%	74%
6-10 cows	13%	17%	16%	17%	15%
11-15 cows	6%	6%	3%	3%	4%
16 or more	6%	3%	6%	7%	6%
I don't know	0%	1%	1%	0%	0%
Household owns phone**	70%	65%	69%	75%	70%
Wife of respondent or women respondent owns phone**	58%	50%	50%	59%	54%
Household owns bicycle	44%	48%	45%	42%	45%
Household owns motorcycle*	12%	8%	10%	11%	10%
Household owns car**	1%	1%	1%	3%	2%
Household does not bike, motorbike, or car	43%	44%	44%	44%	44%
Household owns TV**	6%	3%	6%	6%	5%
Household owns radio	91%	87%	90%	88%	89%
Asset Index (0-7)**	2.6	2.4	2.6	2.6	2.5
Asset Index (0-7) if respondent is male**	3.0	2.8	3.0	2.7	2.8
Asset Index (0-7) if respondent is female**	2.4	2.3	2.4	2.5	2.2

Notes: from Table 1 are consistent for statistics in this table.

Joint Significance F-tests measure if summary statistic is statistically different by marketing message group relative to participant receiving no message group and are denoted by: * at the 10% level ** at the 5% level, and *** at the 1% level.

Table 3: Summary statistics of household characteristics by message group continued

	Marketing Message Received				
	No Message	**Saves Time and Money**	**Improves Health**	**Saves Time, Money and Health**	**Total**
Primary Cooking Fuel Source					
Wood***	98%	93%	93%	96%	95%
Charcoal***	2%	4%	1%	3%	3%
Wood&Charcoal***	0%	3%	6%	0%	2%
Other*	0%	0%	1%	1%	0%
Household buys wood (last week or month)**	30%	33%	25%	32%	30%
Household gathers wood (last week or month)	81%	86%	86%	86%	85%
Household buys and gathers wood (last week or month)***	21%	20%	25%	14%	24%
# of people who ate lunch yesterday (average)	4.57	4.51	4.53	4.31	4.48
Type of stove already owned					
None***	70%	76%	78%	69%	73%
Charcoal stove***	10%	14%	6%	20%	12%
Built-in mud stove***	15%	7%	14%	8%	11%
Other**	6%	3%	3%	4%	4%
Respondent is primary cook***	65%	69%	70%	75%	70%
Who is Primary Cook					
Wife***	86%	87%	92%	84%	87%
Husband***	4%	5%	3%	8%	5%
Children*	4%	4%	2%	3%	3%
Other**	6%	3%	4%	5%	5%
Who is Decision Maker about major purchases (restricted to married HHs)					
Wife & Husband jointly***	55%	57%	42%	67%	55%
Husband***	28%	25%	42%	23%	29%
Wife***	18%	17%	15%	9%	15%
Other	0%	0%	1%	0%	0%

Notes: from Table 1 are consistent for statistics in this table.
Joint Significance F-tests measure if summary statistic is statistically different by marketing message group relative to participant receiving no message group and are denoted by: * at the 10% level ** at the 5% level, and *** at the 1% level.

Table 4: The effect of messages

Coefficient (standard error)	Pay Within a Week Auction		Time Payment Auction		Difference
	y=bid US $	y=bid US $	y=bid US $	y=bid US $	y=% diff
Received message "Saves time/money" only	0.0487		0.631*		
	(0.275)		(0.374)		
Received message "Improves health" only	0.937***		-0.0122		
	(0.266)		(0.368)		
Both messages	0.344		-0.112		
	(0.264)		(0.363)		
Received either "Improves health" only or both messages		0.629***		-0.370	-0.173***
		(0.193)		(0.265)	(0.0176)
Received either "Saves time/money" only or both messages		-0.282		0.260	0.0983***
		(0.193)		(0.265)	(0.0176)
# of people who ate lunch yesterday	0.0145	0.0161	0.0711	0.0727	0.00481
	(0.0487)	(0.0487)	(0.0669)	(0.0669)	(0.00444)
Household did not cook lunch yesterday	-0.254	-0.180	-0.631	-0.552	-0.0575*
	(0.336)	(0.333)	(0.455)	(0.452)	(0.0302)
Constant	8.964***	9.087***	12.62***	12.77***	0.313***
	(0.706)	(0.703)	(0.973)	(0.968)	(0.0641)
Observations	2119	2119	2129	2129	2093
R-squared	0.156	0.154	0.150	0.149	0.102

Notes: In all specifications above additional control variables (not shown) include: whether the household collected wood for cooking last week or month, if the household bought wood last week or month, and parish fixed effects have been included. Only parish fixed effects are statistically significant at the 1% level for all specifications while household bought wood last week is significant for the time payment auction at the 10% level for column 4. The sample size drops from 2125 (2135) participants who bid on pay-within-the-week (time payments) auction due to seven respondents missing data on number of assets owned. Column 7's dependent variable is the percent increase of the time payments auction compared to the pay-within-a-week auction. A dummy variable- Household did not cook lunch yesterday- is included for those households who are reported as missing-# of people who ate lunch yesterday. As a result households missing- # of people who ate lunch yesterday have been imputed to the median. Statistical significance is indicated by * $p< 0.10$, ** $p< 0.05$, *** $p< 0.01$ and standard errors are in parantheses.

Table 5: The effect of gender (sample is married households only)

	Pay Within a Week Auction				Time Payment Auction			
	y=bid US $	y=bid US $	y=bid US $	y=bid US $	y=bid US $	y=bid US $	y=bid US $	y=bid US $
Participant is female	-1.124***	-1.107***	-1.079**	-1.236***	-1.423***	-1.417***	-1.335**	-1.454**
	(0.262)	(0.264)	(0.434)	(0.423)	(0.357)	(0.361)	(0.583)	(0.576)
Woman is decision maker		-0.138				-0.0480		
		(0.316)				(0.431)		
Respondent is primary cook			-0.0565				-0.113	
			(0.440)				(0.591)	
Woman earns year round income at least partly in cash				0.184				0.0186
				(0.502)				(0.682)
Earns year round income at least partly in cash				-0.0898				-0.204
				(0.432)				(0.588)
Asset Index (0-7)	0.474***	0.471***	0.474***	0.473***	0.671***	0.670***	0.671***	0.688***
	(0.0961)	(0.0964)	(0.0962)	(0.0981)	(0.131)	(0.131)	(0.131)	(0.133)
# of people who ate lunch yesterday	-0.00265	-0.00288	-0.00291	-0.00212	0.0838	0.0837	0.0833	0.0859
	(0.0566)	(0.0566)	(0.0567)	(0.0568)	(0.0768)	(0.0769)	(0.0769)	(0.0771)
Household did not cook lunch yesterday	-1.134***	-1.136***	-1.140***	-1.134***	-1.001*	-1.002*	-1.014*	-0.992*
	(0.385)	(0.385)	(0.388)	(0.390)	(0.520)	(0.520)	(0.524)	(0.527)
Constant	8.512***	8.520***	8.526***	8.566***	10.85***	10.85***	10.87***	10.95***
	(0.876)	(0.876)	(0.883)	(0.934)	(1.186)	(1.187)	(1.194)	(1.264)
Observations	1691	1691	1691	1685	1699	1699	1699	1693
R^2	0.167	0.167	0.167	0.166	0.164	0.164	0.164	0.164

Notes: Additional control variables (not shown) include whether the household collected wood for cooking last week or month have no significant effect. Additional control variables (not shown) include if the household bought wood last week or month is significant for the time payment auction at the 10% level and parish fixed effects are statistically significant at the 1% level for all specifications. A dummy variable- Household did not cook lunch yesterday- is included for those households who are reported as missing-# of people who ate lunch yesterday. As a result households missing-# of people who ate lunch yesterday have been imputed to the median. Statistical significance is indicated by * p< 0.10, ** p< 0.05, *** p< 0.01 and standard errors are in parentheses.

Table 6: The effect of stable income and age

	Pay Within a Week Auction		Time Payment Auction	
	y=bid US $	y=bid US $	y=bid US $	y=bid US $
Asset Index (0-7)	0.547***	0.510***	0.714***	0.671***
	(0.0828)	(0.0843)	(0.113)	(0.115)
Earns year-round income paid at least partly in cash		0.501**		0.562**
		(0.207)		(0.283)
# of people who ate lunch yesterday	-0.0171	-0.0172	0.0118	0.0127
	(0.0513)	(0.0513)	(0.0703)	(0.0703)
Household did not cook lunch yesterday	-0.379	-0.349	-0.140	-0.0959
	(0.333)	(0.334)	(0.452)	(0.454)
Household buys wood (last week or month)	0.233	0.196	0.640**	0.599*
	(0.237)	(0.238)	(0.325)	(0.325)
Household gathers wood (last week or month)	0.212	0.259	0.325	0.387
	(0.341)	(0.341)	(0.467)	(0.468)
Age	-0.00534	-0.00548	-0.00795	-0.00822
	(0.00763)	(0.00765)	(0.0104)	(0.0104)
Constant	3.528***	3.328***	4.808***	4.582***
	(0.530)	(0.535)	(0.724)	(0.732)
Observations	2118	2112	2128	2122
R^2	0.021	0.024	0.021	0.023

Notes: A dummy variable- Household did not cook lunch yesterday- is included for those households who are reported as missing-# of people who ate lunch yesterday. As a result households missing- # of people who ate lunch yesterday have been imputed to the median. Statistical significance indicated by * p< 0.10, ** p< 0.05, *** p< 0.01 and standard errors are in parentheses.

Figure

Figure 1: Maps of parishes

The 36 parishes in the Mbarara district are denoted in blue and the red marker is where the data collection team was based in the town of Mbarara. Source: Google maps and GPS data from location of team meetings.

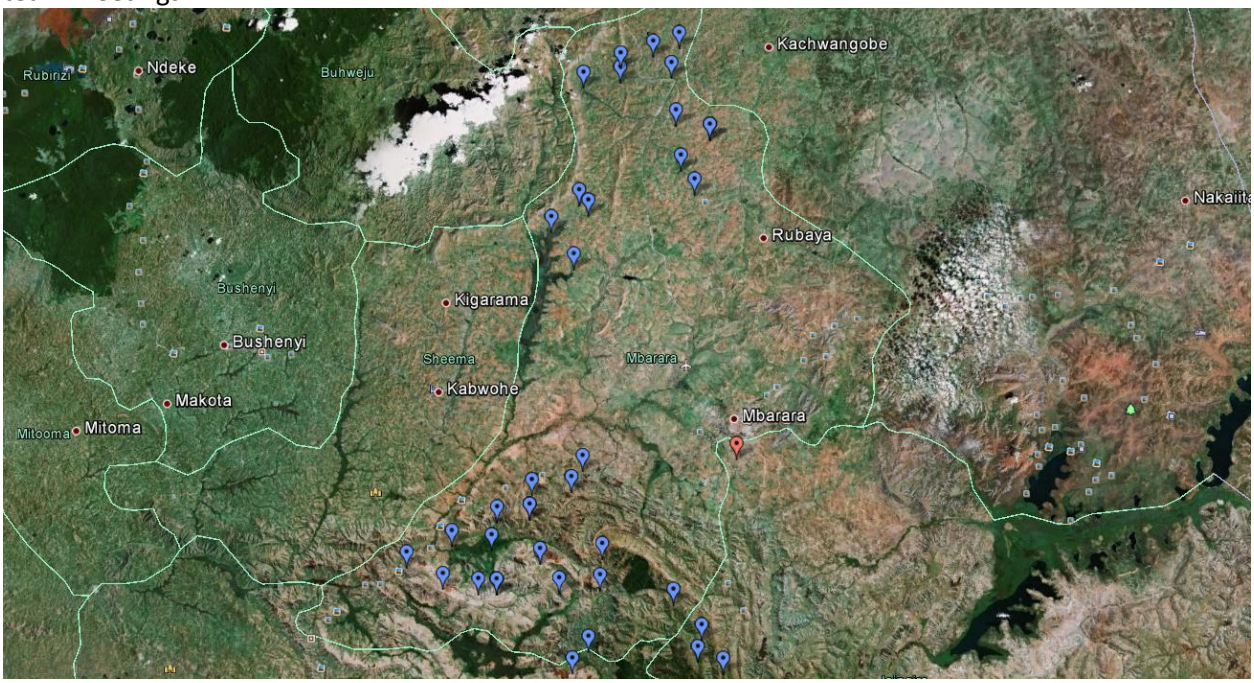
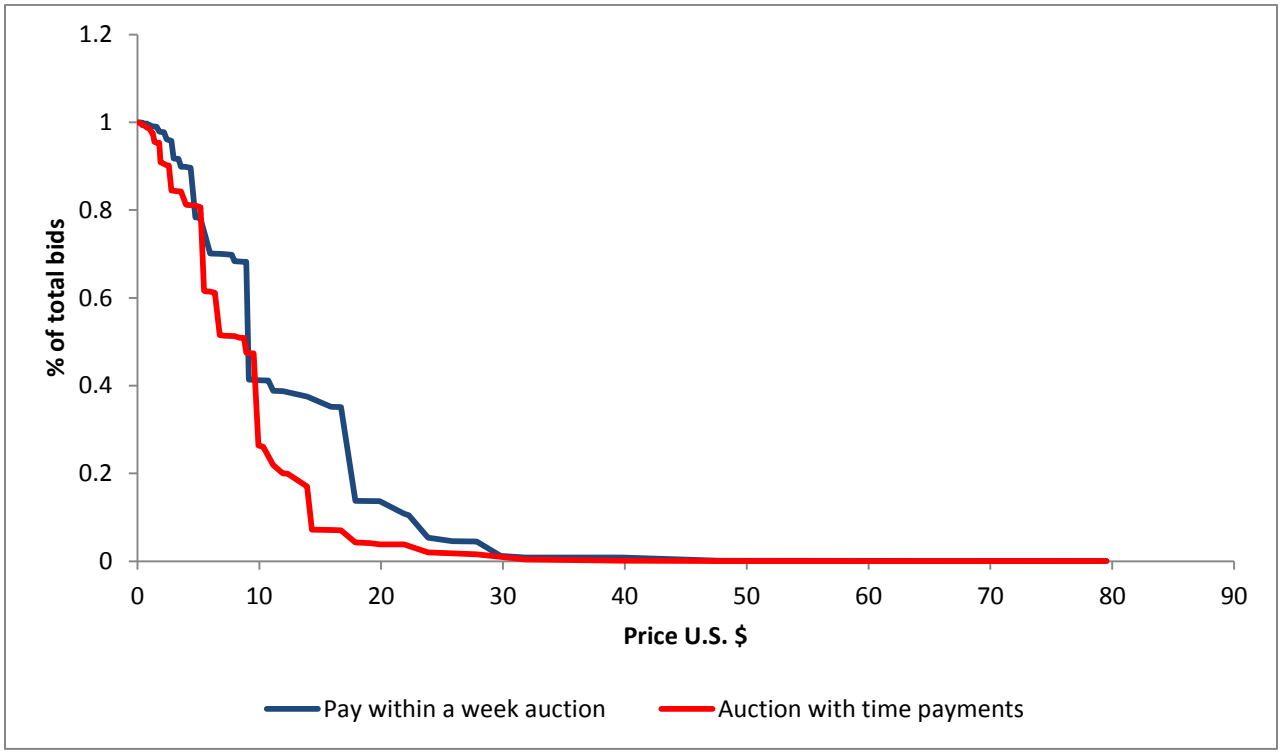


Figure 2: Demand curves by auction type



Appendix 1: Table 1.1: OLS regression results for sub-samples of participants who buy, collect or both buy and collect wood

	Pay Within a Week Auction			Time Payment Auction		
	y=bid US $	y=bid US $	y=bid US $	y=bid US $	y=bid US $	y=bid US $
Received either "Saves time/money" only or both messages	-0.0422	-0.213	0.236	0.768	0.216	1.028
	(0.336)	(0.207)	(0.418)	(0.487)	(0.280)	(0.582)
# of people who ate lunch yesterday	0.0202	0.00129	-0.00180	0.0496	0.0846	0.0335
	(0.0882)	(0.0532)	(0.106)	(0.127)	(0.0723)	(0.149)
Dummy if missing # of people who ate lunch yesterday	-0.449	-0.472	-0.462	-0.934	-0.384	-0.893
	(0.544)	(0.357)	(0.670)	(0.788)	(0.477)	(0.938)
Age Group	0.157	-0.00621	0.174	0.232	-0.0417	0.182
	(0.107)	(0.0659)	(0.130)	(0.154)	(0.0893)	(0.181)
Constant	9.973***		9.144***	8.367***	10.86***	12.42***
9.378***						
	(1.416)	(0.694)	(1.591)	(2.047)	(0.942)	(2.226)
Observations	651	1870	450	652	1880	452
R^2	0.197	0.150	0.204	0.190	0.150	0.208

Notes: In all specifications above parish fixed effects have been included (though not shown for space considerations) and are statistically significant at the 1% level for all specifications. Statistical significance is indicated by * p< 0.10, ** p< 0.05, *** p< 0.01 and standard errors are in parentheses.

Appendix 1 Table 1.2: OLS regression results for restricted sample- columns 1 & 4 buy wood only; columns 2 & 5 collect wood only; & columns 3 & 6 both buy and collect wood

	Pay Within a Week Auction			Time Payment Auction		
	Buys only	Collects only	Buys & collects	Buys only	Collects only	Buys & collects
Received either "Saves time/money" only or both messages	-0.0422	-0.213	0.236	0.768	0.216	1.028
	(0.336)	(0.207)	(0.418)	(0.487)	(0.280)	(0.582)
# of people who ate lunch yesterday	0.0202	0.00129	-0.00180	0.0496	0.0846	0.0335
	(0.0882)	(0.0532)	(0.106)	(0.127)	(0.0723)	(0.149)
Dummy if missing # of people who ate lunch yesterday	-0.449	-0.472	-0.462	-0.934	-0.384	-0.893
	(0.544)	(0.357)	(0.670)	(0.788)	(0.477)	(0.938)
Age Group	0.157	-0.00621	0.174	0.232	-0.0417	0.182
	(0.107)	(0.0659)	(0.130)	(0.154)	(0.0893)	(0.181)
Constant	9.973***	9.144***	8.367***	10.86***	12.42***	9.378***
	(1.416)	(0.694)	(1.591)	(2.047)	(0.942)	(2.226)
Observations	651	1870	450	652	1880	452
R^2	0.197	0.150	0.204	0.190	0.150	0.208

Notes: In all specifications above parish fixed effects have been included (though not shown for space considerations) and are statistically significant at the 1% level for all specifications. Statistical significance is indicated by * p< 0.10, ** p< 0.05, *** p< 0.01 and standard errors are in parentheses. Age group is a discrete choice variable where 1= age 20 or below; 2=ages 21-25; 3=ages 26-30; 4=ages 31-35; 5=ages 36-40; and 6=ages 41 and above.

Appendix 1 Table 1.3: OLS regression results for restricted sample- columns 1 & 4 buy wood only; columns 2 & 5 collect wood only; & columns 3 & 6 both buy and collect wood

	Pay Within a Week Auction			Time Payment Auction		
	Buys only	Collects only	Buys & collects	Buys only	Collects only	Buys & collects
Received either "Saves time/money" only or both messages	-0.158	-0.248	0.102	0.765	0.245	1.090
	(0.336)	(0.207)	(0.422)	(0.490)	(0.281)	(0.590)
Received either "Improves health" only or both messages	1.062**	0.539**	0.834	0.0291	-0.492	-0.404
	(0.341)	(0.208)	(0.426)	(0.498)	(0.282)	(0.597)
# of people who ate lunch yesterday	0.0256	0.00846	0.00397	0.0498	0.0789	0.0304
	(0.0876)	(0.0532)	(0.106)	(0.127)	(0.0723)	(0.149)
Dummy if missing # of people who ate lunch yesterday	-0.0521	-0.249	-0.129	-0.923	-0.583	-1.053
	(0.555)	(0.367)	(0.689)	(0.810)	(0.490)	(0.968)
Age Group	0.167	-0.0118	0.195	0.233	-0.0360	0.173
	(0.106)	(0.0658)	(0.130)	(0.155)	(0.0893)	(0.181)
Constant	9.211***	8.871***	7.801***	10.84***	12.67***	9.649***
	(1.427)	(0.701)	(1.612)	(2.080)	(0.952)	(2.264)
Observations	651	1870	450	652	1880	452
R^2	0.210	0.153	0.211	0.190	0.151	0.209

Notes: In all specifications above parish fixed effects have been included (though not shown for space considerations) and are statistically significant at the 1% level for all specifications. Statistical significance is indicated by * p< 0.10, ** p< 0.05, *** p< 0.01 and standard errors are in parentheses. Age group is a discrete choice variable where 1= age 20 or below; 2=ages 21-25; 3=ages 26-30; 4=ages 31-35; 5=ages 36-40; and 6=ages 41 and above.

Appendix Table 2: The effect of wealth interacted with messages

Coefficient (standard error)	Pay Within a Week Auction			Time Payment Auction			Difference
	y=bid US $	y=bid US $	y=bid US $	y=bid US $	y=bid US $	y=bid US $	y=% diff
Asset Index (0-7)	0.507***	0.593***	0.581***	0.652***	0.778***	0.786***	-0.0140
	(0.0805)	(0.155)	(0.135)	(0.110)	(0.214)	(0.186)	(0.0124)
Received message "Saves time/money" only		0.785			1.423*		
		(0.625)			(0.841)		
Received message "Improves health" only		0.820			-0.186		
		(0.614)			(0.852)		
Both messages		0.834			0.559		
		(0.631)			(0.868)		
Asset index*"Saves time/money" only		-0.256			-0.258		
		(0.224)			(0.302)		
Asset index*"Improves health" only		0.0547			0.0755		
		(0.213)			(0.296)		
Asset index*Both messages		-0.190			-0.259		
		(0.220)			(0.304)		
Received either "Improves health" only or both messages			0.423			-0.554	-0.200***
			(0.441)			(0.603)	(0.0406)
Received either "Saves time/money" only or both messages			0.408			1.107*	0.0491
			(0.438)			(0.599)	(0.0404)
Asset index*"Improves health" or both messages			0.0707			0.0537	0.00976
			(0.155)			(0.212)	(0.0143)
Asset index*"Saves time/money" only or both messages			-0.258*			-0.309	0.0192
			(0.155)			(0.212)	(0.0142)
# of people who ate lunch yesterday	-0.0190	-0.0198	-0.0176	0.0308	0.0264	0.0286	0.00469
	(0.0486)	(0.0486)	(0.0486)	(0.0666)	(0.0668)	(0.0668)	(0.00447)
Household did not cook lunch yesterday	-0.555*	-0.331	-0.245	-0.398	-0.742	-0.643	-0.0569*
	(0.317)	(0.334)	(0.331)	(0.430)	(0.453)	(0.450)	(0.0303)
Constant	7.897***	7.312***	7.491***	10.73***	10.41***	10.57***	0.345***
	(0.724)	(0.813)	(0.780)	(0.996)	(1.124)	(1.077)	(0.0719)
Observations	2118	2118	2118	2128	2128	2128	2092
R-squared	0.1719	0.1792	0.1779	0.1673	0.1707	0.1697	0.1067

Notes: In all specifications above additional control variables (not shown) include: whether the household collected wood for cooking last week or month, if the household bought wood last week or month, and parish fixed effects have been included. Only parish fixed effects are statistically significant at the 1% level for all specifications while household bought wood last week is significant for the time payment auction at the 10% level. The sample size drops from 2125 (2135) participants who bid on pay-within-the-week (time payments) auction due to seven respondents missing data on number of assets owned. Column 7's dependent variable is the percent increase of the time payments auction compared to the pay-within-a-week auction. A dummy variable- Household did not cook lunch yesterday- is included for those households who are reported as missing-# of people who ate lunch yesterday. As a result households missing- # of people who ate lunch yesterday have been imputed to the median. Statistical significance is indicated by * p< 0.10, ** p< 0.05, *** p< 0.01 and standard errors are in parantheses.

Table 1: Overview of outcome by auction type (bids in US $)

General summary statistics	**N**	**%**		
HH's that took Demand Determinant Survey	2297	100.0		
Count of female participation	2297	70.4		
HH's that bid on Pay Within a Week Auction	2125	92.5		
HH's that bid on Time Payment Auction	2135	92.9		
Pay Within a Week Auction Offer	**N**	**Mean**	**S.D.**	**Median**
All bids	2125	4.86	4.65	3.98
Bids by females	1509	4.55	3.96	3.98
Share of bids >$10	2125	8.3%		1
Winning bids	47	15.78	8.56	15.90
Second price paid	47	12.87	5.07	11.93
Deposit paid for stove	47	5.61	4.37	3.98
Stoves returned: percent of stoves sold	47	8.5%		
Defaults: percent of stoves sold	47	4.3%		
Average % of winning bid paid prior to default		35.4%		
Time Payment Auction Offer	**N**	**Mean**	**S.D.**	**Median**
All bids	2135	6.83***	6.38	4.77
Bids by females	1517	6.42***	5.62	3.98
Share of bids >$10	2135	15.7%**		
Winning bids	45	23.03***	14.95	19.88
Second price paid	45	16.78***	6.38	15.90
Deposit paid for stove	45	5.06	2.77	4.77
Stoves returned: percent of stoves sold	45	15.6%		
Defaults: percent of stoves sold	45	8.9%		
Average % of winning bid paid prior to default		24.8%		

Notes: The intention to treat sample or the number of participants on the Master Roster who initially registered upon arrival the day of the meeting is 2,355. The "households (HH's) that took Demand Determinant Survey" and "# female participants" are from the survey entitled "Demand Determinants". The remaining statistics are from the "Bid Record survey". This sample drops twenty-eight observations of initial auction winners who refused to pay the second-highest bid. There were 36 of each auction type. The # of winners >36 due to tie bids. In the event of a tie both bidders were given the opportunity to purchase the stove at the second highest price. Percent of stoves returned and defaults represent percent of total stoves purchased by auction type. All auction bids have been converted from Ugandan Shillings to US $ at the exchange rate of 2515 Uganda Shillings to 1 US $. The exchange rate is the official quarterly exchange rate from the United States Treasury's report, "Exchange Rate for March 31, 2012", available at: http://www.fms.treas.gov/intn.html. As a result, all amounts for Mean, S.D. and Median are in US $.

Significance of t-tests, from difference of means between auction offer types, is denoted by:* at the 10% level ** at the 5% level, and *** at the 1% level.

Table 2: Marketing message and bids for auctions (in US$)

Pay Within a Week Auction Offer							
Marketing message received	**N**	**Mean bid (S.D.)**	**Median bid**	**Mean deposit (S.D.)**	**Median deposit**	**Count and percentage of winners by auction**	**Count and percent of bids above 10US$**
No Message	546	4.58 (4.82)	3.98	6.26 (3.69)	5.96	10 21%	26 5%
Saves Time & Money	513	4.47 (4.14)	3.98	5.14 (5.43)	5.96	7 15%	34 7%
Improves Health	525	5.50*** (5.22)	3.98	6.45 (4.67)	3.98	19** 40%	68*** 13%
Time, Money & Health	541	4.88 (4.28)	3.98	3.87 (3.64)	1.99	11 23%	49*** 9%
Joint F-test	F	(3,2121) =5.22***		(3,43) =0.91		(3,2121) =2.32*	(3,2121) =8.80***
Time Payment Auction Offer							
Marketing message received	**N**	**Mean bid (S.D.)**	**Median bid**	**Mean deposit (S.D.)**	**Median deposit**	**Count and percentage of winners by auction**	**Count and percent of bids above 10US$**
No Message	544	6.73 (6.87)	4.77	5.28 (3.57)	4.97	9 20%	73 14%
Saves Time & Money	535	7.17 (6.38)	5.96	4.76 (2.61)	3.98	20 44%	86 17%
Improves Health	514	6.82 (6.35)	4.77	5.14 (3.61)	3.98	8** 18%	85** 16%
Time, Money & Health	542	6.61 (5.90)	4.77	5.47 (1.30)	5.47	8 18%	92 17%
Joint F-test	F	(3,2131) =0.77		(3,41) =0.15		(3,2131) =2.58*	(3,2131) =1.04**

Notes: from Table 1 are consistent for statistics in this table.
Significance tests: the effect of marketing message relative to the no message group on bid amount, deposit amount, count of winners, and count of individuals bidding more than $10 : *** p<0.01, ** p<0.05, * p<0.10
Joint Significance F-tests: tests if the four market messaging groups are equal: *** p<0.01, ** p<0.05, * p<0.10. For the F-test by message group for the variable Count and percentage of winners above $10 USD , the F statistic is based on the average bid above $10.

Table 3: Summary statistics of household characteristics by message group

	Marketing Message Received				
	No Message	**Saves Time and Money**	**Improves Health**	**Time, Money and Health**	**Total**
Respondent's gender is female	69%	73%	70%	72%	71%
Average age of respondent	39	40	40	39	39
Marital status					
Married (monogamous)**	72%	75%	80%	76%	76%
Widow**	9%	14%	10%	10%	11%
Single (never married)	7%	5%	5%	5%	6%
Married (polygamous)***	6%	4%	1%	5%	4%
Divorced or separated***	6%	2%	4%	4%	4%
Earns income***	96%	83%	78%	92%	87%
How paid					
Cash only***	43%	57%	58%	97%	64%
Cash and in-kind***	55%	42%	41%	3%	35%
In-kind only***	2%	1%	0%	0%	1%
Not paid*	0%	0%	1%	0%	0%
Main employer					
Self-employed***	88%	72%	71%	78%	78%
Non-family member***	10%	11%	13%	21%	14%
Family member***	2%	17%	16%	2%	8%
Length of employment					
All year***	53%	55%	67%	77%	63%
Seasonal***	46%	43%	31%	21%	36%
Occasional	1%	2%	2%	2%	2%
Respondent has annual income & paid partly in cash***	51%	45%	52%	71%	54%
Woman has annual income & paid partly in cash**	30%	31%	30%	50%	35%
Woman employed by non-family & paid partly in cash***	4%	7%	8%	15%	8%
Household own cows	31%	27%	32%	28%	29%
0-5 cows	75%	74%	74%	74%	74%
6-10 cows	13%	17%	16%	17%	15%
11-15 cows	6%	6%	3%	3%	4%
16 or more	6%	3%	6%	7%	6%
I don't know	0%	1%	1%	0%	0%
Household owns phone**	70%	65%	69%	75%	70%
Wife of respondent or women respondent owns phone**	58%	50%	50%	59%	54%
Household owns bicycle	44%	48%	45%	42%	45%
Household owns motorcycle*	12%	8%	10%	11%	10%
Household owns car**	1%	1%	1%	3%	2%
Household does not bike, motorbike, or car	43%	44%	44%	44%	44%
Household owns TV**	6%	3%	6%	6%	5%
Household owns radio	91%	87%	90%	88%	89%
Asset Index (0-7)**	2.6	2.4	2.6	2.6	2.5
Asset Index (0-7) if respondent is male**	3.0	2.8	3.0	2.7	2.8
Asset Index (0-7) if respondent is female**	2.4	2.3	2.4	2.5	2.2

Notes: from Table 1 are consistent for statistics in this table.

Joint Significance F-tests measure if summary statistic is statistically different by marketing message group relative to participant receiving no message group and are denoted by: * at the 10% level ** at the 5% level, and *** at the 1% level.

Table 3: Summary statistics of household characteristics by message group continued

	Marketing Message Received				
	No Message	**Saves Time and Money**	**Improves Health**	**Saves Time, Money and Health**	**Total**
Primary Cooking Fuel Source					
Wood***	98%	93%	93%	96%	95%
Charcoal***	2%	4%	1%	3%	3%
Wood&Charcoal***	0%	3%	6%	0%	2%
Other*	0%	0%	1%	1%	0%
Household buys wood (last week or month)**	30%	33%	25%	32%	30%
Household gathers wood (last week or month)	81%	86%	86%	86%	85%
Household buys and gathers wood (last week or month)***	21%	20%	25%	14%	24%
# of people who ate lunch yesterday (average)	4.57	4.51	4.53	4.31	4.48
Type of stove already owned					
None***	70%	76%	78%	69%	73%
Charcoal stove***	10%	14%	6%	20%	12%
Built-in mud stove***	15%	7%	14%	8%	11%
Other**	6%	3%	3%	4%	4%
Respondent is primary cook***	65%	69%	70%	75%	70%
Who is Primary Cook					
Wife***	86%	87%	92%	84%	87%
Husband***	4%	5%	3%	8%	5%
Children*	4%	4%	2%	3%	3%
Other**	6%	3%	4%	5%	5%
Who is Decision Maker about major purchases (restricted to married HHs)					
Wife & Husband jointly***	55%	57%	42%	67%	55%
Husband***	28%	25%	42%	23%	29%
Wife***	18%	17%	15%	9%	15%
Other	0%	0%	1%	0%	0%

Notes: from Table 1 are consistent for statistics in this table.
Joint Significance F-tests measure if summary statistic is statistically different by marketing message group relative to participant receiving no message group and are denoted by: * at the 10% level ** at the 5% level, and *** at the 1% level.

Table 4: The effect of messages

Coefficient (standard error)	Pay Within a Week Auction		Time Payment Auction		Difference
	y=bid US $	y=bid US $	y=bid US $	y=bid US $	y=% diff
Received message "Saves time/money" only	0.0487		0.631*		
	(0.275)		(0.374)		
Received message "Improves health" only	0.937***		-0.0122		
	(0.266)		(0.368)		
Both messages	0.344		-0.112		
	(0.264)		(0.363)		
Received either "Improves health" only or both messages		0.629***		-0.370	-0.173***
		(0.193)		(0.265)	(0.0176)
Received either "Saves time/money" only or both messages		-0.282		0.260	0.0983***
		(0.193)		(0.265)	(0.0176)
# of people who ate lunch yesterday	0.0145	0.0161	0.0711	0.0727	0.00481
	(0.0487)	(0.0487)	(0.0669)	(0.0669)	(0.00444)
Household did not cook lunch yesterday	-0.254	-0.180	-0.631	-0.552	-0.0575*
	(0.336)	(0.333)	(0.455)	(0.452)	(0.0302)
Constant	8.964***	9.087***	12.62***	12.77***	0.313***
	(0.706)	(0.703)	(0.973)	(0.968)	(0.0641)
Observations	2119	2119	2129	2129	2093
R-squared	0.156	0.154	0.150	0.149	0.102

Notes: In all specifications above additional control variables (not shown) include: whether the household collected wood for cooking last week or month, if the household bought wood last week or month, and parish fixed effects have been included. Only parish fixed effects are statistically significant at the 1% level for all specifications while household bought wood last week is significant for the time payment auction at the 10% level for column 4. The sample size drops from 2125 (2135) participants who bid on pay-within-the-week (time payments) auction due to seven respondents missing data on number of assets owned. Column 7's dependent variable is the percent increase of the time payments auction compared to the pay-within-a-week auction. A dummy variable- Household did not cook lunch yesterday- is included for those households who are reported as missing-# of people who ate lunch yesterday. As a result households missing- # of people who ate lunch yesterday have been imputed to the median. Statistical significance is indicated by * $p< 0.10$, ** $p< 0.05$, *** $p< 0.01$ and standard errors are in parantheses.

Table 5: The effect of gender (sample is married households only)

	Pay Within a Week Auction				Time Payment Auction			
	y=bid US $	y=bid US $	y=bid US $	y=bid US $	y=bid US $	y=bid US $	y=bid US $	y=bid US $
Participant is female	-1.124***	-1.107***	-1.079**	-1.236***	-1.423***	-1.417***	-1.335**	-1.454**
	(0.262)	(0.264)	(0.434)	(0.423)	(0.357)	(0.361)	(0.583)	(0.576)
Woman is decision maker		-0.138				-0.0480		
		(0.316)				(0.431)		
Respondent is primary cook			-0.0565				-0.113	
			(0.440)				(0.591)	
Woman earns year round income at least partly in cash				0.184				0.0186
				(0.502)				(0.682)
Earns year round income at least partly in cash				-0.0898				-0.204
				(0.432)				(0.588)
Asset Index (0-7)	0.474***	0.471***	0.474***	0.473***	0.671***	0.670***	0.671***	0.688***
	(0.0961)	(0.0964)	(0.0962)	(0.0981)	(0.131)	(0.131)	(0.131)	(0.133)
# of people who ate lunch yesterday	-0.00265	-0.00288	-0.00291	-0.00212	0.0838	0.0837	0.0833	0.0859
	(0.0566)	(0.0566)	(0.0567)	(0.0568)	(0.0768)	(0.0769)	(0.0769)	(0.0771)
Household did not cook lunch yesterday	-1.134***	-1.136***	-1.140***	-1.134***	-1.001*	-1.002*	-1.014*	-0.992*
	(0.385)	(0.385)	(0.388)	(0.390)	(0.520)	(0.520)	(0.524)	(0.527)
Constant	8.512***	8.520***	8.526***	8.566***	10.85***	10.85***	10.87***	10.95***
	(0.876)	(0.876)	(0.883)	(0.934)	(1.186)	(1.187)	(1.194)	(1.264)
Observations	1691	1691	1691	1685	1699	1699	1699	1693
R^2	0.167	0.167	0.167	0.166	0.164	0.164	0.164	0.164

Notes: Additional control variables (not shown) include whether the household collected wood for cooking last week or month have no significant effect. Additional control variables (not shown) include if the household bought wood last week or month is significant for the time payment auction at the 10% level and parish fixed effects are statistically significant at the 1% level for all specifications. A dummy variable- Household did not cook lunch yesterday- is included for those households who are reported as missing-# of people who ate lunch yesterday. As a result households missing-# of people who ate lunch yesterday have been imputed to the median. Statistical significance is indicated by * p< 0.10, ** p< 0.05, *** p< 0.01 and standard errors are in parentheses.

Table 6: The effect of stable income and age

	Pay Within a Week Auction		Time Payment Auction	
	y=bid US $	y=bid US $	y=bid US $	y=bid US $
Asset Index (0-7)	0.547***	0.510***	0.714***	0.671***
	(0.0828)	(0.0843)	(0.113)	(0.115)
Earns year-round income paid at least partly in cash		0.501**		0.562**
		(0.207)		(0.283)
# of people who ate lunch yesterday	-0.0171	-0.0172	0.0118	0.0127
	(0.0513)	(0.0513)	(0.0703)	(0.0703)
Household did not cook lunch yesterday	-0.379	-0.349	-0.140	-0.0959
	(0.333)	(0.334)	(0.452)	(0.454)
Household buys wood (last week or month)	0.233	0.196	0.640**	0.599*
	(0.237)	(0.238)	(0.325)	(0.325)
Household gathers wood (last week or month)	0.212	0.259	0.325	0.387
	(0.341)	(0.341)	(0.467)	(0.468)
Age	-0.00534	-0.00548	-0.00795	-0.00822
	(0.00763)	(0.00765)	(0.0104)	(0.0104)
Constant	3.528***	3.328***	4.808***	4.582***
	(0.530)	(0.535)	(0.724)	(0.732)
Observations	2118	2112	2128	2122
R^2	0.021	0.024	0.021	0.023

Notes: A dummy variable- Household did not cook lunch yesterday- is included for those households who are reported as missing-# of people who ate lunch yesterday. As a result households missing- # of people who ate lunch yesterday have been imputed to the median. Statistical significance indicated by * p< 0.10, ** p< 0.05, *** p< 0.01 and standard errors are in parentheses.

Appendix 1: Table 1.1: OLS regression results for sub-samples of participants who buy, collect or both buy and collect wood

	Pay Within a Week Auction			Time Payment Auction		
	y=bid US $	y=bid US $	y=bid US $	y=bid US $	y=bid US $	y=bid US $
Received either "Saves time/money" only or both messages	-0.0422	-0.213	0.236	0.768	0.216	1.028
	(0.336)	(0.207)	(0.418)	(0.487)	(0.280)	(0.582)
# of people who ate lunch yesterday	0.0202	0.00129	-0.00180	0.0496	0.0846	0.0335
	(0.0882)	(0.0532)	(0.106)	(0.127)	(0.0723)	(0.149)
Dummy if missing # of people who ate lunch yesterday	-0.449	-0.472	-0.462	-0.934	-0.384	-0.893
	(0.544)	(0.357)	(0.670)	(0.788)	(0.477)	(0.938)
Age Group	0.157	-0.00621	0.174	0.232	-0.0417	0.182
	(0.107)	(0.0659)	(0.130)	(0.154)	(0.0893)	(0.181)
Constant	9.973***		9.144***	8.367***	10.86***	12.42***
9.378***						
	(1.416)	(0.694)	(1.591)	(2.047)	(0.942)	(2.226)
Observations	651	1870	450	652	1880	452
R^2	0.197	0.150	0.204	0.190	0.150	0.208

Notes: In all specifications above parish fixed effects have been included (though not shown for space considerations) and are statistically significant at the 1% level for all specifications. Statistical significance is indicated by * p< 0.10, ** p< 0.05, *** p< 0.01 and standard errors are in parentheses.

Appendix 1 Table 1.2: OLS regression results for restricted sample- columns 1 & 4 buy wood only; columns 2 & 5 collect wood only; & columns 3 & 6 both buy and collect wood

	Pay Within a Week Auction			Time Payment Auction		
	Buys only	Collects only	Buys & collects	Buys only	Collects only	Buys & collects
Received either "Saves time/money" only or both messages	-0.0422	-0.213	0.236	0.768	0.216	1.028
	(0.336)	(0.207)	(0.418)	(0.487)	(0.280)	(0.582)
# of people who ate lunch yesterday	0.0202	0.00129	-0.00180	0.0496	0.0846	0.0335
	(0.0882)	(0.0532)	(0.106)	(0.127)	(0.0723)	(0.149)
Dummy if missing # of people who ate lunch yesterday	-0.449	-0.472	-0.462	-0.934	-0.384	-0.893
	(0.544)	(0.357)	(0.670)	(0.788)	(0.477)	(0.938)
Age Group	0.157	-0.00621	0.174	0.232	-0.0417	0.182
	(0.107)	(0.0659)	(0.130)	(0.154)	(0.0893)	(0.181)
Constant	9.973***	9.144***	8.367***	10.86***	12.42***	9.378***
	(1.416)	(0.694)	(1.591)	(2.047)	(0.942)	(2.226)
Observations	651	1870	450	652	1880	452
R^2	0.197	0.150	0.204	0.190	0.150	0.208

Notes: In all specifications above parish fixed effects have been included (though not shown for space considerations) and are statistically significant at the 1% level for all specifications. Statistical significance is indicated by * p< 0.10, ** p< 0.05, *** p< 0.01 and standard errors are in parentheses. Age group is a discrete choice variable where 1= age 20 or below; 2=ages 21-25; 3=ages 26-30; 4=ages 31-35; 5=ages 36-40; and 6=ages 41 and above.

Appendix 1 Table 1.3: OLS regression results for restricted sample- columns 1 & 4 buy wood only; columns 2 & 5 collect wood only; & columns 3 & 6 both buy and collect wood

	Pay Within a Week Auction			Time Payment Auction		
	Buys only	Collects only	Buys & collects	Buys only	Collects only	Buys & collects
Received either "Saves time/money" only or both messages	-0.158	-0.248	0.102	0.765	0.245	1.090
	(0.336)	(0.207)	(0.422)	(0.490)	(0.281)	(0.590)
Received either "Improves health" only or both messages	1.062**	0.539**	0.834	0.0291	-0.492	-0.404
	(0.341)	(0.208)	(0.426)	(0.498)	(0.282)	(0.597)
# of people who ate lunch yesterday	0.0256	0.00846	0.00397	0.0498	0.0789	0.0304
	(0.0876)	(0.0532)	(0.106)	(0.127)	(0.0723)	(0.149)
Dummy if missing # of people who ate lunch yesterday	-0.0521	-0.249	-0.129	-0.923	-0.583	-1.053
	(0.555)	(0.367)	(0.689)	(0.810)	(0.490)	(0.968)
Age Group	0.167	-0.0118	0.195	0.233	-0.0360	0.173
	(0.106)	(0.0658)	(0.130)	(0.155)	(0.0893)	(0.181)
Constant	9.211***	8.871***	7.801***	10.84***	12.67***	9.649***
	(1.427)	(0.701)	(1.612)	(2.080)	(0.952)	(2.264)
Observations	651	1870	450	652	1880	452
R^2	0.210	0.153	0.211	0.190	0.151	0.209

Notes: In all specifications above parish fixed effects have been included (though not shown for space considerations) and are statistically significant at the 1% level for all specifications. Statistical significance is indicated by * p< 0.10, ** p< 0.05, *** p< 0.01 and standard errors are in parentheses. Age group is a discrete choice variable where 1= age 20 or below; 2=ages 21-25; 3=ages 26-30; 4=ages 31-35; 5=ages 36-40; and 6=ages 41 and above.

Appendix Table 2: The effect of wealth interacted with messages

Coefficient (standard error)	Pay Within a Week Auction			Time Payment Auction			Difference
	y=bid US $	y=bid US $	y=bid US $	y=bid US $	y=bid US $	y=bid US $	y=% diff
Asset Index (0-7)	0.507***	0.593***	0.581***	0.652***	0.778***	0.786***	-0.0140
	(0.0805)	(0.155)	(0.135)	(0.110)	(0.214)	(0.186)	(0.0124)
Received message "Saves time/money" only		0.785			1.423*		
		(0.625)			(0.841)		
Received message "Improves health" only		0.820			-0.186		
		(0.614)			(0.852)		
Both messages		0.834			0.559		
		(0.631)			(0.868)		
Asset index*"Saves time/money" only		-0.256			-0.258		
		(0.224)			(0.302)		
Asset index*"Improves health" only		0.0547			0.0755		
		(0.213)			(0.296)		
Asset index*Both messages		-0.190			-0.259		
		(0.220)			(0.304)		
Received either "Improves health" only or both messages			0.423			-0.554	-0.200***
			(0.441)			(0.603)	(0.0406)
Received either "Saves time/money" only or both messages			0.408			1.107*	0.0491
			(0.438)			(0.599)	(0.0404)
Asset index*"Improves health" or both messages			0.0707			0.0537	0.00976
			(0.155)			(0.212)	(0.0143)
Asset index*"Saves time/money" only or both messages			-0.258*			-0.309	0.0192
			(0.155)			(0.212)	(0.0142)
# of people who ate lunch yesterday	-0.0190	-0.0198	-0.0176	0.0308	0.0264	0.0286	0.00469
	(0.0486)	(0.0486)	(0.0486)	(0.0666)	(0.0668)	(0.0668)	(0.00447)
Household did not cook lunch yesterday	-0.555*	-0.331	-0.245	-0.398	-0.742	-0.643	-0.0569*
	(0.317)	(0.334)	(0.331)	(0.430)	(0.453)	(0.450)	(0.0303)
Constant	7.897***	7.312***	7.491***	10.73***	10.41***	10.57***	0.345***
	(0.724)	(0.813)	(0.780)	(0.996)	(1.124)	(1.077)	(0.0719)
Observations	2118	2118	2118	2128	2128	2128	2092
R-squared	0.1719	0.1792	0.1779	0.1673	0.1707	0.1697	0.1067

Notes: In all specifications above additional control variables (not shown) include: whether the household collected wood for cooking last week or month, if the household bought wood last week or month, and parish fixed effects have been included. Only parish fixed effects are statistically significant at the 1% level for all specifications while household bought wood last week is significant for the time payment auction at the 10% level. The sample size drops from 2125 (2135) participants who bid on pay-within-the-week (time payments) auction due to seven respondents missing data on number of assets owned. Column 7's dependent variable is the percent increase of the time payments auction compared to the pay-within-a-week auction. A dummy variable- Household did not cook lunch yesterday- is included for those households who are reported as missing-# of people who ate lunch yesterday. As a result households missing- # of people who ate lunch yesterday have been imputed to the median. Statistical significance is indicated by * p< 0.10, ** p< 0.05, *** p< 0.01 and standard errors are in parantheses.