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Investigating Thai Shopping Behaviour: Wet-Markets, Supermarkets and Food Quality

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Abstract

An analysis of primary survey data on Thai shopping behavior seeks to understand the relative satisfaction of consumers with wet markets and supermarkets and identify the factors that affect frequency of visit to, and purchase behavior within, these retail outlets. This is used as a basis for engaging in wider debates on the 'supermarket revolution' in Asia. On all salient attributes affecting retail outlet choice, wet markets are perceived, in general, to be inferior to supermarkets. However for fresh produce sales, wet markets retain an advantage. Both socio-economic characteristics and retail outlet attributes are considered as determinants of food shopping behavior. Bootstrapped bivariate ordered probit models identify that those using wet markets more frequently are older and characterized by lower incomes and educational achievement. Bootstrapped bivariate Tobit models reveal that those purchasing a higher proportion of fresh produce from wet markets do so based on product quality and do not regard wet markets as lacking cleanliness. Visit data are consistent with Reardon's model of supermarket diffusion.

Keywords and JEL Codes

Food choice, retail, Thailand. D12, L81, P46

I) Introduction

As in other parts of Southeast Asia (Reardon *et al*. 2003), Eastern Europe (Dries *et al.* 2004), and Central and South America (Berdegué *et al.* 2007), Thailand has witnessed a 'supermarket revolution' – the rapid development of typically foreign-owned, food retail chains. Within a little over a decade, supermarkets have gone from being limited to sub-sections of department stores to the main outlet for grocery sales in urban Thailand (Australian Department of Foreign Affairs and Trade, 2002, cited in Cadilhon *et al.* 2006). This has occurred partially at the expense of traditional wet markets (also referred to as fresh or street markets) and independent grocers. The supermarket revolution has attracted much attention, principally from a business strategy perspective (Mukoyama, 2005), focussing on debates about standardisation or adaptation of retail formats across countries, or from a policy standpoint, concerned about the opportunities for small-scale domestic producers and farmers within restructured supply chains (Reardon *et al.* 2003). While these debates are important, it is essential that consumer perspectives are not ignored, particularly when assessing the extent to which 'the supermarket revolution' is customer driven. As Neven *et al.* (2006) remark - consumer retail studies for developing economies remain rare. This is despite the fact that relative growth rates for supermarkets tend to be higher outside of North America and Western Europe and that emerging markets have witnessed an unprecedented wave of Foreign Direct Investment (FDI) in retailing (Dawson, 2001).

The paper addresses this gap in the literature by investigating consumer food shopping behaviour in Thailand. Specifically, our objectives are to quantify the relative satisfaction of consumers with wet markets and supermarkets and identify the factors that affect frequency of visit to, and purchase behaviour within, the two main retail formats in Thailand, namely supermarkets and traditional wet markets. In explaining behaviour the analysis considers both socio-economic characteristics and retail format attributes. Previous studies that seek to model food choice in developing countries tend to consider solely socio-economic characteristics as determinants. This

means that to date there is limited information on the role played by the characteristics of different retail formats, so 'it would be worthwhile studying the in-store characteristics that attract customers to supermarkets, or avert them' (D' Haese *et al.* 2008, p.613). This should generate a more refined picture of the determinants of food shopping behaviour, contributing to a wider debate on the 'retail revolution'.

The paper draws on two literatures: the debate concerning the 'supermarket revolution' and theories of consumers' choice of retail outlets. These are presented in the next section. Section three presents an overview of the evolution of the Thai retail sector since the mid-1990s. Section four outlines the methodology employed, justifying the design of a consumer questionnaire and the econometric models employed. The dataset is introduced in Section 5. Descriptive statistics of survey results and the econometric analysis are evaluated in Section 6 and conclusions drawn in Section 7.

II) Literature Review

Reardon and Berdegué (2006) define retail modernisation as the spread of supermarkets, hypermarkets and convenience stores at the expense of traditional food outlets (markets, independent stores and traders). Of the three modern retail formats, supermarkets, defined by Humphrey (2007, p.440) as a 'self-service store with trolleys and/or baskets and a checkout at the exit', are the most widespread. Reardon *et al.* (2007) argue that developing and transitional economies have undergone a 'supermarket revolution' characterised by four main features. First, its spread occurred in three established waves, and a fourth emerging wave. The first wave of supermarket-sector "takeoff" took place in the early to mid 1990s in much of South America and East Asia outside China, Central Europe and South Africa. This 'take off' was spectacular: the average share of total food retail spending accounted for by supermarkets rose from roughly 10-20 per cent circa 1990 to 50-60 per cent by the early 2000s (Reardon and Berdegué 2002; Reardon *et*

al. 2003). Subsequent waves followed, covering Mexico and much of Southeast Asia, Central America, and Southern-Central Europe.

Second, the speed of the supermarket revolution has accelerated, due to not only demand side factors (urbanisation, rising incomes) but also a 'tidal wave of FDI' (Reardon *et al*. 2003, p.1143) and a policy environment conducive to the internationalisation of retailing. This has pushed the growth of supermarkets ahead of the advance of broad social trends (Reardon *et al.* 2007). Third, the diffusion of supermarkets originates from capital cities / largest markets. Retail networks then expand into intermediate cities and towns, followed by rural small towns. The target market also expands from an initial focus on higher income groups, to the middle classes and then the urban poor. This pattern of diffusion develops from retailers initially targeting the most lucrative markets but as these become saturated, new opportunities for growth are sought which can be combined with cost savings and reaping economies of scale. Fourth, a critical strategy for reducing costs and improving quality is the modernisation of procurement systems. This typically involves the 'delocalisation' of supply networks, investment in distribution centres and less reliance on traditional wholesalers, and the greater use of private standards and contracting (Dries *et al.* 2004; Reardon *et al.* 2003; Reardon *et al.* 2007). This is crtical for increasing the penetration of supermarkets in fresh produce markets, where their market share tends to lag that in processed goods.

Humphrey (2007), however, questions the extent of the supermarket revolution, arguing that Reardon *et al.* (2007) and others underestimate the competitiveness of traditional retail formats. To support this, Humphrey (2007) draws on data for Brasil and Argentina which suggest that the penetration of supermarkets has stagnated, or in certain cases declined. Goldman *et al.* (1999) also doubt the superiority of modern retail formats in an Asian context, drawing on consumer research for Hong Kong. The latter authors argue that wet markets possess advantages in terms of costs and distribution, which make them more attractive to consumers based on the price and freshness of

their products. Goldman *et al.* (1999) also argue that some Western scholars underestimate the role played by wet markets in Asian culture and how they are best placed to meet a diet and culture built on local foods and freshness.

Reardon *et al.* (2007) respond to these criticisms, arguing that Goldman *et al.*'s (1999) analysis is based on data for the mid-1990s and precedes the 'take off' of modern retail formats in East Asia. Since Goldman *et al.*'s (1999) analysis for Hong Kong, the share of total food expenditure accounted for by wet markets has fallen from a peak of 65 per cent in 1994–1995, to 49 per cent in 1999–2000 (Ho, 2005). Pingali (2007) studied the evolution of Asian diets, concluding that significant shifts have occurred since the early 1980s with a relative shift away from rice and indigenous fruits and vegetables toward wheat and dairy based products, processed goods, fast food and exotic fruits and vegetables. Some of these changes have been dramatic: for instance between 1981 and 2001 rice's share of the average Thai diet fell from 60 per cent to 43 per cent. Pingali (2007) labels this a 'Westernisation' of Asian diets, which is both conducive to, and reinforced by, the spread of global supermarket chains.

Understanding consumers' choice of retail outlets has attracted considerable academic debate. This literature, which emerged principally from North America and Western Europe, rests on the premise that choices depend on perceived or expected customer satisfaction. Customer satisfaction regarding retail outlets has been modelled in a number of ways, with many building on the multi-attribute attitudinal model developed by Bass and Talarzyk (1972). This assumes that customers derive satisfaction to the extent that a store offers desired attributes:

$$A_{hi} = \sum_{g=1}^{n} W_{ig} B_{ihg} \qquad [1]$$

Where A_{hi} is consumer *i*'s attitude score for retail outlet *h*, W_{ig} is the importance weight assigned by consumer *i* to attribute *g*, B_{ihg} is consumer *i*'s belief as to the amount of attribute *g* offered by outlet

h and *n* is the number of relevant attributes in the selection of a given type of store (McGoldrick, 2002).

Empirical research has sought to identify relevant attributes. For instance, Arnold *et al.* (1983) used shopping data to study food store choice in North America and Western Europe, ascertaining that that the most significant aspects are location/convenience, lowest overall prices, assortment/variety of merchandise, friendly/courteous service, fast check out, quality of products, and store environment. Louviere and Faeth (1987), using conjoint analysis, identified four critical attributes: price, quality, selection and convenience. For empirical testing, several researchers (Davies and Brooks, 1989; Ness *et al.* 2002; Stoltman *et al.* 1991) use scales developed by Lindquist (1974), who included items on merchandise, service, clientele, convenience, promotion, atmosphere and post-transaction satisfaction. This assumes that store attributes are the main determinants of retail outlet choice and, hence, shopping behaviour, although this has not been commonly considered for developing countries (D'Haese *et al.* 2008). Studies for the latter group of states have principally used socio-economic and demographic data as predictors of food purchasing behaviour (Neven *et al.* 2006; Goldman *et al.* 2002).

The existing literature on retail attributes, however, presents a number of problems for understanding shopping behaviour in Thailand. Notwithstanding some notable exceptions (Trappey, 1997), research instruments on the importance consumers place on particular retail attributes have been overwhelmingly developed for, and empirically tested in, North America and Western Europe. Given its Western origins, previous research focuses therefore on understanding consumers' choice between different types of 'modern retail' stores. In other market environments, however, this may not be the critical decision made by consumers. For instance in Thailand, the main retail choice is between supermarkets and wet markets. Moreover, scales and research instruments designed to understand consumer decision making in Western markets may not incorporate the critical attributes that underpin decisions elsewhere. For instance, cleanliness and food safety are neither included as

attributes in the scales of Lindquist (1974) nor in subsequent studies by Davies and Brooks (1989) and Ness *et al.* (2002), but these have been suggested as important factors for declining use of wet markets in Asia (Ho, 2005).

This suggests that for Thailand models should assume that consumers choose between two retail formats, *s* denoting supermarkets and *m* wet markets. Let ν (*s*, *i* ,*t*) be the expected utility that arises if the *i*th consumer chooses retail format *s* in time *t*. The *i*th consumer will choose retail format *s* if:

$$\nu(s,i,t) > \nu(m,i,t) \qquad [2]$$

Where expected utility is a function of all relevant variables including store format attributes and socioeconomic characteristics. In the simplest form, a dummy variable *d*(*s*, *i* ,*t*), may take the value of 1 if the *i*th consumer chooses to shop at retail format *s* in time *t* and 0 if otherwise. The econometric specification of retail format choice involves a probabilistic model, whereby the likelihood of the *i*th consumer choosing format *s* in time *t* is given by:

$$\Pr ob_{i,t}(d(s,i,t) = 1/m = \Phi(V(s,i,t,/m)) \qquad [3]$$

Where Φ (.) is the cumulative distribution function (cdf) and *V*(*s,i,t* / *m*) is the deterministic component of the difference in expected utility between formats *s* and *m* (Arnade *et al.* 2008). Rather than a binary dependent variable, it is more realistic to assume, however, that in time period *t*, consumers may use both formats s and *m* but differ in the frequency of visits and the percentage of total spending on a product category accounted for by *s* and *m*.

III. The Thai Context

Prior to the mid-1990s, supermarkets were largely confined to department stores. These department stores targeted higher income consumers and were restricted to the capital city, Bangkok, and its suburbs. Within Bangkok, convenience stores were successfully introduced in the late 1980s, most

notably 7-Eleven, which fitted with the rising job market participation of women and a consequent reduction in time devoted to 'household' activities (Feeney *et al.* 1996). However, traditional wet markets, characterised by minimal central control or organization and family ownership remained the main food distribution channel (Trappey, 1997).

In 1994, two supermarket chains were established, 'Lotus', controlled by the Thai-based CP Group, and 'Big C', controlled by the domestically owned Central Group. In 1996, Central Group collaborated with the French retailer Carrefour to open a store in the latter's name. The Central Group also established a chain of 'Tops' supermarkets jointly with the Dutch multinational grocer Royal Ahold. A host of other Thai retailers also sought to enter the supermarket business but these were largely unsuccessful.

As a result of the Asian economic crisis in the late 1990s, Thai retailers, which had rapidly expanded into supermarkets, funded by foreign loans, faced severe financial difficulties. A large chunk of the supermarket sector was sold to foreign investors. Namely, Central sold their share in Big C to the French Casino Group, their stake in Carrefour to the French company, and their interest in Tops Supermarkets to Royal Ahold. At the same time, CP sold their majority shareholding in Lotus to the British retailer Tesco.

During the early 2000s, foreign ownership thus became integral to the expansion of supermarket groups. However in 2004, the Central Group bought out Royal Ahold's interests in the Tops supermarket chain as the Dutch company divested all its Asian interests. By 2007 the Central group had approximately 59 per cent market share of the supermarket sector (GMID, 2008). The second largest retailer by market share is the Ek-Chai Distribution System, the Thai subsidiary of Tesco, which controls the "Talad Lotus" chain. Talad Lotus has a market share of approximately 8.6 per cent (GMID, 2008). For the supermarket sector as a whole, the number of outlets and selling space are currently rising at annual rates of 8 and 9 per cent respectively (GMID, 2008).

The rise of super/hypermarkets has been partially at the expense of traditional street and wet markets and independent grocery stores. For instance, the number of traditional grocery stores fell from 283,009 in 2002 to 273,314 in 2003 (ACNielson data cited by USDA, 2004). Approximately 90 percent of urban Thai shoppers use supermarkets at least once a month (USDA, 2007). However while squeezed, markets remain important: USDA (2004) report that 87 per cent of all Thai consumers visited a wet market at least once a week and that the majority of food shoppers, particularly those outside of Bangkok, continue to visit wet markets to buy fresh food. While precise data are unavailable, USDA (2004) estimates that 'modern retail' which includes both supermarkets and convenience stores, accounts for approximately 35 per cent of total Thai food sales. However this average masks a considerable urban – rural divide and in Bangkok modern retail is likely to predominate.

IV) Methodology

The lack of secondary data on the determinants of food shopping behaviour in Thailand justifies primary data collection. Development of a survey instrument began with the verified scales of retail outlet attributes as developed by Lindquist (1974) and refined by Davies and Brooks (1989) and Ness *et al.* (2002). The applicability of these attributes for the Thai context and whether other salient factors were missing was discussed in a focus group of Thai shoppers. This led to the modification of the survey design to include 'cleanliness of place', 'speed of service', 'food safety' and 'atmosphere' as attributes. Other variables such as convenient location, low prices, assortment, product quality and variety of products, identified in previous studies, were seen as salient in the Thai context. A second focus group confirmed the appropriateness of the modifications.

The final version of questionnaire consists of three sections. The first part measures the use of supermarkets and wet markets. Specifically, it includes questions on frequency of visits to supermarkets and wet markets. Respondents were also asked about the average percentage of their

total spending on fresh fruit and vegetables [FFV], fresh meat, fresh fish, packaged goods and beverages accounted for by wet markets, supermarkets and other outlets in a typical month. This recognises that patterns of behaviour and motivations may vary across food product categories.

Section two considers retail attributes and the weighting attached to them by consumers. First, respondents were asked to rate the importance of individual attributes (e.g. cleanliness of place) in their decision for where to buy food on a five point Likert scale (1= not at all important, 5= most important). They then rated supermarkets and wet markets in their locality according to how well they scored on each attribute. This again was based on a five point scale (1 = very poor, 5 = excellent). In accordance with [1], this captures both W_{ig} and B_{ihg}. Section 3 elicits socio-economic and demographic information (location, gender, age, income band and highest level of education achieved).

The econometric analysis is divided into two stages. As a first step, frequency of visits to wet-markets and supermarkets are modelled respectively. Secondly, we evaluate the determinants of proportionate spending in wet markets and supermarkets for selected product categories.

Bivariate ordered probit model

The first step is based on the estimation of a bivariate ordered probit model. This model can be treated as an extension of a standard bivariate probit model where the number of categories of the dependent variables is greater than two (see Kilkenny and Huffman, 2003; Sajaha, 2008).[1] As for the univariate ordered probability model, the bivariate model type can be derived from a latent variable model (Sajaha, 2008). Assume that two latent variables y_1^* and y_2^* are determined by:

$$y_{1i}^* = x_{1i}^{'}\beta_1 + \varepsilon_{1i} \qquad [4]$$

$$y_{2i}^* = x_{2i}^{'}\beta_2 + \varepsilon_{2i} \qquad [5]$$

[1] The BIOPROBIT Stata module (version 2/4/2008) was utilised.

where β_1 and β_2 are vectors of unknown parameters, ε_1 and ε_2 are the error terms, and subscript *i* denotes the individual observation. Further we assume that the explanatory variables in [4] and [5] satisfy the conditions of exogeneity such that $E(x_{1i}, \varepsilon_{1i}) = 0$ and $E(x_{2i}, \varepsilon_{2i}) = 0$. y_1 and y_2 are observed as categorical variables such that:

$$y_{1i} = \begin{cases} 1 \text{ if } y_{1i}^* \le c_{11} \\ 2 \text{ if } c_{11} < y_{1i}^* \le c_{12} \\ \quad . \\ J \text{ if } c_{1J-1} \le y_{1i}^* \end{cases} \qquad y_{2i} = \begin{cases} 1 \text{ if } y_{2i}^* \le c_{21} \\ 2 \text{ if } c_{21} < y_{2i}^* \le c_{22} \\ \quad . \\ K \text{ if } c_{1K-1} \le y_{2i}^* \end{cases} \qquad [6]$$

and where the unknown cutoffs satisfy: $c_{11} < c_{12} < ... < c_{1,J-1}$ and $c_{21} < c_{22} < ... < c_{2,K-1}$ and $c_{10} = c_{20} = -\infty$ and $c_{1J} = c_{2K} = \infty$. The probability that $y_{1i} = j$ and $y_{2i} = k$ is:

$$\begin{aligned} \Pr(y_{1i} = j, y_{2i} = k) &= \Pr(c_{1j-1} < y_{1i}^* \le c_{1j}, c_{2k-1} < y_{2i}^* \le c_{2k}) \\ &= \Pr(y_{1i}^* \le c_{1j}, y_{2i}^* \le c_{2k}) \\ &\quad - \Pr(y_{1i}^* \le c_{1j-1}, y_{2i}^* \le c_{2k}) \\ &\quad - \Pr(y_{1i}^* \le c_{1j}, y_{2i}^* \le c_{2k-1}) \\ &\quad + \Pr(y_{1i}^* \le c_{1j-1}, y_{2i}^* \le c_{2k-1}) \end{aligned} \qquad [7]$$

If the error terms follow a bivariate standard normal distribution with correlation $\tilde{\rho}$ the individual contribution to the likelihood function may be expressed as:

$$\begin{aligned} \Pr(y_{1i} = j, y_{2i} = k) &= \Phi_2(c_{1j} - x_{1i}'\beta_1, (c_{2k} - \gamma x_{1i}'\beta_1 - x_{2i}'\beta_2)\zeta, \tilde{\rho}) \\ &\quad - \Phi_2(c_{1j-1} - x_{1i}'\beta_1, (c_{2k} - \gamma x_{1i}'\beta_1 - x_{2i}'\beta_2)\zeta, \tilde{\rho}) \\ &\quad - \Phi_2(c_{1j} - x_{1i}'\beta_1, (c_{2k-1} - \gamma x_{1i}'\beta_1 - x_{2i}'\beta_2)\zeta, \tilde{\rho}) \\ &\quad + \Phi_2(c_{1j} - x_{1i}'\beta_1, (c_{2k-1} - \gamma x_{1i}'\beta_1 - x_{2i}'\beta_2)\zeta, \tilde{\rho}) \end{aligned} \qquad [8]$$

where Φ_2 is the bivariate standard normal cumulative distribution function, $\zeta = 1/\sqrt{1 + 2\gamma\rho + \gamma^2}$ and $\tilde{\rho} = \zeta(\gamma + \rho)$. The logarithmic likelihood of observation *i* is given by:

$$\ln L_i = \sum_{j=1}^{J} \sum_{k=1}^{K} I(y_{1i} = j, y_{2i} = k) \ln \Pr(y_{1i} = j, y_{2i} = k) \qquad [9]$$

Assuming, lastly, that the observations are independent we can sum across all observations to obtain the log likelihood for the entire sample of size N:

$$\ln \mathrm{L}=\sum_{i=1}^{N}\sum_{j=1}^{J}\sum_{k=1}^{K} I(y_{1i}=j, y_{2i}=k)\ln \Pr(y_{1i}=j, y_{2i}=k) \qquad [10]$$

In the case of modelling step 1, the categorical dependent variables y_1 and y_2 equal the frequency of visits to wet-markets and the frequency of visits to supermarkets respectively. These variables carry the value '1' for "everyday", '2' for "2-3 times a week", '3' for "once a week", '4' for "2-3 times a month", '5' for "once a month", and '6' for "less than once a month". The vectors of explanatory variables x_1 and x_2 contain the following independent variables related to retail outlet attributes: convenience of location, price of products, special offers, assortment, quality of service, speed of service, product quality, variety of products, payment by card, atmosphere, cleanliness, food safety as well as a cross variable for the combined effect of product quality and cleanliness. Further, socioeconomic variables are included: a location dummy for the household residing in Bangkok, gender, age, household income, and the level of education of the customer.

We check for the robustness of our models by applying a simple stochastic resampling procedure based on bootstrapping techniques (see Efron 1979). This appears necessary as our cross-sectional sample consists of a limited number of observations. If we suppose that $\hat{\Psi}_n$ is an estimator of the parameter vector ψ_n including all parameters obtained by estimating [4] and [5] based on our original sample of 201 observations $X=(x_1,...,x_n)$, then we are able to approximate the statistical properties of $\hat{\Psi}_n$ by studying a sample of 1000 bootstrap estimators $\hat{\Psi}_n(c)_m, c=1,...,C$. These are obtained by resampling our 201 observations – with replacement – from X and recomputing $\hat{\Psi}_n$ by using each generated sample. Finally the sampling characteristics of our vector of parameters are obtained from:

$$\hat{\Psi}=\left[\hat{\Psi}_{(1)m},...,\hat{\Psi}_{(500)m}\right] \qquad [11]$$

As discussed extensively by Horowitz (2001) and Efron and Tibshirani (1993), the bias of the bootstrap as an estimator of $\hat{\Psi}_n$, $B_{\tilde{\psi}} = \tilde{\Psi}_n - \hat{\Psi}_n$, is itself a feasible estimator of the bias of the asymptotic estimator of the true population parameter ψ_n.[2] This holds also for the standard deviation of the bootstrapped empirical distribution, providing a natural estimator of the standard error for each initial parameter estimate. By using a bias corrected bootstrap we aim to reduce the likely small sample bias in the initial estimates.

Bootstrapped Bivariate Tobit

The second step of our analysis is based on the estimation of a bivariate Tobit model (see Maddala, 1994).[3] As for the previous model the main concern is to estimate the two parameter vectors β_1 and β_2 in the following two-equation model derived again from a latent variable model (see Amemiya, 1984; Lee, 1993; Cornick *et al.*, 1994; Bellemare, 2006) as outlined by [4] and [5]. As for the previous model we assume that the explanatory variables in [4] and [5] satisfy the conditions of exogeneity such that $E(x_{1i}, \varepsilon_{1i}) = 0$ and $E(x_{2i}, \varepsilon_{2i}) = 0$. The observed dependent variables are defined as follows:

$$\left(y_{1i}^{'}, y_{2i}^{'}\right) = \begin{cases} \left(c_1, c_2\right) \text{ if } y_{1i}^{'} \le c_1 \text{ and } y_{2i}^{'} \le c_2 \\ \left(c_1, y_{2i}^{'}\right) \text{ if } y_{1i}^{'} \le c_1 \text{ and } y_{2i}^{'} > c_2 \\ \left(y_{1i}^{'}, c_2\right) \text{ if } y_{1i}^{'} > c_1 \text{ and } y_{2i}^{'} \le c_2 \\ \left(y_{1i}^{'}, y_{2i}^{'}\right) \text{ if } y_{1i}^{'} > c_1 \text{ and } y_{2i}^{'} > c_2 \end{cases} \qquad [12]$$

where c_1 and c_2 are the unknown cutoffs for the dependent variables y_{1i} and y_{2i}. This model can be developed in the context of a joint distribution for $\left(y_{1i}^{'}, y_{2i}^{'}\right)$, assuming again a bivariate normal distribution $BVND\left(x_{1i}^{'}\beta_1, x_{2i}^{'}\beta_2, \sigma_1^2, \sigma_2^2, \rho\right)$ where σ_1, σ_2 and ρ are the standard deviations of the

[2] Hence the bias-corrected estimator of ψ_n can be computed by $\hat{\psi}_n - B_{\tilde{\psi}} = 2\hat{\psi} - \tilde{\psi}$.

[3] The BITOBIT Stata module (version 11/8/2007) was utilised.

marginal distributions of $y_{1i}^{'}$ and $y_{2i}^{'}$, and the correlation coefficient of $y_{1i}^{'}$ and $y_{2i}^{'}$, respectively. If g(·, ·) is the joint normal density of $\left(\varepsilon_{1i}, \varepsilon_{1i}\right)$ the likelihood function can be stated as:

$$L = \prod_{\{i|y_{1i}>0, y_{2i}>0\}} g\left(y_{1i} - x_{1i}^{'}\beta_1, y_{2i} - x_{2i}^{'}\beta_2\right) \prod_{\{i|y_{1i}>0, y_{2i}=0\}} \int_{-\infty}^{-x_{2i}^{'}\beta_2} g\left(y_{1i} - x_{1i}^{'}\beta_1, \varepsilon_2\right) d\varepsilon_2$$
$$\prod_{\{i|y_{1i}=0, y_{2i}>0\}} \int_{-\infty}^{-x_{1i}^{'}\beta_1} g\left(y_{2i} - x_{2i}^{'}\beta_2, \varepsilon_1\right) d\varepsilon_1 \prod_{\{i|y_{1i}=0, y_{2i}=0\}} \int_{-\infty}^{-x_{2i}^{'}\beta_2} \int_{-\infty}^{-x_{1i}^{'}\beta_1} g\left(\varepsilon_1, \varepsilon_2\right) d\varepsilon_1 d\varepsilon_2 \qquad [13]$$

where Π denotes the product over all observations. In the case of modelling step 2, the censored dependent variables y_1 and y_2 equal the percentage of spending accounted for by wet markets and supermarkets for the following product categories: fresh fruit and vegetables, fresh meat, fresh fish, and packaged goods. These variables are censored at 0 and 100 by definition. As in step 1, the vectors of explanatory variables x_1 and x_2 contain the following independent variables relating to retail outlet attributes: convenience of location, price of products, special offers, assortment, quality of service, speed of service, product quality, variety of products, payment by card, atmosphere, cleanliness, food safety as well as a cross variable for the combined effect of product quality and cleanliness. Similarly, the same socioeconomic variables are included as in step 1: a location dummy for Bangkok, gender, age, household income, and level of education. Finally, we check for the robustness of the estimates by applying again a simple stochastic resampling procedure as outlined in the previous subsection.

V) Data Set

The data set consists of 201 questionnaire responses split almost equally between two locations: Bangkok and Chachoengsao. Bangkok has a population of over 6 million and has the highest penetration of supermarkets in Thailand (USDA, 2004). The provincial city of Chachoengsao has a population of only around one-tenth of Bangkok but has been subject to an influx of supermarkets in recent years. As the study seeks understand choice of retail outlet, only districts within which

both wet markets and supermarkets are located were included in the study. Quota sampling, based on four age groups, was utilised. The size of the each age group quota matches Thailand's demographic profile. As the study was limited to those responsible for the majority of food purchases in their household, approximately two-thirds of the sample is female. Data collection occurred via face to face interviews in 2007.

VI) Analysis

Table 1 reports the average percentage spend in a typical month by type of retail outlet (wet market, supermarket / hypermarket and other)[4] for five food categories (fresh fruit and vegetables, fresh meat, fresh meat, packaged goods and beverages). Important differences are apparent across the food categories. For fresh produce (fruit and vegetables, meat and fish) wet markets continue to account for the majority of spending. For packaged goods and beverages, supermarkets are more important. This divide between fresh and 'longer-life' goods has been reported for other Asian countries but the penetration of supermarkets into fresh market markets is greater than some previous assessments (Goldman *et al.* 1999; Ho, 2005).

Table 2 details the average importance weighting given to retail outlet attributes in the choice of where to buy food (1= not important, 5 = most important). Attributes are listed in descending order of importance. The most important factors are quality of products, food safety, variety of products, cleanliness of place and quality of service. Facilities to pay by card are of little importance. The latter two columns of Table 2 report how well wet markets and supermarkets in respondents' local area score (1= very poor; 5 = very good) on each of these attributes. On all items, supermarkets perform better. The greatest divide is apparent for food safety, cleanliness of place, assortment and, albeit of little importance, payment by card. There is little difference in the ratings attached to price of products. Data in Table 2, therefore, suggest that the switch to supermarkets has

[4] The other category includes convenience stores.

been customer driven as they appear to offer a superior shopping experience. Most shoppers, however, are *dual format users*, frequenting both supermarkets and wet markets. 53.4% visit a wet market 2-3 times a week or more often. Visits to supermarkets are less common, with less than one–quarter of respondents visiting 2-3 times a week or more frequently.

Regarding the econometric analysis, the different diagnosis tests performed indicate that all estimated model specifications show a statistical significance at a satisfactory level and no severe signs of misspecification (see different model quality measures). These conclusions are supported by the bootstrapped bias-corrected standard errors which confirm the robustness of the various estimates. The linear hypotheses tests conducted with respect to the significance of explanatory variables indicate for all models the statistical relevance of the stated factors for retail outlet attributes and socioeconomic characteristics.

Table 3 presents the bootstrapped bivariate ordered probit model for frequency of wet-market and supermarket visits. Considering the determinants of wet market visits both retail outlet attributes and socio-economic characteristics are important. Males are significantly less frequent visitors to wet markets compared to females. Frequent wet market visits are also biased to older consumers, those in lower income groups, with lower education achievement and located outside of the capital city. Frequency of supermarket visits is negatively related to age and educational attainment. Chachoengsao residents are significantly less frequent visitors to supermarkets. This socio-economic profile is consistent with Reardon *et al*.'s (2007) theory of supermarket diffusion, which suggests that traditional formats will lose first the custom of higher educated, younger and affluent consumers in capital cities.

Regarding retail attributes, frequency of wet market visits is positively related to the importance given to speed of service and product quality, and negatively related to atmosphere and the interaction of quality and cleanliness. In other words, for instance, those that view speed of service as more important in their choice of retail outlets are more frequent vistors to wet markets.

The frequency of supermarket visits is positively related to the importance given to a good atmosphere, convenient location, assortment and range of offers. Frequency of supermarket visits is negatively related to the importance placed on price.

An analysis for all products, however, may mask significant variations in the determinants of format choice for specific product categories. This is accounted for in the second stage of the analysis which identifies the determinants of variations in the percentage of total spending for four product categories (FFV, fresh meat, fresh fish and packaged goods) accounted for by wet markets and supermarkets. Regarding FFV (Table 4), those with a higher proportion of spending in wet markets rate price and cleanliness of place as being of greater importance. Payment by card and atmosphere are significantly less important for this group. The percentage spent on FFV in wet markets is significantly higher in Chachoengsao. Gender, age, income and education are not significant in explaining variations in the percentage of total FFV spend accounted for by wet markets or supermarkets. There are positive relationships between supermarket spending on FFV and speed of service and variety of products. This suggests that supermarket shoppers value more highly the convenience of 'a one stop shop'. Those relying on supermarkets for FFV are biased to the capital city. Supermarket shoppers for FFV also rate food safety as being of greater importance.

Analysis of the bivariate Tobit model for percentage of total spending on fresh meat accounted for by wet markets and supermarkets (Table 5) reveals negative relationships between percentage spent in wet markets and the importance of speed of service, payment by card and atmosphere. As for FFV, wet market shoppers are biased toward Chachoengsao. However, positive relationships between wet market spending and the importance of product quality, cleanliness of place, quality of service and the interaction of quality and cleanliness are observed. This suggests that meat available in wet markets is still perceived to be fresher with customers having greater control in selecting specific cuts. Those buying a greater proportion of fresh meat from supermarkets rate price as being less important and have higher incomes. This suggests that those

relying on supermarkets for fresh meat are more affluent. They are also biased to the capital city. Use of supermarkets for fresh meat, as with FFV, is positively associated with consumers who place greater emphasis on food safety. This may reflect that quality assurance is seen as superior in supermarkets.

The results of the bivariate Tobit model for the percentage of total spending on fresh fish accounted for by wet markets and supermarkets are detailed in Table 6. Significant positive relationships between percentage spent in wet markets and the importance of product quality, cleanliness and the interaction of quality and cleanliness are revealed. These mirror the relationships identified for fresh meat and suggest that with regard to freshness wet markets retain an advantage. As in the case of FFV and meat, spending in wet markets for fresh fish is significantly higher in Chachoengsao. Those relying on supermarkets for fresh fish are biased to Bangkok. Other socioeconomic characteristics (age, gender, income and education) are not significant for explaining variations in the percentage spent in wet markets and supermarkets for fresh fish. Supermarket shoppers for fresh fish are less concerned about assortment but rate quality of service as being of greater importance.

For packaged goods (Table 7), speed and quality of service are not significant for explaining variations in the percentage spent at supermarkets and wet markets. Those relying on wet markets for packaged goods rate convenient location and special offers as being of greater importance. As with fresh produce, spending in wet markets is significantly higher in Chachoengsao. A positive relationship between percentage spent in supermarkets and assortment is recorded, which suggests that multiple retailers appeal most to those who value convenience and ‘one stop shopping’. Those relying most on supermarkets for packaged goods are significantly younger and also rate food safety as significantly more important.

VII) Conclusions

Data suggest that the growing market share of supermarkets in Thailand is customer driven, as, overall, they offer a superior shopping experience. Considering *all* product categories, supermarkets are perceived as superior by Thai shoppers on all salient attributes. However, significant variations in the penetration of supermarkets between product categories persist. While wet markets retain an advantage in sales of fresh produce, the market share of supermarkets in these product categories has grown significantly when compared against studies for Asian markets in the 1990s.

In understanding shopping behaviour in developing economies, previous studies principally consider socio-economic characteristics as determinants. Income, age, gender and education are significant for explaining variations in the *frequency of visits* to wet markets and supermarkets. The greater penetration of supermarkets in the capital city and their more frequent use by higher income, better educated and younger consumers is also consistent with Reardon *et al.*'s (2007) model of diffusion.

However, apart from location, socio-economic characteristics are poor predictors of the variation in the percentage spent on fresh FFV accounted for by wet markets and supermarkets. In understanding relative spending on fresh produce, differences in the importance attached to retail outlet attributes are, however, significant. This vindicates the dual consideration of both socio-economic characteristics and retail attributes. For FFV, meat and fish, wet markets attract most custom from those that value food quality highly, which is principally perceived in terms of freshness. The appeal of supermarkets rests on food safety, a good atmosphere and convenience. The spread of supermarkets will, in part, therefore, depend on the extent to which they can close the gap in perceived freshness of produce and the salience of the appeal of 'one stop shopping'. The latter is likely to be linked to working patterns, especially female participation in the job market. Current trends regarding labour market participation and Asian diets are conducive to an on-going steady erosion of the market share of wet markets.

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Table 1: Average percentage spent by type of retail outlet for different food product categories.

	Wet market	Supermarket	Other
Fresh Fruit and Vegetables (FFV)	55.5	36.8	7.6
Fresh meat	53.4	40.3	6.1
Fresh fish	62.4	31.0	7.1
Packaged goods	30.1	59.9	10.0
Beverages	17.9	69.1	13.0

Source: analysis of survey data

Table 2: Importance weightings for retail outlet attributes and mean score on those attributes for supermarkets and wet markets

	Average importance rating given to attribute	Average score of wet markets for attribute	Average score for supermarkets for attribute
Quality of products	4.45	3.41	3.87
Food Safety	4.34	3.05	3.95
Variety of products	4.28	3.44	3.95
Cleanliness of place	4.25	2.74	4.10
Quality of service	4.08	3.14	3.83
Speed of service	3.97	3.38	3.67
Convenience of location	3.87	3.16	4.06
Price of products	3.87	3.4	3.52
Atmosphere	3.55	3.01	3.95
Assortment	3.31	2.94	3.96
Special offers	3.24	2.68	3.61
Payment by card	2.21	1.79	3.67

Source: analysis of survey data

Table 3: Bootstrapped Bivariate Ordered Probit Model: Frequency of Wet Market and Supermarket Visits

(n = 201) independents	coefficient[1]	z-value	bootstrapped bias-corrected standard error 95% confidence interval[2]
equation 1	***dependent 1*: *frequency of wet market visits***		
Retail outlet attributes			
Convenience of location	0.088	0.72	[0.108; 0.138]
Price of products	0.225	1.43	[0.138; 0.177]
Special offers	0.031	0.25	[0.107; 0.139]
Assortment	-0.209	-1.30	[0.141; 0.179]
Quality of service	-0.075	-0.50	[0.128; 0.167]
Speed of service	0.331**	2.10	[0.135; 0.179]
Product Quality	0.575***	3.21	[0.265; 0.493]
Variety of products	0.149	0.134	[0.116; 0.152]
Payment by card	-0.094	-0.96	[0.088; 0.107]
Atmosphere	-0.226***	-4.72	[0.128; 0.167]
Cleanliness	1.153**	2.24	[0.389; 0.639]
Food safety	0.029	0.19	[0.132; 0.172]
Product quality x cleanliness	-0.202***	-4.95	[0.102; 0.179]
socio-economic characteristics			
Location	0.522***	3.14	[0.154; 0.178]
Gender	0.352**	2.14	[0.152; 0.178]
Age	0.236***	2.56	[0.079; 0.099]
Household income	-0.223**	-2.53	[0.078; 0.098]
Level of education	-0.299***	-3.26	[0.079; 0.105]
equation 2	***dependent 2*: *frequency of supermarket visits***		
Retail outlet attributes			
Convenience of location	0.498***	2.84	[0.151; 0.199]
Price of products	-0.283*	-1.88	[0.131; 0.169]
Special offers	0.455***	2.94	[0.135; 0.174]
Assortment	0.164***	3.65	[0.152; 0.198]
Quality of service	0.257	1.27	[0.177; 0.228]
Speed of service	0.162	1.09	[0.124; 0.173]
Product Quality	0.615	0.76	[0.727; 0.901]
Variety of products	0.211	1.38	[0.135; 0.170]
Payment by card	-0.044	-0.43	[0.085; 0.118]
Atmosphere	0.404***	3.63	[0.183; 0.239]
Cleanliness	0.381	0.51	[0.656; 0.828]
Food safety	0.154	0.91	[0.133; 0.203]
Product quality x cleanliness	-0.173	-0.93	[0.166; 0.207]
socio-economic characteristics			
Location	-0.464***	-2.95	[0.148; 0.166]
Gender	-0.026	-0.16	[0.149; 0.169]
Age	-0.127***	-2.29	[0.084; 0.107]
Household income	0.058	0.68	[0.077; 0.095]
Level of education	-0.133***	-3.31	[0.078; 0.102]
constant	0.341***	3.73	[0.081; 0.101]

Table 3: Bootstrapped Bivariate Ordered Probit Model: Frequency of Wet Market and Supermarket Visits (continued)

	coefficient[1]	z-value	bootstrapped bias-corrected standard error 95% confidence interval[2]
Rho	0.328***	4.05	[0.083; 0.112]
cut11	3.418**	2.34	[0.998; 1.878]
cut12	3.793***	2.58	[0.999; 1.886]
cut13	4.138***	2.81	[0.998; 1.889]
cut14	5.171***	3.51	[1.002; 1.892]
cut15	6.494***	4.32	[1.009; 1.898]
cut21	4.342	1.40	[2.757; 3.477]
cut22	5.021	1.63	[2.754; 3.475]
cut23	5.739	1.86	[2.752; 3.472]
cut24	6.682**	2.16	[2.758; 3.477]
cut25	8.619***	2.75	[2.783; 3.501]
LR-test of Independent Equations [chi2(1)]	15.69*** [0.001]		
Log likelihood	-574.948		
Wald chi2(18) [prob>chi2]	71.18*** [0.000]		
linear hypotheses tests on model specification ($chi^2(x)$)			
H_0: stated factors for buying decision have no significant effect for wet markets ($chi^2(13)$)			*37.60*** (rejected)*
H_0: stated factors for buying decision have no significant effect for supermarkets ($chi^2(13)$)			*29.84*** (rejected)*
H_0: socio-economic characteristics have no significant effect for wet markets ($chi^2(5)$)			*43.33*** (rejected)*
H_0: socio-economic characteristics have no significant effect for supermarkets ($chi^2(5)$)			*11.84** (rejected)*

1: * - 10%-, ** - 5%-, *** - 1%-level of significance; 2: 1000 replications.

Table 4: Bootstrapped Bivariate Tobit Model for Percentage of Spending on Fresh Fruits & Vegetables accounted for Wet Markets and Supermarket s

(n = 201) independents	coefficient[1]	z-value	bootstrapped bias-corrected standard error 95% confidence interval[2]
equation 1	***dependent 1: percentage of spending on fresh fruit and vegetables accounted for by wet markets***		
Retail outlet attributes			
Convenience of location	-0.169	-0.12	[1.214; 1.603]
Price of products	4.13**	2.19	[1.625; 2.146]
Special offers	1.42	0.95	[1.288; 1.701]
Assortment	-2.44	-1.31	[1.605; 2.120]
Quality of service	1.34	0.80	[1.443; 1.906]
Speed of service	-1.69	-0.93	[1.566; 1.068]
Product Quality	4.49	0.98	[3.948; 2.068]
Variety of products	0.189	0.12	[1.357; 1.792]
Payment by card	-3.19***	-3.41	[0.806; 1.065]
Atmosphere	-4.68***	-2.81	[1.435; 1.895]
Cleanliness	8.59**	2.81	[2.634; 3.479]
Food safety	1.35	0.75	[1.551; 2.049]
Product quality x cleanliness	-1.36	-0.80	[1.465; 1.935]
socio-economic characteristics			
Location	27.69***	7.70	[3.098: 4.093]
Gender	1.68	0.47	[3.080; 4.068]
Age	-0.45	-0.23	[1.686; 2.227]
Household income	-1.16	-0.63	[1.587; 2.096]
Level of education	-0.58	-0.29	[1.724; 2.276]
constant	-0.56	-0.03	[16.086; 21.247]
equation 2	***dependent 2: percentage of spending on fresh fruit and vegetables accounted for by supermarkets***		
Retail outlet attributes			
Convenience of location	-3.47	-1.70	[1.759; 3.323]
Price of products	0.01	0.01	[0.862; 1.138]
Special offers	0.56	0.33	[1.462; 1.931]
Assortment	2.36	1.22	[1.667; 2.202]
Quality of service	-1.91	-0.83	[1.983; 2.619]
Speed of service	2.84***	3.12	[0.784; 1.036]
Product Quality	-4.70	-0.51	[7.942; 10.489]
Variety of products	2.54***	-4.10	[-0.705; -0.534]
Payment by card	1.26	1.09	[0.996; 1.316]
Atmosphere	0.71	0.30	[2.039; 2.694]
Cleanliness	-7.55	-0.88	[7.393; 9.766]
Food safety	4.80**	2.49	[1.661; 2.194]
Product quality x cleanliness	0.87	0.41	[1.829; 2.415]
socio-economic characteristics			
Location	-31.47***	-9.07	[2.990; 3.949]
Gender	2.45	0.72	[2.932; 3.873]
Age	1.79	0.94	[1.641; 2.167]
Household income	1.12	0.63	[1.532; 2.023]
Level of education	1.45	0.73	[1.711; 2.261]
constant	84.68***	2.34	[31.185; 41.191]
lnsigma1	3.15***	59.98	[0.045; 0.059]
lnsigma2	3.09***	56.97	[0.047; 0.062]
atrho12	-1.32***	-17.60	[0.065; 0.085]
sigma1	23.27***	19.06	[1.052; 1.389]
sigma2	22.18***	18.38	[1.039; 1.373]
rho12	-0.86***	-46.24	[0.016; 0.021]
LR-test of rho12 [chi2(1)]	249.445*** [0.000]		
Log likelihood	-1603.524		
Wald chi2(36) [prob>chi2]	151.04*** [0.000]		

1: * - 10%-, ** - 5%-, *** - 1%-level of significance; 2: 1000 replications.

Table 5: Bootstrapped Bivariate Tobit Model for Percentage of Spending on Fresh Meat accounted for Wet Markets and Supermarket s

(n = 201) independents	coefficient[1]	z-value	bootstrapped bias-corrected standard error 95% confidence interval[2]
equation 1	***dependent 1: percentage of spending on fresh meat accounted for by wet markets***		
Retail outlet attributes			
Convenience of location	0.99	0.67	[1.273; 1.682]
Price of products	1.27	0.66	[1.658; 2.190]
Special offers	1.59	1.01	[1.357; 1.792]
Assortment	-1.51	-0.78	[1.668; 2.204]
Quality of service	2.71***	3.57	[0.654; 0.864]
Speed of service	-2.71***	-3.47	[0.673; 0.889]
Product Quality	13.50***	2.60	[4.474; 5.910]
Variety of products	-0.61	-0.38	[1.383; 1.827]
Payment by card	-3.28***	-2.80	[1.009; 1.333]
Atmosphere	-4.65***	-2.73	[1.468; 1.939]
Cleanliness	14.69**	2.20	[5.754; 7.600]
Food safety	1.812	0.71	[2.199; 2.905]
Product quality x cleanliness	3.75**	2.00	[1.616; 2.134]
socio-economic characteristics			
Location	28.27***	7.56	[3.222; 4.256]
Gender	0.21	0.05	[3.619; 4.781]
Age	-1.68	-0.84	[1.723; 2.276]
Household income	-2.41	-1.27	[1.635; 2.159]
Level of education	-0.84	-0.40	[1.809; 2.390]
constant	-16.04	-0.72	[19.198; 25.358]
equation 2	***dependent 2: percentage of spending on fresh meat accounted for by supermarkets***		
Retail outlet attributes			
Convenience of location	2.09	1.01	[1.783; 2.356]
Price of products	-3.18**	-1.92	[1.427; 1.885]
Special offers	0.45	0.26	[1.491; 1.970]
Assortment	-0.18	0.09	[-2.276; -1.723]
Quality of service	0.83	0.35	[2.043; 2.699]
Speed of service	0.37	0.20	[1.594; 2.106]
Product Quality	2.78	0.29	[8.261; 10.911]
Variety of products	-1.25	-0.73	[1.476; 1.949]
Payment by card	1.32	1.13	[1.007; 1.329]
Atmosphere	-1.41	-0.59	[2.059; 2.720]
Cleanliness	1.21	0.14	[7.448; 9.838]
Food safety	2.99***	2.50	[1.031; 1.361]
Product quality x cleanliness	-1.05	-0.48	[1.885; 2.489]
socio-economic characteristics			
Location	-32.68***	-9.15	[3.078; 4.065]
Gender	1.69	0.46	[3.166; 4.182]
Age	2.21	1.12	[1.700; 2.246]
Household income	3.37*	1.87	[1.553; 2.051]
Level of education	0.17	0.08	[1.831; 2.419]
constant	63.55*	1.69	[32.405; 42.802]
lnsigma1	3.26***	62.52	[0.045; 0.059]
lnsigma2	3.19***	61.19	[0.045; 0.059]
atrho12	-1.41***	-19.30	[0.063; 0.083]
sigma1	25.93***	19.21	[1.163; 1.536]
sigma2	24.42***	19.15	[1.099; 1.451]
rho12	-0.89***	-57.21	[0.013; 0.018]
LR-test of rho12 [chi2(1)]	264.284*** [0.000]		
Log likelihood	-1602.0945		
Wald chi2(36) [prob>chi2]	150.61*** [0.000]		

* - 10%-, ** - 5%-, *** - 1%-level of significance; 2: 1000 replications.

Table 6: Bootstrapped Bivariate Tobit Model for Percentage of Spending on Fresh Fish accounted for Wet Markets and Supermarket s

(n = 201) independents	coefficient[1]	z-value	bootstrapped bias-corrected standard error 95% confidence interval[2]
equation 1	***dependent 1: percentage of spending on fresh fish accounted for by wet markets***		
Retail outlet attributes			
Convenience of location	3.38*	1.98	[1.471; 1.943]
Price of products	1.74	0.66	[2.272; 3.001]
Special offers	-0.29	-0.14	[1.785; 2.358]
Assortment	-3.01	-1.17	[2.217; 2.928]
Quality of service	-0.11	-0.06	[1.579; 2.087]
Speed of service	-1.60	-0.65	[2.121; 2.802]
Product Quality	19.41***	2.87	[5.828; 7.698]
Variety of products	1.72	0.79	[1.876; 2.478]
Payment by card	0.44	0.28	[1.354; 1.789]
Atmosphere	-1.49	-0.64	[2.006; 2.649]
Cleanliness	27.13***	3.03	[7.716; 10.192]
Food safety	0.58	0.23	[2.173; 2.870]
Product quality x cleanliness	7.239***	2.90	[2.151; 2.841]
socio-economic characteristics			
Location	7.24***	2.49	[2.506; 3.309]
Gender	24.05***	6.14	[3.375; 4.458]
Age	0.28	0.07	[3.447; 4.553]
Household income	-2.19	-1.03	[1.832; 2.420]
Level of education	1.44	0.63	[1.969; 2.602]
constant	-56.73***	-2.07	[23.617; 31.194]
equation 2	***dependent 2: percentage of spending on fresh fish accounted for by supermarkets***		
Retail outlet attributes			
Convenience of location	0.17	0.05	[2.929; 3.870]
Price of products	-1.52	-0.57	[2.298; 3.035)
Special offers	-1.48	-0.57	[2.237; 2.955]
Assortment	-3.99***	-2.91	[1.181; 1.561]
Quality of service	7.33**	2.07	[3.051; 4.031]
Speed of service	-1.69	-0.61	[2.387; 3.153]
Product Quality	-5.96	-0.42	[12.229; 16.152]
Variety of products	1.28	0.48	[2.298; 3.035]
Payment by card	0.49	0.28	[1.508; 1.992]
Atmosphere	1.32	0.36	[3.159; 4.174]
Cleanliness	-11.78	-0.91	[11.155; 14.735]
Food safety	0.77	0.26	[2.552; 3.371]
Product quality x cleanliness	1.88	0.58	[2.793; 3.689]
socio-economic characteristics			
Location	-31.33***	-7.45	[3.624; 4.787]
Gender	-2.49	-0.58	[3.699; 4.887]
Age	0.68	0.28	[2.093; 2.764]
Household income	2.62	1.14	[1.981; 2.616]
Level of education	0.95	0.38	[2.154; 2.846]
constant	96.34*	1.76	[47.171; 62.306]
lnsigma1	3.29***	65.24	[0.043; 0.057]
lnsigma2	3.35***	58.30	[0.049; 0.065]
atrho12	-1.12***	-14.85	[0.065; 0.086]
sigma1	27.05***	19.78	[1.178; 1.557]
sigma2	28.52***	17.40	[1.412; 1.866]
rho12	-0.81***	-30.67	[0.023; 0.030]
LR-test of rho12 [chi2(1)]	249.445*** [0.000]		
Log likelihood	-1603.524		
Wald chi2(36) [prob>chi2]	151.04*** [0.000]		

1: * - 10%-, ** - 5%-, *** - 1%-level of significance; 2: 1000 replications.

Table 7: Bootstrapped Bivariate Tobit Model for Percentage of Spending on Packaged Goods accounted for Wet Markets and Supermarket s

(n = 201) independents	coefficient[1]	z-value	bootstrapped bias-corrected standard error 95% confidence interval[2]
equation 1	***dependent 1: percentage of spending on packaged goods accounted for by wet markets***		
Retail outlet attributes			
Convenience of location	4.97*	1.83	[2.463; 2.969]
Price of products	1.69	0.47	[3.531; 3.661]
Special offers	5.39*	1.84	[2.675; 3.184]
Assortment	-2.84	-0.78	[3.533; 3.749]
Quality of service	-1.43	-0.43	[3.266; 3.385]
Speed of service	-2.59	-0.74	[3.398; 3.602]
Product Quality	9.62	1.11	[8.513; 8.820]
Variety of products	-0.82	-0.27	[2.999; 3.074]
Payment by card	-0.65	-0.30	[2.125; 2.208]
Atmosphere	-0.39	-0.12	[3.233; 3.267]
Cleanliness	-1.18	-0.10	[11.786; 11.814]
Food safety	-1.77	-0.51	[3.400; 3.541]
Product quality x cleanliness	-0.53	-0.16	[3.290; 3.335]
socio-economic characteristics			
Location	22.36***	4.72	[4.085; 5.389]
Gender	1.39	0.29	[4.753; 4.833]
Age	0.73	0.29	[2.477; 2.557]
Household income	-0.78	-0.31	[2.473; 2.556]
Level of education	-3.13	-1.20	[2.442; 2.774]
constant	-23.47	-0.69	[33.919; 34.109]
equation 2	***dependent 2: percentage of spending on packaged goods accounted for by supermarkets***		
Retail outlet attributes			
Convenience of location	-2.18	-0.46	[4.676; 4.803]
Price of products	2.32	0.58	[3.919; 4.080]
Special offers	-0.93	-0.23	[4.012; 4.075]
Assortment	9.93***	2.14	[4.344; 4.936]
Quality of service	7.33	1.35	[5.243; 5.616]
Speed of service	5.87	1.38	[4.063; 4.444]
Product Quality	-27.84	-1.27	[21.746; 22.097]
Variety of products	2.32	0.58	[3.919; 4.080]
Payment by card	2.57	0.93	[2.635; 2.892]
Atmosphere	-2.63	-0.47	[5.531; 5.661]
Cleanliness	-19.29	-0.96	[19.961; 20.226]
Food safety	7.22***	2.63	[2.382; 3.109]
Product quality x cleanliness	4.55	0.91	[4.874; 5.126]
Socio-economic characteristics			
Location	-26.09	-4.83	[4.734; 6.069]
Gender	-6.03	-1.08	[5.434; 5.733]
Age	-5.09***	-3.59	[0.922; 1.914]
Household income	2.53	0.86	[2.823; 3.061]
Level of education	-1.06	-0.34	[3.071; 3.165]
constant	188.03**	2.22	[84.391; 85.005]
lnsigma1	3.43***	59.76	[-8.204; 8.319]
lnsigma2	3.61***	68.61	[-9.432; 9.538]
atrho12	-0.83***	-10.92	[-1.434; 1.586]
sigma1	30.89***	17.42	[-0.635; 4.181]
sigma2	36.93***	19.01	[-0.685; 4.571]
rho12	-0.68***	-16.73	[-2.272; 2.353]
LR-test of rho12 [chi2(1)]	103.569*** [0.000]		
Log likelihood	-1730.620		
Wald chi2(36) [prob>chi2]	70.33*** [0.000]		

1: * - 10%-, ** - 5%-, *** - 1%-level of significance; 2: 1000 replications.