CONSUMER AND MARKET DEMAND

AGRICULTURAL POLICY RESEARCH NETWORK

Household Demand for Convenience Chicken Meat Products in Canada

Lingling Yu and Getu Hailu
Department of Food, Agricultural and Resource Economics (FARE)
University of Guelph

Research Project Number: CMD 10-01

PROJECT REPORT

January 2010

Department of Rural Economy
Faculty of Agricultural, Life and Environmental Sciences
University of Alberta
Edmonton, Canada

Household Demand for Convenience Chicken Meat Products in Canada

This paper empirically examines the effect of the opportunity cost of time and household characteristics on the expenditure on convenience chicken meat. Heckman two-step and multivariate tobit estimation procedures were employed using a 2007 AC Nielsen weekly chicken meat expenditure data over 52 weeks period. We find that households with higher income tend to spend more on most convenience chicken meat. Our results provide additional evidence on household production theory predication that that wages/income has a positive influence on the demand for convenience foods. Finally, the evidence obtained confirms the effects some demographic characteristics have on the demands for convenience foods.

Keywords: Food Demands, Convenience Foods; Chicken; Opportunity of Cost of Time

JEL Codes: D13, J22, C24

1. Introduction

For decades there have been structural changes in the demands for foods. Changing demographics and lifestyles, increasing female workforce participation, rising household income, increasing awareness of the links between diet and health, and progressing food production, processing and preparation technologies all contribute to changes in the demands for foods and food attributes. In particular, the increases in the demands for *convenience foods* show the influence of a rise in the households' opportunity cost of time. One explanation for the changes in the demand and consumption patterns is that firms benefit – i.e., from increased households' *opportunity cost of time* in the labour market– from the introduction of time and effort saving food products. With increasing household labour market participation, changing lifestyle and changing household structure, the impact the opportunity cost of time has on the demand for time and energy saving food is receiving much attention from academician and practitioners alike.

The potential benefits of convenience chicken meat products as they emerge in the food industry are pointed out by Buzby and Farah (2006, p.1): "part of the rise in chicken consumption results from the chicken industry's response to demands by consumers and foodservice operators for value-added, brand-name, and convenience products." From an industry perspective, convenience has been recognized as an important attribute for obtaining competitive advantage. For instance, ten percent of food dollars spent in grocery stores was on convenience foods[1], up from six percent in 1981 (Agriculture and Agri-Food Canada, 2007). Canadians spent only six per cent of their time on food related chores - making easy/quick foods to prepare more appealing - in an average seven-day period (Statistics Canada, 1998). The 2005 Time Use General Social Survey conducted by Statistics Canada (2005) reveals that the average amount of time spent in meal

[1] Convenience refers to food products with features that save time and effort. Using convenience foods involves choosing to avoid home labour to create more leisure and work time.

preparation, grocery shopping and cleanup was approximately one hour a day (Yu 2009). The expenditure shares on restaurant meals were up from 25% in 1961 to 34 in 2004 in Canada (Zafirious 2005).

The enhanced demands for foods sustained by the development and introduction of convenience attributes is referred to as the opportunity cost of time effects. Consumers can obtain food preparation time and effort saving benefits from the purchase of convenience foods. For instance, the introduction of ready-to-prepare, ready-to-cook, heat-and-serve and ready-to-eat chicken products provides time and effort saving benefits to households with high opportunity cost of time in labour markets. Meanwhile, economists are increasingly taking interest in household decision making models – such as *household production model* - for describing to what extent the opportunity cost of time influence household consumption decisions. The household production model explicitly recognizes the effects of the opportunity of cost of households' time in consumption decision making. In this paper, we empirically test the hypothesis that increased households' opportunity cost of time in labour market is associated with greater demands for convenience foods using data on chicken meat products.

Empirical evidence tends to support the proposition that cost of time has positive influence on expenditure in convenience food products. For example, Danish households with more money and less time bought more convenience foods than households with less income and more time bought (Bonke 1992; 1993). Martinez and Stewart (2003) found that consumers with higher time costs spent more on convenience food. College-educated U.S. households (Capps *et al.* 1985) and high-income Spanish households (Manrique and Jensen 1997) spent more on convenience meats. For Spanish households, being more educated women and living in urban areas were positively related to greater expenditure on convenience meat products (Manrique and Jensen 1997).

Despite the growing importance of convenience food attributes (*e.g.*, Capps *et al.* 1985; Melton *et al.* 1996; Manrique and Jensen 1997; Nayga, 1998; Richards *et al.* 1998; Kola and Latvala 2002) and the vast literature on consumer demand for food attributes Mullen and Wohlgenant 1991; Schmitz et al. 1993; West *et al.* 2001; McCluskey and Loureiro 2003), the empirical evidence on the impact of the opportunity cost of time in labour market on consumption of convenience chicken meat products is limited.

A study of the demand for convenience food is a useful first step towards answering questions about the likely future path of food processing patterns over the coming decades. The paper reveals interesting points. First, the theoretical model shows that changes in the opportunity cost of households' time may have influence on food consumption patterns. Second, convenience is an important product attribute that creates value to buyers - where consumers place higher values on their time and effort (O'Shaughnessy 1987) - and provides competitive edges to food processors. Recognizing consumers' heterogeneity in food marketing may help - through a better segmentation of consumers- the food industry in efficiently allocating resources when developing products and marketing mix. Marketing strategy and marketing management can be enhanced if demographic correlates of convenience-oriented behavior can be identified (Anderson 1971).

What is Convenience?

According to the American Heritage® Dictionary of the English Language[2] (p. 411), "convenience" means: "the quality of being suitable to one's comfort, purposes, or needs; something that increases comfort or save work." There are numerous definitions of the term "convenience" in the academic literature. Consequently, there is no universally accepted definition of convenience, and it must be viewed as multi-dimensional and complex attribute (Brown 1989; Costa et al. 2001; Jack et al. 1997). In particular, defining convenience food is difficult because multiple characteristics can contribute to the convenience attribute of food products. Preparation method, preparation time, preservation, packaging, and added culinary skills can all contribute to the convenience attributes of foods.

Early marketing definitions of convenience focus on *ease of access* dimension. Based on consumers' purchasing habits, the amount of time and effort spent in acquiring a product (search cost), Copeland (1923) categorized retail merchandise into three groups: convenience goods, shopping goods, and specialty goods. According to this classification, convenience refers to goods that are purchased at easily accessible stores. Kotler (1980) defined convenience goods as goods that the primary shopper usually purchases frequently, immediately, and with a minimum effort in comparing and buying.

Convenience attribute has also been defined based on the *type* and *timing* dimensions of food (Darian and Cohen 1995). The type dimension includes saving of time and physical or mental energy. The timing dimension includes the stage of consumption at which convenience is obtained. For food, these stages include deciding what to eat, purchasing, preparing, consuming and cleaning up. Convenience foods have also been identified as those that are "fully or partially prepared foods

[2] The American Heritage® Dictionary of the English Language (1992), Third Edition, by Houghton Mifflin Company. Houghton Mifflin Company.

in which a significant amount of preparation time, culinary skills, or energy inputs have been transferred from the home kitchen to the food processor and distributor" (Traub and Odland 1979; p.3).

The key benefits of convenience products and services are time and effort savings (Yale and Venkatesh 1986; O'Shaughnessy 1987; Brown 1990; Anderson and Shugan 1991). Increasingly, consumers make product choice decisions partly based on convenience characteristics (O'Shaughnessy 1987). With increasing opportunity cost of time, consumers are becoming more convenience-oriented (Gross and Sheth 1989). From firms' perspective, convenience - as a product attribute- plays an important role in competitive product positioning. For example, the increased consumer preference for convenience might be responsible for poultry producers' success in competing with beef producers (Anderson and Shugan 1991).

Other food research focused on taxonomy of convenience foods by providing a continuum based on the degree of processing (Capps *et al.* 1985): basic convenience, complex convenience, and manufactured convenience. Basic convenience foods is more closely related to preservation method than to ease of preparation, single or limited number of ingredients, or limit in time or energy inputs without culinary expertise (e.g., canned and frozen fruits and yoghurt). Complex convenience foods have high levels of time and energy saving inputs, and culinary expertise built in (e.g., frozen entrees and canned soups). Manufactured convenience foods have fewer requirements for home-preparation (*e.g.,* beverages and dry cereals.

Another set of literature took a different classification approach focusing on differentiating between different levels of readiness, not just different levels of processing (Paulus 1978). Foods are disaggregated into five phases: ready-to-process, ready-to-kitchen process, ready-to-cook foods, ready-to-heat, ready-to-eat foods. Similarly, the degree of preparation requirement is used to classify foods into five: no preparation, mixing, heating, mixing, cooking, and cooking (Pepper 1980). This

approach mainly focuses on the amount of preparation and the time needed to produce ready to eat food. Meanwhile, classification time is used to classify convenience foods (Pearson *et al.* 1985).

Overall, convenience suggests that something can be done with reduced or saved time and effort; and that the preparation time and efforts are transferred from the household manager to the food processor. The total costs of food consumption, thus, include product prices and the time and energy that are spent on preparing food, eating food and cleaning up after a meal.

2. Household Production Model and Convenience Food

Several food consumption studies (Reynolds and Goddard 1993; Manrique and Jensen 1997; Richards *et al.* 1998; Angulo *et al.* 2007) using household production theory emphasize the allocation of household time between market and non-market activities, and employ the assumption that any commodity produced by a household has a perfect market substitute. For example, prepared food is a substitute for home food preparation as babysitter is for home childcare.

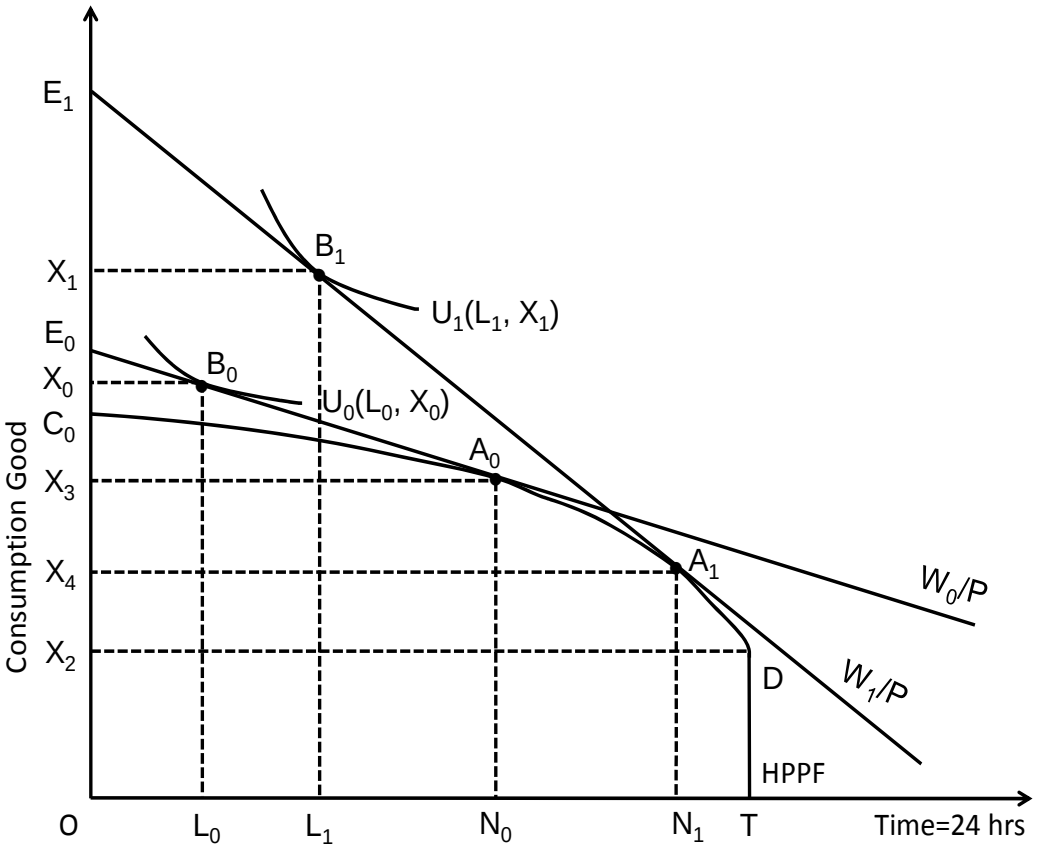
Households make food choices based on the total cost of food consumption that includes cash expenditure on food, time costs for preparing food, and the value of the time for consuming food (Gofton 1995). Household production theory states that a person with higher opportunity cost of time in labour market spends more on convenience foods or childcare services. Becker (1965) modified the neoclassical economic model by stating that the household obtains utility from some underlying goods that cannot be bought in the market but are instead produced in the household from market goods and time inputs.

Figure 1 provides a graphical illustration of Becker's household production idea. A household must decide how to allocate its time across three activities: market (wage) labour, home labour, and leisure. The horizontal axis represents time, and the vertical axis consumption goods. It is assumed that the price index of goods is one, the household has only one person, and household

production activities do not provide extra benefits – in the form of leisure- beyond the consumption value of household production.

Based on these simplifying assumptions, the consumption opportunities made possible by home production can be represented by a household's production possibilities frontier (HPPF), relating household labour inputs to home produced goods. In the absence of labour market participation, the HPPF is represented by the concave curve TA_0C_0. The HPPF is the production possibility frontier that shows the different combinations of labour time and goods produced. For each hour of labour, the household must decide whether to produce along its HPPF or supply that hour to the market at wage rate w. Further, we expect a household to choose the activity with the greatest returns. If households expend the first hour in labour rather than leisure, the labour hour will be allocated to household production. This will continue as long as the marginal product of home production exceeds the market wage rate. Once the marginal product of home production begins to fall below the market wage rate, any additional labour hours would be allocated to wage labour. One of the important insights from this model is that a person will work at home as long as the marginal product of home production exceeds the marginal product of market work (*i.e.,* the market wage rate).

Figure 1 Allocation of Time with an Increase in the Wage Rate



A representative household that supplies L_0N_0 units of market labour at an initial wage rate of W_0, allocates N_0T units of home labour, and $0N_0$ units of leisure labour, and purchases market goods $0X_2$ with non-labour income, achieving a utility of U_0. Starting with the household production possibility frontier HPPF and price line w_0/p, the household's optimizing bundle of market goods (*e.g.,* convenience goods) and leisure becomes located at the point where the highest possible indifference curve is tangent to the budget frontier. If the point of tangency is achieved along the linear portion of the frontier, the hours to the left of the point D to the tangency represents leisure, the hours between the tangency point (B_0) and A_0 represent market labour, and the hours between point A_0 and the endowment T represent labour time devoted to home

production. If the point of tangency occurs along the concave portion of the frontier, the household will choose only leisure and home production labour.

Because the market wage rate is greater than marginal product of home production starting from point A_0., the household allocates some hours to work in the market (L_0N_0) rather than only work in the home, From point A_0 on, the individual can obtain more consumption goods by working any additional hours in the market. The individual obtains X_2X_3 units of home-produced goods and X_3X_0 units of market goods with wages, enjoys $0L_0$ hours of leisure, and use L_0N_0 hours to work in the market and N_0T hours to work at home.

If, however, the wage rate increases from w_0 to w_1, the price line tilts to w_1/p, and the linear portion of the frontier becomes steeper, corresponding to the highest market wage rate. When the market wage rate becomes higher, it now exceeds the marginal product of labour allocated to household production for a greater portion of the household's HPPF. Therefore, the vertical line marking the transition point from household to market labour shifts to the right, from N_0A_0 to N_1A_1, resulting in an increase in market labour supplied by the household − net of substitution and income effects of wage changes that would arise.

Therefore, if the household works in the market, a change in wage rate influences the consumption of goods and the allocation of time. The rise in wage rate expands the household's goods consumption from $0X_0$ to $0X_1$. The individual obtains X_2X_4 units of home-produced goods and X_4X_1 units of goods purchased with income from wage market, enjoys higher hours of leisure ($0L_1$), and uses L_1N_1 hours to work in the market and N_1T hours to work at home. The outcome of the changes is that the time allocated to home production falls as the wage rate increases. If the marginal product of home production is lower than the market wage rate, the household will choose to work more in the market, and perhaps buy. As the wage rate increases, the household decreases home production labour time from N_0T to N_1T; increases its market labour hours from L_0N_0 to

L_1N_1; increase the purchases of market goods from $0X_0$ to $0X_1$; and decreases home produced goods from X_2X_3 *to* X_2X_4. Thus, *wage rates are expected to have a positive effect on household demand for convenience chicken meat products* (x_i).

3. Empirical Framework

Based on the household production model, the demand functions for market purchased goods (*e.g.,* convenience) can be generalized for a consumer or household as

$$x_{ijt} = f(p_{ijt}, w_{ijt}, V_{ijt}, T_{ijt}) \quad (1)$$

where i = 1,…n indexes the m goods; j =1,…, m indexes the households; t =1,…, T indexes the weeks; x_{ijt} is quantity demand for market purchased convenience chicken meat products, p_{ijt} is price of market purchased inputs, w_{ijt} is the wage rate, and V_{ijt} is non-labour income, and T (24 hours) is the total time available for a household. In equation (1) the demand for convenience chicken meat products depends on the price of the product, wage rates, and non-labour income, and total time available for the household.

Multiplying equation (1) by market prices faced by the i-th household and normalizing all prices at unity, as done by Yen (1993), Nayga (1998) and Angulo et al. (2007), and T is normalized to unity, the expenditure function are obtained:

$$y_{ijt} = p_{ijt} x_{ijt} = f_i(w_{ijt}, V_{ijt}) \quad (2)$$

y_{ijt} represents household's weekly expenditure. Wage rates are expected to have a positive effect on consumer demand for convenience chicken meat products from the household production model (Becker 1965). This hypothesis cannot be tested directly because wage rates are missing. Instead, aggregate income (wage + non-labour income) is used.

Information on socio-demographic variables can play distinctive roles in consumption decisions (McCracken and Brandt 1987; Yen 1993; Nayga 1998) to capture differences in taste

(Pollak and Wales 1992). To control for household heterogeneity, the expenditure functions in (2) is augmented to by socio-demographic variables:

$$y_{ijt} = f_i(I_{ijt}; se_{ijt}) \qquad (3)$$

where I_{ijt} (= w_{ijt} + V_{ijt}) is aggregate income and se_{ijt} is a vector of socio-economic variables. The above relationship can be estimated using ordinary least square. The use of household micro-data on detailed products raises, however, econometric issue related to zero consumption[3] of one or more of the products. The three possible reasons that may contribute to the zero expenditure problems are infrequency of purchase (too short duration of the survey not allowing households to report any purchase), non-consumption (households not interested in buying a specific product), and corner solution (potential buyers do not buy a specific product at current prices and household income level).

As indicated above, zero expenditure is a limited dependent variable econometric issue related to censoring, truncation and sample selection. The distinction among censoring, sample selection, and truncation is that for both censoring and sample selection, the information on selected and non-selected subsamples is available, but for truncation only the information for selected subsample is available. To deal with zero expenditure problems, depending on whether the data is censored, sample-selected, or truncated, different econometric methods have been used in the literature. The models include the Tobit model (Tobin 1958), the Heckman two-step model (Heckman 1979), the double hurdle model (Pudney 1990), Generalized Multivariate Heckman (reference), and multivariate Tobit model (Lee 1993; Shonkwiler and Yen 1999; Yen *et al.* 2003; Barslund 2007).

[3] The proportion of a household with zero expenditure is high when increases as both the record period is short (*e.g.,* daily) and the categories are more specific. For example, the number of households with zero expenditure would increase as the survey period decreases from monthly to weekly; and there would be more households with zero expenditure for chicken than for meat, and more for chicken wings than for chicken.

Note that parameter estimates are inconsistent when only observed positive expenditure data are used to estimate expenditure functions by OLS regression. The Tobit model has been found to be appropriate when zero consumption problems are caused by economic factors such as high prices or low income (corner solutions). The restrictive feature of the Tobit model is the nature of its parameterization. The Tobit model treats recorded zeros as true non-consumption and implies that the probability and level of consumption are determined by the same sets of parameters and variables. This parameterization has been criticized in food demand analyses (Reynolds 1990; Jones and Posnett 1991). A variable is constrained to influence the probability of censoring and the level of expenditure in the same direction (Barslund 2007).

The double-hurdle model was proposed by Cragg (1971) and Atkinson *et al.* (1984) as an alternative to deal with zero expenditure problems. The double-hurdle model features two separate stochastic processes, which determine the probability and conditional level of consumption and accounts for zero expenditure resulting from true non-consumption as well as other factors (Pudney 1990). The double-hurdle model, however, ignores zero expenditure resulting from infrequency of purchase.

Heckman two-step is another popular method that has been used in the empirical demand analysis (Heckman 1979). Maddala (1992, p.53) has raised the question of when it is appropriate to use the censored regression model (Tobit) instead of the sample selection model (Heckman). The censored (*e.g.,* Tobit) regression model is appropriate if the censored dependent variables are caused by the way in which the data were collected or recorded. The Tobit regression model is not appropriate if the censored data is because of some decision on the part of the respondents (*e.g.,* a decision not to purchase any convenience chicken meat).

In this study, the equation-by-equation Heckman two-stage and a multivariate Tobit models are used to correct for the zero expenditure problem. As discussed above, each model is based on

different assumptions regarding zero expenditure. The Heckman two-step is appropriate when zero expenditure is because of sample selection, and the multivariate Tobit model when zero expenditure is caused by corner solutions. Using Monte Carlo simulation Tauchmann shows that– compared to multivariate selection models– "…if computational simplicity and consistency are the major concern, the equation-by-equation Heckman appears to be the best choice" (Tauchmann, 2008; p. 7). "Heckman-OLS, -SUR, show a remarkably good performance and might be the best choice for practical applications." (Tauchmann, 2005:372).

The Heckman's two-step procedure has been widely applied in estimating wage rates (Heckman 1980), and in demand studies (*e.g.,* Cheng and Capps 1988; Heien and Wessells 1990; Nayga 1995; Nayga 1998). The Heckman two-step procedure models purchase decisions and the level of purchase separately. The first step (the participation decision) is whether or not to purchase (1= yes, 0 = no), and the second step (the purchase decision) deals with the quantity purchased or the amount spent on purchasing. An intermediate parameter, the inverse Mills ratio, is calculated from the first step, and then incorporated into the second step. The first step models the probability of participation:

$$\begin{aligned} y_{ijt}^{*} &= x_{ijt}'\beta_i + \varepsilon_{ijt} \\ d_{ijt}^{*} &= z_{ijt}'\alpha_i + u_{ijt} \end{aligned} \tag{4}$$

where i = 1,…n indexes the m goods; j =1,…, m indexes the households; t =1,…, T indexes the weeks; d_{ijt}^{*} is the latent variable (unobservable) for 0/1 purchase (participation) decisions; z_{ijt} y_{ijt} ; x_{ijt} are vectors of observed independent variables; α_i's are coefficients to be estimated; ε_{ijt} and u_{ijt} are the random error term.

$$d_{ijt} = \begin{cases} 1 & if \;\; d_{ijt}^{*} > 0 \\ 0 & if \;\; d_{ijt}^{*} \le 0 \end{cases} \tag{5}$$

The inverse Mills ratio (imr) ($\lambda(z_{ijt}'\alpha_i)$) for each household can be calculated as

$$\lambda(z_{ijt}'\alpha_i) = \frac{\phi(z_{ijt}'\alpha_i)}{\Phi(z_{ijt}'\alpha_i)} \tag{6}$$

where $\phi(z_{ijt}'\alpha_i)$ are the standard normal density function and $\Phi(z_{ijt}'\alpha_i)$ the cumulative distribution function. The mean of the expenditure equation for households:

$$E[y_{ijt} \mid x_{ijt}, z_{ijt}, d_{ijt}] = \begin{cases} x_{ijt}'\beta_i + \delta_i\lambda(z_{ijt}'\alpha_i) & if\ d_{ijt} = 1 \\ 0 & if\ d_{ijt} = 0 \end{cases} \tag{7}$$

where y_{ijt} is the level of actual expenditure on convenience chicken products, $\delta_i = \rho\sigma_\varepsilon$ is the coefficient of the inverse Mills ratio. The inverse Mills ratio is derived for each equation and is used as an explanatory variable in the second step estimation of purchasing decision to capture sample selection bias (Heckman 1979). Importantly, only the positive observations on y_{ijt}'s are used in the second step to estimate the conditional marginal effects. The estimates of α_i from the probit model are then used to construct consistent estimates of the inverse Mills ratio term. By assumption, the means of u and ε are zero, the standard deviation of u is one and the standard deviation of ε is σ_ε (Greene 2008, pp.883-886).

Another way to solve zero expenditures problem is to use multivariate Tobit model (Lee 1993; Shonkwiler and Yen 1999; Yen, Lin and Smallwood 2003), where both the participation decision and the consumption decision are determined by the same process. The advantages of the Multivariate Tobit model are to capture corner solution problem and cross-equation correlations. Following Yen, Lin and Smallwood (2003), Yen and Lin (2002) and Barslund (2007), the Amemiya-Tobin approach with a system of Tobit expenditure shares are specified. Yen, Lin and Smallwood (2003) used a simulated maximum likelihood (SML) estimator of a similar system. For the

multivariate Tobit model, the conditional recursive mixed process (CMP) estimator (Roodman 2009) is used.

4. Data

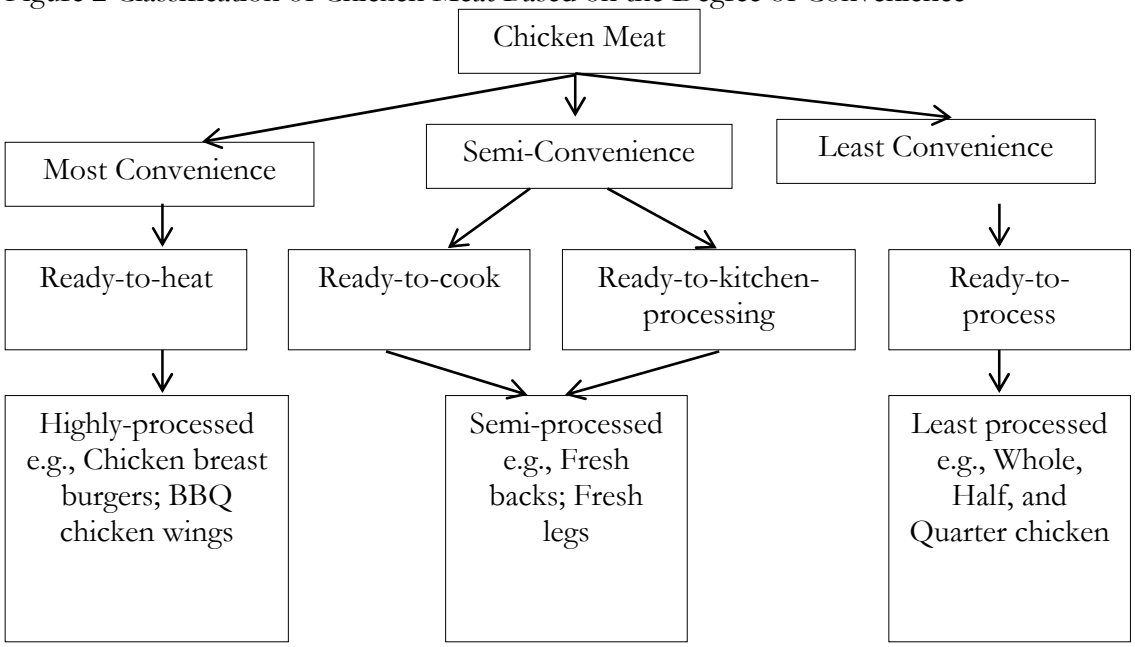
The data used in this study is from AC Nielsen weekly scanner data providing information on the Canadian retail chicken market. AC Nielsen data for 2007 include frozen and fresh chicken meat products weekly purchases of 82,936 numbers of observations across Canada for approximately 9,000 households over 52 weeks. The data include product characteristics, such as brand (branded, unbranded), meat cuts (wing, leg, etc.), preparation form (popcorn, wings, etc.), preparation type (breaded, fried, etc.), expenditure in cents, number of packages or units, and weight in pounds (for frozen products). Household characteristics include region (Ontario, Quebec, West Canada, British Columbia), language, household size, age and presence of children, household head age, income, household head education, and urban and rural. The chicken meat product category contains forty-six types of meat cuts: thirty-eight fresh and eight frozen chicken. The forty-six meat cut types are then categorized into three based on the degree of convenience.

The following discussion provides the basis for classifications of convenience chicken meat products. The categories of convenience chicken meat draw on the work of Paulus (1978) and Park and Capps (1997). Five degrees of convenience are identified by Paulus (1978): ready-to-process, ready-to-kitchen-process, ready-to-cook, and ready-to-heat, and ready-to-eat. As showed in Table 1, this scheme provides five phases of degree of readiness. Phase 1 (i.e., ready-to-process) represents the lowest level convenience. In Phase 2 (i.e., ready-to-kitchen processing) the extent of processing still is considerable. In Phase 3 (i.e., ready-to-cook) the basic operations in the treatment of foods were already accomplished. Phase 4 (ready-to-heat) refers to products that are already cooked and

preserved, and what remains to be done is only heating. Phase 5 (ready-to-eat) requires no further processing; the products can immediately be served.

Convenience food classification usefully focuses not only on the degree of processing or the degree of readiness, but also on the households' opportunity cost of time (wage rate). Following the notion of time saved in preparing food and Paulus's work, three *ex post* categories of convenience are identified (Table 2): most convenience (prepared), semi-convenience (semi-prepared), and least convenience (unprepared). The most convenience category includes the ready-to-heat phase. Semi-convenience includes the ready-to-cook and ready-to-kitchen-processing phases. Least convenience contains the phase of ready-to-process. Because the information on the ready-to-eat is not available in the date, it is not included in the current classification.

Figure 2 Classification of Chicken Meat Based on the Degree of Convenience



The dependent variables are defined as the expenditure on the three convenience groups[4]. The average household total chicken meat expenditure was $12.457 per week, with $3.613 per week on most convenience (29%), $6.851 per week on semi-convenience (55%), and $1.993 per week on least convenience (16%).

Because information on wage rates is not available in the data, the annual household incomes (wages and non-labour income) are included to capture the opportunity cost of households' time in the labour market. From household production theory (Becker 1965), household income is expected to have a positive effect on convenience chicken meat expenditures. Other independent variables include household size, household head age, and household head education, presence of children, seasons, location, and region. All the independent variables are dummy variables. The effect of household is not clear. Larger households may spend less money on convenience chicken

[4] Because the information on some meat cuts is very limited, they are excluded from the study.

products if economies of scale (Vernon 2005) in food preparation exist. There is a higher tendency for some household members to specialize in food preparation, therefore, larger family can use less time for meal preparation than smaller family. On the other hand, for households with higher opportunity cost of time in the labour market, it is possible that they may spend more on convenience food (Nayga 1998).

Further, based on household production theory, households with children are expected to influence expenditure on convenience chicken meat positively. This is because the presence of children in the family increases the opportunity of cost of household labour. Age is included to capture the stage of the household in the life cycle (Nayga 1998). Older households are expected to spend less on convenience foods than others. Younger household might be more receptive to the increased availability of convenience foods and additional mechanical labour saving kitchen equipment than older household (Reynolds and Goddard 1993).

Regional dummy variables are included to control for location specific-effects such as regional price and wage rates variations. Seasonal dummy variables for winter, spring, and summer are included to control for the possible seasonal effects, such as temporal price variations, holidays and weather. Table 3 presents data description along with descriptive statistics for the dependent and independent variables.

5. Results and Discussions

Parameter estimates of Heckman-two step model are presented in Table 4. Most of the estimated coefficients are statistically significant at the 0.05 level or better for both selection and level equations. Some of parameter estimates have opposite signs in the selection and level equations, which highlight the importance of using sample selection model such as Heckman-two stage (Table 4), rather than models such as Multivariate Tobit (Table 6). For example, for most convenience model, being in higher income category has a negative coefficient on the participation equation but a

positive effect of the expenditure equation. On the other hand, the estimated result from the Multivariate Tobit model shows that households with income greater than $69,000 spent less than households with income between $40,000 and $69,000, but spent more than households with income less than $20,000 on *most convenience*. This results shows that the multivariate tobit model do not separate participation and intensity effects of the explanatory variables. Thus, the following discussion is based on results from Heckman-two step.

For the probability model, the LR chi-square test statistic was significant at a five percent significance level. The selection equation correctly predicts the probability of participation 70 percent of the time for *most convenience*, 60 percent of the time for *semi-convenience* and 82 percent of the time for *least convenience*. The pseudo R-square are low, as typical for cross-sectional data (*e.g.,* Yen 2005) 0.02 for most convenience, 0.02 for semi-convenience, and 0.02 for *least convenience*. Sample selectivity is present for the *semi-convenience* and *least convenience* equations as evidenced by the significance of the coefficient of the Inverse Mill ratios in the expenditure equations.

5.1. Selection (Participation) Model Results

The statistical test in this section is based on marginal effects (Table 5). For the selection equation a higher income level was associated with a lower probability of consumption of most convenience (*i.e.,* households with income greater than $69,000 were less likely to purchase *most convenience* chicken meat products), and a higher probability of consumption of *semi-convenience* and *least convenience* chicken meat consumption. The probability model does not support our hypothesis that the consumption of most convenience increases with wage rate (income). In particular, households with income from $20,000 to $69,000 were more likely to purchase most convenience chicken meat. Based on the marginal effects (Table 5), compared to household in income category above $79,000, the probability of purchasing "most convenience" was higher by 2.8% for

households with $20,000 to $29,000 annual income, by 1.1% for household with $30,000 to $39,000 annual income, by 2.5% for household with $40,000 to $49,000 annual income, and by 1.2% for households with income with $50,000 to $69,000 annual income.

For other socio-demographic variables, some conclusions can be drawn from the participation equation. In general, households with more than four members are more likely to purchase *most convenience* chicken meat than those with four and less. Households without children were less likely to purchase *most convenience* and were more likely to purchase *semi-convenience.*

In relation to household head age effects, most of the marginal effects are positive. Those household heads with age less than 65 were more likely to purchase *most convenience* (Table 5) than those with age greater than 64. The result may indicate that younger household heads are more receptive to the increased availability of convenience foods than older households, as it is easier for younger households to try new things (Capps *et al.* 1985). Our result for the relationship between household age and demand for convenience food is consistent with Angulo, Gil and Mur's (2007) for Spanish consumers.

Our results indicate that households with higher level of education were less likely to purchase *most convenience* chicken meat. In particular, those households with education level less than university graduate were more likely to purchase *most convenience.*

Our results indicate regional variations in the probability of participation in *most convenience* chicken meat purchasing. Households in Quebec, Ontario, and Manitoba/Saskatchewan were more likely to purchase most convenience chicken meat products than those in British Columbia. Urbanization also explains variations in the probability of purchasing convenience chicken meat. Urban residents were less likely to purchase *most convenience* chicken than rural residents; but urban residents are more likely to purchase *semi-* and *least- convenience* chicken than rural residents.

Seasonality plays a significant role in explain temporal variation in the probability of purchasing most convenience, semi-convenience and least convenience chicken meat. Our findings suggest that households were more likely to purchase most convenience and less likely to purchase least convenience in winter season. In summer and spring, the probability of purchasing *most convenience* is lower, *semi-convenience* is greater, and *least convenience* is lower.

5.2. Expenditure Model Results

To empirically test the hypothesis that an *increase income is associated with a greater expenditure on convenience chicken meat products,* the results of the second steps of Heckman's two-step procedure are presented in Table 4. The test was based on the statistical significance of marginal effect of income variable categories (Table 5). Contrary to the results for the participation model, for the expenditure level, a higher income level was associated with a greater level of expenditure on *most convenience* and *semi-convenience*, but has no significant effect on the level of expenditure on *least convenience* at 5 percent significance level.

In particular, households with income less than $70,000 spent less on *most* and *semi convenience* than households with income of $70,000 and higher. The expenditure on *most convenience* chicken meat was lower than the reference group (i.e., $70,000 and above) by $1.57 per week for households with annual income from $20,000 to $29,000, by $1.69 per week from $40,000 to $49,000, by $1.43 per week for households with annual income from$30,000 to $39,000 and by $0.35 per week for households with annual income from $50,000 to $69,000. Similar results were obtained for *semi-convenience* that households with income greater than $69,000 spent more on *semi-convenience*. Thus, income has a significant positive effect on the level of expenditure on *most* and *semi-convenience* chicken products, and the results support the hypothesis that increased income is associated with greater expenditure on most convenience meat.

Our results are consistent with the household production theory (Becker 1965) since the higher the wage rate (household income), the higher will be the opportunity cost of time for the household. Households may be unwilling to spend much time on food preparation due to the increasing value placed on leisure time. Previous studies (McCracken and Brandt 1987) have also shown that wage rate – the opportunity cost of household's time- is an important factor in determining convenience foods consumption. This result is consistent with findings from other convenience foods studies (Reynolds and Goddard 1993; Manrique and Jensen 1997; Nayga, 1998), which concluded increase in income would increase demand for convenience foods. Bonke (1992; 1993) showed that households with higher incomes spent more on convenience foods.

Households with four or less members spent less on *most convenience*, *semi-convenience, and least convenience* chicken meat products (Table 5). The finding for *most convenience* is consistent with other studies in that household size positively affected the expenditure on most convenience meats (Manrique and Jesen 1997), and the consumer demand for complex and basic convenience foods (Capps *et al.* 1985). Others found a positive relationship between household size and expenditures on prepared salads/disserts and miscellaneous prepared foods, and negative relationship between household size and expenditures on frozen meals and frozen prepared food other than meal (Nayga 1998).

Households without children spent approximately six cents per week more on *most convenience* and sixteen cents per week more *semi-convenience* than household with children. This result is unexpected since the household production theory predicts that the opportunity cost time for household with children is higher than those without children. Perhaps households without children may not spend much time on cooking. Similar results have been found for U.S consumer that households without children spent more o food away from home than do households with children

(Nayga 1995). Nayga (1998) argues that larger labour supply for households with children– economies of scale – may explain this relationship.

Our results indicate regional variations in the level of expenditure on *most convenience*. The marginal effect shows that households in Maritimes, Quebec, Ontario, Manitoba/Saskatchewan, and Alberta spent less on *most convenience* chicken meat than households in British Columbia. For example, the expenditure on *most convenience* chicken meat less than British Columbia by $4.80 per week for Maritimes by $4.95 per week for Quebec, by $4.49 per week for Ontario, by $1.32 per week for Manitoba/Saskatchewan, and $1.04 per week for Alberta. The differences in marginal effects for *most convenience* may reflect regional variations in prices, because price variables are missing from the analysis. Regarding seasonality, households spent more on *most convenience* and *semi-convenience* meat in spring and summer seasons than in fall season; and they spent less on *semi-convenience* meat in winter season than in the fall. There was no statistically significant difference in the level of expenditure on *least convenience* between winter and fall seasons.

Age has a mixed effect on expenditures on most convenience: expenditures on *most convenience* is higher for age category 45 to 64 year than those higher than 64 years old, and there is not statistical different between age category 18 to 44 and those higher than 64 years old. This may suggest non-linear relationship between age and expenditure on most convenience (see Nayga 1998) – the opportunity cost of time increase with age, reaches maximum and eventually decline with age. Expenditure on *semi-convenience* is lower for age higher than 64 years old suggesting that younger households with your head spend more on semi-convenience.

Education dummy variables have statistically significant effect on expenditures on *most* and *semi-convenience* chicken meat. Household headed by high school and technical college graduates spent more on most and semi-convenience than do household headed by post graduates. On the other

hand, household headed by college and university graduate spend less on *most* and *semi-convenience* than households headed by post graduates.

6. Concluding Remarks

The purpose of this study is to empirically examine the effects of household income – as a measure of the opportunity cost of time – and other socio-demographic variables on the demand for convenience chicken meat. Theoretical relationship between wage rate and consumption of convenience food was established; and household income was selected to proxy wage rates. This research is the first one to consider the relationship between income and convenience chicken meat consumption in the Canadian context. In addition, the study documents the importance of modeling chicken consumption at a disaggregate level based on convenience attribute. The findings of this research contribute to food demand literature by providing additional evidence on the influence of households' opportunity cost of time (i.e., income) and demographic characteristics on the demands for foods.

The results from selection model show that households with higher income were less likely to participate in the purchases of *most convenience* and *semi-convenience* chicken meat. Meanwhile, the findings from expenditure equation suggest that households with higher income spent more on *most convenience* and *semi-convenience*. Note that the positive relationship between household income and the expenditure on *semi-convenience* may indicate the importance of other attribute (e.g., diet and health). Approximately 47 percent of the expenditure on semi-convenience is on breast meat (i.e., white meat) which is claimed to have health benefits. The time-saving and energy-saving benefits of eating some convenience foods have been criticized as having negative effect on health. Examples of this include the potential link between the level of fast food consumption and the prevalence of obesity

(Wolf and Colditz 1994, 1998; Chou, Grossman, and Saffer 2004; Rashad, Grossman, and Chou 2005; Binkley 2006; Gayaneh et al. 2007) and other health issues. One factor that is held largely responsible for excess and obesity since the 1970s is dietary intake and dietary quality; in particular, fast food is one of the major contributors to excess and obesity (Binkley 2006).

With regards to demographic variables, the empirical results have considerable importance for food industries. Most of the non-income variables examined significantly influenced the participation in chicken market and the expenditure on chicken meat. For example, having higher level of education, having smaller numbers of household members, being older, living in urban area, being without children were all associated with lower probability of purchasing *most convenience chicken* products. The expenditures on *most convenience* and *semi-convenience* were higher in spring and summer seasons than in the fall. Households living in Maritime, Quebec, Ontario, Manitoba/Saskatchewan and Alberta spent less on both most convenience and semi-convenience than those living in British Columbia. Thus, it is important for policymakers and the food industry to recognize observed and unobserved consumer heterogeneity. Policy makers can use this information in public policy design, while food industry can use it in marketing policy design.

Despite the important contribution of the study to the literature, data limitations resulted in some challenges. Obtaining information on actual wage rates (the opportunity cost of time), non-labour income and prices market goods may help to disentangle the influence of total income into wage rate effects (substitution effect) and income (non-wage and wage) effects. As well, extension to other meat types (e.g., beef and pork) may prove useful, as chicken in itself is claimed by some as more time saving than beef or pork. "…binding time constraints of increased number of women in workforce may also direct meat consumption towards categories in which poultry products predominate – those that favor quick preparation and fast food choices." (Haley, 2001: p.42).

The present study is based on *ex post* classification of chicken meat into most convenience, semi-convenience and least convenience. Further research could use latent class model to classify chicken products and consumers into different categories based on the underlying unobserved heterogeneity. The results may show which consumer categories spend more on chicken with certain attributes. For example, convenience-oriented consumers may spend more on most convenience chicken products, while health-oriented consumers may spend more on less processed and less convenient chicken products. Those results may provide useful information to better understand consumers purchase behavior.

One important result relates to the choice of estimators when dealing with the problem of zero expenditure. The Heckman equation-by-equation approach that is adopted in this study appears to be the best choice when computational simplicity and consistency is considered (Tauchmann 2008). But, an extension to multivariate Heckman-type sample selection model (*e.g.,*Tauchmann 2005; 2008; Shonkwiler and Yen 1999; Yen 2005) to capture cross-equation correlation in the second stage worth considering. In terms of econometric modeling, further research could be also carried out to capture the dynamic and heterogeneous nature of consumer behavior using dynamic panel model (Bover and Arellano 1997).

References

Agriculture and Agri-Food Canada. "An Overview of the Canadian Agriculture and Agri-Food System 2007." Web page, [accessed 1 January 2010]. Available at http://www4.agr.gc.ca/AAFC-AAC/display-afficher.do?id=1201291159395&lang=eng.

Anderson, E. W. and Shugan, S. M. (1991). Repositioning for Changing Preferences: The Case of Beef versus Poultry. *Journal of Consumer Research, 18,* 219-232.

Anderson, W. T. Jr. (1971). Identifying the Convenience-oriented Consumer. *Journal of Marketing Research, 8,* 179-183.

Angulo, A. M., Gil, J. M. and Mur, J. (2007). Spanish Demand for Food Away from Home: Analysis of Panel Data. *Journal of Agricultural Economics, 58*(2), 289-307.

Atkinson, A. B., Gomulka, J., and Stern, N. H. (1984). Household Expenditure on Tobacco 1970-1980: Evidence from The Family Expenditure Survey, ESRC Program on Taxation, Incentives, and the Distribution of Income. London School of Economics, Discussion Paper No. 60.

Barslund, M. (2007). Estimation of Tobit Type Censored Demand Systems: A Comparison of Estimators. Discussion Papers, Department of Economics, University of Copenhagen, 1-23.

Becker, G. S. (1965). A Theory of Allocation of Time. *Economic Journal, 75*, 493-517.

Binkley, J. K. (2006). The Effect of Demographic, Economic, and Nutrition Factors on the Frequency of Food Away from Home. *Journal of Consumer Affairs, 40*(2), 372-391.

Bonke, J. (1992). Choice of Foods: Allocation of Time and Money, Household Production and Market Services. Copenhagen, MAPP working paper No.3.

Bonke, J. (1993). Choice of Foods: Allocation of Time and Money, Household Production and Market Services. Part II, Copenhagen, MAPP working paper No.

Bover and Arellano. (1997). Estimating Dynamic Limited Dependent Model for Panel Data. Investigaciones Economicas, 21: 141-165.

Brown, L. G. (1989). The Strategic and Tactical Implications of Convenience in Consumer Product Marketing. *The Journal of Consumer Marketing, 6*(3), 13-19.

Brown, L. G. (1990). Convenience in Services Marketing. *The Journal of Services Marketing, 4*(1), 53-59.

Buzby, J. C. and Farah, H. A. (2006). Chicken Consumption Continues Longrun Rise. Amber Waves 4:5.

Capps, O., Tedford, J. R. and Havlicek, J., Jr. (1985). Household Demand for Convenience and Nonconvenience Foods. *American Journal of Agricultural Economics, 67*(4), 862-869.

Cheng, H. T. and Capps, O. J. (1988). Demand Analysis of Fish and Frozen Finfish and Shellfish in the United States. *American Journal of Agricultural Economics, 70*, 533-42.

Chou S-Y, Grossman M and Saffer H (2004). An Economic Analysis of Adult Obesity: Results from the Behavioral Risk Factor Surveillance System. *Journal of Health Economics, 23*, 565-587.

Copeland, M. T. (1923). Relation of Consumers' Buying Habits to Marketing Methods. *Harvard Business Review, 1*, 282-289.

Costa, A. I. D., Dekker, M., Beumer, R. R., Rombouts, F. M. and Jongen, W. M. F. (2001). A Consumer-oriented Classification System for Home Meal Replacements. *Food Quality and Preferences, 12,* 229-242.

Cragg, J. G. (1971). Some Statistical Models for Limited Dependent Variables with Applications to the Demand for Durable Goods. *Econometrica, 39*, 829-844.

Darian, J.C. and Cohen, J. (1995). Segmenting by Consumer Time Shortage. *Journal of Consumer Marketing*. 12, 32-44.

Gayaneh, K., Rodolfo, M. N. Jr., Davis, G. C., and Lin B. (2007). Food Away from Home Consumption and Obesity: An Analysis by Service Type and by Meal Occasion. Selected Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Portland, OR, July 29 – August 1, 2007.

Gofton, L. (1995). Dollar Rich and Time Poor? Some Problems in Interpreting Changing Food Habits. *British Food Journal, 97*(10), 11-16.

Greene, W. H. (2008). Econometric Analysis Sixth Edition. New Jersey: Prentice Hall Press.

Gross, B. L. and Sheth, J. N. (1989). Time-oriented Advertising: A content Analysis of United States Magazine Advertising, 1890-1988. *Journal of Marketing, 53*, 76-83.

Haley, M. M. (2001). Changing Consumer Demand for Meat: The U.S Example, 1970 - 2000Changing Structure of Global Food Consumption and Trade. Anita Regmi, editor. Market and Trade Economics Division, Economic Research Service, U.S. Department of Agriculture, Agriculture and Trade Report. WRS-01-1. Accesed [February 02, 2010]: http://www.ers.usda.gov/publications/wrs011/wrs011.pdf

Heckman, J. (1980). Sample Selection Bias as Specification Error. In J.P. Smith (ed), Female Labour Supply: Theory and Estimation. Princeton, NJ: Princeton University Press.

Heckman, J. J. (1979). Sample Selection Bias as a Specification Error. *Econometrica. 47*(1), 153-161.

Heien, D. and Wessells, C. R. (1990). Demand Systems Estimation with Microdata: A Cencored Regression Approach. *Journal of Business and Economic Statistics, 3*(July), 365-371.

Jack, F. R., O'Neill, J., Piacentini, M. G. and Schroder, M. J. A. (1997). Perception of Fruit as a Snack: Comparison with Manufactured Snack Foods. *Food Quality and Preferences, 8,* 175-182.

Jones, A. M. and Posnett, J. (1991). Charitable Donations by UK Households: Evidence from the Family Expenditure Survey. *Applied Economics, 23,* 343-51.

Kola, J. and Latvala, T. Demand for Credence Characteristics in Beef. Selected paper presented at the AAEA-WAEA Annual Meeting, July 2002.

Kotler, P. (1980). Principles of Marketing. Englewood Cliffs, NJ: Prentice Hall Inc.

Lee, L. (1993). Multivariate Tobit Models in Econometrics. In G.S. Maddala, C.R. Rao, and H.D. Vinod, eds. *Handbook of Statistics*, vol. 11., chap. 6. Amsterdam: North-Holland, 145-173.

Maddala, G. S. (1992). *Censored Data Models*. In J. Eatwell, M. Milgate, and P. Newman (Eds.), The New Palgrave Econometrics (pp.54-57). London:Macmillan.

Manrique, J. and Jensen, H. H. (1997). Spanish Household Demand for Convenience Meat Products. *Agribusiness (New York), 13*(6), 579-586.

Martinez, S. and Stewart, H. (2003). From Supply Push to Demand Pull: Agribusiness Strategies for Today's Consumers. *Amber Waves*, 1-8.

McCarthy, B. and Pitts, E. (1999). The Irish Prepared Consumer Food Sector: Factors Contributing to Sustainable Competitive Advantage, National Food Center Working Paper. The National Food Centre, Teagasc, Dublin.

McCluskey, J. J. and Loureiro, M. L. (2003). Consumer Preferences and Willingness to Pay for Food Labeling: A Discussion of Empirical Studies. *Journal of Food Distribution Research, 34*(3), 95-102.

McCracken, V. A. and Brandt, J. A. (1987). Household Consumption of Food Away from Home: Total Expenditure and by Type of Food Facility. *American Journal of Agricultural Economics, 69*(2), 274-284.

Melton, B. E., Huffman, W. E., Shogren, J. F. and Fox, J. A. (1996). Consumer Preferences for Fresh Food Items with Multiple Quality Attributes: Evidence from an Experimental Auction of Pork Chops. *American Journal of Agricultural Economics, 78*(4), 916-923.

Mullen, J. D. and Wohlgenant, M. K. (1991). The Willingness of Consumers to Pay for Attributes of Lamb. *Australian Journal of Agricultural Economics, 35*(3), 247-262.

Narver, J. C. and Slater, S. F. (1990). The Effect of a Market Orientation on Business Profitability. *Journal of Marketing, 54* (4), 20-35.

Nayga Jr., R. M. (1995). Microdata Expenditure Analysis of Disaggregate Meat Products. *Review of Agricultural Economics, 17(3)*, 233-43.

Nayga Jr., R. M. (1998). A Sample Selection Model for Prepared Food Expenditures. *Applied Economics, 30*(3), 345-352.

O'Shaughnessy, J. (1987). Why People Buy. New York: Oxford University Press.

Ott, N. (1992). Intrafamily Bargaining and Household Decisions. Berlin, Springer- Verlag.

Park, J. L. and Capps, J. (1997). Demand for Prepared Meals by U.S. Households. *American Journal of Agricultural Economics, 79(3)*, 814-824.

Paulus, K. (1978). Ready-to-serve Foods: Definitions, Applications, Quality Requirements: How Ready Are Ready-to-use Foods. B. S. Karger, ed. 6-14.

Pearson, J. M., Capps, J., Gassmann, C., and Axelton, J. (1985). Degree-of-readiness Classification Systems for Foods: Development, Testing, and Use. *Journal of Consumer Studies and Home Economics, 9,* 133-143.

Pepper, A. W. (1980). The Relationship Between Fast Foods and Convenience Foods-Definitions and Developments. *Journal of Consumer Studies and Home Economics, 4*, 249-255.

Pollak, R. A. and Wales, T. J. (1992). Demand System Specification and Estimation, Oxford University Press.

Pudney, S. (1990). The Estimation of Engel Curves. Measurement and Modelling in Economics. Amsterdam: Elsevier Science Publishers B.B.

Rashad I., Grossman M. and Chou S-Y (2005). Fast-Food Restaurant Advertising on Television and It's Influence on Childhood Obesity. National Bureau of Economic Research, Working Paper 11879.

Reynolds, A. (1990). Analyzing Fresh Vegetable Consumption from Household Survey Data. *Southern Journal of Agricultural Economics, 22*(2), 31-38.

Reynolds, A. and Goddard E. (1993). Food Consumption Away from Home by Type of Facility and Type of Meal. Working Paper WP 93/10. Guelph: University of Guelph, Department of Agricultural Economics and Business, October.

Richards, T. J., Gao, X. M. and Patterson, P. M. (1998). The Demand for Value-added and Convenience: A Household Production Approach. *Agribusiness (New York) 14*(5): 363-378.

Shonkwiler, J. S. and Yen, S. T. (1999). Two-step Estimation of a Censored System of Equations. *American Journal of Agricultural Economics, 81*: 972-982.

Schmitz, J. D., Menkhaus, D. J., Whipple, G. D., Hoffman, E. and Field, R. A. (1993). Impact of Changing Consumer Preferences on Willingness-to-Pay for Beef Steaks in Alternative Retail Packaging. *Journal of Food Distribution Research, 24*(2), 23-36.

Statistics Canada. 1998. General Social Survey. Retrieved January, 01 2010 from http://www.statisticscanada.ca

Tauchmann, H. (2005). Efficiency of two-step estimators for censored system of equations: Shonkwiler and Yen reconsidered, Applied Economics, 27:367-374.

Tauchmann, H. (2008). Consistency of Heckman-type two-step estimators for the multivariate sample selection model. Applied Economices, 1-8:

Tobin, J. (1958). Estimation of Relationships for Limited Dependent Variables. *Econometrica, 26*(1), 24-36.

Traub, L. G. and Odland, D. D. (1979). Convenience Foods and Home Prepared Foods: Comparative Cost, Yield and Quality. Agricultural Economic Report no 429. Washington, D.C.: U.S. Department of Agriculture.

Vermeulen, F. (2001) A note on Heckman-type corrections in models for zero expenditures, Applied Economics, 33: 1089-92.

Vernon, V (2005). Food Expenditure, Food Preparation Time and Household Economies of Scale. Fashion Institute of Technology, State University of New York.

West, G. E., Larue, B., Touil, C. and Scott, S. L. (2001). The Perceived Importance of Veal Meat Attributes in Consumer Choice Decisions. *Agribusiness, 17*(3), 365-382.

Wolf A. M. and Colditz G. A. (1994). The Cost of Obesity: the US Perspective. *Pharmacoeconomics, 5*(1), 34-37.

Wolf A. M. and Colditz G. A. (1998). Current Estimates of the Economic Cost of Obesity in the United States. *Obesity Research*, 6, 97-106.

Yale, L. and Venkatesh, A. (1986). Toward the Construct of Convenience in Consumer Research. *Advances in Consumer Research, 13*, 403-408.

Yen, S. (2005). A multivariate sample selection model: estimating cigarette and alcohol demand with zero observations, American Journal of Agricultural Economics, 87: 453-66.

Yen, S. T. (1993). Working Wives and Food Away from Home: the Box-Cox Double Hurdle Model. *American Journal of Agricultural Economics, 75 (November):* 884-95.

Yen, S. T. and Lin, B. (2002). Beverage Consumption among US Children and Adolescents: Full Information and Quasi Maximum-Likelihood Estimation of a Censored System. *European Journal of Agricultural Economics, 29*, 85-103.

Yen, S. T., Lin, B., and Smallwood, D. M. (2003). Quasi- and Simulated-Likelihood Approaches to CensorFed Demand Systems: Food Consumption by Food Stamp Recipients in the United States. *American Journal of Agricultural Economics, 85*(2), 458-478.

Yu, L. (2009). Consumer Demand for Convenience Chicken Meat Products in Canada. Unpublished M.Sc Thesis. University of Guelph, Guelph.

Zafirious, M. (2005). Food retailing in Canada: Trends, dynamics and consequences. Agriculture and Agri-Food Canada. Paper Presented at the Pacific Economic Cooperation Meetings, Pacific Food Systems Outlook. Kunming, China.

Table 1 Categories of Ready-to-serve Foods

Phase	Designation	Explanation	Example	Processing Required
1	Ready to process	Products still subject to processing other than those within the direct scope of production	Carcass halves	Cutting of the meat, preparation
2	Ready to kitchen processing	Suitable for kitchen processing	Cuts of meat	Preparation, dimensioning, recipe, cooking, portioning
3	Ready to cook	Suitable for direct cooking	Portioned meat	Cooking, portioning if necessary
4	Ready to heat	Suitable for heating to eating temperature	Ready-to-serve foods	Final cooking and/or heating to eating temperature, portioning, if necessary
5	Ready to eat	Suitable for direct consumption	Hot meals from central kitchen	Portioning if necessary

Source: Paulus 1978, pp.6-14.

Table 2 Percentage Expenditure Share by Meat Cut and Convenience Categories

Category	Meat cut	Category expenditure share	Overall expenditure Share	Proportion of Zeros
Most Convenience (Frozen)		100%	28.86%	68.4%
	Breast (processed)	30.1%	9.00%	89.7%
	Thighs	0.62%	0.19%	99.8%
	Wings	15.88%	4.58%	94.4%
	Drumsticks	0.37%	0.11%	99.9%
	Unspecified (processed)	52.31%	14.61%	82.3%
	Mini drums	0.48%	0.14%	99.8%
Semi-convenience (Fresh)		100%	55.10%	40.7%
	Breast	46.82%	26.34%	70.8%
	Thighs	11.36%	6.25%	92.2%
	Legs	5.44%	2.95%	96.3%
	Wings	4.21%	2.32%	97.1%
	Drumsticks	6.8%	3.68%	95%
	Drummettes	0.31%	0.17%	99.8%
	Gizzards/Giblets	0.38%	0.20%	99.7%
	Not applicable	12.8%	6.97%	91.6%
	Breast/Thighs	0.34%	0.19%	99.8%
	Assorted	1.88%	1.05%	98.8%
	Legs w/backs	4.57%	2.49%	97%
	Breast w/backs	2.91%	1.62%	98.1%
	Thighs w/backs	0.67%	0.36%	99.5%
Least Convenience		100%	16.04%	81.9%
	Whole	96.35%	15.32%	82.5%
	Half	1.67%	0.26%	99.7%
	Quarter	1.97%	0.31%	99.6%

Table 3 Descriptive Statistics for Variables in the Demand for Convenience Chicken Meat Products (2007)

Dependent Variables	Descriptions	Mean	Standard Deviation	
Decision to buy *most convenience*	= 1 if expenditure > 0; 0, otherwise	0.318	0.466	
Decision to buy *semi convenience*	= 1 if expenditure > 0; 0, otherwise	0.590	0.492	
Decision to buy *least convenience*	= 1 if expenditure > 0; 0, otherwise	0.183	0.386	
Total expenditure (in $/week)	MC +SC+LC	12.457	10.203	
Most convenience expenditure share	Most convenience expenditure/total expenditure	0.289	0.438	
Semi convenience expenditure share	Semi convenience expenditure/total expenditure	0.551	0.481	
Least convenience expenditure share	Least convenience expenditure/total expenditure	0.160	0.354	
Independent Variables				Canadian Population [a]
Income under20k	=1 if household income <20K; 0 otherwise	0.060	0.238	0.153
Income 20k-29k	=1 if household income 20K-29K; 0 otherwise	0.098	0.297	0.105
Income 30k-39k	=1 if household income 30K-39K; 0 otherwise	0.112	0.316	0.110
Income 40k-49k	=1 if household income 40K-49K; 0 otherwise	0.117	0.322	0.099
Income 50k-69k	=1 if household income 50K-69K; 0 otherwise	0.204	0.403	0.167
Income above70k	=1 if household income > 69K; 0 otherwise	0.408	0.492	0.367
age18-34	= 1 if age = 18-34; 0 otherwise	0.054	0.227	0.293
age35-44	=1 if age = 35-44; 0 otherwise	0.234	0.424	0.184
age45-54	= 1 if age = 45-54; 0 otherwise	0.283	0.450	0.200
age55-64	= 1 if age = 55-64; 0 otherwise	0.211	0.408	0.150
age above 64	= 1 if age = >64; 0 otherwise	0.217	0.412	0.173
Not high school grad	=1 if education = Not high school grad; 0 otherwise	0.128	0.334	0.154
High school graduate	=1 if education = High school graduate; 0 otherwise	0.180	0.384	0.239
College	=1 if education = College; 0 otherwise	0.140	0.346	0.124
College grad	=1 if education = College grad;	0.240	0.427	0.253

	0 otherwise			
University	=1 if education = University; 0 otherwise	0.084	0.278	
Post Graduate	=1 if education = Post Graduate; 0 otherwise	0.228	0.419	0.229
Household size 1	=1 if household size = 1; 0 otherwise	0.168	0.374	0.268
Household size 2	=1 if household size = 2; 0 otherwise	0.406	0.491	0.336
Household size 3	=1 if household size = 3; 0 otherwise	0.151	0.358	0.159
Household size 4	=1 if household size = 4; 0 otherwise	0.179	0.383	0.150
Household size above 4	=1 if household size > 4; 0 otherwise	0.096	0.294	0.088
Presence of Children	=1 if children present=; 0 otherwise	0.689	0.463	0.715
Location	=1 if location = Urban; 0 otherwise	0.622	0.485	0.800
Maritimes	=1 if region = Maritimes; 0 otherwise	0.145	0.352	0.055
Quebec	=1 if region = Quebec; 0 otherwise	0.272	0.445	0.233
Ontario	=1 if region = Ontario; 0 otherwise	0.325	0.468	0.389
Manitoba/Saskatchewan	=1 if region = Manitoba/Saskatchewan; 0 otherwise	0.084	0.278	0.067
Alberta	=1 if region = Alberta; 0 otherwise	0.090	0.288	0.107
British Columbia	=1 if region = British Columbia; 0 otherwise	0.082	0.274	0.131

[a] Statistic Canada 2006 census

Table 4 Parameter estimates of purchasing convenience chicken products

	Most Convenience		Semi-convenience		Least Convenience	
Variable	Probit	Expenditure	Probit	Expenditure	Probit	Expenditure
Income under 20k	-0.029	-1.588***	0.055**	-2.089***	-0.105***	0.243
	(-1.240)	(-5.010)	(2.550)	(-11.080)	(-4.180)	(0.690)
Income 20K-29k	0.078***	-1.636***	-0.030*	-1.633***	-0.095***	-0.279
	(4.300)	(-6.510)	(-1.760)	(-9.990)	(-4.720)	(-0.950)
Income 30K-39k	0.032*	-1.412***	0.021	-1.064***	-0.081***	-0.008
	(1.910)	(-6.190)	(1.300)	(-7.410)	(-4.360)	(-0.030)
Income 40K-49k	0.070***	-0.789***	-0.031**	-0.695***	-0.059***	0.196
	(4.320)	(-3.560)	(-2.020)	(-4.680)	(-3.260)	(0.840)
Income 50K-69k	0.034***	-0.327*	-0.022	-0.468***	0.00002	0.030
	(2.610)	(-1.900)	(-1.810)	(-3.970)	(0.000)	(0.200)
Household size 1	-0.494***	-2.736***	0.184***	-4.827***	0.113***	-3.857***
	(-19.860)	(-5.920)	(7.650)	(-17.400)	(3.970)	(-11.290)
Household size 2	-0.375***	-1.103***	0.152***	-2.712***	0.091***	-2.235***
	(-17.380)	(-3.270)	(7.180)	(-11.790)	(3.590)	(-7.860)
Household size 3	-0.271***	-1.305***	0.144***	-2.168***	0.058**	-2.144***
	(-13.770)	(-4.630)	(7.400)	(-9.790)	(2.450)	(-8.080)
Household size 4	-0.077***	-0.779***	0.042**	-1.171***	0.014	-1.775***
	(-4.370)	(-3.750)	(2.370)	(-6.690)	(0.640)	(-7.450)
Age 18-34	0.471***	0.717*	-0.093***	1.027***	-0.361***	0.437
	(20.460)	(1.680)	(-4.220)	(4.850)	(-13.510)	(0.590)
Age 35-44	0.442***	0.907**	-0.083***	0.658***	-0.334***	0.808
	(27.100)	(2.450)	(-5.420)	(4.340)	(-18.780)	(1.210)
Age 45-54	0.372***	1.069***	-0.069***	0.815***	-0.268***	1.123**
	(25.160)	(3.210)	(-5.060)	(6.040)	(-17.250)	(2.080)
Age 55-64	0.185***	1.149***	-0.020	0.858***	-0.103***	0.652***
	(12.170)	(4.470)	(-1.410)	(6.950)	(-6.780)	(2.620)
Not high school grad	0.289***		-0.140***		-0.044**	

	(16.490)		(-8.440)		(-2.300)	
High school graduate	0.273***		-0.145***		-0.075***	
	(18.020)		(-10.060)		(-4.510)	
College	0.205***		-0.084***		-0.072***	
	(12.630)		(-5.460)		(-4.040)	
College graduate	0.168***		-0.070***		-0.062***	
	(12.010)		(-5.280)		(-4.060)	
University	0.130***		-0.068***		-0.037*	
	(6.780)		(-3.780)		(-1.820)	
Quarter 1	0.092***	-0.084	-0.001	-0.225	-0.107***	0.050
	(7.010)	(-0.470)	(-0.050)	(-1.930)	(-7.370)	(0.200)
Quarter 2	-0.046***	0.442**	0.108***	0.050	-0.095***	0.409*
	(-3.550)	(2.520)	(8.650)	(0.350)	(-6.610)	(1.740)
Quarter 3	-0.073***	0.393*	0.092***	0.103	-0.025*	-0.013
	(-5.600)	(2.200)	(7.440)	(0.770)	(-1.740)	(-0.080)
Maritimes	-0.037*	-4.824***	0.216***	-1.655***	-0.171***	0.693*
	(-1.760)	(-17.160)	(11.100)	(-6.500)	(-7.980)	(1.820)
Quebec	0.061***	-4.902***	0.184***	-4.051***	-0.274***	0.204
	(3.260)	(-19.200)	(10.450)	(-18.160)	(-14.070)	(0.370)
Ontario	0.048***	-4.460***	0.247***	-3.499***	-0.360***	0.770
	(2.630)	(-17.910)	(14.290)	(-13.670)	(-18.750)	(1.090)
Manitoba/Sask	0.184***	-1.185***	-0.076***	1.726***	-0.152***	-0.327
	(8.100)	(-3.770)	(-3.550)	(7.740)	(-6.340)	(-0.880)
Alberta	0.041*	-1.009***	-0.022	0.691***	-0.026	0.196
	(1.800)	(-3.340)	(-1.020)	(3.360)	(-1.140)	(0.860)
Urban	-0.084***	0.175	0.064***	-0.066	0.035***	-0.021
	(-8.310)	(1.210)	(6.600)	(-0.630)	(3.100)	(-0.150)
No child	-0.088***		0.074***		0.003	
	(-5.210)		(4.460)		(0.160)	
Constant	-0.599***	16.702***	-0.053*	18.435***	-0.453***	16.364***
	(-20.720)	(15.440)	(-1.930)	(15.650)	(-14.400)	(5.870)

Mills lambda	0.989		-3.749***	-3.996*
	(1.100)		(-2.800)	(-1.630)
Number of observations	82936	82936	82936	
Censored observations	56598	34012	67791	
Uncensored observations	26338	48924	15145	
Wald chi-square(22)	339.97	2061.09	339.97	
Rho	0.100	-0.410	-0.554	
Sigma	9.862	9.136	7.207	

Note: ***, **,* represent statistically significant at 1%, 5%, and 10% respectively; t-values are in parentheses.

Table 5 Marginal effects of purchasing convenience chicken products

	Most Convenience		Semi-convenience		Least Convenience	
Variable	Probit	Expenditure	Probit	Expenditure	Probit	Expenditure
Income under 20k	-0.010	-1.568***	0.021**	-1.969***	-0.026***	-0.092
	(-1.250)	(-4.940)	(2.560)	(-10.140)	(-4.380)	(-0.260)
Income 20K-29k	0.028***	-1.692***	-0.012*	-1.699***	-0.024***	-0.581*
	(4.240)	(-6.720)	(-1.760)	(-10.130)	(-4.900)	(-1.930)
Income 30K-39k	0.011*	-1.435***	0.008	-1.019***	-0.021***	-0.267
	(1.900)	(-6.280)	(1.300)	(-6.890)	(-4.500)	(-0.980)
Income 40K-49k	0.025***	-0.839***	-0.012**	-0.764***	-0.015***	0.010
	(4.270)	(-3.780)	(-2.020)	(-5.010)	(-3.330)	(0.040)
Income 50K-69k	0.012***	-0.351**	-0.009*	-0.517***	0.00001	0.030
	(2.600)	(-2.040)	(-1.810)	(-4.280)	(0.000)	(0.190)
Household size 1	-0.157***	-2.367***	0.070***	-4.436***	0.030***	-3.503***
	(-22.500)	(-5.120)	(7.810)	(-15.740)	(3.840)	(-9.930)
Household size 2	-0.129***	-0.830**	0.059***	-2.382***	0.024***	-1.948***
	(-17.860)	(-2.450)	(7.220)	(-10.160)	(3.560)	(-6.590)
Household size 3	-0.090***	-1.105***	0.055***	-1.861***	0.015**	-1.962***
	(-14.630)	(-3.910)	(7.510)	(-8.270)	(2.410)	(-7.120)
Household size 4	-0.027***	-0.723***	0.016**	-1.080***	0.004	-1.731***
	(-4.430)	(-3.470)	(2.380)	(-6.030)	(0.640)	(-6.990)
Age 18-34	0.179***	0.394	-0.037***	0.819***	-0.080***	-0.733
	(19.640)	(0.920)	(-4.190)	(3.760)	(-16.300)	(-0.980)
Age 35-44	0.163***	0.596	-0.032***	0.474***	-0.080***	-0.261
	(26.350)	(1.610)	(-5.400)	(3.050)	(-20.630)	(-0.390)
Age 45-54	0.135***	0.805**	-0.027***	0.662***	-0.066***	0.270
	(24.610)	(2.410)	(-5.040)	(4.790)	(-18.300)	(0.500)
Age 55-64	0.067***	1.017***	-0.008	0.815***	-0.026***	0.324

	(11.920)	(3.950)	(-1.410)	(6.410)	(-6.980)	(1.280)
Not high school grad	0.106***	-0.150	-0.055***	-0.227*	-0.011**	-0.291
	(15.930)	(-0.850)	(-8.380)	(-1.890)	(-2.340)	(-1.110)
High school graduate	0.100***	0.475***	-0.057***	0.283**	-0.019***	0.107
	(17.490)	(2.710)	(-9.990)	(1.970)	(-4.620)	(0.450)
College	0.075***	0.446**	-0.033***	0.302**	-0.018***	-0.090
	(12.280)	(2.490)	(-5.430)	(2.210)	(-4.150)	(-0.570)
College graduate	0.060***	-4.797***	-0.027***	-1.199***	-0.016***	0.146
	(11.800)	(-17.050)	(-5.260)	(-4.650)	(-4.120)	(0.380)
University	0.047***	-4.947***	-0.027***	-3.656***	-0.010*	-0.672
	(6.620)	(-19.340)	(-3.760)	(-16.170)	(-1.850)	(-1.220)
Quarter 1	0.033***	-4.495***	0.000	-2.970***	-0.027***	-0.379
	(6.940)	(-18.020)	(-0.050)	(-11.490)	(-7.570)	(-0.540)
Quarter 2	-0.016***	-1.315***	0.042***	1.557***	-0.024***	-0.813**
	(-3.570)	(-4.170)	(8.710)	(6.820)	(-6.760)	(-2.140)
Quarter 3	-0.025***	-1.038***	0.035***	0.644***	-0.006*	0.113
	(-5.650)	(-3.430)	(7.470)	(3.050)	(-1.750)	(0.470)
Maritimes	-0.013*	0.235	0.082***	0.074	-0.042***	0.089
	(-1.770)	(1.620)	(11.410)	(0.690)	(-8.490)	(0.630)
Quebec	0.022***	-0.204***	0.071***	-0.314***	-0.067***	-0.139**
	(3.240)	(-16.940)	(10.600)	(-8.270)	(-14.990)	(-2.300)
Ontario	0.017***	-0.193***	0.095***	-0.323***	-0.088***	-0.239***
	(2.620)	(-18.410)	(14.530)	(-9.880)	(-20.000)	(-4.500)
Manitoba/Saskatchewan	0.067***	-0.146***	-0.030***	-0.187***	-0.037***	-0.229***
	(7.870)	(-12.860)	(-3.530)	(-5.400)	(-6.760)	(-4.030)
Alberta	0.014*	-0.120***	-0.008	-0.154***	-0.007	-0.197***
	(1.780)	(-12.130)	(-1.020)	(-5.240)	(-1.150)	(-4.050)
Urban	-0.030***	-0.093***	0.025***	-0.151***	0.009***	-0.118
	(-8.280)	(-6.860)	(6.590)	(-3.740)	(3.110)	(-1.820)
No child	-0.031***	0.063***	0.029***	0.162***	0.001	0.010
	(-5.170)	(5.230)	(4.450)	(4.440)	(0.160)	(0.160)

Note: ***, **,* represent statistically significant at 1%, 5%, and 10%, respectively; t-values are in parentheses.

Table 6 Multivariate Tobit Model Parameter estimates of purchasing convenience chicken products

Variable	Most Convenience	Semi-convenience	Least Convenience
Income under 20k	-1.131***	-1.092***	-1.324***
	(-2.760)	(-5.090)	(-3.840)
Income 20K-29k	0.383	-1.488***	-1.337***
	(1.280)	(-8.420)	(-4.640)
Income 30K-39k	-0.098	-0.554***	-1.155***
	(-0.340)	(-3.210)	(-4.250)
Income 40K-49k	0.751***	-0.859***	-0.765***
	(2.730)	(-4.930)	(-2.930)
Income 50K-69k	0.477**	-0.530***	0.030
	(2.110)	(-3.810)	(0.140)
Household size 1	-8.056***	-1.958***	0.011
	(-17.750)	(-7.150)	(0.030)
Household size 2	-5.928***	-0.662***	0.183
	(-14.990)	(-2.610)	(0.450)
Household size 3	-4.306***	-0.139	0.047
	(-12.420)	(-0.590)	(0.120)
Household size 4	-1.209***	-0.364*	-0.452
	(-3.930)	(-1.660)	(-1.290)
Age 18-34	6.949***	0.002	-4.837***
	(17.500)	(0.010)	(-11.990)
Age 35-44	6.901***	-0.153	-4.221***
	(23.720)	(-0.930)	(-15.320)
Age 45-54	5.829***	0.014	-3.422***
	(21.800)	(0.090)	(-14.830)
Age 55-64	3.326***	0.524***	-1.132***
	(12.520)	(3.600)	(-5.260)
Not high school grad	4.802***	-1.271***	-0.404
	(15.360)	(-6.990)	(-1.420)
High school graduate	3.984***	-1.318***	-1.044***
	(14.790)	(-8.160)	(-4.300)
College	3.252***	-0.773***	-0.893***
	(11.480)	(-4.590)	(-3.450)
College graduate	2.477***	-0.535***	-0.728***
	(10.170)	(-3.640)	(-3.240)
University	2.117***	-0.771***	-0.433
	(6.340)	(-3.940)	(-1.410)
Quarter 1	1.294***	-0.132	-1.294***
	(5.770)	(-0.950)	(-5.880)
Quarter 2	-0.466**	1.115***	-1.220***
	(-2.070)	(8.150)	(-5.630)
Quarter 3	-0.934***	1.033***	-0.329

	(-4.170)	(7.590)	(-1.590)
Maritimes	-2.329***	1.426***	-1.951***
	(-6.100)	(6.150)	(-6.250)
Quebec	-0.520	-0.734***	-3.509***
	(-1.490)	(-3.530)	(-12.370)
Ontario	-0.842**	0.249	-4.310***
	(-2.430)	(1.200)	(-14.830)
Manitoba/Saskatchewan	1.926***	0.098	-2.858***
	(4.560)	(0.350)	(-8.210)
Alberta	-0.021	0.120	-0.595*
	(-0.050)	(0.450)	(-1.770)
Urban	-0.963***	0.755***	0.366**
	(-5.580)	(7.070)	(2.250)
Nochild	-1.244***	1.121***	-0.024
	(-4.190)	(5.900)	(-0.080)
Constant	-9.300***	2.388***	-7.068***
	(-15.930)	(7.270)	(-12.640)
Number of observations	82936		
Wald chi-square(28)	2998.04		

Note: ***, **,* represent statistically significant at 1%, 5%, and 10% respectively; t-values are in parentheses.