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What is in a label? Examining the influence of cultural and colonial heritage on preferences and willingness to pay for local and international rice labels in Senegal

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Abstract

Africa's cultural and colonial heritage have profoundly segmented rice markets. Whereas in ancient centers of rice domestication consumers maintained preferences for local rice, in coastal areas around seaports preferences have shifted towards imported Asian rice, due to prior exposure to colonial import substitution policies. To enhance the competitiveness of African rice with imports, it is necessary to tailor new local rice products to both market segments. A study was conducted in Senegal to test branding strategies for local rice in a country where both market segments coexist. Brands that mimic local and international labels were developed for local rice, and urban consumers bid to upgrade non-preferred to preferred brands through BDM auctions. Contrary to expectations, descendants from Senegalese rice domesticators placed premiums on local rice with foreign-looking brands, indicating that foreignness is perceived as a quality cue even in market segments rooted in cultural heritage. Thus, branding local rice using a combination of local and foreign cues could be an effective strategy to market domestic rice to both segments shaped by cultural and colonial heritage.

Keywords: rice; endogenous endowment; willingness to pay; branding; BDM auctions

Introduction

Across the Global South where rice has emerged as the *de facto* staple, several governments are encouraging the production of local varieties. This is especially echoed in many regions across sub-Saharan Africa (SSA), which is projected to lead global imports of rice by 2026, representing 32% of global rice trade (Nigatu et al. 2017). Global events may also be driving recent policy shifts towards rice import substitution across SSA, including the conflict between Russia and Ukraine, given substantial exports of grain from these areas to Africa—approximately 44% of the continent’s wheat between 2018 and 2020 (UNCTAD 2022). With the many logistical hurdles that have stymied grain transport into SSA as a result of the conflict, the urgency to explore home-grown food and grain security solutions has been further amplified. Domestic efforts to alleviate deficits are timely, because over the past several decades, rice production in SSA has trailed consumption, thanks to prolonged urban bias policies, market trends, and general dietary shifts (Lipton 1977; Reardon et al. 2021). Despite the widening gap between local production and consumption levels, local rice markets have the potential to flourish in SSA, with recent findings showing significant capacity for an expanded market share for locally produced rice through value chain upgrading (Demont et al. 2013; Demont and Ndour 2015; Demont et al. 2017). It has been noted, however, that focusing on supply-side interventions as the main driver in the development of local rice portfolios may not be enough to improve its competitive edge against imported rice (Demont 2013), as consumers in SSA have consistently demonstrated a preference for rice quality attributes which they typically associate with imported versions. This has even led to rice consumers perceiving extrinsic attributes such as ‘foreignness’ as a quality cue, a general phenomenon in developing countries (Batra et al. 2000).

Twine et al. (2021) found consumers in several SSA countries preferred head rice (proportion of intact grains), slender grains, and parboiled rice. Zossou et al. (2022) found an increased valuation of parboiled rice in Benin, particularly when extrinsic attributes such as information on the benefits of the technology were conveyed. Similarly, Akoa Etoa et al. (2016) observed a greater likelihood to purchase locally produced rice processed through an improved parboiling technology among Cameroonian consumers, particularly when they perceived the product to be imported. In Uganda, Britwum et al. (2020) found agronomic gains of a non-preferred local variety had gained popularity in the markets over a preferred fragrant local version, although the popularity of imported fragrant rice was unmatched by both local versions, alluding to the complex amalgam of consumer constituents. The latter studies suggest that while focusing on preferred attributes is essential in the development of local food products, other demand-side interventions and cues may be needed to improve the competitiveness of local rice against imported brands. In this context, an aspect that has received little attention in the literature is the improvement of the competitiveness of African rice vis-à-vis imports through extrinsic cues such as labeling and branding. Demont et al. (2013a) found that urban Senegalese consumers in Saint Louis and Dakar were willing to pay price premiums for locally produced rice labeled with a geographic indication referring to the Senegal River Valley. The evidence did not strongly support the hypothesis that Senegalese consumers favor imported rice for reasons other than quality, such as its perceived foreignness. However, this does not exclude the possibility that foreignness is construed as a quality cue, given that local rice generally has the reputation of being of inferior quality relative to imported rice.

Given the potential construction of foreignness as a quality cue, to increase market penetration of local rice in SSA, a logical question arises as to whether there is a need to

differentiate or *undifferentiate* domestic from imported rice (Demont 2013). In other words, should domestic rice feature labels that *mimic* imported versions, or rather *differentiate* itself from the latter through distinctly local branding with traditional symbols and themes? This is poignant particularly in the light of recent insights concerning the role of cultural and colonial heritage in shaping African rice markets (Britwum and Demont 2021a, b). The evidence so far suggests consumers along the West African coastlines and farther away from centers of rice domestication tend to feature preferences for imported rice as a result of colonial heritage, whereas consumers who have descended from the lineage of original African rice domesticators, or who are culturally or geographically close to centers of rice domestication (cultural heritage) prefer local rice (Demont et al. 2017; Britwum and Demont 2022). This divergence in preferences along local and imported rice traits presents an opportunity to explore parallels between heritage and rice branding preferences. In this study, we attempt to unravel these issues with a focus on Senegal in West Africa. Senegal makes an ideal case study: its average per capita rice consumption, at 71kg, is distinctly higher than the West African average of 39kg (Soullier et al. 2020), and while imported rice is still a common fixture of Senegalese markets which is a direct result of colonial heritage, the southern region of Senegal is home to centuries-old cultural heritage in rice with accompanying preference for local varieties. In other words, in Senegal both market segments coexist.

Given this background, the main goal of the study is to elicit preferences for local versus international rice brands among urban Senegalese consumers, to understand the role of colonial and cultural heritage in brand preferences, and to determine price premiums for the brands in an endow-and-upgrade experimental auction framework. To the best of the authors' knowledge, this is the first such study to examine the role of branding and external cues on local rice preferences

within the context of cultural heritage and colonial heritage. Costello et al. (2013) found two market segments from auction experiments on rice branding in Senegal: a segment sensitive to domestic branding, and another with preferences aligned towards international branding. Although Costello et al. (2013) and subsequently Demont and Ndour (2015) reported qualitative results from the market experiment, neither study integrated the results with recent insights on preferences induced by cultural and colonial heritage. It would be expected that cultural and colonial heritage drive preferences for, respectively, local and foreign brands, but this research question has never been formally analyzed. This study subjects the dataset collected by Costello et al. (2013) to a formal econometric framework, and given that participants ethnicities were collected, we are able to examine the role cultural heritage (through genealogical lineage) and colonial heritage play in shaping preferences for extrinsic cues on local rice.

At a time when policymakers in several countries across SSA are seeking to increase production and importantly the appeal of local rice, findings from this study can be illuminating to the retail sector of rice value chains. Understanding external cues for local rice that resonate with both urban and rural consumers alike have the potential to grow the appeal of local rice in African markets. Consequently, this study extends the literature beyond demand-side preference elicitation of intrinsic quality attributes (see for example, Demont and Ndour 2015; Akoa Etoa et al. 2016) to a focus on extrinsic characteristics (branding) using a real choice and auction experiment. In addition, while current studies on rice preferences that incorporate cultural heritage and colonial heritage have largely focused on intrinsic attributes such as grain quality characteristics (Demont et al 2017; Britwum and Demont 2021a, b, 2022a), we examine whether there is evidence for branding preferences for local rice among these key consumer segments.

The next section is devoted to a discussion on the cultural and colonial heritage hypotheses and provides evidence that leads up to the identification of participants' ethnicities with rice preferences induced by either cultural heritage or colonial heritage.

The hypotheses and evidence of rice cultural heritage and colonial heritage

Demont et al. (2017) observed that consumers who descended from the *Mandé* people, believed to be early domesticators of the original African rice species, *Oryza glaberrima*, prefer local rice and are willing to pay price premiums for them. In addition to direct descendants from the *Mandé* extraction, consumers who live in geographic proximity to centers of rice domestication were also evidenced to have similar preferences for local rice, and thus considered to be endowed with rice cultural heritage. There are two documented centers of African rice domestication. Linares (2002) traces the primary origin of domestication of the African rice species to the inner Niger Delta region, which is present day Mali some 2,000 to 3,000 years ago. From there, the species is believed to have moved to two secondary centers of rice domestication, along the coast of Gambia, the Casamance (in southern Senegal), and Guinea Bissau on the one hand, and the Guinea forest on the other. In the context of these secondary centers, Linares (2002; 2009) extend the original African rice domesticators to also include the *Jola* people who were coastal dwellers in the Casamance region, in southern Senegal.

This background sets the stage for the cultural heritage hypothesis, which suggests consumers whose ancestry is genealogically or geographically aligned with original African rice domesticators prefer local rice, and specifically, traits which include unbroken grains, no fragrance, sensory quality and varieties from *Oryza glaberrima* parentage (Britwum and Demont, 2021a, b; Demont et al. 2017). On the other end of the heritage spectrum are consumers whose rice preferences have been shaped by colonial heritage. The colonial heritage hypothesis

broadly captures rice preferences for consumers outside the *Mandé* and *Jola* ancestry or their geographical affiliates and evidenced by preference for imported Asian rice with accompanying traits such as broken grains (in Senegambia and Mauritania), fragrance, high swelling capacity, and varieties that have evolved or have been developed from the Asian rice species, *Oryza sativa* (Britwum and Demont, 2021a, b). Demont and Ndour (2015) demonstrated evidence for the colonial heritage hypothesis, albeit prior to a formal designation of the hypothesis. Demont et al. (2017) and Fiamohe et al. (2018) further validated this concept with an observation of increased pressure and eroding price premiums and market shares for local rice in areas close to seaport centers and farther away from primary and secondary centers of African rice domestication.

Using this available evidence, participants' ethnicities collected and used in this study (from Costello et al. 2013) were segmented into cultural heritage (precisely, from the primary or secondary centers of domestication), or colonial heritage, displayed in Table 1.

< Table 1 >

With respect to intrinsic attributes, the evidence so far supports preferences for local rice traits among consumers whose preferences have been shaped by cultural heritage, while traits for imported rice have been identified among consumers with preferences induced by colonial heritage. In fact, Britwum and Demont (2021b) uncovered two market segments in Senegal's Casamance region for intrinsic trait preferences that closely mirrored consumers with cultural heritage (unbroken grains) and colonial heritage (broken grains). Other studies have corroborated the divergence in intrinsic trait preferences among consumers aligned to either cultural heritage, or colonial heritage. What is yet to be explored, however, is whether these findings on trait preferences segmented by cultural heritage and colonial heritage can also extend to *extrinsic* cues and attributes, such as labeling and branding strategies. The main hypothesis being tested is

whether consumers with cultural heritage-induced preferences are drawn to labels with local themes, or, whether internationally themed brands appeal to consumers with colonial heritage preferences. This will also shed light on earlier hypotheses (e.g., Demont et al., 2013a) on whether foreignness is perceived as a quality cue among urban consumers in Senegal. This is a research gap this study seeks to fill using experimental auction data from Costello et al. (2013). Unlike Britwum and Demont's (2021b) study where cultural heritage and colonial heritage preferences were examined in the southern Senegalese region of the Casamance, participants in this study were mainly urbanites sampled from two large cities in Senegal, Saint Louis, and Dakar. Consequently, the study's findings will shed light on effective branding and labeling strategies for local rice, an important endline in value chain upgrading. Our experimental design offers two additional methodological innovations. First, we measure brand appeal both from a distance (of two meters) and after close product inspection. This enables us to isolate purely extrinsic brand appeal effects from intrinsic considerations. Secondly, we endogenize the endowment. This enables making optimal use of experimental data that is expensive to obtain. Fixing the endowment in experimental auction designs based on the endow-and-upgrade method has the disadvantage of censoring negative WTP. Endogenizing the endowment enables measuring both positive and negative WTP, and hence produces a more complete distribution of valuation among a heterogeneous population of consumers.

The remaining sections are structured as follows: we discuss the experimental and auction procedures, which are followed by the econometric model, description of results, and a conclusion to the study.

Experimental and Auction Procedures

As mentioned previously, this study uses data collected from the auction procedure in Costello et al. (2013). While Costello et al. (2013) and Demont and Ndour (2015) reported only descriptive results from the auctions, these studies also preceded the development of the cultural heritage and colonial heritage hypotheses. We employ this dataset, which included ethnic information of respondents to test branding preferences for local rice among consumers with cultural heritage and colonial heritage through a formal econometric framework. While key aspects of the procedure are captured, additional details are reported in Costello et al. (2013). Unlike previous auction procedures which began with recruiting a sample and organizing experimental auctions, brands used in the experiments for this study were designed first and are summarized below.

Design of rice brands

The design of the brands followed an extensive review of available rice brands in the market, from which four each of internationally (foreign) and locally themed rice brands were developed in black and white to minimize potential confounding effects of color. Care was taken in the designs to avoid brand names or symbols similar to already existing ones to preclude bias. Regarding the brands, the local versions were suggestive of traditional Senegalese symbols: the lion, which is a national symbol, a drum, and a silhouette of an African woman carrying a gourd, each with their unique descriptions in the *Wolof* language, which is popularly spoken in the regions the experiments were conducted. The international brands involved symbols that depicted royalty fragrance (with a rose flower), concepts such as freedom (a star with the word ‘freedom’), happiness (also with a star), and nobility (with a crown), all with accompanying descriptions in French, the national language.

Four of the eight brands were subsequently selected in a pre-selection phase that involved two women associations through a voting process. The women associations were the *Société de promotion et de commercialisation du riz sénégalais* (SPCRS) and *Khar Yalla Gueye*, whose members pretested the brands to be certain they were of acceptable quality for the auction experiments. After the voting exercise, two local brands were chosen: *Sunu Ceeb* (translated our rice) and *Ndanane* (translated noble), with *Happiness* and *Noblesse* as the two international brands. Additional details can be found in Costello et al. (2013). The four brands are shown in Figure 1.

< Figure 1 >

Recruitment and sampling

Similar to other auction experiments on rice in Africa (see for example Demont et al. 2013a, b; Akoa Etoa et al. 2016; Britwum et al. 2020), women market goers estimated to be between 18 years to 65 years were targeted for the study by research enumerators in April 2012. Consistent with other rice auction studies in Africa, women tend to be the key decision-making players when it comes to rice purchases (see Britwum and Demont 2021b, where women participants are recruited in Senegalese rice auctions). Participants were recruited using flyers from test experimental auctions in urban markets at two different cities in Senegal; the *Sor* market in the city of Saint Louis, and the *Tilène* market in the capital city, Dakar, with approximately 120 women targeted in each city. The total sample size from the two cities was 241 participants. Those who agreed to participate were escorted to food shops, venues that were rented purposely for the market experiments in the two cities. Approximately 40 participants were recruited daily in each of the two cities, which spanned approximately 7 hours per day.

This study is distinct from the previous rice auctions referenced, in that no compensation was paid to participants, thus presenting a real budget constraint, and making the auctions as close to an actual purchase scenario as possible. This mitigates potential “house money” effects (e.g., Corgnet et al. 2014) where participants feel obliged to reciprocate the experimenter’s gesture. Instead, allowing participants to use their own money in bidding has been suggested (Canavari et al. 2019), and argued to potentially minimize deviation of bids from one’s true value. In another departure from other rice auction experiments in Africa, the Becker-DeGroot-Marschak (BDM, 1964) mechanism was used to elicit WTP premiums in an endow and upgrade framework rather than the second-price Vickrey (1961) auction. The auction procedure is described next.

Rice auctions

The experiments involved four 50kg bags of rice each displaying one of the four brands as showcased in Figure 2 (see Appendix). To purposely capture only the extrinsic value of the brand, the four bags featured the same type of rice, although this was unknown to participants. The fragrant *Sahel 329* rice was used, which was among the best local rice varieties from the Senegal River Valley (SRV), implying that only the bags with their respective brands were different. The *Wolof* language which is commonly spoken in these two regions was mostly used in the experiments, although French was also spoken as and when it became necessary. Participants were told during recruitment that this was a market experiment to test two new fragrant SRV rice brands that had not yet been introduced to the market. Thus, despite the objective of the study to test local versus international brands, it was clear from the onset of the experiment that the product consisted of local rice produced in the SRV.

For the actual auction experiments, a two-stage process was followed to elicit preferences and WTP. First, each participant indicated their preference between one local versus one internationally branded bag of rice from a distance of two meters. This setup was intended to exclusively capture participants' preferred brands. The pairings between local and internationally branded bags were randomized (local versus international each time), such that each participant saw only one of the four possible pairs. Next, participants were invited to approach and inspect the rice in each of the two bags and restate their preference. While the majority maintained their preferred brand from the first step, a small segment of participants switched their preference upon a close inspection of the bags. We call this phenomenon *preference shift*. Based on the participant's response to the second question, they were endowed with a one-kilogram bag of their non-preferred rice and elicited their WTP to exchange their endowed bag for a one-kilogram bag of rice from their preferred brand. That is, rather than a fixed benchmark (as in for example, Roosen et al. 1998; Akoa Etoa et al. 2016), the choice of endowment varied depending on the participant's preference between the local and international brand from the second question. In other words, the endowment was endogenous to a participant's preference.

The BDM mechanism was then used to elicit WTP premiums in an endow and upgrade procedure. To help calibrate participants' price premiums, they were told their endowed benchmark was priced at 400 FCFA per kilogram, which was the average retail price of the Sahel 329 at the time of the experiment. According to the workings of the BDM mechanism, a participant's WTP bid was compared against a randomly drawn pre-determined amount enclosed in an envelope. This was explained to participants before the auction process. The predetermined amounts varied between 25 FCFA and 75 FCFA and were randomly shuffled for each participant. If the bid was higher or equal to the randomly drawn amount, the participant was

given their preferred brand of rice and paid an amount equal to the predetermined amount. Alternatively, if the participant's bid was lower than a randomly drawn predetermined amount, they were given their endowed benchmark. Participants faced a real budget constraint in that they paid price premiums depending on the auction outcomes out-of-pocket. It should be noted though that there were a few participants who were unwilling to pay their stated premiums out of pocket even when the auction outcome determined they had the opportunity to purchase their preferred brand of rice. For such participants, the auction experiment was deemed to be hypothetical to them, in that they were unwilling to back their stated premiums with their money. This is included and modeled econometrically to determine whether it had significant impacts on WTP premiums. After the auction experiments, participants completed a short survey that collected demographic information including ethnicity, rice brand familiarity, and other relevant variables.

Data and Descriptive Statistics

We provide in Table 2 a summary of variables collected from the survey and descriptive statistics, disaggregated by the two auction venues. Two variables in Table 2 are directly associated with the auction procedure, *Hypothetical*, and *Preference shift*. Overall, only about 5% of participants were unwilling to pay their stated premiums out of pocket after outbidding the randomly predetermined amount. With respect to brand preference, approximately 18% of respondents switched brands after closely examining the rice in the two bags, versus when they were two meters away. Although most rice was purchased monthly rather than daily, there were some differences based on the city participants were sampled from. Previous experimental auctions on rice in Africa found WTP to be higher in the morning and sometimes dropped after

tasting (Akoa Etoa et al. 2016; Demont and Ndour 2015; Britwum et al. 2020; Britwum and Demont 2021a). This effect could be related to hunger which has been shown to affect bidding (e.g., Bi et al. 2012; Briz et al. 2015). Rather than ask participants whether they were hungry in this study which may arguably lead to subjective responses, they were asked to state how many hours it was since their last meal. On average, the time since the last meal was about three and half hours.

Only a few participants had lineages that were traced to either the primary or secondary center of rice domestication. Specifically, just about 5% of participants each featured cultural heritage that was traced separately to either the primary or secondary centers of domestication (see Table 1 for ethnicities), suggesting that most participants had preferences induced by colonial heritage. The nearly a quarter of participants with secondary school education paralleled previous findings in Senegal (Britwum and Demont 2021b), although this sample had a higher proportion of traders, at 42%, perhaps reflecting a relatively more urban occupation. The average age of participants was similar to the sample in Britwum and Demont (2021b).

While more than half of all respondents indicated a preference for imported rice, this was especially the case for participants from Dakar. Participants from Dakar were also more likely to correctly identify common rice brands sold in the market than those in Saint-Louis, although they (Dakar participants) could correctly identify four brands on average.

< Table 2 >

Econometric Approach

Consumers preference for rice branding

As was narrated in the auction procedure, participants made a choice between the locally branded rice versus an internationally/foreign branded option. These preferences can be analyzed

within the random utility framework, where individuals who are assumed to be utility maximizers select a brand if and only if the utility derived from their choice is higher than the alternative. We follow Zheng et al. (2020) and Ma et al. (2022) and specify a latent variable, S_i^* capturing the utility difference between the selected and non-selected brand. While S_i^* is unobservable, it can be expressed as a function of observable characteristics (Cameron and Trivedi 2010; Wooldridge 2010), shown in equation 1 as:

$$S_i^* = \delta Z_i + e_i, \text{ where } S_i = \begin{pmatrix} 1 \text{ if } S_i^* > 0 \\ 0 \text{ otherwise} \end{pmatrix} \quad (1)$$

S_i is the observed binary variable of the latent variable, S_i^* , δ represents a vector of parameters to be estimated, and e_i an error term. Given this, individual i 's probability of selecting a label can be expressed as:

$$\begin{aligned} Pr(S_i = 1) &= Pr(S_i^* > 0) = Pr((-e_i < \delta Z_i)) \\ &= \Phi(\delta Z_i) \end{aligned} \quad (2)$$

where Φ is the standard normal cumulative distribution function (CDF) of e_i .

Specific to equation 1, we proceeded to investigate factors that influenced brand preferences from a distance of two meters using the Probit model. Here, we specifically examined the impact of the rice brands, cultural/colonial heritage, venue of auction, and demographic characteristics on the choice of brand from a distance. Branding choice from a distance decidedly reflects participants' extrinsic preference for rice and worth investigating from a modeling context.

Willingness to Pay premiums and brand selection

We assume that WTP price premiums is a linear function of observable factors and a brand selection dummy, specified in the following linear equation:

$$Y_i = \alpha S_i + \beta X_i + u_i \quad (3)$$

where Y_i represents the outcome variable; S_i is a binary indicator variable denoting participants' selection of brands; α and β are estimable parameters, and u_i is the error term. Equation 3 assumes that the selection of a brand is exogenously determined, in which case the ordinary least squares method can be used in estimation. However, this may lead to biased estimates given that our endow-and-upgrade method endogenized the endowment resulting in participants tacitly selecting their benchmark brand from their non-preferred alternative, as described in the auction procedure. Thus, it is likely that factors not directly observable (such as participants' implicit biases, rice consumption experiences) that influence WTP price premiums may also be correlated with brand selection, leading to potential self-selection bias. Consequently, correlation in the error terms between the selection equation and the outcome equation ($[\text{corr}(e_i, u_i)] \neq 0$) is deemed a likely outcome. Given that the endogenous switching regression can overcome the self-selection bias from factors observed and unobserved, this was ultimately adopted and utilized in this study.

Endogenous switching regression

Endogenizing the benchmark in endow-and-upgrade auctions and subsequently analyzing the data through the endogenous switching regression (ESR) model is relatively unique and a departure from the more popular fixed-endowment auctions analyzed through double-hurdle models that have been popularly utilized in the analysis of rice auctions in Africa (Demont et al.

2013a, b; Demont et al. 2017; Britwum et al. 2020; Ouedraogo et al. 2022; Zossou et al. 2022).

The ESR model uses the full-information maximum likelihood method to simultaneously estimate the selection of a brand, and in the estimation of factors that influence WTP price premiums for the chosen brands (Lokshin and Sajaia 2004; Zheng et al. 2021; Ma et al. 2022).

Recall premiums were captured as the amount participants were willing to pay to exchange their endogenously endowed 1kg benchmark rice for the alternative 1kg bag of rice. The selection equation splits observations over two regimes, which in this study is captured by participants' selection of a local brand or selection of an international brand, denoted by a binary indicator variable S_i . These are shown in equations 4a and 4b as follows:

$$\text{Regime 1 (Local brand preference): } Y_{Li} = \beta_{Li}X_{Li} + u_{Li} \text{ if } S_i = 1 \quad (4a)$$

$$\text{Regime 2 (Foreign brand preference): } Y_{Fi} = \beta_{Fi}X_{Fi} + u_{Fi} \text{ if } S_i = 0 \quad (4b)$$

where Y_{Li} and Y_{Fi} are dependent variables representing WTP price premiums for the local label and foreign/international labels, respectively; X_{Li} and X_{Fi} are vectors of exogenous variables, and u_{Li} and u_{Fi} are error terms. It is assumed that the error terms for equations 1, 4a and 4b are distributed trivariate normal with zero mean and the following covariance matrix:

$$\Omega = \begin{bmatrix} \sigma_e^2 & \sigma_{eL} & \sigma_{eF} \\ \sigma_{Le} & \sigma_L^2 & . \\ \sigma_{Fe} & . & \sigma_F^2 \end{bmatrix}$$

where σ_e^2 is the variance of the error term in the selection equation, σ_L^2 and σ_F^2 are variances of the error terms in the continuous equation. σ_{eL} is the covariance between e_i and u_{Li} , with σ_{eF} being the covariance between e_i and u_{Fi} . Since u_{Li} and u_{Fi} are not simultaneously observed, their covariance is not defined (Lokshin and Sahaia 2004).

Given the set-up of the auction procedure, selection of a brand is endogenous to WTP price premiums. This suggests unobserved characteristics that influence a consumer's probability of selecting a brand were also likely to influence their WTP price premiums for a 1kg bag of rice with their preferred brand. As such, it was important to include at least one instrumental variable in the selection equation which is omitted from the continuous equation to improve the model's identification. Two instrumental variables were identified and included in the selection equation: *brand awareness* (which captured the share of nine common rice brands in the market that a participant recognized) and *preference for imported rice* (whether a participant's household usually purchased imported rice). Both were expected to highly influence preference for a label but weakly influence WTP premiums for the upgrades, an assumption supported by subsequent correlation analysis. Notably, since all brands used in this study were non-existing brands in the market, it was hypothesized that a consumer's general awareness of rice brands would be an important predictor in the choice of a locally themed or internationally themed brand. In addition, being generally aware of rice brands was arguably not expected to increase WTP premiums for one's preferred brand. A consumer's preference for imported rice was likely to influence their preference for the internationally/foreign-themed rice. However, since all labels were developed solely for the experiments and not used in the markets, it is argued that preference for imported rice did not necessarily influence premiums participants were willing to pay for an unknown label, even if they were more predisposed to selecting those labels.

The ESR model specified in equations 4a and 4b above captures observable characteristics between individuals who prefer the local brand or the international brand. In accounting for the unobserved factors given the brand selection bias, inverse mills ratios for participants who chose a local brand (β_{Li}) and an international brand (β_{Fi}) are jointly computed

with σ_{eL} and σ_{eF} after equation 1 is estimated using the full information maximum likelihood estimator, and then included in equations 4a and 4b. This can be expressed as:

$$\text{Regime 1 (Local brand preference): } Y_{Li} = \beta_{Li}X_{Li} + \sigma_{eF}\lambda_{Li} + \varphi_{Li} \text{ if } S_i = 1 \quad (5a)$$

$$\text{Regime 2 (Foreign brand preference): } Y_{Fi} = \beta_{Fi}X_{Fi} + \sigma_{eF}\lambda_{Fi} + \varphi_{Fi} \text{ if } S_i = 0 \quad (5b)$$

where $\sigma_{eF}\lambda_{Li}$ and $\sigma_{eF}\lambda_{Fi}$ are the inverse mills ratios, and φ_{Li} and φ_{Fi} are error terms. Jointly estimating the selection and continuous equations yields correlation coefficients $\rho_{eF}(\sigma_{eF}/\sigma_e\sigma_F)$ and $\rho_{eL}(\sigma_{eL}/\sigma_e\sigma_L)$. The (statistical) significance of ρ_{eF} and ρ_{eL} suggest the existence of selection bias from the unobserved factors and validates the appropriateness of the ESR model.

Results

Brand Preference from two Choice Scenarios

Recall that prior to the auction procedures, participants chose their preferred brand between two brands with a local versus an international appeal. Table 3 summarizes the proportion of participants who preferred each brand, first, from two meters away, and subsequently from close inspection. In particular, the table captures the proportion of participants' preferred brands which are unconfounded from their endogenized benchmark. Of the four brands, the two local versions, *Ndanane* and *Sunu Ceeb* were mostly preferred over the international brands. *Ndanane* was the preferred of the two local brands from a distance of 2 meters. Upon close inspection, both local brands were still preferred to the international brands. While preference for the local brands diminished on close inspection (more so for *Ndanane*), it increased somewhat for the international brands. We argue though that the choice of brand from a distance captures the

“real” brand effect as it is untainted by preferences for intrinsic characteristics. Among the international brands, *Happiness* was only slightly preferred to *Noblesse* from a distance, although the latter gained popularity following close inspection.

< Table 3 >

Willingness to Pay Price Premiums

A summary of participants WTP for their preferred rice brands is displayed in Table 4. Similar to Britwum et al. (2020), the WTP amounts are interpreted as price premiums over the endogenously endowed 1kg benchmark rice. Table 4 disaggregates this by experimental location (Dakar or St. Louis) and includes the proportion of zero bids across all iterations of initial endowments and subsequent upgrades.

Overall, average premiums were higher upgrading from international to local brands than local to international, a finding that is somewhat backed by the proportion of zero bids at 8.67% in favor of local brands versus 9.89% for international brands. With respect to the specific brands, upgrading either of the international brands to *Ndanane* recorded the highest proportion of zero bids of approximately 15%, consistent with its striking preference shift as captured in Table 3. *Sunu Ceeb* recorded a relatively small proportion of zero bids (in Table 4). In particular, all participants who were endowed with *Noblesse* with the opportunity to upgrade to *Sunu Ceeb* were willing to pay positive price premiums. While the proportion of zero bids among participants endowed with *Happiness* with the opportunity to upgrade to *Sunu Ceeb* was also low at approximately 5%, this group was remarkably willing to pay the highest price premiums on average, although this was true of those in St. Louis than Dakarois.

For the international brands, *Happiness* outperformed *Noblesse* in price premiums in the pooled case, and among St. Louis participants. St. Louis participants were willing to pay between

89 to 93 FCFA in premiums to upgrade the local brands to *Happiness*, although premiums in both cases (of upgrading the two local brands) were lower among Dakar participants. These results suggest that in addition to preference for rice brands, the market may also be segmented by location. For example, while *Sunu Ceeb* was strongly preferred over *Noblesse* and *Happiness* among Dakar and St. Louis participants, respectively, *Ndanane* ranked popular over the international brands among Dakar participants.

Finally, average positive price premiums were further disaggregated by cultural heritage and colonial heritage to gain additional insights into brand preferences by heritage. As displayed in Table 5, participants with rice cultural heritage posted higher bids on average (~108 FCFA) to upgrade local to international than international to local (65 FCFA). To the extent that the cultural heritage hypothesis suggests a preference for local rice among descendants of original rice domesticators, this finding provides weak evidence for the hypothesis. Participants with rice cultural heritage were in fact willing to pay lower price premiums to upgrade the international brands to either *Ndanane* or *Sunu Ceeb* relative to those with preferences induced by colonial heritage. On the contrary, the highest average price premiums were posted for upgrading *Ndanane* or *Sunu Ceeb* to *Happiness*, at approximately 117 FCFA and 100 FCFA, respectively. This may suggest that cultural and colonial heritage preferences may be limited to attribute/trait characteristics rather than branding. However, this needs to be subjected to a formal econometric analysis that controls for relevant variables to make such conclusions robust.

< Table 4 >

< Table 5 >

Choice and Preference for rice branding

Empirical results from econometric models are presented in Table 6. The table shows Probit results regarding factors that influenced brand choice from two meters away, and also presents results from the ESR. We intentionally limit the Probit regression to brand choice made two meters away, given that the selection equation within the ESR captures brand choice following close inspection of the brands and rice.

There were two significant variables, *Ndanane*, and *Dakar*. The positive coefficient for *Ndanane* suggests it was the most popular of the two local brands from a distance. Brand preference also diverged based on location—participants from Dakar were less likely to choose a local brand (Costello et al. 2013) relative to those in St. Louis. With Dakar being the capital hosting the seaport, it is likely participants sampled from there were more exposed to a variety of rice import brands than those in the relatively smaller St. Louis. The significant coefficient may thus suggest that exposure to imported rice, which has been reminiscent of Senegalese rice markets has shaped preferences of consumers in Dakar more strongly towards foreign brands.

The ESR results first showcase the outcome from the binary choice part (the selection equation), and then the two regimes for the continuous stage, i.e., WTP price premiums for international label, and the local label. The positive and significant coefficient of the correlation coefficient (ρ_1) supports the presence of selectivity bias, indicating that the error terms from the selection and outcome equation from the international regime were indeed correlated (Lokshin and Sajaia 2004; Ma et al. 2022) and justifies appropriateness of the ESR model. The variable *hypothetical* was significant in the selection equation, although at the 10% level of significance. Its positive coefficient suggests that participants who treated the experiments as hypothetical, that is, those unwilling to purchase their preferred bag of rice following the auction

process, were also more likely to choose rice with local branding. These participants were also likely to post very high premiums in their local brand selection. While the study was not initially designed to test hypothetical bias in experiments, this finding nonetheless highlights the difference between choices participants make when they do not face real consequences, versus when they do (Harrison 2014). This shines a spotlight on the importance of experimental designs that induce participants to bid truthfully. The popularity of the local brands among this group is, however, not obvious and may require further investigation.

< Table 6 >

Specific to the brands, participants who opted for an international brand were willing to pay lower premiums to upgrade either of the local brands to *Noblesse* relative to *Happiness*, suggesting the popularity of the latter. Those who were willing to upgrade international brands to local discounted *Ndanane*, suggesting a higher valuation of *Sunu Ceeb* among those who preferred local brands. Although *Ndanane* was the most preferred brand of the two local options from a distance of two meters, as a benchmark it performed as well as *Sunu Ceeb* among those who were upgrading to an international brand, given the insignificant *Ndanane* coefficient in the international label regime. Following an endowment of the international brand (*Noblesse* and *Happiness* also performed equally as benchmarks). That means, while *Ndanane* initially attracted a higher market share, it did not translate into a higher price premium for the brand, whereas *Sunu Ceeb* although valued higher, received a lower market share.

The time of auctions (morning or afternoon) did not influence brand selection or price premiums in a significant manner, unlike findings from previous rice auctions in Africa that found a higher willingness to upgrade and WTP price premiums among those who participated in the mornings. (Demont et al. 2012; Demont and Ndour 2015; Britwum et al. 2020). However, the

time since last meal variable emerged significant in the international label regime. The longer it had been since their last meal—a possible proxy for hunger—the more likely they were to pay price premiums for an international label. Time since last meal may consequently work better as a proxy for participants' hunger in economic experiments than a simple “morning” dummy.

Additional perspectives on brand preferences can be gleaned from the difference in auction venue. The Probit regression indicated a weaker preference for the local brands among Dakar participants relative to those in Saint-Louis. However, the ESR model shows that Dakarois discounted the international brands as an upgrade over the local versions. To provide some geographical context, Dakar has the largest domestic market in Senegal and closer to a seaport, making it more likely for Dakarois to be better exposed to other rice brands including a variety of imported ones. The finding also implies that participants sampled from St. Louis were willing to pay higher price premiums to exchange local for international brands, which is consistent with previous studies which found higher price premiums for imported rice among St. Louis consumers (Demont et al. 2013a).

With respect to cultural heritage which was delimited to those aligned with primary versus secondary centers of rice domestication, only the latter dummy was significant, relative to colonial heritage. Its positive coefficient in the international label regime implies that those whose lineages were traced to the secondary centers were incidentally willing to pay higher premiums to exchange local for international brands. The suggested preference for international/foreign themed local rice among consumers with cultural heritage seems contrary to previous findings (Demont et al. 2017; Britwum and Demont 2021a, b; Britwum and Demont 2022), where this group has tended to prefer intrinsic attributes of local rice. This suggests that once participants with cultural heritage know they are bidding on local rice, they may still be

sensitive to quality cues that are typically associated with imported rice. This evidence complements findings by Demont et al. (2013a) in the same urban populations in that quality is still the major driver for consumer preferences and that foreignness serves as a quality cue due to the generally low-quality reputation of local rice.

Finally, demographic variables were generally weak predictors of choice and WTP price premiums, except for age. The negative coefficient of age in both regimes shows that, consistent with other auction results (e.g., see review by Demont and Ndour 2015), younger people were willing to pay higher premiums for either local or international brands, demonstrating that innovative brands resonate more with the youth than with older consumers. The brand awareness variable, which was included as an identification restriction was significant (at the 5.1% level) in the selection equation. We find that the more familiar participants were with common brands (which are largely imported), the more likely they were to choose the internationally themed brands. When viewed in tandem with the insignificant instrument, *Prefer imported rice*, it can be inferred that visual recognition of brands is a stronger predictor of preference for extrinsic attributes than habits.

Conclusion

The growing popularity of rice in the Global South, especially on the African continent where it is supplanting more traditional starchy staples has prompted agricultural policies intended to stimulate domestic production in an effort to overcome supply bottlenecks. Tailoring breeding and value chain upgrading priorities towards a complex consumer segment whose preferences have been shaped by both cultural heritage and colonial heritage is an important piece of demand-driven interventions to increase the market share of locally produced rice. This study

explores these issues through experimental auctions to illuminate branding preferences among consumers from both market segments, which coexist in Senegal. Contrary to hypotheses that cultural heritage consumers will be inclined towards the local brands and those induced by colonial heritage the foreign brands, findings revealed that consumers endowed with local cultural heritage placed premiums on domestic rice with foreign looking brands. However, consumers whose preferences have been induced by colonial heritage neither rejected or discounted the local brands. This suggests that foreignness is perceived as a premium quality cue even in market segments induced by cultural heritage. Branding local rice through a mix of local and foreign cues may thus be an effective strategy to market local rice to both market segments shaped by cultural and colonial heritage. Durabilis' successful introduction of Terral is such an example; it features an Indian symbol with a local brand name translating into "welcome" or "hospitality" in *Wolof* (<https://durabilis.eu>).

The study also makes a methodological contribution to the experimental auction literature by employing the endogenous switching regression model in an endow-and-upgrade framework where the endowment is endogenous. Given that this auction framework yielded uncensored data, the full WTP distribution was elicited. In lieu of researchers endowing participants with a fixed benchmark, this set-up demonstrates an alternative where participants can be part of the decision in choosing their own benchmarks in an endow-and-upgrade methodology.

A few limitations of the study are worth noting. First, although the two-stage elicitation (i.e., from a distance of 2 meters, and then from close inspection) mirrors consumers' decision-making process for bagged rice purchases, it could have unwittingly signaled differences in intrinsic rice quality among the different bags. When consumers take a sample from the bags to examine the rice, there is a potential for sampling error as the product typically contains

impurities which are not perfectly randomized. This perhaps explains the weakening of the statistical significance of the determinants between the Probit and Selection equations, which may have weakened the explanatory power of the ESR model. We also note that the ‘hypothetical’ variable is not completely observed, since this was revealed only when participants outbid the randomly drawn amount but were reluctant to pay out-of-pocket. It is not observed among participants whose bids were lower than the randomly drawn amount. Thus, the ‘hypothetical’ variable should be interpreted with care, especially against the backdrop of this being observed for only 5% of participants. Finally, just about 10% of participants had ethnicities that aligned with cultural heritage (5% from the primary center of ancient rice origin, and 5% from the secondary center). This is likely because participants were sampled from large urban centers farther away from rice cultural heritage. As such, the results need to be interpreted with care in terms of its generalizability.

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LIST OF TABLES AND FIGURES

Table 1. Segmentation of ethnicities into cultural heritage and colonial heritage

Ethnic group	Cultural/colonial heritage	Genealogical lineage, evidence or rationale
<i>Bambara</i>	Cultural heritage, primary center of origin	<i>Mande</i> group; Demont et al. (2017)
<i>Sosse (Soce, Sossé, Socé, Saussai)</i>	Cultural heritage, primary center of origin	<i>Mande</i> group; Demont et al. (2017)
<i>Soninke</i>	Cultural heritage, primary center of origin	<i>Mande</i> group; Demont et al. (2017)
<i>Jola (Diola)</i>	Cultural heritage, secondary center of origin	Britwum and Demont (2021a, b)
<i>Susu (Soussou)</i>	Cultural heritage, secondary center of origin	https://www.universalis.fr/encyclopedie/soussou-susu/
<i>Moor (Maure)</i>	Colonial heritage	Britwum and Demont (2022a)
<i>Moroccan</i>	Colonial heritage	Morocco was a French protectorate
<i>Fula (Pulaar)</i>	Colonial heritage	Britwum and Demont (2022a)
<i>Serer (Séréér)</i>	Colonial heritage	Britwum and Demont (2022a)
<i>Wolof</i>	Colonial heritage	Britwum and Demont (2022a)
<i>Lebou</i>	Colonial heritage	<i>Wolof</i> ; Britwum and Demont (2022a)

Table 2. Variable names and descriptive statistics

Variable	Description	Mean (Std dev)		
		Saint-Louis	Dakar	Overall
Hypothetical	1 if participant was unwilling to pay out of pocket; 0 otherwise	0.05 (0.22)	0.06 (0.24)	0.05 (0.23)
Preference shift	1 if subject changed brand preference between first and second question; 0 otherwise	0.19 (0.39)	0.17 (0.37)	0.18 (0.38)
Daily purchase	1 if household purchases rice daily; 0 otherwise	0.24 (0.43)	0.38 (0.49)	0.31 (0.46)
Monthly purchase	1 if household purchases rice monthly; 0 otherwise	0.72 (0.45)	0.53 (0.50)	0.62 (0.49)
Morning	1 if field experiment was conducted in the morning; 0 otherwise	0.58 (0.50)	0.50 (0.50)	0.54 (0.50)
Time since last meal	Hours since a participant's last meal	3.76 (3.40)	3.58 (3.76)	3.67 (3.58)
Dakar	1 if participant was sampled from Dakar; 0 for a participant from Saint-Louis			0.50 (0.50)

Cultural heritage- Primary	1 if subject traces genealogy to primary center of rice domestication; 0 otherwise	0.04 (0.20)	0.07 (0.25)	0.05 (0.23)
Cultural heritage- Secondary	1 if subject traces genealogy to secondary center of rice domestication; 0 otherwise	0.04 (0.20)	0.05 (0.22)	0.05 (0.21)
Higher education	1 if subject has secondary or tertiary education; 0 otherwise	0.38 (0.49)	0.12 (0.32)	0.25 (0.43)
Trader	1 if subject is active in trading; 0 otherwise	0.40 (0.49)	0.45 (0.50)	0.42 (0.49)
Age	Subject age in years (average)	38.84 (13.25)	37.19 (12.06)	38.02 (12.67)
Cooking housemaid	1 if household has a cooking housemaid; 0 otherwise	0.12 (0.33)	0.07 (0.25)	0.10 (0.29)
Household size	Number of individuals in a household	10.80 (9.17)	8.69 (4.63)	9.75 (7.35)
Prefer imported rice	1 if household usually purchases imported rice	0.43 (0.50)	0.75 (0.43)	0.59 (0.49)
Brand awareness	Share of nine brands correctly identified	3.67 (1.94)	4.17 (1.50)	3.92 (1.75)

Table 3. Brand preference by proportion

Preferred brand	% Proportion	
	Two meters away	Close inspection
<i>Happiness</i>	15%	18%
<i>Noblesse</i>	14%	20%
<i>Ndanane</i>	39%	31%
<i>Sunu Ceeb</i>	32%	31%

Notes: There were approximately 60 participants for each unique rice brand pair.

Table 4. Percentage of zero bids and mean WTP price premiums

		Dakar	Saint Louis	Pooled
	% (WTP = 0)	Mean (WTP > 0)	Mean (WTP > 0)	Mean (WTP > 0)
<i>Happiness</i> upgraded to <i>Ndanane</i>	15.00	69.23 (25.32)	54.76 (29.18)	60.29 (28.28)
<i>Ndanane</i> upgraded to <i>Happiness</i>	0.00	60.00 (27.67)	89.29 (57.48)	69.76 (41.09)
<i>Noblesse</i> upgraded to <i>Sunu Ceeb</i>	0.00	85.53 (48.82)	69.73 (39.60)	77.63 (44.57)
<i>Sunu Ceeb</i> upgraded to <i>Noblesse</i>	18.18	58.33 (25.00)	58.33 (25.00)	58.33 (24.25)
<i>Happiness</i> upgraded to <i>Sunu Ceeb</i>	5.41	58.93 (28.77)	105.95 (76.61)	87.14 (65.69)
<i>Sunu Ceeb</i> upgraded to <i>Happiness</i>	4.35	61.67 (29.68)	92.86 (53.45)	71.59 (40.31)
<i>Noblesse</i> upgraded to <i>Ndanane</i>	14.29	88.24 (67.38)	63.46 (26.25)	77.50 (54.28)
<i>Ndanane</i> upgraded to <i>Noblesse</i>	16.00	75.00 (26.35)	72.73 (26.11)	73.81 (25.59)
Local to international brand	9.89	63.33 (27.41)	76.47 (40.80)	68.78 (34.00)
International to local brand	8.67	76.98 (48.00)	74.66 (52.59)	75.72 (50.36)

Note: Numbers in parenthesis are standard deviations. WTP premiums are denominated in FCFA/kg

Table 5. Mean price premiums by heritage

	Cultural heritage Mean (WTP > 0)	Colonial heritage Mean (WTP > 0)
<i>Happiness</i> upgraded to <i>Ndanane</i>	50.00	60.61
<i>Ndanane</i> upgraded to <i>Happiness</i>	116.67	61.94
<i>Noblesse</i> upgraded to <i>Sunu Ceeb</i>	70.83	78.91
<i>Sunu Ceeb</i> upgraded to <i>Noblesse</i>	–	58.33
<i>Happiness</i> upgraded to <i>Sunu Ceeb</i>	66.67	89.06
<i>Sunu Ceeb</i> upgraded to <i>Happiness</i>	100.00	70.24
<i>Noblesse</i> upgraded to <i>Ndanane</i>	60.00	81.00
<i>Ndanane</i> upgraded to <i>Noblesse</i>	100.00	71.05
Local to international brand	108.33	65.66
International to local brand	65.00	77.05

Table 6. Determinants of consumers' propensity of upgrading and willingness to pay (WTP) for local and international rice brands

	Probit model	Endogenous switching regression model		
	Choice of label 2 meters away	Selection	International label regime	Local label regime
Hypothetical	0.516 (0.486)	0.679 (0.385)*	−2.584 (22.990)	98.022 (19.654)***
Noblesse	0.089 (0.188)	−0.148 (0.172)	−22.267 (7.891)***	2.283 (9.734)
Ndanane	0.453 (0.191)**	−0.147 (0.169)	1.102 (7.859)	−21.456 (9.258)**
Daily purchase	0.159 (0.401)	0.546 (0.388)	15.820 (17.824)	32.217 (21.028)
Monthly purchase	0.133 (0.386)	0.501 (0.366)	4.447 (16.200)	20.670 (20.119)
Morning	−0.054 (0.192)	−0.013 (0.169)	−3.567 (7.988)	0.948 (9.538)
Time since last meal	−0.006 (0.026)	0.027 (0.025)	3.073 (1.257)**	−0.176 (1.342)
Dakar	−0.412 (0.210)**	−0.195 (0.183)	−20.936 (9.596)**	−11.395 (10.267)
Cultural heritage - Primary	0.201 (0.409)	0.116 (0.358)	25.425 (17.504)	2.879 (19.775)
Cultural heritage - Secondary	0.821 (0.584)	0.295 (0.414)	81.962 (25.428)***	7.272 (20.875)
Higher education	0.340 (0.257)	−0.144 (0.210)	−14.807 (10.819)	−12.793 (11.953)
Trader	−0.155 (0.203)	−0.042 (0.183)	−6.823 (8.021)	−15.419 (10.330)
Age	0.009 (0.008)	0.000 (0.008)	−0.642 (0.306)**	−0.759 (0.403)*
Cooking housemaid	0.274 (0.349)	0.121 (0.285)	3.158 (13.955)	3.474 (15.384)
Household size	0.008 (0.016)	0.009 (0.015)	−0.198 (0.771)	0.436 (0.624)
Prefer imported rice	−0.066 (0.204)	−0.058 (0.131)		
Brand awareness	−0.056 (0.055)	−0.064 (0.033)*		
Constant	0.192 (0.689)	0.157 (0.683)	115.344 (28.931)***	52.630 (31.970)*
Rho 0			0.620 (0.701)	
Rho 1				2.336 (0.652)***
Wald test χ^2		37.30***		

Notes: Values in parentheses are standard errors. Asterisk (*), double asterisk (**) and triple asterisk (***) denote variables significant at 10 per cent, 5 per cent and 1 per cent, respectively.

Probit models: Dependent variables are both dummy variables, with 1=local brand, and 0 = international brand

Endogenous switching regression model: Selection equation based on choice of label after inspection

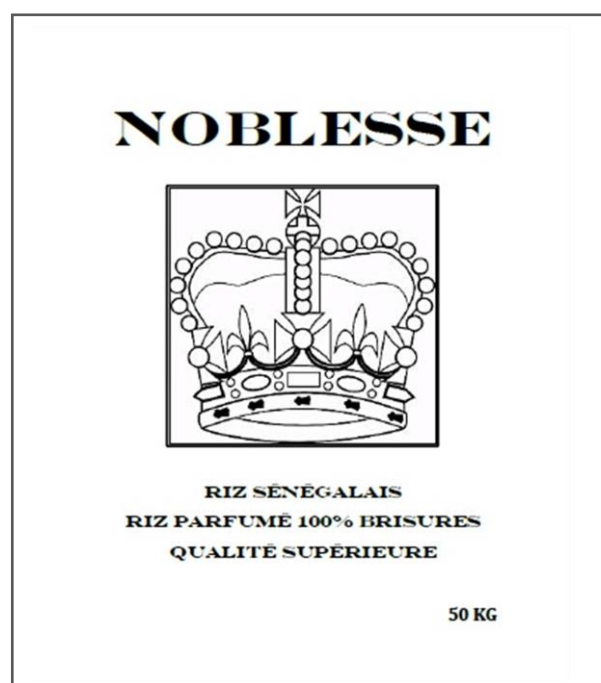
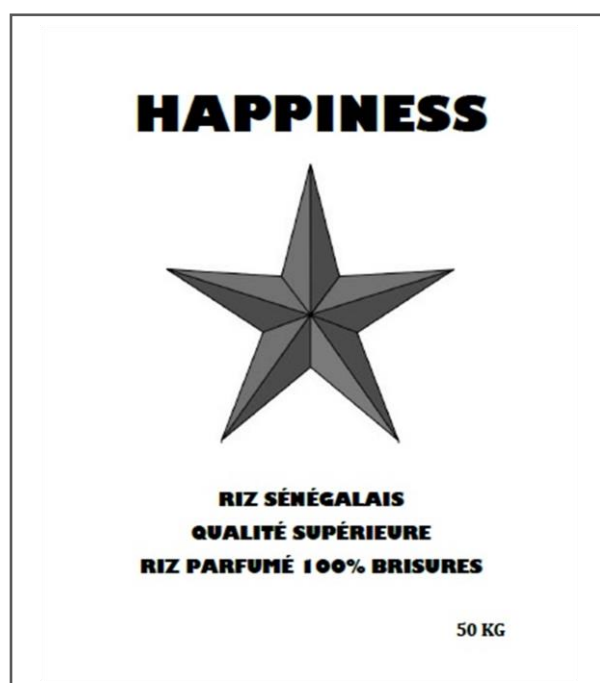
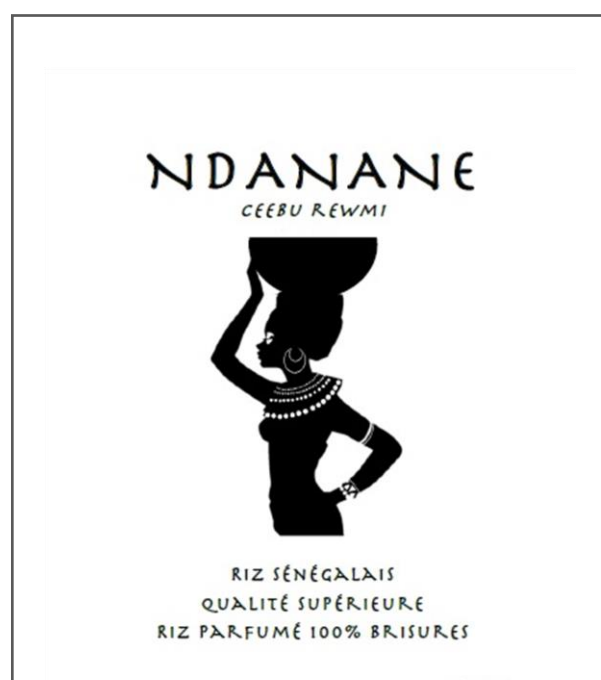
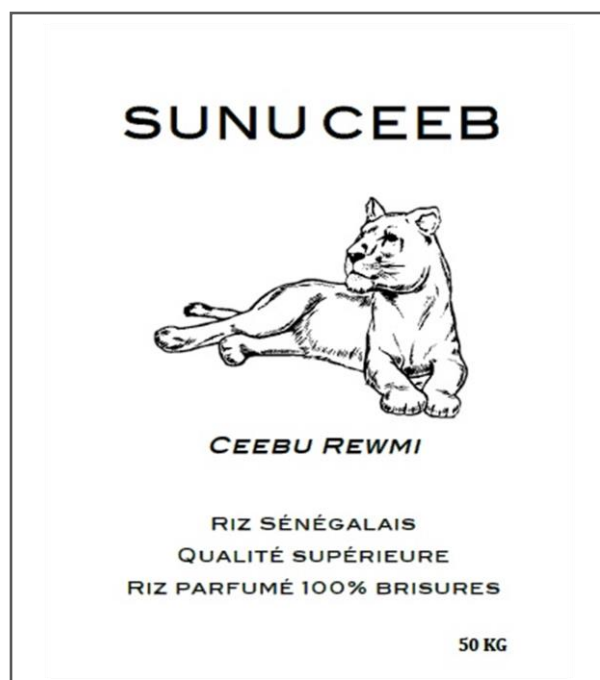


Figure 1. Brands developed for the study. First panel shows the local brands, and second panel the international brands.

APPENDIX



Figure 2. 50kg bags of rice used in auction experiments.