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Original Article

Choice of Fresh Vegetable Retail Outlets by Developing-Country Urban Consumers: The Case of Kale Consumers in Nairobi, Kenya

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Abstract Fresh produce retailing in many developing-country urban centers is changing with the recent emergence and rapid growth of supermarkets and specialty stores. These retail outlets are competing with the traditional wet markets in developing-country urban centers for buyers. This article uses information obtained from interviews with 449 kale consumers in Nairobi to assess the factors conditioning their choice between open-air markets, roadside markets, supermarkets and specialty markets when buying fresh vegetables. It uses non-parametric methods to identify these factors and then tests the causal effect of the identified factors on choice of retail outlet by consumers using parametric techniques. Both the non-parametric and parametric methods identify income, level of education, risk perception, living environment, level of willingness to pay for safe kale, and confidence in the consistency of quality of kale as the major conditioners of the choice of retail outlet by consumers. The article discusses the implications of these findings.

La distribution de produits frais est en pleine évolution dans de nombreux pays en développement, avec l'apparition récente et le développement rapide des grandes surfaces et magasins spécialisés. Ces distributeurs rivalisent avec les marchés ouverts traditionnels dans les centres urbains des pays en développement. Cette étude mobilise des données issues d'entretiens réalisés à Nairobi avec 449 consommateurs de chou frisé, dans le but de déterminer les facteurs qui les influencent dans leur choix d'acheter leurs légumes frais dans des marchés à ciel ouvert, de bord de route ou dans des grandes surfaces et magasins spécialisés. Elle s'appuie sur des méthodes non-paramétriques pour identifier ces facteurs, et mobilise ensuite des techniques paramétriques pour tester l'effet causal des facteurs repérés sur le choix de distributeurs par les consommateurs. Les méthodes non paramétriques et paramétriques permettent d'identifier les revenus, le niveau d'éducation, la perception du risque, le cadre de vie, la disposition à payer pour du chou sain et la confiance dans sa qualité comme facteurs importants du choix de tel ou tel type de distributeurs par les consommateurs. L'article analyse les implications de ces résultats.

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Introduction

Fresh vegetable retailing in most developing countries has until recently largely been limited to on-farm and wet (open-air and roadside) markets. However, the last decade has witnessed the emergence and rapid growth of non-traditional outlets for retailing fresh vegetables in some of these countries (Neven and Reardon, 2004; Minten and Reardon, 2008). These non-traditional outlets include supermarkets and specialty stores. Major

supermarkets in large developing-country cities currently carry elaborate grocery sections that feature a wide variety of fresh vegetables.

The expansion of non-traditional fresh vegetable retail outlets in developing-country cities stems from increased demand for fresh vegetables with specific quality attributes by consumers in these cities. The increase in demand for such vegetables is, on the other hand, driven by a number of factors. First, increased incomes (which translate into higher purchasing power) in many developing countries' urban centers have made consumers more discriminating of quality and source of food (Reardon *et al*, 2001; King and Venturini, 2005; Regmi and Gelhar, 2005a, b). These consumers thus source their supplies from outlets they consider safe or perceive to offer quality food. Second, the widespread food safety scandals (involving deadly pathogens such as salmonella) especially in developed countries have led some classes of developing-country consumers to be more discerning about the sources of food they purchase (Okello and Swinton, 2007). Third, there is increased awareness, among developing-country urban consumers, of the medical health dangers of consuming foods grown using unsafe practices. Fourth, there is a general belief among consumers that vegetables sold through certain outlets (for example, supermarkets and specialty stores) are produced using safer production practices (Ngigi *et al*, 2011).

Despite the changing nature of fresh vegetable retailing in developing-country urban centers, the traditional outlets (that is, open-air markets, roadside markets, kiosk vendors, on-farm purchases) have remained significant points of purchase for many city consumers in developing countries. These outlets still serve the majority of urban consumers in developing countries (Tshirley and Ayieko, 2008). In Kenya, for instance, more than 90 per cent of the fresh vegetable purchases are made through the non-traditional retail outlets (Tshirley, ibid.). Thus, although there has been rapid expansion of non-traditional fresh vegetable retail outlets, many urban consumers have resisted the lure of modernity and have continued to purchase their fresh vegetables from traditional outlets.

Studies suggest that the propensity of consumers to use a given retail outlet is driven by income growth (as a result of increasing urbanization), changing consumer preferences, the changing nature of consumer eating habits and cultural/social changes (Chen *et al*, 2005; Neven *et al*, 2006; Lapar *et al*, 2009). Other factors that are likely to affect the kind of outlet used by consumers include time needed to travel to grocery outlets, price charged and consumer tastes (Moore, 1989; Coyle, 2006; Minten and Reardon, 2008).

Many developing countries have recorded high rates of urbanization and income growth over the last decade. At the same time, recent studies indicate that urbanization and income growth in developing countries' urban centers are causing significant changes in food retailing sectors (Reardon *et al*, 2003; Regmi and Gelhar, 2005a; Minten and Reardon, 2008). Despite these changes, little is known about the factors that condition the choice of retail outlet used by consumers in developing-country urban centers. This article uses data collected from 449 urban leafy vegetable consumers stratified by type of retail outlet to examine the factors that affect the choice of retail outlet used by developing-country urban consumers. The article specifically uses both parametric and non-parametric techniques to identify the conditioners of consumer choice of market outlet from which to purchase kale. It focuses on kale consumers in Nairobi, Kenya. Kale is one of the most consumed[1] fresh vegetables by both rural and urban households in Kenya. At the same time, there has been a phenomenal increase in the number of supermarkets, with extensive green grocery sections in Nairobi in the last decade (Neven and Reardon, 2004). Nairobi also has a large concentration of consumers with varied education, age groups, living environments and

family characteristics. Thus, Nairobi provides a suitable developing-country urban city case to study. Understanding the drivers of the choice fresh vegetable retail outlet has implications for the the design of strategies for controlling the safety of vegetables sold in urban centers. It also has implications on the welfare of urban households since different markets offer different safety standards and prices.

Analytical Methods, Data and Study Areas

This study uses a combination of non-parametric and parametric methods to assess the factors that influence the choice of market. First, we use probabilistic classification tree analysis (a non-parametric technique) to assess the factors likely to influence the type of retail market outlet chosen by consumers for the purchase of kale. Using this method, we identify the consumer, household and product-specific factors associated with kale consumers' choice of market outlet. Probabilistic classification tree analysis has the advantage that it captures effects that tend to be concealed by the parametric analysis. Second, we use a discrete choice model (DCM, a parametric technique), namely, the multinomial logit regression, to test the causal effect of the factors identified above on the retail market outlet chosen by kale consumers.

Non-Parametric Analysis of Conditioners of Choice of Retail Outlets: Probabilistic Classification Tree Technique

We use the non-parametric method known as 'Classification and Regression Trees (CART)' proposed by Breiman *et al* (1983) and refined by Hothorn *et al* (2006) (HHZ) to assess the probability that a consumer uses a given market outlet. It involves repeated subdivisions of a group of subjects (that is, consumers in our case) on the basis of the choice of optimal cut-points of binary, ordinal or continuous covariates that maximizes a certain split criterion. The CART method has the advantage that it represents a flexible category of algorithms for exploratory data analysis. Specifically, the strength of the CART approach as a non-parametric data exploration tool is that it establishes a hierarchical order of causal interactions/relationships between the dependent variable and a potentially large set of diverse explanatory factors that do not necessarily need to be independent from each other. CART therefore works regardless of potential collinearity and has the additional advantage of being less sensitive to potential outliers.

The conventional CART algorithms theoretically run until each observation of the dependent variable within a given data set is represented by an individual node from this regression tree. However, this can result in over-fitting of the classification tree. In the HHZ framework, conditional distributions are estimated between a dependent variable and the set of explanatory variables under consideration. The HHZ algorithm, though similar to the basic CART algorithm, differs in the sense that binary splitting at each node is performed according to the variable that shows the strongest explanatory power in terms of an estimated *P*-value. The algorithm therefore does not split the sample into individual observations, but instead stops as soon as no statistically significant split can be detected. Hothorn *et al* (2006) demonstrate that the 'Conditional Binary Recursive Inference Algorithm', an improvement of the CART, is not subject to variable selection bias, as a conventional CART may be.

Parametric Analysis of Conditioners of Choice of Retail Outlet: DCM

We use the DCM to test the causal effect of the factors identified using the non-parametric techniques on the choice of retail outlet. DCMs have been used widely in assessing the drivers of consumer choice of retail outlet because they provide greater insight into consumer behavior relative to other models that do not allow the consumer choice to be disaggregated (Moore, 1989). In this article, we test these effects by controlling for other factors likely to influence consumer choice of a retail outlet based on *a priori* expectations and the literature.

The underlying principle of DCM is that an individual acts to maximize his/her utility within a range of constraints. An individual consumer's choice of market outlet is therefore assumed to be the result of a subjective selection of the most preferred alternative from a restricted set of options. In our context, the choice of where to shop is made among four fresh vegetable retail outlets, subject to conventional constraints including income and tastes and preferences.

We use the multinomial logit regression model because of the discrete nature of the dependent variable. The model has been used widely in assessing discrete choices where, as in our case, the choice is about the most preferred retail market alternative (Lapar *et al*, 2009). In choosing where to shop, consumers have to internalize the location-specific attributes, as well as both the intrinsic and extrinsic product quality attributes (Bond *et al*, 2009). The location attributes likely to affect the choice of market include distance to the market, convenience of shopping at the market and whether the market carries a variety of other products. The extrinsic attributes that condition the choice of market include perceptions of food safety and the production processes used such as environmental (for example, organic/pesticide-free) and ethical practices employed. The intrinsic attributes, on the other hand, relate to perceptions of nutritional content, purity, freshness, taste and bundle size, among others. However, the choice of market may also be affected by consumer/household-specific characteristics. Past studies suggest that income and education affect consumer perceptions of food safety (Freidberg, 2004; Okello, 2005). Size of the family is also likely to affect the choice of market, especially if income is constrained and the different markets charge different prices. This study therefore controls for these other factors in estimating the multinomial logit model used to test the effect of factors identified via the non-parametric technique on the choice of type of retail outlet.

The multinomial logit model typically allows for the estimation of the probability that the *i*th type of retail outlet is chosen as the most preferred alternative. The dependent variable in our case is therefore a discrete choice corresponding to the retail outlet type selected as the most preferred. The retail outlet types considered included open-air market, roadside market, supermarket and specialty store. The explanatory variables include proxies for risk perception and consistency of quality of produce, as well as consumer/household-specific variables such as education, gender, income and living environment.

The estimated logit model is thus expressed as follows:

$$p_j = \left(Y_j = k|X_j\right) = \exp\left(\beta_{kj} + \sum_k \beta_{1k} x_{jk} + \varepsilon_j\right) \Big/ \sum_{i=1}^{J} \exp\left(\beta_{kj} + \sum_k \beta_{1k} x_{jk} + \varepsilon_j\right) \quad (1)$$

where β represent the vector of coefficients to be estimated, X is the vector of covariates and ε is the stochastic term.

Data and Brief Description of Study Areas

The data used in this study were generated through personal interviews with 449 kale consumers in Nairobi. The interviews were all conducted at the time and point of kale purchase in four different market types, namely, (a) roadside markets (Githurai) ($n = 84$), (b) open-air markets (Kawagware and Kangemi) ($n = 215$), (c) supermarket outlets (that is, Uchumi stores in Buruburu and Wetlands) ($n = 113$) and (d) specialty stores (the Zucchini Green Grocery stores in Westlands and Gigiri) ($n = 37$). However, we did not include kiosks (that is, makeshift selling points) and street hawking and roadside sale of kale in the analysis owing to difficulties in surveying consumers who purchase kale in these outlets. Hence, it may be erroneous to extrapolate the findings of this study to cover these channels. The sampling procedure encompassed systematic selection of every third person purchasing kale from the respective outlets. Thus, every third kale buyer was sampled and interviewed until the quota for the market segment was attained. In the roadside and open-air markets, a zoning sampling method was applied. The zoning method entailed positioning enumerators in different zones in the markets from where every third person who came to buy kale from that zone was sampled.

More buyers purchase kale from the supermarkets and specialty stores on weekends and holidays than weekdays. Consequently, the survey was organized such that interviews were conducted in each store on at least 1 day during the week and 1 weekend day. One of the weekend days selected for the interviews in supermarkets and specialty markets coincided with the Easter holiday weekend. The interviews were conducted between 8:00 and 18:00 to allow for shoppers who buy kale after work during weekdays. In supermarkets, the interview ranged from 10:00 (when they open) to 18:00. The survey was conducted in April and May 2010 using pre-designed questionnaires. The interviews were preceded by a pre-test of the questionnaires in markets with similar characteristics to those surveyed. The interviews were conducted by trained enumerators.

The Githurai market, the roadside market selected in this study, is located along the Nairobi–Thika highway. It serves both as a wholesale and retail market. Traders from Nairobi are attracted to the market because it is on the highway and hence easily accessible from the city center and the rest of the residential estates mainly by public transport. Githurai estate is located in a densely populated area characterized by low- to medium-income households. The market has poor hygiene and sanitation. Vegetables sold in this market are exposed to vehicle exhaust (that is, tailpipe) fumes and dust (during the dry season) emitted from vehicles plying the highway and dirt from garbage (during the wet season). Roadside retailers take advantage of busy buyers who seek the convenience of buying kale at the bus stops along the road rather than walking into the markets, often located some distance from the main highway points.

Kangemi, the first open-air market selected in this study, is located on the Nairobi–Naivasha highway and is hence easily accessible. The market is also located in a densely populated area, with a population of over 100 000 people (CBS, 2001, p. 15). Households in the area are predominantly low income. On the other hand, Kawangware, the second open-air market, is situated approximately 15 km to the west of Nairobi. It is located in a densely populated area, with a population of over 70 000 people. Most of the residents are also low-income earners (CBS, 2001).

The third type of market segment studied was the supermarkets. Supermarkets have become important outlets for vegetable purchase in Nairobi in the last decade. They target middle- to high-income consumers who do not have the time to go to other outlets

(especially wet markets) and/or who are concerned about the level of hygiene in other markets. These include consumers who purchased kale from Buruburu and the Westlands area supermarkets. These areas are classified as middle- and high-income residential areas, respectively (CBS, 2001; Daily Nation, 2011). Neven and Reardon (2004) indicate that supermarkets are growing at an annual rate of 18 per cent and have a 20 per cent share of the urban food retail markets in Nairobi, of which 4 per cent comprises fresh fruits and vegetables. The expansion of supermarket share of fresh vegetable retailing may be attributed to many factors, including the fact that they offer better presentation, convenience and hygiene than the open open-air and roadside markets.

The Zucchini Green Grocery store, the specialty market covered in this study, has three retail outlets in Nairobi all controlled centrally from the head office located in Westland's ABC Place, a high-income neighborhood. The outlets are perceived by their shoppers as highly dependable spots for clean and a wide variety of fresh vegetables. Zucchini controls the quality of vegetables it retails through frequent visits to contracted farms to ensure that the production practices used are safe. It serves the middle- to high-income consumers residing in Runda, Parklands and Gigiri estates.

The variables used in this study include:

- *Consumer-specific variables* including natural log of age measured in years *(lnage)*; *gender*, a dummy variable equal 1 if a consumer is male and 0 otherwise; highest education attained (*educ*), a categorical variables given as 1 = primary, 2 = secondary, 3 = college and 4 = university and above; employment status (*slfemploy*), a dummy variable equal to 1 if consumer is self-employed and 0 otherwise; natural log of annual income (in Kenya Shillings) of the consumer (*lnincome*); and natural log of consumer willing to pay for safety (*lnWTP)*. Consumer WTP for safety was generated using payment card method and represented how much a consumer was willing to pay for kale of the best possible quality/safety standards as opposed to kale grown using polluted water, sprayed with toxic pesticides and harvested before the expiry of the pre-harvest interval, and handled unhygienically. The details of the two scenarios can be found in Ngigi *et al* (2011).
- *Household characteristics* including living area (*periurabliving*), a categorical variable given as 1 = urban, 2 = peri-urban and 3 = rural; household size (*hhdsize*) is the size of consumer's household measured as number of family members; and the number children under 5 years of age (*under5*).
- *Quality/nutritional characteristics* including consumer confidence in the consistency of quality of kale sold in the retail outlet used (*consistency*); consumer's subjective assessment of the quality of kale (*qltyassmnt*) obtained by using a zero-centered Likert-scale in five levels (−2 = strongly disagree to 2 = strongly agree) following Kimenju and De Groote (2008). Scale items were *When I buy kale I am concerned that it will not meet my requirements/be as I expected* and *When I buy kale I am never sure if I have chosen the right quality*; natural log of consumer's perceived health risk (*lnpercvdrisk*) attributable to seven risk sources along the food supply chain (see Ngigi *et al* (2010) for details). Perceived risk (PR) is measured as:

$$PR = \sum_{i=1}^{n} (s_i I_{si} * l_i I_{li} * t_i I_{ti}) R_i \qquad (2)$$

where n is the number of health risk attributes; si is the severity of impact of risk source i to the respondent, li is the likelihood of being affected by the source of risk,

ti is the time in future when any harmful effect of risk from source *I* will be noticed. For each attribute, all the three dimensions $j = (s, I, t)$ were weighted by the subjective relative importance of *Iji*, respectively, with $\sum Ij = 100$ per cent. Finally, *Ri* is the subjective overall risk importance to respondent of source *i*.

- *Motivational factors* include dummy variables importance of ease of access to market (*mktaccess*) (1 = ease of access is very important in selecting market outlet, 0 otherwise) and importance of a fair (low) price (*fairprice*) (1 = low price is important in selecting market outlet, 0 otherwise).
- *WorkFulltime* is a dummy variable equal to 1 if individual works full-time and 0 otherwise.
- (*TrMult7*) is a dummy variable equal to 1 when the product has been contaminated with heavy metals from the use of fertilizers, dust or vehicle emissions, and 0 otherwise.
- *ConsuKale* is the intensity with which kale is consumed measured in terms of number of days kale is purchased per week.

Table 1 presents the summary statistics for variables used in this article. It shows that consumers interviewed are of relatively low and variable average annual income. The table also shows that the average WTP for quality is relatively high (ksh 8/kg), indicating that consumers are on average willing to pay Ksh 8/kg over and above the price of kale if the kale is safe. These results further show that the consumers covered in this study are middle aged (31 years). The average level of education is, on average, secondary and college.

Table 1: Summary statistics of variables used in the parametric/econometric estimation

Variable	*Mean*	*Standard deviation*
Consumer-specific variables		
Age	31.13	10.53
WTP	8.24	7.91
Income	68 652.79	143 301.40
Educ	2.48	1.04
Gender	0.39	0.49
Slfemploy	0.27	0.44
Household characteristics		
Periurbanliving	1.23	0.43
hhdsize	3.18	2.01
under5	0.43	0.50
Quality/nutritional characteristics		
Consistency	−0.70	2.97
qltyassmnt	0.16	1.83
lnpercvdrisk	4.78	0.87
Motivational factors		
Mktacess	0.82	0.38
Low price	0.07	0.25

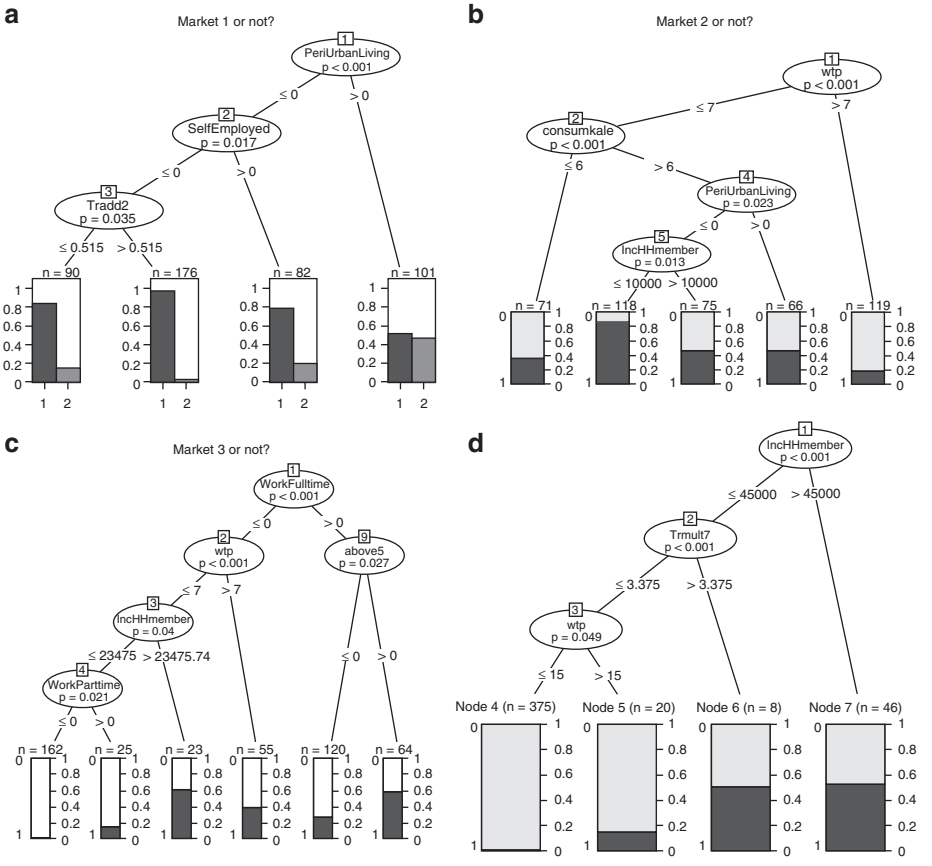

Figure 1: Conditional binary recursive inference tree for the probability*of purchasing kale in markets 1, 2, 3 or 4 or not. (a) Buyer Chooses Market 1 or not? (b) Buyer Chooses Market 2 or not? (c) Buyer Chooses Market 3 or not? (d) Buyer Chooses Market 4 or not?
Source: Survey data: *Probability is given by the *y*-axis of the bar charts at the terminal node.

Results

Explaining Market Choice: Probabilistic Tree Classification Technique

The results of the probabilistic classification tree analysis are presented in Figures 1a–d. The structure of the estimated classification tree shows why a conventional parametric regression model alone may conceal some useful information by failing to take the nested structure of interacting factors into account. Indeed, as shown in Figures 1a–d, different explanatory variables exhibit the strongest statistical significance (expressed as the *P*-value) at different splitting points. This implies that certain variables will not exhibit statistical significance for the entire sample, but may very well do so within one of the subsamples that are effectively created with each individual split. Figures 1a–d specifically places the focus on each market type separately and detects the probability of choosing one specific market out of {1,2,3,4}, with all other markets set to zero. Market types

1 and 2 are the same in many respects, with the key difference being the fact that market type 2 is informal and located along the roadside.

Starting with consumers who purchased kale in market type 1 (= open-air market) among the 449 respondents interviewed, and noting that some of the splitting in market 1 may apply to market 2 owing to their similarities, the first split in Figure 1a shows that consumer's living area (*PeriUrbanLiving)* is the most significant explanatory variable (*P*-value <0.001). Consumers who live in peri-urban areas have an approximately 0.45 probability of purchasing kale in open-air markets. This is probably the result of the closer proximity of these markets to such consumers. Regarding the observed choice of individuals who live in peri-urban areas, no other explanatory factor can contribute additional explanatory power.

The results, however, show that, for observed individuals who do not live in peri-urban areas, the interacting effects are further differentiated by whether the individual is self-employed or otherwise. The nature of self-employment common among the respondents consisted of small-scale enterprises (that is, selling of wares). For consumers who are self-employed, the probability of buying kale from open-air markets was approximately 0.8. Individuals who were not involved in self-employment could be further split into two groups. The most statistically significant splitting variable at this stage was involvement in trading activities (*P*-value < 0.05). Both groups have very high probability (probability >0.8) of purchasing kale in open-air markets.

Figure 1b presents the probabilistic classification tree for market 2 (that is, the Githurai roadside market). As shown, the most statistically significant factor (*P*-value $= 0.001$) that determines whether consumers choose roadside markets or otherwise is the willingness to pay (*WTP*) for safety of kale. The cut-off WTP used in splitting the consumers is Kshs 7/kg. As expected, consumers who are willing to pay more than Kshs 7/kg for safer kale are much less likely to purchase kale in roadside markets. The probability that this group of consumers will shop in roadside markets is <0.2. For consumers who are not willing to pay more than Ksh 7/kg, the most statistically significant variable (*P*-value < 0.001) determining where they will shop is the intensity with which they consume kale (*ConsuKale*). The cut-off point is <6 days per week. As shown, consumers who consume kale less often are also less likely to purchase their supplies in roadside markets (probability < 0.4). However, for consumers who consume kale every day of the week, the choice of retail outlet is further determined by the area in which they live (*PeriUrbanLiving)*. Those who live in peri-urban areas have a probability of 0.4 of purchasing kale from roadside markets. On the other hand, the probability that consumers who consume kale every day of the week but live in the urban area will shop in the roadside markets is further determined by whether or not their monthly household income is greater than Kshs 10 000. As shown in Figure 1b, there is a very high probability (>0.8) that consumers from poorer households (that is, with monthly income less than Kshs 10 000) will use roadside markets. This finding is credible as prices are usually lower in roadside markets, compared, for instance, with supermarkets or specialty stores. Prices, however, tend to be comparable in the roadside and wet markets. As expected, consumers who consume kale every day but are less poor (that is, with monthly income greater than Kshs 10 000) have a lower likelihood of shopping in roadside markets (probability < 0.5).

The classification tree depicting the decision as to whether or not to purchase kale in the supermarket is presented in Figure 1c. As shown, the most statistically significant variable (*P*-value <0.001) is whether or not the consumer has full-time employment (*WorkFulltime*). This variable is a proxy for high income. For consumers in full-time

employment, the choice of supermarket is further determined by the variable *above5* (that is, having children over 5 years of age). Consumers with children older than 5 years (that is, *above5* > 0) have a higher probability ($=0.6$) of choosing supermarkets, whereas their counterparts have lower probability (<0.3) of shopping in supermarkets. For consumers who are not in full-time employment, the most statistically significant variable (P-value $<$ 0.001) determining whether or not they choose the supermarket is WTP more than Ksh 7/kg or not for quality of kale. The probability of choosing supermarkets among those willing to pay more than Ksh 7/kg is 0.4. However, the decision as to whether or not to use supermarkets among those not willing to pay more than Ksh 7/kg is affected by whether or not their monthly household income is greater than Ksh 23 475.74. For consumers who have greater monthly income than this cutoff, the probability of choosing supermarkets is relatively high (that is, 0.6). Although not unexpected, this finding reinforces the perception that supermarkets are associated with safer (higher-quality) kale. However, Figure 1c shows that for consumers whose monthly households are less than Kshs 23 475.74, the decision to use supermarkets is statistically significantly affected (P-value $<$ 0.021) by whether or not they have casual employment (*WorkPartime*). In general, these consumers are very unlikely to choose to buy kale in the supermarkets. The probability of choosing supermarkets as a source of kale is <0.2 for these types of consumers. In general, these findings suggest that households on low unstable incomes with low willingness to pay for safety are very unlikely to choose supermarkets as a source of kale.

Lastly, Figure 1d presents the consumer's decision as to whether or not to choose market type 4 (specialty store). The first statistically significant variable (P-value <0.001) in determining whether a consumer chooses specialty stores for kale purchases is whether or not the consumer earns a monthly income of more than Kshs 45 000. The probability that a consumer earning more than this cut-off income will choose a specialty store is 0.5, which is the highest for this market type, indicating that income plays the most significant role in the decision to buy kale in specialty stores. For consumers who earn less than this cut-off income, whether or not they choose specialty stores is determined by their perception of the risk posed by such produce (*TrMult7*), defined as follows: 'Product has been contaminated with heavy metals by the use of certain fertilizers, dust as well from emissions from emission from vehicles during transport. This can cause long-term diseases like cancer'. Risk perception had a cut-off level 3.375. It is expected that consumers who have a higher perception of the riskiness of kale from other outlets will have a higher propensity to purchase kale in specialty stores, owing to the general perception that kale from specialty stores is safer. Indeed, the probability that such consumers will choose specialty stores is 0.5, which is also among the highest in this retail outlet. On the other hand, the most statistically significant variable (P-value $<$ 0.047) affecting the decision by consumers with lower risk assessment to purchase kale in specialty stores is the WTP more Ksh 15/kg or not. As shown in Figure 1c, the probability that consumers with lower WTP than this cutoff will choose specialty stores is very small (<0.1). By contrast, consumers with higher WTP than the cutoff have a slightly higher probability (>0.15) of choosing specialty markets. These findings suggest that consumers who choose specialty stores are likely to be those with higher income, higher level of risk assessment and higher willingness to pay for safety of kale.

This section has used the non-parametric probabilistic classification tree to identify the variables likely to affect the decision to purchase kale in one retail outlet rather than the others. It has highlighted the importance of, among others, income level, willingness to pay for safety of kale, living environment, quality assessment and risk perception in the

choice of retail outlet. In the section below, we use the parametric method to empirically test the causal effect of these variables on the choice of one retail market over the rest.

Parametric Assessment of Factors Conditioning Choice of Market Outlet

Table 2 presents the results of the multinomial logit regression model estimated to test the factors that condition consumer choice of market outlet. The open-air market is used as the base market in the estimation. The results of the multinomial logit regression models bear much resemblance to those of the probabilistic classification tree analysis above. Starting with the roadside market, results suggest that among consumer-specific variables, education, income and willingness to pay affect the likelihood of a consumer choosing the roadside market as the preferred retail outlet over the others. Results show that, other things being constant, the higher the level of education and willingness to pay for safety of kale, the less likely that the consumer will choose the roadside market as the primary market outlet for kale instead of the wet market. These findings may be related to the fact that, in comparison to open-air markets, roadside markets present additional food safety risks (from vehicle exhaust fumes and dust). Consequently, more educated and higher-income consumers who care about these risks are more likely to buy kale in open-air markets where these risks are lower. The effect of income on likelihood of purchase of kale in roadside markets is, however, contrary to our expectations. Other things being constant, it increases the likelihood of purchasing kale in roadside markets. Earlier studies have shown that income

Table 2: Factors affecting the choice of kale market outlet by consumers: Multinomial logit regression

Variable	*Roadside*		*Supermarket*		*Specialty*	
	Coefficient	*P-value*	*Coefficient*	*P-value*	*Coefficient*	*P-value*
Consumer-specific characteristics						
Lnage	0.01	0.979	3.66	0.000	0.13	0.913
Educ	−0.31	0.090	−0.23	0.359	0.24	0.569
lnIncome	0.71	0.001	2.08	0.000	3.67	0.000
lnwtp	−0.12	0.015	0.15	0.099	0.33	0.039
Household characteristics						
under5	0.79	0.012	0.82	0.065	−0.51	0.579
periurbanliving	2.11	0.000	−0.06	0.918	0.35	0.697
Hhldsize	−0.11	0.167	−0.26	0.028	−0.42	0.054
Quality/nutritional factors						
Qltyassmnt	0.07	0.415	−0.10	0.284	−0.30	0.076
Consistency	0.11	0.075	1.34	0.000	1.34	0.000
lnpercvdrisk	0.01	0.564	0.01	0.008	0.01	0.000
Motivational factors						
Distance is main motive	−0.20	0.801	−1.44	0.017	−0.66	0.413
Fair price is main motive	−0.68	0.493	−1.44	0.144	0.64	0.639
Constant	−9.75	0.001	−32.91	0.000	−45.54	0.000
$N = 449$	Wald $\chi^2 = 220.12$		P-value = 0.000		Pseudo $R^2 = 0.486$	

Dependent variable = market outlet chosen; base market is the open-air market.

increases demand for food safety (Regmi and Gelhar, 2005a). It would therefore seem that consumers have factors they value in this market other than safety. The most likely attribute this market outlet offers that is unique and may be of value to consumers is convenience. Consumers have the convenience of shopping upon alighting from their vehicles on their way home from work without wading through the sometimes unclean paths into the municipal markets located some distance away from the main roads.

Among the household characteristics, living in peri-urban areas and presence of children under the age of 5 years affect the likelihood that a consumer would choose the roadside market relative to the open-air market. In particular, other things being constant, living in peri-urban areas increases the probability that a consumer will choose the roadside market over the open-air market. This result corroborates earlier findings of the probabilistic classification tree. The finding further supports the above argument that consumers enjoy the convenience that the roadside market offers. It suggests that consumers who live in peri-urban areas, but work in the city, probably make stopovers at roadside markets to purchase kale before proceeding to their homes. Results further show that having children under the age 5 years also increases the likelihood of buying kale in the roadside market relative to the open-air market. Among the nutritional and safety characteristics, the results show that consumers who perceive the vegetables offered in the roadside markets to be of consistent quality and have confidence in their safety are likely to choose this market over the open-air market.

The factors affecting the likelihood of choosing the supermarket relative to the open-air market also include consumer, household, nutritional and motivational factors. Among the consumer-specific variables, age, income and willingness to pay for safety increase the likelihood that a consumer will choose to purchase kale in supermarkets rather than open-air markets. In particular, other things being constant, higher incomes and higher willingness to pay for safety increase the likelihood of choosing to buy kale in supermarkets instead of wet markets. Among the household characteristics, having a large family reduces the likelihood that a consumer will choose supermarkets as the main source of kale, *ceteris paribus*. This finding is probably related to the fact that larger families consume much more kale and hence that dependence on the higher-priced supermarket kale can greatly increase household expenditure on kale. The finding with regard to willingness to pay corroborates those of the non-parametric analysis above. It shows that, other things being constant, willingness to pay more for safety of kale increases the likelihood of choosing the supermarket over the open-air market as a source of kale. Indeed, as the results further show, other things being constant, the perception that kale sold in the open-air market is risky/unsafe and also that kale sold in the supermarket is of consistent quality increases the likelihood of choosing the supermarket over the open-air market as a source of kale. Together, these results suggest that consumers who choose supermarkets over open-air markets as a source of kale perceive the former as a source of safer kale or to be of more consistent quality than the latter. However, the results also show that consumers who consider distance to the market as the main motive for choosing the market outlet are less likely to choose supermarkets over the open-air markets, other things being constant. Indeed, the widespread availability of kale in wet market/vending spots makes these outlets more accessible to the majority of Nairobi consumers than supermarkets.

Lastly, the results of the multinomial logit regression analysis show that various consumer, household, nutritional and motivational factors affect the probability that a consumer will choose the specialty store over the open-air market. Among the consumer-specific characteristics, income and willingness to pay for safety of kale affect the probability that a consumer will choose the specialty market. That is, consumers with higher

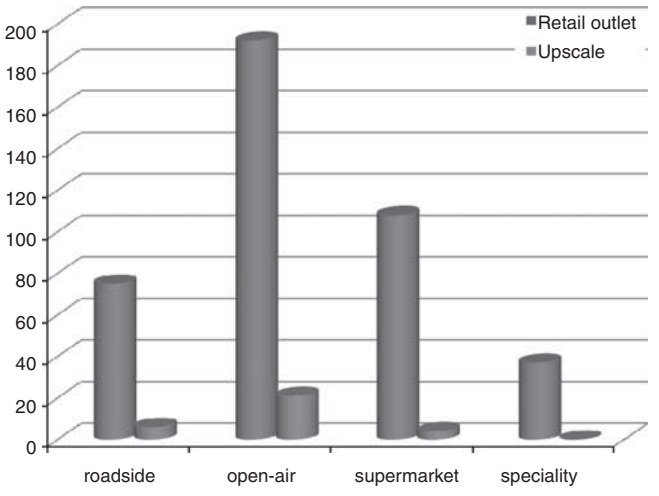

Figure 2: First best alternative market outlet entails upscaling to a different market type. *Source*: Survey data.

income and WTP for safe kale have, ceteris paribus, a higher probability of choosing specialty markets as a source of kale. Results also suggest that, among the household characteristics, large household size reduces the probability of choosing specialty markets, ceteris paribus. Results further show that, other things being constant, risk perception and perception that kale sold via specialty markets are consistent in quality increases the probability of choosing the specialty store.

We also investigated whether consumers interviewed in this study would change their market outlet/type during future purchases. Figure 2 presents the responses to the case where the consumer had to decide whether his/her first best alternative is to 'upscale' (that is, move to a market that is perceived to offer quality kale) or otherwise (that is, remain in the same market type). Figure 3 presents the opposite case (that is, whether to 'downscale' or stay in the same market type). Interestingly, in both cases, an overwhelming majority of the respondents would remain in the same market type as their first best alternative, indicating that the interviewed respondents normally purchase kale in the outlets where they were interviewed. The figures also show that more consumers who purchase kale in open-air markets could upscale than in the rest of the market types, whereas consumers who purchase kale in the specialty stores are quite loyal, preferring neither to upscale nor downscale.

Conclusion and Implications

This article assesses the factors that condition the choice of fresh vegetable market in developing-country cities by urban consumers. It uses data drawn from 449 kale consumers in Nairobi, Kenya, stratified by the market they purchase kale from. The markets studied included open-air markets, roadside markets, supermarkets and specialty stores. A non-parametric method, namely, the probabilistic classification tree, is used to identify the factors that affect the choice of market outlet used for purchase of kale. A parametric method involving the estimation of the multinomial logit regression model, with open-air market as the base market, is then used to test the causal effect of the identified factors

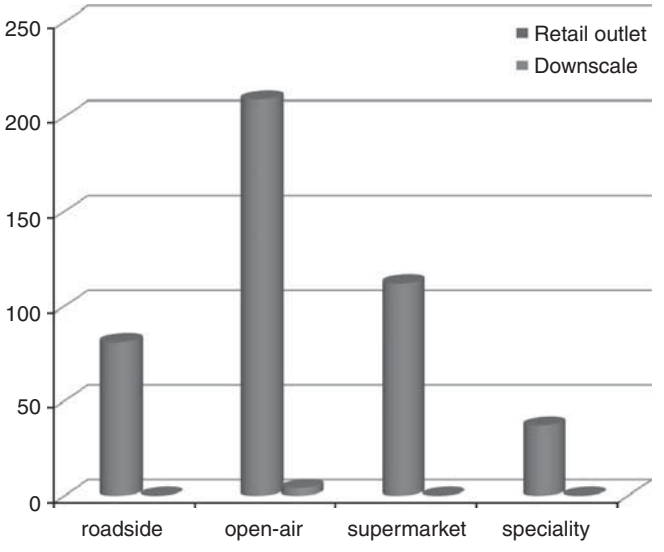

Figure 3: The first best alternative market outlet entails 'downscaling' to a different market type. *Source*: Survey data.

on the decision to buy kale from the roadside, supermarket and specialty market instead of the open-air market, and hence to assess the robustness of the findings of the non-parametric technique.

This study finds that the choice of kale retail market by urban consumers is affected by a broad range of factors including consumer specific, household specific, nutritional and motivational factors. Both the non-parametric and parametric results indicate that income, living environment, risk perception, willingness to pay for safety and perception of consistency of quality of kale affect the probability of choosing the roadside, supermarket or specialty store over the open-air market. The significance of risk perception in consumers' choice of supermarkets and specialty store outlets corroborates findings of past studies (Neven and Reardon, 2004; Minten and Reardon, 2008). Overall, the findings of the parametric analysis corroborate those of the non-parametric analysis. However, the findings of this study should be interpreted with caution because of the design limitations, especially relating to the way in which the respondents were sampled. Nonetheless, we conclude, based on the study findings, that the choice, by consumers, of whether to purchase kale in open-air markets, roadside markets, supermarkets or specialty stores is affected by income, level of PR, confidence in the consistency of quality of kale retailed in respective outlets, living environment and household characteristics (especially household size). Notwithstanding the design limitations, these findings imply that the regulation of quality of kale (and safety standards in the retailing of fresh vegetables in general) should take into account the different needs of the different categories of consumers. Specifically, they imply that regulations that target quality and safety improvements, and that result in a kale price increase, should be targeted to high- and middle-income households (often characterized by small households and young families) rather than to the poorer and larger households. These findings also have implications for the design of strategies to improve fresh vegetable retail markets in developing-country urban centers. Such countries, especially in Eastern and Southern Africa, are in the process of formulating trade policies that encompass the standardization of grades and standards in markets across the region.

Note

1. This is based on information about the volume of sales of kale compared with other leafy vegetables obtained from vegetable traders in all the market outlets during the pre-survey. Other studies (for example, Karanja *et al*, 2010) have also shown that kale is the most widely grown (and hence consumed) leafy vegetable in Kenya.

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