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Understanding consumer attitudes to and valuation of organic food in Sub-Saharan Africa: A double-bound contingent method applied in Dakar, Senegal

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Abstract

Although organic farming is increasingly perceived as a viable alternative to conventional agriculture in the face of deteriorating environmental ecosystems, little is known about consumers' preferences for organic products in Sub-Saharan Africa. This paper bridges this gap in research and investigates the extent to which consumers value organic food in Dakar, Senegal. The double-bound contingent valuation approach was used on primary data from urban individuals. The results indicate that consumers do indeed significantly value organic vegetables, with a premium averaging 53% and varying across food items. The results also indicate that the current market structure of organic farming tends to undervalue organic products, as the actual price is 25.7% below the average consumers' reservation price. Consumers who attach a higher value to organic products are found to be young, female, well-educated, wealthy, and fairly concerned about the health and environmental impacts associated with food production. All of these results contribute to laying the foundations to promote sustainable farming practices that make use of local solutions to address global environmental challenges.

Key words: **organic farming; economic valuation; Senegal**

1. Introduction

The growth of organic farming (OF) in sub-Saharan Africa (SSA) has been advocated as a contributor to environmental and social benefits for the agricultural system as a whole. Organic farming refers to farming practices that make use of less or no chemical fertilisers and pesticides. Its adoption is expected to contribute to an improvement in food security (Peramaiyan *et al*. 2009; Guesmi *et al*. 2012; Ponisio *et al*. 2015), a reduction in the magnitude of water pollution and biodiversity losses (Stolze *et al*. 2000; Sivaranjani & Rakshit 2019), and the promotion of diets that provide a higher standard of nutritional quality (Schoonbeek *et al*. 2013). Despite these expected benefits, previous studies have shown that the spread of organic farming in Africa is still slow compared to the situation

in other regions of the world. For example, only 0.2% of Africa's farmland is considered organic, compared to 0.4% and 5% for China and Latin America respectively (NEPAD 2013; De Bon *et al*. 2018). The low yield associated with organic farming when compared with conventional farming (i.e. chemically intensive) is the major constraint that limits the increased adoption of on the continent. For instance, recent evidence shows that, on average, yields achieved under organic farming are 43% lower than yields that are obtained under conventional agriculture (Seufert *et al*. 2012).

Despite these limitations, more recent studies suggest that, when properly supported by appropriate public policies, crops produced under organic farming can produce the same level of benefits as the ones cultivated under conventional agriculture that rely on synthetic pesticides (Lohr & Salomonsson 2000; Acs *et al*. 2007; Ponisio *et al*. 2012; Seufert *et al*. 2012). The argument put forward is that the yield gap could be reduced when one goes beyond the balance sheet approach, which is used to compute the yield differentially, by including the long-term environmental and health-related benefits associated with organic farming. In addition, the yield gap between conventional and OF practices is influenced by temporal and spatial variability, which characterises soil properties and farming conditions. When such additional benefits are included, organic farming is expected to offer sustainable solutions to the current agricultural system, especially in a context where agricultural practices around the world are being affected negatively by climate change. More importantly, for farmers in SSA, organic farming may offer practical and locally adapted solutions. Most farming activities in the region are labour intensive and on a relatively small scale. They make less use of mechanisation and rely on local resources to produce crops. Therefore, organic farming could support the continent not only to diversify its agricultural production in a way that values its rich ecosystem services, but also one that addresses the problem of youth unemployment.

In addition, for many smallholder farmers, organic farming could contribute to reducing poverty by linking their products to markets in which consumers are willing to pay a higher premium to purchase organically grown food. However, this requires strong government support and institutional changes that foster the implementation of new agricultural policies that value healthy food, and not just food, and that encourage changes in consumers' behaviour towards the consumption of organic crops. These changes in food consumption behaviours are found to be motivated mainly by health, product quality and concerns about the degradation of the natural environment (Rana & Paul 2020).

The purpose of this paper is to evaluate the willingness to pay of urban African consumers to purchase local organically grown crops. A good understanding of how consumers value locally produced organic crops, as well as their attitudes to such crops, could allow producers to assess the market potential of this burgeoning agricultural system in Africa, in particular the extent to which investments made in sustainable farming could provide long-term benefits for African farmers and consumers alike. Although most of the organically grown crops in Africa are exported to more affluent foreign markets, such as Europe and the USA, there is a new and growing trend among local and urban consumers to value healthy food. These are often middle-class consumers who reside in urban areas and tend to report a high willingness to pay for organically grown food. For instance, studies conducted in some African countries, such as Uganda, Kenya and Ghana, show a growing demand for organic food, although still in smaller proportions (Kledal *et al*. 2010; Owusu & Anifori 2013; Chiputwa & Qaim 2016; Kyomugisha *et al*. 2019).

This trend is often associated with an increase in selling points where organic farmers meet directly with urban consumers and commercialise their crops without any intermediate agents playing a role. These are markets that take place twice a week or on weekends, where buyers are given the opportunity to purchase vegetables that are organic and grown locally. These weekly markets are found in several major African cities, such as Nairobi, Dakar, Johannesburg, Tunis and Kampala.

We made use of data collected from Dakar, the capital city of Senegal, to study the extent to which urban residents are willing to pay a premium for organic products. Subsequently, we identified the factors that drive individual valuations of and attitudes towards organic food. This research considers the crops that are among the most widely used by Senegalese households, namely onions, potatoes, carrots and tomatoes. Senegal is a country that has taken organic farming seriously. Alongside the *Conseil Senegalais de l'Agriculture Biologique* (CSAB), an organic farmers' organisation established in 1998, several NGOs contribute to supporting national and local initiatives that aim to enhance the share of organic farming in overall agricultural production. These NGOs have created various platforms organised around local farm cooperatives and associations that support farmers who share their experiences and therefore acquiring new and localised knowledge about organic farming practices. Members of such cooperatives meet once a month to discuss and exchange information to identify best practices that support the dissemination of organic farming. Beyond the NGOs and the CSAB, the supporting framework involves private firms that have been playing an important role by providing financial and technical support to farmers who grow organic crops. The presence of various stakeholders operating in organic farming shows the potential of the sector to support the country's national development plans and long-term strategy for food security, and the reduction of poverty and inequality.

The paper adds scientific and policy recommendations to the sustainable farming practices in sub-Saharan Africa by providing a better understanding of attitudes towards and the valuation of organically grown produce in a developing country context, where there is relatively limited knowledge of consumers' demands (Pacho 2020). Understanding the mechanisms underlying consumers' preferences, attitudes and willingness to pay for safe food in sub-Saharan Africa is currently the subject of a growing empirical literature (Akinwehinmi *et al*. 2021). Existing studies examining the demand side of organic food markets have shown the importance of drivers such as food quality and security, along with trust in the certification and brand name (Krystallis & Chryssohoidis 2005), subjective norms and attitudes, knowledge of organic food, health consciousness, environmental concerns, and hedonic shopping value (Katt & Meiner 2020; Pacho 2020), consumer demographics and perceptions regarding taste and quality (Wang *et al*. 2019; Wekeza & Sibanda 2019; Akinwehinmi *et al*. 2021).

Drivers of preferences and valuation are not universal, and differ, for instance, between developing and advanced economies. This is largely owing to the specific nature of the food products and, more importantly, the socio-economic context, even within closed settings. Krystallis and Chryssohoidis (2005), for example, have suggested that prices and consumers' socio-demographic profiles do not constitute determinants of willingness to pay for some fresh as well as processed organic food products in Athens, in contrast to what Katt and Meiner (2020) found for grocery retailing in the USA, Güney and Giraldo (2020) for organic eggs in Turkey, and Wekeza and Sibanda (2019) for organic fruits and vegetables in the KwaZulu-Natal province of South Africa.

As the heterogeneous socioeconomic contexts tend to be shaped by the extent to which national policies are incentivising organically grown food, or trying to influence public perceptions and awareness, the empirical findings do not lend themselves to generalisation. This warrants more research on the topic so as to generate enough evidence to allow for the emergence of clear, robust patterns. The purpose of this study is to add to this knowledge through the differentiated and uniquely African lenses in general, and Senegalese ones in particular.

The remainder of the paper is presented as follows. Section 2 discusses the context of the study. The methodology of the paper is presented in Section 3. Section 4 gives an overview of the data. Section 5 presents the results of our analysis, and Section 6 concludes the paper.

2. Context of the study

Agriculture is key to the Senegalese economy and the sector contributes to the livelihoods of a large share of the population. Although the sector makes up only 15% of the country's GDP, it represents a major source of direct and indirect income for about two-thirds of the population, most of whom live in rural areas. The sector is therefore rightfully key to the overall development strategy of the country, and it has been recognised as such by the Plan for an Emerging Senegal (*Plan Sénégal Émergent* – PSE), which aims to make the country an emerging economy by 2035.

The agricultural sector is dominated mostly by small family farming, which contributes 90% of the sectoral value-added (République du Sénégal 2018). There are many constraints that impair the development of farming, which the PRACAS[1] – the sectoral translation of the PSE – tries to remedy. These include: (i) limited access to inputs, such as high-quality seeds, (ii) insufficient valorisation of hydro-agricultural infrastructure, (iii) degradation of soils, (iv) high predominance of rain-fed crops and vulnerability to climate-related shocks, (v) an inadequate land rights system, and (vi) limited access to domestic and export markets.

If most of the ensuing reforms of the PRACAS end up tackling these many structural and climate-related challenges successfully, the resultant rise in agricultural productivity and the prospects for agro-industrial development would undeniably contribute to improving the economic status of a large segment of the population. However, the rush to more productive agriculture in the face of the urgency to improve livelihoods and food security is associated with increasing concerns about the quality of the food and the sustainability of the farming system with regard to environmental conservation. In fact, by subsidising fertilisers to the tune of 50%, the government is encouraging more use of this input, as per continental recommendations.[2] As a result of the increased use of chemical fertilisers, productivity has been on the rise. For instance, Seck (2017) has shown that, in the case of the Senegal River Valley, fertiliser use has increased significantly, especially among large-scale farmers and those affiliated with farmers' organisations, and as a result of this, productivity (yield or efficiency) has increased by as much as 154%.

To the extent that government and most farmers tend to be motivated solely by productivity and income gains, the increasing use of hazardous chemical fertilisers and pesticides is more likely to affect human health and the chemical composition of agricultural produce. As more and more of the inputs are put in the hands of often poorly educated farmers who are less aware of the technical process and protocols that guide the use of these chemical inputs, there are reasons to worry about the further degradation of soils, loss of biodiversity, deterioration of food quality and adverse consequences to human health. For instance, David-Benz and Seck (2017) have documented that the heavy use of urea and water allows farmers to harvest larger size onions, which ensures higher price and revenue to farmers at the expense of product safety to consumers, and the ability to store them for a long time under conditions that are often characterised by humidity and high temperature.

However, awareness of and concerns about the adverse health and environmental impacts associated with conventional farming practices are mounting. Increased consciousness among a growing portion of the population appears to be fuelled by rising income and education levels, leading to an expanding middle class. These developments tend to follow the general premise that agroecology has a large potential to build climate-resilient livelihoods and sustainable food systems (Leippert *et al*. 2020). As

[1] Programme d'acceleration de le cadence de l'agriculture Senegalaise (PRACAS).

[2] The 2006 Abuja Declaration of the African Union urges countries "to increase the level of use of fertilizer from the current average of eight kilograms per hectare to an average of at least 50 kilograms per hectare by 2015". The African Fertilizer Development Financing Fund has been set up to "mobilize and pool resources to finance, in particular, fertilizer production, distribution, procurement and use in Africa".

a result, there are growing market niches that many farmers seek to exploit, often with the institutional support of various organisations. In Senegal, the movement towards healthy food and agriculture has attracted a large number of farmers, mostly affiliated with the National Federation for Organic (bio) Agriculture (*Fédération Nationale pour l'Agriculture Biologique*), a 12-year-old grouping of 18 organisations combining 22 000 farmers scattered across all four agroecological zones of the country. The Federation also includes traders, sellers and transformers, as well as consumers, and some six supporting organisations, such as Enda Pronat (2020). The range of institutional support includes capacity development on pilot farms in terms of soil regeneration, production and use of organic fertilisers (compost), water management, and so forth (Enda Pronat 2016). When it comes to market sales, there are some spots, mostly in affluent neighbourhoods, where sellers meet buyers, often once a week. The generally higher price of organic products compared to their conventional counterparts – a reflection of the cost differential – does not seem to deter a growing demand from consumers who view the price differential as a premium that buys increased nutritious and health quality. Understanding the extent of such a premium, what drives it, and how it varies across individuals is crucial to assess the potential for the development of organic agriculture, especially in the context of increased awareness and seemingly changing consumer preferences among the more demanding and growing middle class.

3. Methodology

The following method was used for this study. Placed in a scenario comprising contingent attributes of a good or service, individual *i* was asked to value the good or service. His/her willingness to pay (WTP_i) depends on a series of characteristics, such as his/her income, education, and level of awareness and concern about food quality, alongside specific characteristics that define the contingent nature of the good or service to be valued. In our present example, these characteristics were captured by healthy and nutritious food items. This relationship can be expressed as follows:

$$WTP_i(X_i) = X_i\delta + \mu_i, \quad (1)$$

where X_i is the vector of characteristics of the given goods, δ is a parameter vector to be estimated, and μ_i is an error term. Conceptually, how much an individual *i* is willing to pay for improved quality of food items depends on how much his/her well-being or utility is affected in moving from the status quo, corresponding with food grown using chemical fertilisers, to a situation corresponding to healthy food grown organically. Following the random utility model developed by Hanemann (1984), which draws on the theoretical insights of McFadden (1974, 1977, 1994), individual *i* is willing to pay P_i if the indirect utility, net of payment, derived from the improved food quality of attributes A^1, is greater than that associated with the initial state, A^0; that is:

$$U_i^1(y_i - P_i, A^1, z_i, \varepsilon_i^1) > U_i^o(y_i, A^0, z_i, \varepsilon_i^0) \quad (2)$$

This can be interpreted as the participation constraint, where y_i represents individual i's income, z_i is a vector of additional individual characteristics, and ε_i^1 and ε_i^0 are the stochastic components of preferences.

In the specific contingent valuation format known as the double bound, which was developed by Hanemann *et al*. (1991), individual *i* is offered a first price, P_{i0}, and then a follow-up question introduces a second price, P_{i1}. This second price is higher or lower than the first price, depending on whether the response to the first offer is positive or negative. One can then envision four combinations of answers to the bid prices: (i) "yes-yes", that is, yes to both the first and second price offers, in which case $WTP_i > P_{i1} > P_{i0}$; (ii) "yes-no", which corresponds to $P_{i0} < WTP_i < P_{i1}$; (iii) "no-yes",

which indicates that $P_{i1} < WTP_i < P_{i0}$; and (iv) "no-no", corresponding to $WTP_i < P_{i1} < P_{i0}$, with a lower bound of zero.

The preferences that govern consumers' choices are represented by a random utility model with separable and additive deterministic and random components; that is, $U_i^j\left(y_i, A^j, X_i, \varepsilon_i^j\right) = V_i^j\left(y_i, A^j, X_i\right) + \varepsilon_i^j$, with j = 0,1 denoting the initial and improved states of food quality, and ε_i^j is an error term assumed to be normally distributed, with variance σ^2 and standardised into $\theta_i^j = /\sigma$.

(i) $$Pr(yes_i, yes_i) = \Phi\left(z_i\frac{\alpha}{\sigma} - P_{i1}\frac{\beta}{\sigma}\right) \quad (3)$$

(ii) $$Pr(yes_i, no_i) = \Phi\left(z_i\frac{\alpha}{\sigma} - P_{i0}\frac{\beta}{\sigma}\right) - \Phi\left(z_i\frac{\alpha}{\sigma} - P_{i1}\frac{\beta}{\sigma}\right) \quad (4)$$

(iii) $$Pr(no_i, yes_i) = \Phi\left(z_i\frac{\alpha}{\sigma} - P_{i1}\frac{\beta}{\sigma}\right) - \Phi\left(z_i\frac{\alpha}{\sigma} - P_{i0}\frac{\beta}{\sigma}\right) \quad (5)$$

(iv) $$Pr(no_i, no_i) = 1 - \Phi\left(z_i\frac{\alpha}{\sigma} - P_{i0}\frac{\beta}{\sigma}\right), \quad (6)$$

where $\Phi(.)$ is the standard cumulative normal distribution function. It then comes down to the following log-likelihood function that accounts for the realisation of each one of these possible combinations of responses:

$$\ln(\alpha, \beta, \sigma | y, z, P_0, P_1) = \sum_{i=1}^{N}\left\{d_i^{1,1}\left[\Phi\left(z_i\frac{\alpha}{\sigma} - P_{i1}\frac{\beta}{\sigma}\right)\right] + d_i^{1,0}\left[\Phi\left(z_i\frac{\alpha}{\sigma} - P_{i0}\frac{\beta}{\sigma}\right) - \Phi\left(z_i\frac{\alpha}{\sigma} - P_{i2}\frac{\beta}{\sigma}\right)\right] + d_i^{0,1}\left[\Phi\left(z_i\frac{\alpha}{\sigma} - P_{i1}\frac{\beta}{\sigma}\right) - \Phi\left(z_i\frac{\alpha}{\sigma} - P_{i0}\frac{\beta}{\sigma}\right)\right] + d_i^{0,0}\left[1 - \Phi\left(z_i\frac{\alpha}{\sigma} - P_{i1}\frac{\beta}{\sigma}\right)\right]\right\}, \quad (7)$$

with $d_i^{j,j}$ being a set of indicator variables representing the actual responses to price offers, and $j = 1$ corresponding to a positive response and $j = 0$ being the opposite. Estimates of the parameters α, β and σ are obtained from the maximisation of the likelihood function, as well as the estimated WTP at desired values of interest for the explanatory variables, as suggested in Equation (1). One can obtain the average WTP with two specifications of Equation (1): one without the controls, where the constant term represents the average WTP, and another with the controls, in order to see how the latter could explain the differences in individual valuations.

The double-bound format of the contingent valuation approach is very popular, given its ability to fairly capture the diversity of attributes of an environmental good or service, such as the improved quality of food that does not make use of hazardous chemical residues from synthetic fertilisers and other sanitary and phytosanitary inputs. One of the limitations relates to the direct elicitation format, which tends to underestimate the WTP, as shown by Cooper *et al*. (2002). Some of the reasons have to do with a refusal by consumers to pay the price hike (Carson *et al*. 1992), strategic behaviour by respondents to drive the price down (Altaf & DeShazo 1994), or a consumer's loss aversion and framing of the first price (DeShazo 2000).

Discussions of this include those of List and Gallet (2001), who provide some evidence of a systematic overstatement of WTP; Diamond and Hausman (1994), who suggest that CV contradicts consumer preferences, as indicated by economic theory; Hausman (2012), who offers a comprehensive criticism of the whole contingent valuation exercise, including the single- and double-bound approaches, which he viewed as "dubious" and "hopeless"; and Haab *et al*. (2013), who provide perspective on such criticism. Overall, careful implementation of the approach, which is still

popular in the literature, can indeed provide reliable estimates of individual valuations. Precautions that underlie its statistical efficiency include (i) that the concise design and clear explanation of the contingent scenario is to be fully understood by respondents, (ii) the choice of the first price should be informed by some knowledge of the preference schemes (during a pilot survey), and (iii) the first offer should vary across individuals so as to further avoid the anchoring bias.

4. Data

An in-person survey was conducted between February and May 2019 in the region of the capital city, Dakar.[3] The sampling design considered all four administrative departments or provinces that make up the region: Dakar, Pikine, Guediawaye and Rufisque. We used a random stratification approach to the individuals selected in each of these departments to guarantee a representative sample at the regional level. First, the proportional distribution of individuals across departments (strata) follows that of the actual population, as suggested in Table 1 below. Second, over four weekends, the surveyors randomly roamed the streets and picked a given number of participants so as to match *in fine* the relative distribution, or randomly entered houses to survey members.[4] During each round of interviews, surveyors moved to different locations/neighbourhoods (*quartiers*) within each stratum so as to better capture all characteristics of the corresponding population, while reducing the risk of interviewing some individuals two or more times.[5]

Table 1: Stratification of the population (2018)

Strata/departments	Population	Share (%)	Sample	Share (%)
Dakar	1 363 444	36.5	160	37.1
Guediawaye	392 190	10.5	39	9.2
Pikine	1 392 876	37.3	155	36.7
Rufisque	583 774	15.6	68	16.1
Total	3 732 284	100.0	422	100.0

Source: Agence Nationale de la statistique et de la Démographie (ANSD) (population) and authors (sampling).

The questionnaire was made up of three main parts, and the actual survey started with a conventional approach consisting of informing individuals about the objective of the interview and its structure, as well as obtaining their consent. First, there was a hypothetical scenario that laid out the main characteristics of the organic food item, which tend to be unknown to many, namely its improved health and nutritional benefits as a result of a farming process that makes no use of chemical inputs (fertilisers or phytosanitary products). A careful explanation of the scenario was crucial to reduce the hypothetical bias that comes about because interviewees may not be familiar with such a market valuation scheme, and therefore are unable to accurately reveal the value they attach to the product. Four vegetables were considered: carrots, onions, potatoes and tomatoes (cherry and regular size).

Second, individuals were asked to value food items that had been picked randomly. They were first informed about the actual market price of the conventional products, and then asked about their willingness to pay an additional amount (premium) for the organic counterpart.[6] The initial offer was varied randomly across individuals so as to account for the anchoring or starting point bias, namely

[3] As this study did not involve any external party (for instance there was no funding from anyone except from the authors themselves), there was no need for approval from any ethics committee.
[4] The choice of weekends, and the random selection of participants on the streets or at homes, guaranteed that all the segments of the population had an equal probability of being sampled. This allowed for the reduction of the self-selection and attrition biases.
[5] To further avoid this issue, each participant was asked prior to the interview whether he/she had been surveyed before.
[6] In addition to the survey, information on the actual market price for both conventional and organic products was collected at the same locations where the individuals were interviewed.

CFA150, 200 and 300.[7] The follow-up question offered a higher or lower bid, with a difference of CFA100.[8]

Third, demographic attributes were collected, such as gender, age, education, income, employment status, concerns about food quality and awareness of organic foods and their associated nutritious benefits, as well as household status and structure.

In the end, a total of 423 individuals were interviewed. Table 2 describes their perceptions and attitudes towards organic products. On average, almost all surveyed individuals expressed concerns about the safety, health and quality of the food they consumed, irrespective of their gender, age, education and income. But, when it came to awareness of issues related to organic agriculture, fewer than half (40.5%) of the individuals had no significant knowledge about organic food production and market initiatives. This figure is in line with the level of awareness found in African countries such as Rwanda (45%) and Burundi (48%),) but is higher than that in Kenya (29%) or Tanzania (20%), and much lower than in Uganda (58%) (IFOAM 2014). Individuals who appeared to be the least aware tended to be female, young, less educated and less well off, as opposed to their male, adult, highly educated and relatively rich counterparts.

Table 2: Consumers' attitudes to and preferences for organic farming

		Concern (health/quality)	Awareness of organic food	Actual consumption
Gender	Male	0.978	0.446	0.217
	Female	0.992	0.321	0.102
Age	Youth (< 30 years)	0.980	0.193	0.115
	Adults	0.984	0.435	0.189
Education	Secondary/higher	0.982	0.656	0.356
	less	0.985	0.247	0.069
Income	+200 K/month	0.988	0.776	0.506
	Less	0.982	0.311	0.098
Sample		**0.983**	**0.405**	**0.180**

Source: Authors' calculations from survey data.

When it comes to actual consumption, only 18% of the sample consumed organic food, which is far below the East African average of 59% (IFOAM 2014). A higher incidence of consumption was found among male, adult, highly educated and wealthy individuals. The survey reveals that, while 29.4% indicated no consumption of organic food, more than half (52.6%) reported not knowing at all whether or not they consumed organic food, especially among young (62.5%), less-educated (61.0%) and low-income (59.3%) individuals, as well as females (56.2%). This is a further indication of the relatively low popularity and visibility of organic agriculture as opposed to conventional agriculture.

Table 3 shows the distribution of responses to the first and second prices offered. Consistent with the standard theory of demand, the proportion of acceptance decreases as the first offer increases. This is shown more clearly with the first bid: as the price goes from 150 to 200 and 300, the proportion of yes answers decreases from 65.5% to 55.3% and 38.0% respectively.

[7] Although the concept of premium suggests that organic produce must be more expensive that conventional produce, the opposite is not ruled out in the valuation scheme. This is the case when both the initial and the second offers are rejected, indicating that organic produce is at most as valuable as conventional produce. This is also the case when differentiated market structures can translate into actual price differentials, which could influence the premium. By assuming that most individuals state positive values, however, it is very likely to end up with an average premium that is positive.

[8] The realism of the same price structure across products can rightfully be questioned. Here, simplicity has guided the choice made, with the assumption of no impact on the WTP estimates.

Table 3: Distribution of responses to first and second prices or premium (CFA per kilogram)

Bid 1	Responses	Count	Share	Bid 2	Responses	Count	Share
150	Yes	131	65.5%	**250**	Yes	68	51.9%
					No	63	48.1%
	No	69	34.5%	**50**	Yes	55	79.7%
					No	14	20.3%
200	Yes	63	55.3%	**300**	Yes	27	42.9%
					No	36	57.1%
	No	51	44.7%	**100**	Yes	30	58.8%
					No	21	41.2%
300	Yes	41	38.0%	**400**	Yes	15	36.6%
					No	26	63.4%
	No	67	62.0%	**200**	Yes	34	50.7%
					No	33	49.3%

Source: Authors' calculations from survey data.

Among individuals who responded "yes" to the first price offered, the likelihood to provide the same response to the follow-up offer decreases the higher it gets, while those who responded "no" to the first offer had an increasing tendency to answer the same way the lower the second offer. This is indicative of negative price elasticity, especially with regard to the choice of the initial price offered. These response patterns are indicative of the fact that accounting for the follow-up questions would likely generate a lower WTP than limiting the valuation to the first price offered. This is in line with the general tendency of the double-bound format to generate a lower valuation than the single bound (see Cooper *et al*. (2002) for theoretical evidence and insightful discussions).

Table 4 further breaks down the individual responses to both price offers across food items. Going from "no-no" to "yes-yes" combinations of answers corresponds to an increase in how individuals value the products. Across all five instances (except for carrots), the distribution indicates first an increase and then a decrease in the proportion of positive responses. For onions, potatoes and regular tomatoes, the peak occurred between the "yes-no" and the "yes-yes" combinations, suggesting that the average WTP is likely to fall in the third price interval, that is $P_{i0} < WTP_i < P_{i1}$. For cherry tomatoes, the valuation was expected to be one interval below. These responses' profiles are a further indication of the relatively precise choice of the initial price offered, therefore reducing the incidence of any potential anchoring bias. Along with the follow-up offer, the survey was expected to provide a fair amount of accuracy in the estimates of WTP as a premium for organic food.

Table 4: Combinations of responses to bids (premium) across products

	"No-No"		"No-Yes"		"Yes-No"		"Yes-Yes"		All	
	Count	**Share**	**Count**	**Share**	**Count**	**Share**	**Count**	**Share**	**Count**	**Share**
Onion	5	4.3%	27	23.3%	46	39.7%	38	32.8%	116	100%
Potatoes	16	17.8%	24	26.7%	27	30.0%	23	25.6%	90	100%
Carrots	17	21.0%	28	34.6%	15	18.5%	21	25.9%	81	100%
Tomatoes (cherry)	16	23.9%	24	35.8%	16	23.9%	11	16.4%	67	100%
Tomatoes (regular)	14	20.6%	16	23.5%	21	30.9%	17	25.0%	68	100%

Source: Authors' calculations from survey data.

Table 5 shows how price responses are individually correlated with various characteristics of interest. Overall, the valuation pattern, which appears to peak at the "yes-no" interval for most of the food items, tends to positively espouse the distribution of gender, education, labour market status and household head status. More broadly, going from the "no-no" to the "yes-yes" combinations corresponds to the lowest and the highest valuations, given the initial price offered. The remaining characteristics show a positive association with values attached to organic food, such as awareness and concern about food health, actual organic food consumption, and household head status. In contrast, age, household size and structure (share of five-year-olds) appear to be negatively correlated

with individual valuation. These pair-wise correlations are suggestive of some heterogeneity in individual valuations of improved food quality.

Table 5: Combinations of responses to bids (premium) across individual characteristics

	"No-No"	"No-Yes"	"Yes-No"	"Yes-Yes"	All
Awareness of organic (1 = yes)	0.40	0.35	0.43	0.44	0.41
Food health concern (1 = yes)	0.93	0.98	1.00	1.00	0.98
Organic food consumption (1 = yes)	0.13	0.11	0.18	0.28	0.18
Gender (1 = male)	0.59	0.67	0.77	0.63	0.68
Age (years)	50.1	48.8	45.3	46.1	47.3
Education (1 = secondary & higher)	0.18	0.34	0.48	0.45	0.39
Occupation (1 = employed)	0.46	0.63	0.76	0.59	0.63
Income (1 = CFA200 K+)	0.04	0.21	0.26	0.23	0.20
HH head (1 = yes)	0.68	0.74	0.70	0.72	0.71
HH head gender (1 = male)	0.44	0.60	0.63	0.57	0.58
HH size (count)	10.9	9.7	9.0	8.3	9.3
Proportion of five-year-olds in HH	0.17	0.19	0.17	0.15	0.17

Source: Authors' calculations from survey data.

5. Results and discussions

Estimates of WTP are shown in Table 6. Overall, individuals were willing to pay a significant premium for organic food. The premium amounts to an average of 53% of the actual price of the non-organic counterpart for model specification (Equation (1) with or without controls).[9] Despite the fact that the absolute values of the premium appear to be not significantly different from one food item to another, which owes to the identical bid structure (same initial price offers and same increments), the extent of the WTP a premium appears to vary across products.

In fact, more expensive non-organic food (regular tomatoes and potatoes, which cost CFA560.3 and CFA484.4 / kg) tend to be associated with lower premium (43.4 and 44.9%) compared to their cheaper counterparts (cherry tomatoes and carrots at respectively CFA281.3 and CFA318.5 / kg), which exhibit premiums that turn at 73.4 and 72%, respectively. It can be argued that these discrepancies in percentages are not simply the result of mathematics (higher denominators translating into lower ratios), but that they reflect a common trait in consumer behaviour. For instance, consumers are reluctant to pay a higher price when the good is already expensive compared to a good that is cheaper.

Consequently, a typical consumer is more willing to reduce his/her surplus when the price of the good is low. This is in line with the perfect rationality hypothesis, introduced under neoclassical economics, which supports the assumption that consumers always want to maximise their utility. A second explanation is that it is due to income differences and elasticities. The rational expectation is that consumers with higher incomes would face lower budget constraints when setting up premiums (the fact that WTP is positively associated with income, as shown below, presents supporting evidence).

The WTP to pay a premium sets the consumer valuation of organic food at 25.7% higher than its current market price (25.3% when considering the model with controls – see Table A1 in the Appendix). This is an indication of the untapped market potential of organic produce, with important surplus margins to be captured without significantly discouraging the current trend in demand. The results also indicate a great deal of heterogeneity across produce: while onions and potatoes are associated with higher margins, at more than 40%, tomatoes and carrots exhibit lower margins, at less than 10%.

[9] The estimation results for the model that includes controls are shown in Table A1 in the appendix.

Table 6: Estimates of the willingness to pay a premium for organic food (CFA per kilo)

	Actual non-organic price	Actual organic price	Estimated organic premium	Estimated organic price premium (%)	Estimated total WTP for organic	Gap between est. total WTP and actual organic price (%)
Onions	436.6	450	212.1*** (9.7)	48.6	648.7	44.2
Potatoes	484.4	500	217.3*** (14.9)	44.9	701.8	40.4
Carrots	318.5	500	229.4*** (18.0)	72.0	547.9	9.6
Tomatoes (cherry)	281.3	400	206.4*** (17.1)	73.4	487.8	22.0
Tomatoes (regular)	560.3	750	243.4*** (17.1)	43.4	803.7	7.2
Overall	419.4	510.7	222.2*** (6.6)	53.0	641.7	25.7

Notes: Prices are in CFA per kilo (the exchange rate against the US$ is approximately 550). The WTP estimates are obtained from the model with no controls, which turn out not to be significantly different, on average, from those from the model with controls (shown in Table A1 in the Appendix). Values in parentheses are standard errors, and the stars (***) denote significance at the 1% level.

To the extent that a price increase is to be envisioned in the actual organic market, these estimated margins could provide the basis for a heterogeneous pricing scheme (higher price increase where margins are the highest). Better knowledge of differences across generating mechanisms of individual valuations (why some value more than others) is also crucial to further exploit the margins.

Table 7 shows the factors underlying the heterogenous generating mechanisms of individual valuations. Non-organic prices appear to be positively associated with the WTP an absolute premium: more expensive organic products, once grown organically, command a higher premium, or the most valued organic produce also coincides with the most valued non-organic produce. This suggests that, when accounting for the premium, the valuation scale (or order) across organic products remains the same as that of non-organic products.

Individuals who are genuinely concerned about the health effects associated with food production also tend to value more organic food. However, the level of awareness, which highlights whether the individual has information about organic farming, appears not to be significant, to the extent that both variables (information and preference for organic farming) should normally converge in order to reveal the preference of consumers for healthier food items. The results therefore could be indicative of a poor set of information that is still insufficient to raise awareness and make consumers more conscious of the positive externalities associated with organic farming. We argue that, if better information about organic farming translates into increased consumption of organic food, then individual consumers will be willing to pay a significant premium. Education is also an important factor, as highly educated consumers (with secondary and higher degrees) are more willing to pay a larger premium. This reveals a greater capacity to fully grasp the scope of health issues at play when consuming and advocating for organic food.

The results also suggest that gender and age are significantly associated with a positive and significant valuation of organic food. Women tend to be in charge of actually buying and preparing food, while men are more likely to be income earners in the socio-economic fabric of Senegal, and therefore the former appear to attach more value to organic food. In addition, young individuals, who tend to be more amenable to changes than their older counterparts, are also more inclined to value organic food.

As organic food tends to be costly and more expensive than its non-organic counterparts, given its limited market share, individuals earning a higher monthly income and enjoying greater purchasing power will be more willing to pay a higher premium. This positive association between income and organic food consumption tends to validate the assumption that rich people are more concerned about food quality than their poorer counterparts, who struggle to afford even cheaper non-organic foods. As income increases, organic farming will be able to tap into a growing demand that is driven mainly by the arrival of new consumers.

Table 7: Determinants of willingness to pay a premium for organic food

Variables	Coefficients
Potatoes [(a)]	5.518 (17.0)
Carrots [(a)]	28.143 (18.1)
Tomatoes (cherry) [(a)]	17.603 (19.4)
Tomatoes (regular) [(a)]	9.889 (19.3)
Price of non-organic (CFA/kg)	0.129*** (0.01)
Awareness (information)	-21.354 (14.4)
Concerns (about health)	250.213*** (54.0)
Consumption of organic (1 = yes)	31.308* (18.8)
Gender (male = 1)	-39.521* (23.8)
Age (years)	-1.102* (0.6)
Education (1 = secondary/higher)	34.338** (14.7)
Employed (1 = yes) [(b)]	13.961 (16.6)
Unemployed (1 = yes) [(b)]	23.132 (22.8)
Income (1 = +CFA200 K/month)	29.643* (17.7)
HH head (1 = yes)	8.804 (22.8)
HH head gender (1 = male)	36.805 (30.3)
HH size (count)	-4.185*** (1.5)
% of five-year-olds in HH	-1.137** (0.5)
Constant	-8.25 (66.2)
N	422
Wald	91.85***
Sigma	108.5***

Notes: Reference categories are (a) onion for food items and (b) inactive population for labour market status. Values in parentheses represent the standard errors, and significance at the level of 1%, 5% and 10% is indicated by ***, ** and * respectively.

Additional determinants of willingness to pay are household size and structure. For example, larger households are less willing to pay a high premium owing to the already relatively high cost of feeding

more members, as are households with more young people (younger than five years old). For the latter, one would have expected the opposite, given the fact that one would assume that the presence of young people within the household would raise parents' concerns about the importance of good quality food to promote their children's health. This result, however, could be a further indication of the costs of livelihood borne by a large household, which are not always related to food, but also to youth-specific non-food expenses such as education and health, which in the end could make organic food a luxury that the household cannot afford.

The willingness to pay a significantly large premium for organic food, and the extent of the heterogeneity in individual valuation schemes, suggest that organic food is a significant part of consumer baskets, especially among wealthy, educated, young and female consumers, and that organic farming has great market potential in the context of growing African cities.

6. Conclusion

This paper made use of the contingent valuation method to investigate whether and, if yes, to what extent, urban consumers in Dakar, Senegal were willing to pay a premium for organic food. Our results show that consumers are indeed willing to pay 53% more than the current price paid for non-organic food. This high premium is indicative of the high preference consumers have for quality food. This paper has also identified several factors that influence consumers' valuation of organic food. From the farmers' and market assessment perspectives, the fact that the current price of organic food is still below the WTP is indicative of the potentially significant and untapped revenue to be made in the sector. These expected revenues are captured only if proper investments are made, both by farmers and policymakers, to promote the expansion of sustainable and environmentally-friendly farming practices. These combine investments in financial, technological as well as human capital that foster agricultural productivity.

The current promotional efforts that support the expansion of organic food in Senegal are enabling more small-scale farmers to adopt sustainable farming practices. What perhaps is needed is to restructure the country's investment portfolios in a way that organic farming is given priority when drafting development policies that aim to reduce poverty. Additional demand-related interventions encompass awareness-raising through the provision of information in order to better expose people to the benefits associated with growing and eating organic food.

Finally, although our present study provides a good foundation for the design and implementation of sustainable farming practices in the country, more insights are needed to capture the country-wide WTP. In fact, the average consumer in the capital city has a higher income than her counterpart in other urban areas, as well as in the rural areas of the country. Additional extensions of this study should also include a larger set of products, as well as a comparison between market valuation and production costs of organic farming as opposed to conventional agriculture. Ultimately, meeting the challenge of making organic farming a long-term and viable food production option in SSA would require policymakers to put in place incentives that will reduce both the costs of organic farming and the associated risks and uncertainty that smallholders may encounter when deciding whether to transition to organic agriculture.

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Appendix

Table A1: Estimates of willingness to pay from the models with and without controls

	Actual non-organic price	Actual organic price	Estimates without controls				Estimates with controls			
			Estimated organic premium	Estimated organic price premium (%)	Estimated total WTP for organic	Gap between est. total WTP and actual organic price (%)	Estimated organic premium	Estimated organic price premium (%)	Estimated total WTP for organic	Gap between est. total WTP and actual organic price (%)
Onions	436.6	450	212.1*** (9.7)	48.6	648.7	44.2	211.2*** (8.2)	48.4	647.9	44.0
Potatoes	484.4	500	217.3*** (14.9)	44.9	701.8	40.4	215.8*** (11.7)	44.6	700.3	40.1
Carrots	318.5	500	229.4*** (18.0)	72.0	547.9	9.6	311.9*** (52.1)	97.9	630.5	26.1
Tomatoes (cherry)	281.3	400	206.4*** (17.1)	73.4	487.8	22.0	195.9 (1 713.9)	69.6	477.3	19.3
Tomatoes (regular)	560.3	750	243.4*** (17.1)	43.4	803.7	7.2	237.1 (284.3)	42.3	797.4	6.3
Overall	419.4	510.7	222.2*** (6.6)	53.0	641.7	25.7	220.7*** (5.8)	52.6	640.1	25.3

Notes: Prices are in CFA per kilo. Values in parentheses are standard errors, and the stars denote significance at 1%.