Using Branding to Signal Quality in Informal Markets. Evidence from an Experimental Auction in the Sahel.

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Abstract

This study tests whether or not rural consumers in sub-Saharan Africa value a brand that is potentially a signal of food safety. We implemented an incentive compatible Becker-Degroot Marschak auction among consumers in Niger and Northern Nigeria to test their willingness to pay for cowpea that was stored and sold in a grain storage container that signaled unobservable quality in the form of insecticide-free grain. We estimated the size of the price differential that the average consumer placed on unobservable grain quality, as measured through the WTP premium for gran sold in the branded bag. We also estimated the effect that a consumer's previous awareness of the brand had on his or her valuation for observable and unobservable quality. Our results indicated that on average consumers in Niger were willing to pay a 10% premium for cowpea stored and sold in the branded storage bag compared to cowpea of the same observable quality that was sold in a bag with no branding. The same branded quality premium was 17% in Nigeria. Interestingly, consumers in Niger who had previous experience with the bag brand were willing to pay twice the premium for cowpea stored and sold in the branded bag compared to consumers who were not familiar with the brand. However, no such premium existed among consumers in Nigeria.

Keywords

Branding, experimental auctions, hermetic storage, price premiums, sub-Saharan Africa

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"Brand are basically a promise. They tell consumers what quality to expect from a product and show off its personality…….. But measuring their value is hard." Economist Magazine (May 21, 2013).

Introduction

Food is not nutritious if it is not safe to eat and households cannot be food secure if their food supply is not safe. Production of food that is not safe to eat, constitutes a waste of scarce resources and poses a threat to human health. As such developed countries have testing, inspection and standards in place to mitigate food safety and quality threats, but these controls largely do not exist or do not function in most developing countries. Regardless, strategies and incentives to increase food quantity in developing countries receive the vast amount of attention from donors, policy-makers and researchers, while the need to improve food quality and safety is often under-valued or ignored. This is an important issue because successful markets depend on a consistent supply of quality product (Hodges, Buzby and Bennett 2011). In fact, lack of quality food in many developing countries has been associated with poorly integrated value chains (Fafchamps, Hill and Minten 2008), and with pushing smallholder farmers towards subsistence food production (Hoffmann and Gotabu 2014). This has implications for the health, safety income and livelihoods of millions of people in developing countries.

Food quality can be divided into observable quality and unobservable quality. Examples of observable quality in grain include size, color and texture of kernels, along with visible signs of mold and/or insect damage to them. A consumer can inspect product to check for observable quality attributes like insect damage and fungus that affect the grain that he or she is considering purchasing. There is evidence to suggest that observable attributes are built into the price of

grain, at least at harvest when quality grain is plentiful (Kadjo, Ricker-Gilbert and Alexander 2015). Examples of unobservable (or partly observable) quality in grain include food safety contaminants such as pesticide residues and levels of aflatoxin, a harmful liver toxin that causes stunting and cancer.

Contrary to observable characteristics, identifying unobservable quality attributes is much more difficult in rural markets of developing countries. Testing methods for pesticide residues and aflatoxins can make these threats observable, but no affordable or accessible testing mechanisms for aflatoxins or chemical residues are readily available in informal rural markets of SSA to our knowledge (Hoffmann and Gatobu 2014; Kadjo et al. 2020). With no easy way for consumers to identify unobservable quality, sellers may have incentives to maintain or improve observable quality, but not unobservable quality. Sellers may even have incentives to take steps to improve observable quality at the expense of unobservable quality and safety. For example, a seller of grain may apply chemical insecticides to grain in an effort to kill insect pests. Thus, he or she will be rewarded with a premium for improving observable quality, in the form of preventing insect damaged kernels, while likely not being penalized for reducing unobservable quality, by making grain less safe to eat due to applying pesticides. This asymmetric information between buyers and sellers creates the classic lemons market following Akerlof (1970), where food with low unobservable quality dominates rural markets.

In the presence of unobservable quality and asymmetric information between buyers and sellers, one potential mechanism for sellers to signal quality is through branding. Brands signal consistency and a level of quality between producers and consumers. Branding works well in markets with repeated transactions between buyers and sellers. However, branding can be more

difficult in an informal spot market with many buyers and sellers, such as is the case in the context of rural grain markets in SSA. When consumers have incomplete or imperfect information on a product's quality they have little to no incentive to pay for it, and firms have little incentive to incur the cost of providing quality to differentiate their product (Bester 1998). This lack of ability to differentiate quality is another symptom of the lemons market. Thus, creating mechanisms for buyers and sellers to signal preferences for consuming and producing quality safe food is important for food safety and food security, along with market development in SSA and elsewhere around the world.

With these considerations in mind the objective of the present study is to estimate the value that rural consumers in Southern Niger and Northern Nigeria place on brand of grain storage container that signals unobservable quality in the form of insecticide-free grain. We estimate the size differential that the average consumer places on unobservable grain quality (measured through the brand) and observable grain quality (measured through insect damage, color and mold) that can be assessed through visual inspection. We also estimate the effect that a consumer's previous awareness of the brand has on his or her valuation for observable and unobservable quality. The result of our study have implication for incentivizing producers and consumers to invest in food safety in rural markets.

We conducted an experimental Becker-Degroot-Marshak auction for cowpea (also called black eyed pea) stored in a relatively well-known storage bag, with a branded label. The bag creates a hermetic (airtight) seal that protects grain from threats to both observable quality (insect damage, color, mold), and unobservable quality (pesticide residues and aflatoxins). The auction took place ten months after harvest when these threats to quality were very prevalent in

the market. Consumers were asked to bid on and purchase cowpea that was stored and sold in different ways. The first bag of cowpea was stored in the hermetic bag and was sold to consumers in the hermetic bag with that bag's brand name on it. Thus, the cowpea from the first bag had high levels of both unobservable quality (signaled through the brand) and observable quality (signaled through visual inspection). The second bag of cowpea was stored in the hermetic bag but the grain was transferred to a standard woven bag immediately before being sold to consumers. Therefore, the second bag had the same level of observable quality as the first bag, but it lacked the unobservable quality signal from the brand label that the first bag had. The third bag of cowpea was stored in a traditional woven bag, so lacked the observable quality in the first and second bag along with the signal of brand value in the first bag (see figure 1). As such the difference in consumers' willingness to pay (WTP) for cowpea between the first and second bag measures the value they place on unobservable quality, while the difference in WTP between the second and third bag measures the value they place on observable quality.

Numerous studies have examined the role of branding and how consumers value food safety in developed countries. However, there is still a dearth of research in developing countries. One notable exception is by Hoffmann and Moser (2017) who found that in the formal market for maize flour in Kenya, higher priced brands are significantly more likely to have lower levels of aflatoxin, thus signaling their quality to consumers. Another notable study by Fafchamps, Vargas-Hill and Minton (2008) based in India found that in the absence of branding and vertical market integration, food safety attributes for horticultural crops were not reflected in its price. The present article adds to the sparse literature in two main ways. First, to our knowledge we are the first study to quantify the value that people place on both observable and unobservable quality

in rural developing country markets. Second, we estimate how past awareness of the brand affects demand for observable and unobservable quality in this context.

Briefly, our results indicated that on average consumers in Niger were willing to pay a 10% premium for cowpea stored and sold in the branded storage bag compared to cowpea of the same observable quality that was not sold in the branded bag. The same branded quality premium was 17% in Nigeria. Interestingly, consumers in Niger who had previous experience with the bag brand were willing to pay twice the premium for cowpea stored and sold in the branded bag compared to consumers who were not familiar with the brand. However, no such premium existed among consumers in Nigeria.

Background Information

Cowpeas in Niger and Nigeria

Worldwide annual production of cowpea was estimated at 6.2 million metric tons, grown on 11.9 million hectares in 2013 with Africa accounting for 95% of the total production (FAOSTAT, 2015). Nigeria is the largest producer of the crop in the world while Niger is the second largest. About 2,950 MT of dried seeds were produced in 2013 in Nigeria versus 1,300 MT in Niger (FAOSTAT, 2015). Cowpea is the main food legume in Niger; it is the second most widely grown crop after millet (MDA, 2015) and the second most important cash crop after onion. Though Nigeria is the largest producer of cowpea, is the largest importer in the world with most of the imported cowpea coming from Niger. Cowpea plays a strategic role in the food security of rural communities in both countries because it is the earliest crop to be harvested in each season. Thus, it complements low-protein staples, such as millet, sorghum and maize.

Cowpea is a high value commodity in West and Central Africa, and demand for the grain is often higher than the supply. This provides farmers an opportunity to earn additional income through storage. However, cowpea productivity in Niger and Nigeria is challenged by many abiotic and biotic constraints. The abiotic stresses include drought, heat and low soil fertility. The biotic stresses include insect pests (aphid, flower thrips, pod sucking bugs, maruca, and bruchids), diseases (bacterial and viral) and parasitic weeds (ICRISAT, 2013). In particular, bruchids (*Callosobruchus maculatus*) cause substantial losses during postharvest storage. Near-certainty of loss to insects causes most farmers to sell cowpea at harvest when prices are at the low point of the year even though they know that the market price may increase as much as three-fold four to six months later.

Hermetic storage technology

In response to these post-harvest challenges, various storage technologies designed to mitigate losses in cowpea and other grains have been developed and promoted but with little success for many reasons including cost, scalability, cultural acceptability, and availability. To address cowpea storage challenges, researchers at Purdue University in the United States in collaboration with scientists from the National Agricultural Research System (NARS) in Cameroon developed a cost-effective triple-layer plastic bag- the Purdue Improved Cowpea Storage (PICS) bag (Murdock et al., 2003). The PICS bag is a chemical free hermetic container composed of one outer polypropylene (PP) woven bag, and two liners of high density polyethylene (HDPE), each 80 microns thick. PICS bags limit oxygen availability leading to insects inactivity, cessation of population growth, desiccation and eventual death (Murdock et al. 2012). Since inception, the

dissemination of PICs bags was coupled with efforts to develop a supply chain to ensure availability of bags in markets to improve access for smallholders farmers (Baributsa et al. 2014).

The use of hermetic bags to store grain in Niger, Nigeria and the rest of SSA has significantly increased in the past 10 years. The adoption of hermetic bags is driven by several factors, including: (i) the severity of storage losses at the farm level; (ii) the efficacy of the technologies, and (iii) availability of quality bags, and (iv) other benefits such as being chemical-free, cost effective, easy to use; and locally available. Hermetic bags significantly reduce food safety risks posed by the conventional method of treating stored grains with insecticides. Farmers in West and Central Africa are currently well aware of the quality improvement offered by PICS technology and are willing to pay for it at a market price of around US $2.50 for one bag that holds 100 kilograms of cowpeas and has an expected life of three seasons.

Though the PICS bag and brand is well known to many farmers and consumers in our study region, the question of whether grains stored with PICS bags receive any price preference compared to grains stored using traditional means or treated with insecticide is still not well informed. While previous cowpea price and quality studies in West and Central Africa have shown that consumers are very conscious of storage damage, and that there is a negative effect of damage on selling price (Faye et al. 2004; Langyintuo et al. 2004) information on cowpea price premium for the grain stored with PICS bags remains anecdotal. As such our study provides an excellent context to test the effect of brand value on quality premiums in rural markets.

Data

In both Niger and Nigeria, 600 participants were selected randomly in the most important cowpea production and consumption zones. The auction took place during the cowpea marketing season, which occurred roughly 10 months after the cowpea harvest. To avoid heterogeneity in the quality of the grains being used for the experiments the sample of grains was bought at the beginning of the storage period, in November 2017 and stored for about ten months to allow significant amount of insects damage, in the non-hermetic bags. The grains were bought from the main market of Kano in Nigeria. In total, six 100 kilogram bags for Nigeria and six 100 kilogram bags for Niger were stored in a safe storage facility during the whole storage period for the auction.

Enumerators were hired and trained to follow up the whole process and collect the required data. In total about 10 enumerators were involved in the surveys in Nigeria. The survey covered the period of September 6 to September 29 in Nigeria and the period of 26 October to 24 November 2018 in Niger. In each country, 600 participants were recruited, so the study sample covered 1,200 farmers in six different states in Nigeria and three main zones in Niger. Recall that one set of cowpea were stored in the hermetic bag and was sold to consumers in the hermetic bag with that bag's brand name on it. The second set of cowpea were stored in the hermetic bag but the grain was transferred to a standard woven bag immediately before being sold to consumers. The third bag of cowpea was stored and sold to consumers in a traditional woven bag, with certified chemicals applied to it in order to protect it from insect pests as effectively as possible.

During the study, consumer were approached at random by enumerators and explained the purpose of the study and asked if they wanted to participate. If they consented to participate verbally, they then answered a short set of demographic questions before the auction was conducted.

Auction procedure

As mentioned in the introduction, we used the standard incentive-compatible Becker-Degroot-Marschak (BDM) auction mechanism following Becker, Degroot and Marschak (1964). The BDM auction is widely used to assess consumers revealed preferences and has been used in similar contexts in recent studies across SSA (Berry, Fisher and Gutieras 2020; Prieto et al. 2020; Channa et al. 2021; Fuller and Ricker-Gilbert 2021). As with the standard BDM auction procedure, participants were instructed that they should bid their true valuation for the three different grades of cowpea, and that it was not in their interest to bid strategically. Participants played two practice rounds of auction bidding to familiarize themselves with the BDM procedure before the auctions for the three cowpea grades took place. The participants were shown each of the three grades of cowpea in random order and bid on each of them. Then the respondent randomly picked a number and the referenced bag of cowpea became binding. As it related to the binding grade of cowpeas, the respondent selected a price from a bag with values ranging from 100 to 500 CFA or Nira in increments of 50. If the random number that was picked was lower than the respondent's bid for that grade of cowpea, then respondent who "won" the auction and could purchase the cowpea for the price he or she drew. If the randomly drawn number was higher than the respondent's bid then he or she "lost" the auction and was not able to purchase the

cowpea. Participants were given a small participation fee of 500 CFA or Nira to alleviate any liquidity constraints they may have faced at that time.

Empirical model

We seek to understand how consumers in rural markets value both observable and unobservable quality is it relates to brand value, and how past experience with a brand affects willingness to pay for products associated with that brand. First, we estimate the following equation separately for consumers in Nigeria and Niger. The willingness to pay (WTP) for consumer (i) for product (j) is estimated as follows:

$$WTP_{ij} = \beta_0 + \beta_1 HH_{ij} + \beta_2 HW_{ij} + \beta_3 P_i + \beta_4 X_i + \sigma_i + \varepsilon_{ij} \quad (1)$$

Where WTP is the consumers valuation of cowpea sold in different containers with different branding. The units are in Naira/kilogram for Nigerian consumers and FCFA/kilogram for consumers from Niger. The variable HH represents the cowpea that was stored in hermetic bags and sold in hermetic bags. This grade of cowpea represents the highest levels of unobservable, and observable quality available to consumers in our auction. The parameter to estimate is β_1, and the coefficient estimate on $\widehat{\beta_1}$ tests how HH compares to the control bag of cowpea that was stored in a woven bag with chemical insecticides to protect it from insect damage and sold in that same bag. The variable HW represents the cowpea that was stored in hermetic bags and sold in woven bags. The parameter to estimate is β_2, and the coefficient estimate on $\widehat{\beta_2}$ tests how HW compares to the control bag of cowpea that was stored in a

woven bag with chemical insecticides and sold in the same bag. This coefficient estimate tells us how the average consumer values observable quality since HW was stored in a hermetic bag resulting in better looking cowpea. But both HW and the control bag were presented to consumers for sale in the same type of woven bag, so the consumer had no way to assess unobservable quality created by the hermetic bag's brand value.

It is also important to note that the cowpea in HW has the same level of observable quality as the cowpea in HH as both were stored securely in hermetic bags, so are free of insects and chemical insecticides. However, HW was presented and sold to consumers in a standard woven bag so consumers had no way to assess the brand value or know that the cowpea was stored in a hermetic bag without the use of chemical insecticides to kill insect pests. Therefore, the F-statistic between $\widehat{\beta_1}$ = $\widehat{\beta_2}$ tests the brand value that consumers in Nigeria and Niger place on purchasing maize that is sold in a hermetic bag.

Other variables in equation 1 include P, which is equal to one if the consumer has previous awareness of the hermetic bag brand PICS. The parameter to estimate is β_3, and the coefficient estimate on $\widehat{\beta_3}$ tests if this previous awareness affects WTP for cowpea stored in that bag or in a traditional woven bag. The variable vector X represents the other household characteristics that can affect WTP for different quality levels of cowpea, and β_3 is the vector of parameters to estimate. The variables in X include, (i) the respondent's age, (ii) the number of members in the respondent's household, (iii) a binary variable =1 if the respondent was female, (iv) a binary variable =1 if the respondent's main occupation was farming, and (v) a binary variable =1 if the respondent was a trader or processor (the latter to variables =0 if the respondent was engaged in another occupation). Finally, the error term in equation 1 is denote

by two components, σ_i and ε_{ij}. The former denotes the respondent specific error term, while denotes the respondents bag-quality specific error term. Given the experimental design of the auction, we expect it to be uncorrelated with any of the covariates in the model.

Second we want to understand how previous awareness of the hermetic brand affects demand for cowpeas sold in that branded bag. Therefore we estimate the following equation for cowpeas WTP by quality type:

$$WTP_{ij} = \alpha_0 + \alpha_1 HH_{ij} + \alpha_2 HW_{ij} + \alpha_3 P_i + \alpha_4 HH_{ij} * P_i + \alpha_5 HW_{ij} * P_i + \alpha_6 X_i + b_i + \mu_{ij} \quad (2)$$

Where the variables in equation 2 are the same as in equation 1 and α_0 - α_6 are parameters to estimate. The difference between equations 1 and 2 are that equation 2 includes an interaction between HH * P and HW * P. The test of the coefficients $\widehat{\alpha_4}$ = $\widehat{\alpha_5}$ informs us if participants who were previously aware of the hermetic bag brand place a premium on the unobservable quality it provides in the form of removing the need to use chemical insecticides to protect grain against losses. The test of coefficients $\widehat{\alpha_1}$ = $\widehat{\alpha_2}$ allows us to know if participants who were previously uninformed about the hermetic bag brand placed a premium on the unobservable quality it provides. In equation 2, b_i respondent the respondent specific error term, while μ_{ij} denotes the respondents bag-quality specific error term. Both are assumed to be uncorrelated with the covariates given the experimental nature of the auction.

Results

Table 1 presents the descriptive statistics for the covariates used to estimate equations 1 and 2. Means and standard deviations are presented for the variables in both Niger and Nigeria. The average respondent's age was 46 years old in Niger, and 47 years old in Nigeria. The average household size in Niger was close to 10 and in Nigeria it was just over 8. Nearly 30% of respondents were female in Niger to 29% in Nigeria. In terms of occupation, 39% of respondents in Niger were farmers, while 62 were traders or processors and just 1% were engaged in something else. In Nigeria 64% were farmers, 28% were traders or processors, and 8% were engaged in something else. Interestingly, 88% of respondents in Niger had previous awareness of the hermetic bag brand (PICS), while only 40% of respondents in Nigeria did. This could be due to the fact that PICS bags had been available for sale for a longer time period in Niger compared to Nigeria. It could also be that most of the sample in Niger happened to be traders. As such, they may have been more aware of the types of storage bags that were available at market.

[Figure 1 here]

Figures 2 and Figures 3 show the sample means and standard deviations of respondents' WTP for cowpea of the three different grades. Figure 2 shows results from Niger, and indicates that on average consumers were willing to pay CFA 343/kilogram for cowpea stored and sold hermetic bags. This is 30 CFA/kilogram more than the price that the average consumer was willing to pay for cowpea stored in a hermetic bag and sold in a woven bag. The latter fetched an average price of 313 CFA/kilogram. This is roughly a 10% premium and can be thought of as the unconditional premium that people place on the brand value of PICS hermetic bags. In addition, the average respondent was willing to pay just 229 CFA/kilogram for cowpea stored in

woven bags and sold in woven bags. The difference between the cowpea stored in PICS and sold in woven and cowpea stored and sold in woven is equivalent to a 37% premium, and can be thought of as the unconditional observable quality premium that people place on undamaged cowpea over damaged cowpea during the lean season.

[Figure 2 here]

The unconditional average WTP for cowpea stored and sold in different bags in Nigeria shown in Figure 3 reveals a similar trend to that of Niger. The average respondent was willing to pay 275 Nira/kilogram for cowpea stored in a hermetic bag and sold in a hermetic bag. This is a 39 Nira/kilogram (equivalent to 17%) premium over the average WTP for cowpea stored in hermetic bags but sold in woven bags. Additionally, the average WTP for cowpea stored in a hermetic bag and sold in a woven bag was 47 Nira/kilogram higher than for cowpea sold and stored in a woven bag, equivalent to a 25% premium for observable quality differences.

[Figure 3 here]

Table 2 presents the regression results for the factors that affect WTP for cowpea in Niger, measured in CFA/kilogram. The first two columns show the results for the model in equation 1, and tests the hypothesis about the extent to which respondents are willing to pay a premium for observable quality and for brand value signaling unobservable quality. Column 1 show the parsimonious model with just the different quality grades of cowpea bags and a constant, while column 2 shows the results with a full set of controls. The results for columns 1 and 2 are consistent, and they indicate that the average respondent was willing to pay 120 CFA/kilogram more for cowpea stored and sold in a hermetic bag, compared to WTP for cowpea stored and sold in a woven bags (p-value=0.00). Furthermore, the average respondent was willing to pay

90 CFA/kilogram more for cowpea stored in a hermetic bag and sold in a woven bag than they were for cowpea stored and sold in a woven bag (p-value=0.00). This indicates that were was a 40% observable quality premium for cowpea that consumers could see was not damaged by insects (90 CFA/ kilogram / 229 CFA / kilogram). The F-test at the bottom of columns 1 and 2 indicate that the 30 CFA/ kilogram premium on cowpea stored and sold in PICS bags and cowpea stored in hermetic bags and sold in woven bags was statistically significant at the 1% level. This was equivalent to a 10% unobservable quality premium, and can be thought of as the value of the hermetic bag brand.

Columns 3 and 4 of table 2 estimate the model presented in equation 2 and test the hypotheses of how prior awareness of the brand affects WTP for cowpea stored and sold in that brand of hermetic bag. Column 3 shows the parsimonious specification, while column 4 shows the fully specified model with a full set of control variables. Focusing on the results in column 4, we find that those who were unaware of the hermetic bag brand previously were willing to pay a 103 CFA/Kilogram premium for cowpea stored and sold in hermetic bags (p-value=0.00). Those who were previously unaware of the hermetic bag brand were willing to pay 92 CFA/kilogram more for cowpea that was stored in a hermetic bag and sold in woven bag on average than they were for cowpea that was stored and sold in a woven bag (p-value=0.00). In addition, respondents who were previously aware of the hermetic bag brand were willing to pay 15 CFA/kilogram less for cowpea stored and sold in a woven bag then were people who were unaware of the hermetic bag brand previously (p-value=0.08). The interaction terms between the bags of cowpea and prior awareness of the hermetic bag brand tell an interesting story about how prior awareness affects WTP for quality. Those who were previously aware of

hermetic bags were willing to pay 19 CFA/kilogram more for cowpea that was stored and sold in a hermetic bag than were those who were unaware of the hermetic bag brand (p-value =0.02). However, those who were aware of the hermetic bag brand previously were not willing to pay more for cowpea stored in hermetic bags and sold in woven bags than were people who were previously unaware of the hermetic bag brand. The bottom of the table in columns 3 and 4 tests the unobservable quality premium or brand value that those who were previously aware and those who were previously unaware of the hermetic bag place on it. The unobservable quality premium for those who were previously unaware of the hermetic bag brand was 10 CFA/kilogram while it was more than double that at 21 CFA/kilogram for those who had prior awareness of the brand.

[Table 2 here]

The Nigeria results in table 3 are presented in the same way as the Niger results in table 2. The results for columns 1 and 2 indicate that the average respondent was willing to pay 110 Nira/kilogram more for cowpea stored and sold in a hermetic bag, compared to WTP for cowpea stored and sold in a woven bags (p-value=0.00). The average respondent was willing to pay 69 Nira/kilogram more for cowpea stored in a hermetic bag and sold in a woven bag than they were for cowpea stored and sold in a woven bag (p-value=0.00). This indicates that were was a 37% observable quality premium for cowpea that was not visibly damaged from insects (69 Nira / kilogram / 189 Nira / kilogram). The F-test at the bottom of columns 1 and 2 indicates that the 41 Nira / kilogram premium on cowpea stored and sold in PICS bags and cowpea stored in hermetic bags and sold in woven bags is statistically significant at the 1% level.

This is equivalent to a 17% unobservable quality premium, for cowpea presented to respondents for sale in the hermetic bags.

the results in column 4 indicate that those who were unaware of the hermetic bag brand previously in Nigeria were willing to pay a 115 Nira/Kilogram premium for cowpea stored and sold in hermetic bags(p-value=0.00). Those who were previously unaware of the hermetic bag brand were willing to pay 72 Nira/kilogram more for cowpea that was stored in a hermetic bag and sold in woven bag on average than they were for cowpea that was stored and sold in a woven bag (p-value=0.00). Interestingly, and different from results in Niger, in Nigeria those who were previously aware of hermetic bags were willing to pay -13 Nira/kilogram less for cowpea that was stored and sold in a hermetic bag than were those who were unaware of the hermetic bag brands (p-value =0.03). In addition, those who were aware of the hermetic bag brand previously were willing to pay 8 Nira/kilogram less for cowpea stored in hermetic bags and sold in woven bags than were people who were previously unaware of the hermetic bag brand (p-value=0.08). The bottom of the table in columns 3 and 4 tests the unobservable quality premium or brand value that those who were previously aware and those who were previously unaware of the hermetic bag place on it. The unobservable quality premium for those who were previously unaware of the hermetic bag brand was 43 Nira/kilogram, but we found that there was no unobservable quality premium in Nigeria for those who had prior awareness of the brand.

[Table 3 here]

Conclusions

The objective of the present study was to test whether or not rural consumers in sub-Saharan Africa value a brand that is potentially a signal of food safety. We implemented an incentive compatible Becker-Degroot Marschak auction among consumers in Niger and Norther Nigeria to test their willingness to pay for cowpea that was stored and sold in a grain storage container that signaled unobservable quality in the form of insecticide-free grain. We estimated the size differential that the average consumer placed on unobservable grain quality that was measured through the WTP premium for gran sold in the branded bag. We also estimated the effect that a consumer's previous awareness of the brand has on his or her valuation for observable and unobservable quality. In doing so, we are one of the first studies to test the extent to which brands have value for signaling quality in rural markets of developing countries.

Our results indicated that on average consumers in Niger were willing to pay a 10% premium for cowpea stored and sold in the branded storage bag compared to cowpea of the same observable quality that was not sold in the branded bag. The same branded quality premium was 17% in Nigeria. Interestingly, consumers in Niger who had previous experience with the bag brand were willing to pay twice the premium for cowpea stored and sold in the branded bag compared to consumers who were not familiar with the brand. However, no such premium existed among consumers in Nigeria.

The reasons for the difference in results between countries could be attributed to the fact that the hermetic bag brand had been available in Niger for a longer period of time than in Niger. This was evidenced by the fact that 88% of respondents to the survey were previously aware of the brand compared to 40% in Nigeria. In addition, in Niger 62% of respondents in the survey and

auction were traders or processors compared to only 28% in Nigeria. As such, traders in Niger may have been more award of the brand and its ability to preserve cowpea quality over time without the need for chemical insecticides to kill insects. Regardless this study has provided experimental evidence that in a limited resource environment where a there is brand awareness, people are willing to pay a premium for food that has been stored in that branded, as a signal of food quality and safety. This suggests that investing in training and potentially subsidizing reliable technologies that signal quality to consumers could help to break rural grain markets out of their currently low-quality equilibrium state.

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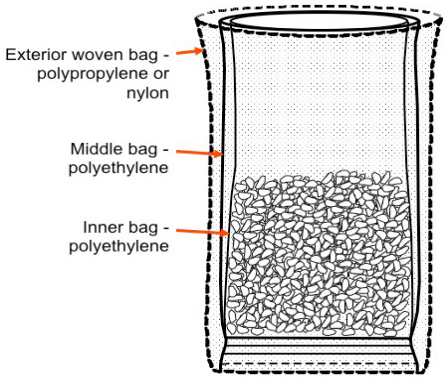
Figure 1: (a) Outside of hermetic storage bag with brand logo; (b) Interior design of hermetic storage bag; (c) Generic woven storage bag with no branding.

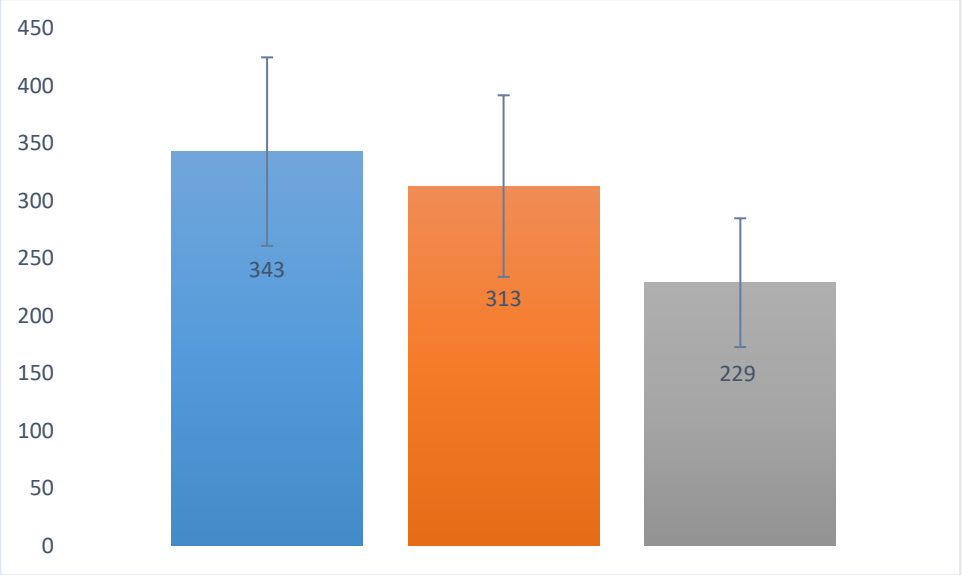
(a)



(b)

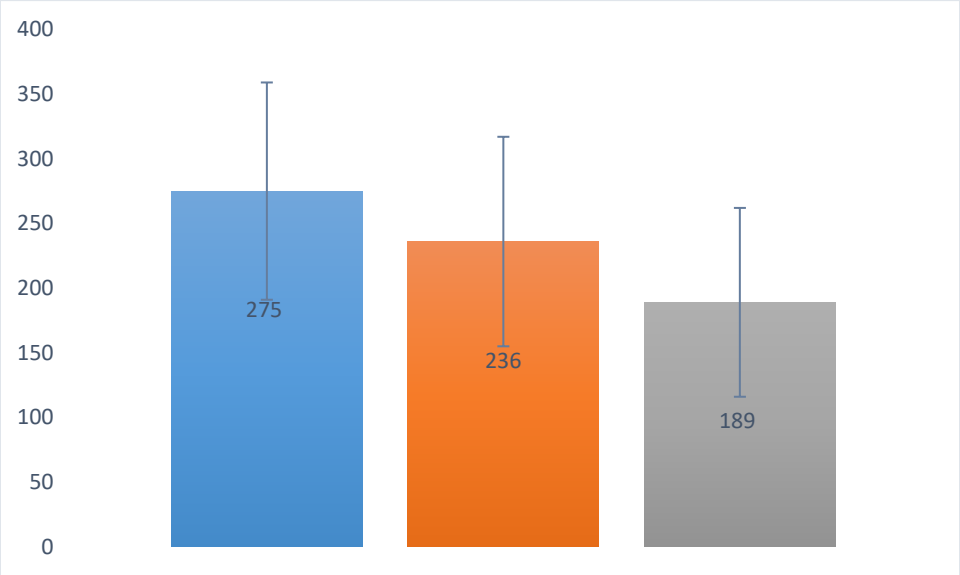
(c)

Figure 2: Mean Willingness to Pay for Cowpea by storage and presentation method in Niger in FCFA/kg



(i) Cowpea stored & sold in hermetic bag; (ii) Cowpea stored in hermetic bag, sold in woven bag; (iii) Cowpea stored in woven bag with insecticide, sold in woven bag; Standard deviation bars included; CFA 550 = USD 1.00; N=1,791

Figure 3: Mean Willingness to Pay for Cowpea by storage and presentation method in Nigeria in Naira/kg



(i) Cowpea stored & sold in hermetic bag; (ii) Cowpea stored in hermetic bag, sold in woven bag; (iii) Cowpea stored in woven bag with insecticide, sold in woven bag; Standard deviation bars included; NAIRA 365 = USD 1.00; N=1,797

Table 1: Descriptive statistics of covariates used in model

	Niger		Nigeria	
Variable	Mean	Std Dev	Mean	Std Dev
Respondent age	46.07	14.70	46.57	13.77
Household size	9.86	5.45	8.28	4.30
Female Respondent (%)	29.97	-	29.22	-
Respondent's main occupation is farming (%)	39.36	-	63.93	-
Respondent is employed as a trader or processor (%)	62.14	-	28.21	-
Respondent is employed in other activity (%)	1.17	-	7.68	-
Respondent was previously aware of PICS bags (%)	88	-	40	-

Note: N=597 in Niger and 599 in Nigeria

Table 2: NIGER, Willingness to pay for cowpea of different quality, and brand awareness.

Dependent Variable: WTP in CFA/kg of Cowpea	(1)	(2)	(3)	(4)
(i) Cowpea stored & sold in hermetic bag	120***	120***	115***	103***
	(0.00)	(0.00)	(0.00)	(0.00)
(ii) Cowpea stored in hermetic bag, sold in woven bag	90***	90***	105***	92***
	(0.00)	(0.00)	(0.00)	(0.00)
(i) Cowpea stored & sold in hermetic bag *Respondent was previously aware of hermetic bag brand			5	19**
			(0.64)	(0.02)
(ii) Cowpea stored in hermetic bag, sold in woven bag * Respondent was previously aware of hermetic bag brand			-16	-2
			(0.12)	(0.76)
Respondent age*10		-2		-2
		(0.36)		(0.36)
Household size		1		1
		(0.13)		(0.13)
Female respondent		-8		-8
		(0.22)		(0.22)
Respondent is employed as a trader or processor		3		3
		(0.64)		(0.64)
Respondent is employed in other activity		29		29
		(0.20)		(0.20)
Respondent was previously aware of hermetic bag brand		-11		-15*
		(0.21)		(0.08)
F-Test for brand value (unobservable quality premium)				
Full sample: Cowpea (i) – Cowpea (ii) = 0	30***	30***		
	(0.00)	(0.00)		
Previously unaware of brand: Cowpea (i) – Cowpea (ii) = 0			10***	10***
			(0.00)	(0.00)
Previously aware of brand: Cowpea (i) – Cowpea (ii) = 0			21***	21***
			(0.00)	(0.00)
R^2	0.37	0.37	0.37	0.37

Note: N=1,791; ***, **, *, indicates that the corresponding coefficients are statistically significant at the 1%, 5% and 10% levels respectively; p-values in parentheses; Models include a constant term that is not shown; FCFA 550 = US $1.00 at time of study.

Table 3: NIGERIA, Willingness to pay for cowpea of different quality, by brand awareness

Dependent Variable: WTP in CFA/kg of Cowpea	(1)	(2)	(3)	(4)
(i) Cowpea stored & sold in hermetic bag	110***	110***	111***	115***
	(0.00)	(0.00)	(0.00)	(0.00)
(ii) Cowpea stored in hermetic bag, sold in woven bag	69***	69***	69***	72***
	(0.00)	(0.00)	(0.00)	(0.00)
(i) Cowpea stored & sold in hermetic bag *Respondent was previously aware of hermetic bag brand			-3	-13**
			(0.70)	(0,03)
(ii) Cowpea stored in hermetic bag, sold in woven bag * Respondent was previously aware of hermetic bag brand			2	-8*
			(0.82)	(0,09)
Respondent age*10		-1		-1
		(0.66)		(0.66)
Household size		1		1
		(0.35)		(0.35)
Female respondent		6		6
		(0.42)		(0.42)
Respondent is employed as a trader or processor		-17**		-17**
		(0.03)		(0.03)
Respondent is employed in other activity		-2		-2
		(0.86)		(0.86)
Respondent was previously aware of hermetic bag brand		3		8
		(0.62)		(0.14)
F-Test for brand value (unobservable quality premium)				
Full sample: Cowpea (i) – Cowpea (ii) = 0	41***	41***		
	(0.00)	(0.00)		
Previously unaware of brand: Cowpea (i) – Cowpea (ii) = 0			42***	43***
			(0.00)	(0.00)
Previously aware of brand: Cowpea (i) – Cowpea (ii) = 0			-5	-5
			(0.28)	(0.28)
R^2	0.27	0.27	0.27	0.27

Note: N=1,797; ***, **, *, indicates that the corresponding coefficients are statistically significant at the 1%, 5% and 10% levels respectively; p-values in parentheses; Models include a constant term that is not shown; Naira 365 = US $1.00 at time of study.