



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
<http://ageconsearch.umn.edu>
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Characteristics of U.S. Organic Fresh Produce Consumers: A Double Hurdle Model Approach

Bo Chen, PhD Student

University of Kentucky, Department of Agricultural Economics

442 Charles E. Barnhart Bldg, Lexington, KY 40546-0276

Phone: 859-218-5201, E-mail: bo.chen@uky.edu

Sayed Saghaian, Associate Professor

University of Kentucky, Department of Agricultural Economics

314 Charles E. Barnhart Bldg, Lexington, KY 40546-0276

Phone: 859-257-2356, E-mail: ssaghaian@uky.edu

***Selected Paper Prepared for Presentation at the South Agricultural Economics Association
(SAEA) Annual Meeting, San Antonio, Texas, February, 6-9 2016***

Copyright 2016 by [Bo Chen and Sayed Saghaian]. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.

Characteristics of U.S. Organic Fresh Produce Consumers: A Double Hurdle Model Approach

Abstract: The organic food market has been in an upward trend and the continuous success of the organic industry lies on a solid understanding of the consumers. This article offers a timely update of the characteristics of the organic consumers with the Nielsen Homescan Consumer Panel. Income is a key factor in the decision of consumers organic market participation yet it does not affect the consumption level of the existing organic consumers. Younger age and more education not only contribute to more consumer participation but also increase the existing consumption level. Moreover, consumption patterns differ across different family features, races and regions.

Keywords: Consumer characteristics, organic food, hurdle model, scanner data.

Introduction

The recent decades have seen a rapid increase of demand for organic food worldwide and this trend is initiated by consumers' concerns for the safety of conventional foods and further contributed by consumers' increasing demand for more healthy and nutritious foods. In the United States, organic food sales has experienced an annual average growth rate of 17% between 1998 and 2006 (Dettmann and Dimitri, 2009); despite a slight decrease due to the financial crisis between 2007 and 2009, sales resumed the previous upward trend, reaching a record high of \$32 billion in 2013 (OTA, 2014).

Among the various categories of organic foods, fresh produce including fruits and vegetables has been taking the leading role since the introduction of organic agriculture decades ago and currently they are still the largest categories of organic foods, accounting for 43 and 15 percent of organic sales in 2012, respectively (Greene, 2013). Besides their dominance in sales, fruits and vegetables have long been considered the "gateway" products; consumers tend to try other organic foods from other categories after experiencing organic produce first (Dettmann and Dimitri, 2009).

The success of the organic industries rests crucially on consumer demand which has been extensively studied. A main line of researches focus on using survey and contingent valuation method to elicit consumers' attitudes, knowledge or willingness to pay (WTP) for the organic products (Briz and Ward, 2009, Hu, et al., 2009, Roitner-Schobesberger, et al., 2008). These stated preference based researches provide valuable information regarding consumers' perceptions of the organic which is likely to influence consumers' food choice.

However, real purchase behaviors of the consumers is of more significance due to its direct implications for organic growers, distributors and policymakers beyond academic interest. This motivates another line of researches to investigate the characteristics of organic buyers and to estimate the demand function of organic foods. Fresh produce is the main category of organic foods under investigation largely due to its large sales. Thompson (1998) overviews the studies conducted before 1998 and summarize the effect of socioeconomic variables including income, age, education, gender, marital status and household size on organic produce demand. Furthermore, with big scanner data, more insights about organic demand have been generated (Dettmann and Dimitri, 2009, Smith, et al., 2009, Zhang, et al., 2008). However, no consensus has been reached for the effect of most explanatory variables in these studies. This seemingly surprising result may actually reflect the complexity to characterize a typical organic consumer and also indicate the dynamic nature of the organic demand in general.

This article aims to provide a timely update for the ongoing empirical researches of characterizing organic consumers with the newly released Nielsen Homescan Consumer Panel 2012 dataset. Specifically, we evaluate the effects of a series of economical and demographical variables on the consumer organic produce demand with a double hurdle model.

Methodology

It is common for the micro-level datasets to have a large number of zero consumption. In modelling this type of data left-censored at zero, OLS estimation is well known to be inconsistent while Tobit model introduced by Tobin (1958) has been frequently used

(Long and Freese, 2006, Wooldridge, 2010). However, the Tobit model implies that zero consumption only stems from the constrained utility maximization of the consumers while in fact corner solution may only be one reason for the zero consumption. For example, non-smokers may choose not to smoke due to individual health reasons rather than income or price concerns (García and Labeaga, 1996) and non-gamblers may choose not to gamble on ethical or religious grounds (Humphreys, et al., 2009). In the demand for organic produce, consumers may choose zero purchase of organic fruits and vegetables because they do not recognize their benefits rather than their income is too low or the price of organic produce is too high. Moreover, in Tobit models the same set of variables are assumed to explain both consumers' decision to enter the market and the level of their consumption. This assumption is too strong to hold since it is probable that participation decisions and consumption decision are explained by different sets of variables and some explanatory variables could even have opposite impacts on the participation decision and the consumption level.

The double-hurdle model originally proposed by Cragg (1971) generalized the Tobit model by allowing different sets of variables to explain the participation decision and consumption level. This leaves room for certain variables to have different impacts on participation and consumption. Due to this generalization, the double hurdle model has gradually gained importance in empirical demand estimation and recent applications of this model include the estimation of powdered milk consumption in China (Wu, et al., 2014), milk purchase in New York (Dong, et al., 2004), organic fruits and vegetables purchase in Denmark and United States (Smed, 2012, Zhang, et al., 2008).

The Cragg double hurdle takes the following form:

$$d_i^* = x_{1i}\alpha + \varepsilon_{1i}, \quad d_i = 1 \text{ if } d_i^* > 0; d_i = 0 \text{ if } d_i^* < 0 \quad (1)$$

$$y_i^* = x_{2i}\beta + \varepsilon_{2i}, \quad y_i = y_i^* \text{ if } d_i^* > 0 \text{ and } y_i^* > 0; y_i = 0 \text{ otherwise}$$

where the first equation models the participation decision while the second equation models the consumption decision. d_i^* is a latent variable describing household's decision to purchase organic produce and d_i is the observed dummy variable of participation. x_{1i} is a set of variables explaining the participation. y_i^* is the latent variable of consumption level and y_i is the observed consumption level explained by a set of variables x_{2i} . ε_{1i} and ε_{2i} are error terms with standard normal distribution. α and β are coefficients need to be estimated. Unlike the Tobit model, the zero consumption may be resulted from either the participation decision or the consumption decision in the double hurdle model.

Consequently in order to observe a positive consumption value, two hurdles must be passed: households must decide to purchase organic produce and must choose to purchase a positive amount if they enter the market.

The estimation of the model is achieved by MLE assuming normal distribution of the error terms in the participation and consumption equations. However, MLE would be inconsistent if the error terms are actually not normally distributed. Yet it is not uncommon to have non-normality in error terms and several methods have been suggested to relax the normality assumption. One approach involves applying transformation to the dependent variable and common transformation include Box-Cox transformation (Jones and Yen, 2000, Yen, 1993) and inverse hyperbolic sine (IHS) transformation (Gao, et al., 1995, Yen and Jones, 1997). An alternative copula approach uses copula functions to construct joint distribution from the marginal distribution of the

error terms in the participation and consumption equation (Smith, 2002, Yen, et al., 2011). Additionally, Cragg (1971) also proposes the specification in which lognormal distribution is assumed for the dependent variable and Hsu and Liu (2008) further shows the robustness of the lognormal model comparing with the truncated normal specification. Thus we adopt the lognormal model here and transforming the dependent variable in the consumption equation (expenditure on fruits and vegetable) with by taking natural logarithm if the dependent variable is positive. Another advantage of this transformation is its simplicity in calculating the marginal effect.

Since the estimation of the double hurdle model cannot be interpreted directly, average marginal effects of the explanatory variables on the participation probability and expected consumption level given participation are of more interest. The probabilities of participation is

$$P(y_i > 0|x_{1i}) = \Phi(x_{1i}\alpha) \quad (2)$$

and the expected value of y given consumption is

$$E(y_i > 0, x_{2i}) = x_{2i}\beta + \sigma\lambda\left(\frac{x_{2i}\beta}{\sigma}\right) \quad (3)$$

For continuous explanatory variables, the average marginal effect is calculated as the average of the derivatives of (2) and (3) across all observations. For the dummy variables, the average marginal effect is the average change of (2) and (3) when the dummy variables shift from zero to one. Delta method is applied to calculate the standard errors of the marginal effects.

Data

Nielsen Homescan Consumer Panel 2012 dataset is the data source in this study. The Consumer Panel data tracks a panel of 40,000-60,000 U.S. households which are geographically dispersed and demographically balanced to be representative of the entire U.S. population. The panelist households are provided with home scanners to record each product they purchase as well as the time and location of these purchases. Additionally, demographic characteristics of these households in the panel are also collected by Nielsen. Therefore, this dataset is ideal in characterizing the households consuming organic produce.

The fruits and vegetables are consumed regularly in the U.S. markets and they mainly fall under the product group of fresh produce in the dataset. Organic produces are defined as those bearing the USDA organic logo. Also, due to the heterogeneous nature of fruits and vegetables, total organic expenditure aggregated over 2012 is used as the explained variable in the consumption equation.

To obtain reliable characterization of the organic consuming households and avoid problems associated with inadvertent reporting by some households, we limit the households under study to those which purchase fresh produce for at least 10 months in 2012. This results a sample of 26,086 households. Household size, income, age, education and region have widely been used to explain organic produce consumption (Smed, 2012, Smith, et al., 2009, Wier, et al., 2008, Zepeda and Li, 2007, Zhang, et al., 2008), and we further include total fresh produce expenditure, presence of children under six into the analysis. The variables, their definitions and descriptive statistics are presented in Table 1. It needs to be noted that panelists are surveyed about their

household income categories, and thus the household income is categorical. Interpolation income from the boundaries of income categories may introduce unnecessary distortion to the data. Also, price of some organic produce can be derived by dividing the total expenditure with the unit in this dataset but not all items can be calculated in this way due to different units used and heterogeneity of the organic produce. This prevents us from including an average price or price for the organic produce in the analysis. Therefore, our estimation is not a demand function for the organic produce. However, the goal of this article is to characterize a typical organic consumer and this model serves our purpose.

As can be seen from Table 1, even though 44% of the households which purchase fruits and vegetables regularly in 2012 have purchased organic fruits and vegetables, the average organic expenditure is merely \$7.95 among all households and \$17.97 among organic buyers, comparing with an average expenditure of \$323.05 on all produce.

Henceforth, organic fruits and vegetables only take up a small proportion of the total fresh produce spending despite the strong marketing campaign in the recent decades. A further breakdown of organic expenditure among organic purchasers by income, age, education, race and region yields more insights into the demographic characters of the organic consumers. As shown in the last column in Table 1, households with higher income and higher education also tend to spend more on organic produce. While as the age of the household head increase, the household organic expenditure decreases.

Organic expenditure also differs across races and regions although the regional difference is mild.

Empirical Results

The results from the maximum likelihood estimation is presented in Table 2 and the corresponding average marginal effect of the variables on participation probability and conditional consumption level is presented in Table 3.

Though an increase in total expenditure on fresh produce would increase both the probability of buying organic produce and the expenditure on organic produce, the marginal effects are small. Hence, even among frequent fruit and vegetable buyers, the preference of organic produce is low. Household income is another important economic factor that could influence expenditure or consumption. Our results indicate that an increase in household income within \$50,000 does not increase consumers probability of buying organic produce while an income increase above \$5000 significantly increase the organic participation probability and the higher the income, the more likely consumers would become organic buyers. Household income, however, does not have significant impact on the level of organic produce consumption for the existent organic buyers. This result is generally consistent with Dettmann and Dimitri (2009) and Smith, et al. (2009). Intuitively, an increase in income would encourage more consumers to buy organic produce since the organic fresh produces are normal goods. While for those customers who are already organic buyers, it could be that the total food expense including organic expenditure is merely a small part of household income and income increase might not significantly affect expenditure on organic produce (Li, et al., 2007, Zepeda and Li, 2007).

Even though family size does not affect consumers participation decision to consume organic foods, it does negatively affect household consumption level of organic foods

given organic buyers. An additional member of household decrease the expenditure on organic consumption by 4.44%. Household age and education level affect both participation and consumption. Household with elder heads are less likely to buy organic foods and among those who are already organic consumers, organic expenditure also decreases with the increase of household head age. Contrary to household age, an increase in household head education level not only increase the probability of buy organic produce but also increase the consumption level among those who already buy organic produce. The opposite effects of the household age and education level may well reflect the effects of food beliefs and information on demand. It could be that elder people are less informed than young people and thus elder people may not recognize the benefits of organic produce to conventional produce, resulting not only less likelihood of becoming organic buyers but also less spending on organic foods among current organic buyers. While more educated tend to know more about the organic produce and consequently more likely to spend on organic produce. These findings are also consistent with Smith, et al. (2009), Dettmann and Dimitri (2009) and Zhang, et al. (2008). The presence of children under six also affects participation and consumption level positively. This makes intuitive sense since organic produce are generally considered to be more safe, healthy and nutritious than conventional produce. The presence of small children in households may prompt these households to switch to the better choices of organic foods for their children.

The organic participation and consumption also demonstrates differences across races. Comparing with the white Americans, African Americans are 4.46% less likely to purchase organic, other things being equals. Among the organic buyers, other races tend

to spend 13% more on organic produce white, black or Asian Americans. The organic purchase is also affected by a set of geographical variables. Urban Residents are not only more likely to buy organic, but also buy more than suburban residents. People residing in the West and Midwest are more likely to buy organic and buy more than residents in other areas. This is likely to be explained by a broader access to organic produce in the west and Midwest and the concentration of organic handlers in the region (Smith, et al., 2009, Zhang, et al., 2008)

Conclusion and Discussion

The organic agriculture provides an important alternative food production method to satisfy consumer's demand for more safe and nutritious foods for the recent decades and the organic sales have maintained a high growth trend. For the continuous success of the organic industry, it is of vital importance to know who are purchasing organic foods. However, due to the dynamic nature of the organic market, previous understanding about the organic market needs to be updated. We contribute to the literature by employing the latest Nielsen Homescan Consumer Panel 2012 to estimate the effects of various economic and demographic characters on consumers' decision to buy organic fresh produce and expenditure on it.

Our results are generally consistent with the previous studies on organic demand. Household income is still an important factor consumers take into account when deciding to purchase organic produce. However, income does not significantly affect the expenditure among existing organic customers. Age and education are still having a large effect on organic demand; both factors may have close links with the information

received by the consumers. The negative impact of old age and less education might be due to elder and less educated customers simply do not recognize the benefits of the organic foods. Racial, geographical and family features also affect organic demand. The implications from these results are clear for the organic industry: Continuous and targeted marketing efforts need to be made so that the notion of organic agriculture can be known and accepted by more customers. Additionally, improving production efficiency or the organic foods is needed to make the organic foods affordable even by less wealthy households.

Even though the Nielsen Homescan dataset is a high-quality dataset that can be used to analyze the purchase behavior and demand of the consumers. One major drawback is that there are other factors beyond the sociodemographic variables in the dataset that can have profound impacts on consumers' purchase of organic foods. For example, in the event of a food safety crisis involving one conventional food, consumers' exposure to media coverage on these issues can have a decisively negative effect on this food and the demand of its organic counterpart could be greatly boosted. These type of perception variables are heavily used in choice experiments which, unfortunately, suffer from the potential bias of not measuring the real demand as mentioned above. Therefore, in order to achieve a more accurate understanding of the purchase of organic produce, a combination of the conventional sociodemographic explanatory variables with consumers' perception of organic food and agriculture is needed.

REFERENCE

- Briz, T., and R.W. Ward. 2009. "Consumer awareness of organic products in Spain: An application of multinominal logit models." *Food Policy* 34:295-304.
- Cragg, J.G. 1971. "Some Statistical Models for Limited Dependent Variables with Application to the Demand for Durable Goods." *Econometrica* 39:829-844.
- Dettmann, R.L., and C. Dimitri. 2009. "Who's Buying Organic Vegetables? Demographic Characteristics of U.S. Consumers." *Journal of Food Products Marketing* 16:79-91.
- Dong, D., B.W. Gould, and H.M. Kaiser. 2004. "Food Demand in Mexico: An Application of the Amemiya-Tobin Approach to the Estimation of a Censored Food System." *American Journal of Agricultural Economics* 86:1094-1107.
- Gao, X., E.J. Wailes, and G.L. Cramer. 1995. "Double-hurdle model with bivariate normal errors: an application to US rice demand." *Journal of Agricultural and Applied Economics* 27:363-376.
- García, J., and J.M. Labeaga. 1996. "ALTERNATIVE APPROACHES TO MODELLING ZERO EXPENDITURE: AN APPLICATION TO SPANISH DEMAND FOR TOBACCO*." *Oxford Bulletin of Economics and Statistics* 58:489-506.
- Greene, C. 2013. "Growth patterns in the US Organic Industry." *US Department of Agriculture, Economic Research Service. Retrieved January 24:2014.*
- Hsu, A.C., and S.C. Liu. 2008. "The hurdle models choice between truncated normal and lognormal." *Applied Economics* 40:201-207.

- Hu, W., T. Woods, and S. Bastin. 2009. "Consumer Acceptance and Willingness to Pay for Blueberry Products with Nonconventional Attributes." *Journal of Agricultural and Applied Economics* 41:47-60.
- Humphreys, B.R., Y.S. Lee, and B.P. Soebbing (2009) "Consumer behaviour in lotto markets: the double hurdle approach and zeros in gambling survey data." In., WP.
- Jones, A.M., and S.T. Yen. 2000. "A Box–Cox Double-hurdle Model." *The Manchester School* 68:203-221.
- Li, J., L. Zepeda, and B.W. Gould. 2007. "The demand for organic food in the US: an empirical assessment." *Journal of Food Distribution Research* 38:54.
- Long, J.S., and J. Freese. 2006. *Regression models for categorical dependent variables using Stata*: Stata press.
- OTA. 2014. "The OTA 2014 Organic Industry Survey." *Greenfield, MA: Organic Trade Association*.
- Roitner-Schobesberger, B., I. Darnhofer, S. Somsook, and C.R. Vogl. 2008. "Consumer perceptions of organic foods in Bangkok, Thailand." *Food Policy* 33:112-121.
- Smed, S. 2012. "Information and consumer perception of the "organic" attribute in fresh fruits and vegetables." *Agricultural Economics* 43:33-48.
- Smith, M.D. (2002) "On specifying double-hurdle models." In A. Ullah, A.T.K. Wan, and A. Chaturvedi eds. *Handbook of Applied Econometrics and Statistical Inference*. New York, Marcel Dekker Inc., New York, pp. 535-552.
- Smith, T.A., C.L. Huang, and B.-H. Lin. 2009. "Does price or income affect organic choice? Analysis of US fresh produce users." *Journal of Agricultural and Applied Economics* 41:731-744.

- Thompson, G.D. 1998. "Consumer Demand for Organic Foods: What We Know and What We Need to Know." *American Journal of Agricultural Economics* 80:1113-1118.
- Tobin, J. 1958. "Estimation of Relationships for Limited Dependent Variables." *Econometrica* 26:24-36.
- Wier, M., K. O'Doherty Jensen, L.M. Andersen, and K. Millock. 2008. "The character of demand in mature organic food markets: Great Britain and Denmark compared." *Food Policy* 33:406-421.
- Wooldridge, J.M. 2010. *Econometric analysis of cross section and panel data*: MIT press.
- Wu, B.B., Y.F. Chen, W. Si, and H.P. Chien. 2014. "A Double-Hurdle Analysis of Demand for Powdered Milk: Evidence from Household Survey Data in an Urban Chinese Province." *Agribusiness* 30:331-344.
- Yen, S.T. 1993. "Working Wives and Food Away from Home - the Box-Cox Double Hurdle Model." *American Journal of Agricultural Economics* 75:884-895.
- Yen, S.T., and A.M. Jones. 1997. "Household Consumption of Cheese: An Inverse Hyperbolic Sine Double-Hurdle Model with Dependent Errors." *American Journal of Agricultural Economics* 79:246-251.
- Yen, S.T., A.K.G. Tan, and R.M. Nayga Jr. 2011. "Determinants of fruit and vegetable consumption in Malaysia: An ordinal system approach*." *Australian Journal of Agricultural and Resource Economics* 55:239-256.
- Zepeda, L., and J. Li. 2007. "Characteristics of organic food shoppers." *Journal of Agricultural and Applied Economics* 39.

Zhang, F., C.L. Huang, B.-H. Lin, and J.E. Epperson. 2008. "Modeling fresh organic produce consumption with scanner data: a generalized double hurdle model approach." *Agribusiness* 24:510-522.

Tables

Table 1 Variable Definitions and Descriptive Statistics

Variable	Definition	Mean (Std. Dev.)	Mean (Std. Dev.) ^a
<i>ofv</i>	Per HH organic expenditure (all sample)	7.95 (31.55)	-
	Per HH organic expenditure (organic consumers)	17.97 (45.49)	-
<i>d</i>	=1 if <i>lofv</i> > 0, =0 otherwise	0.44 (0.50)	-
<i>exp</i>	Total fruits and vegetables expenditure in 2012	323.05(257.87)	-
<i>inc1</i>	=1 if HH income under \$9999	0.02 (0.14)	12.83 (22.22)
<i>inc2</i>	=1 if HH income \$10,000-19,999	0.06 (0.24)	13.11 (30.55)
<i>inc3</i>	=1 if HH income \$20,000-29,999	0.10 (0.30)	12.41 (33.18)
<i>inc4</i>	=1 if HH income \$30,000-39,999	0.12 (0.33)	15.08 (35.97)
<i>inc5</i>	=1 if HH income \$40,000-49,999	0.13 (0.33)	15.60 (47.73)
<i>inc6</i>	=1 if HH income \$50,000-59,999	0.10 (0.30)	16.34 (31.99)
<i>inc7</i>	=1 if HH income \$60,000-69,999	0.09 (0.29)	16.99 (34.75)
<i>inc8</i>	=1 if HH income \$70,000-99,999	0.22 (0.41)	18.86 (40.83)
<i>inc9</i>	=1 if HH income above 100,000	0.16 (0.37)	24.24 (65.91)
<i>size</i>	HH size – number of individual in home	2.52 (1.28)	-
<i>age1</i>	=1 if the higher age of male or female HH is less than 35	0.05 (0.21)	21.16 (43.49)
<i>age2</i>	=1 if the higher age of male or female HH is higher than 35 but less than 50	0.38 (0.49)	20.90 (57.09)
<i>age3</i>	=1 if the higher age of male or female HH is higher than 50	0.57 (0.50)	15.47 (34.64)
<i>educ1</i>	=1 if the higher education of male or female HH is graduated high school	0.16 (0.36)	12.15 (31.77)
<i>educ2</i>	=1 if the higher education of male or female HH is some college	0.29 (0.45)	13.81 (30.56)
<i>educ3</i>	=1 if the higher education of male or female HH is graduated college or post college grad	0.56 (0.50)	20.81 (52.20)
<i>child6</i>	=1 if presence of children under 6	0.03 (0.18)	-
<i>race1</i>	=1 if white HH	0.85 (0.36)	18.01 (47.25)
<i>race2</i>	=1 if black HH	0.08 (0.27)	14.13 (24.90)
<i>race3</i>	=1 if Asian HH	0.03 (0.17)	21.27 (34.11)
<i>race4</i>	=1 if other races	0.04 (0.19)	20.37 (44.75)
<i>urban</i>	=1 if residing in urban	0.85 (0.36)	-
<i>region1</i>	=1 if residing in Northeast	0.18 (0.38)	18.11 (39.13)
<i>region2</i>	=1 if residing in Midwest	0.28 (0.45)	17.39 (44.56)
<i>region3</i>	=1 if residing in South	0.35 (0.48)	18.17 (55.43)
<i>region4</i>	=1 if residing in West	0.19 (0.39)	18.22 (34.10)

Source: Nielsen Homescan Consumer Panel 2012

^a Mean and standard deviation of organic expenditure of organic purchasers by income, age, education, race and region.

Table 2 MLE estimation of the double hurdle model

Variable	Participation	Consumption
constant	-0.9056*** (0.0767)	5.9330*** (0.0994)
<i>exp</i>	0.0017*** (0.0000)	0.0016*** (0.0000)
<i>inc2</i>	-0.0883 (0.0663)	0.0235 (0.0919)
<i>inc3</i>	0.0034 (0.0625)	-0.0261 (0.0852)
<i>inc4</i>	0.0618 (0.0616)	0.0220 (0.0834)
<i>inc5</i>	0.0528 (0.0615)	-0.0225 (0.0831)
<i>inc6</i>	0.1280** (0.0625)	0.1024 (0.0838)
<i>inc7</i>	0.1710*** (0.0633)	0.0677 (0.0842)
<i>inc8</i>	0.1974*** (0.0602)	0.0840 (0.0808)
<i>inc9</i>	0.2918*** (0.0616)	0.1324 (0.0816)
<i>size</i>	-0.0029 (0.0070)	-0.0444*** (0.0085)
<i>age2</i>	-0.1742*** (0.0400)	-0.1548*** (0.0455)
<i>age3</i>	-0.2633*** (0.0400)	-0.3631*** (0.0457)
<i>educ2</i>	0.1098*** (0.0262)	0.0795** (0.0351)
<i>educ3</i>	0.1881*** (0.0251)	0.2359*** (0.0332)
<i>child6</i>	0.1188** (0.0468)	0.1057** (0.0516)
<i>race2</i>	-0.1256*** (0.0304)	-0.0444 (0.0391)
<i>race3</i>	0.0783 (0.0491)	0.0771 (0.0513)
<i>race4</i>	-0.0223 (0.0420)	0.1042** (0.0499)
<i>urban</i>	0.1389*** (0.0237)	0.0875*** (0.0313)
<i>region2</i>	0.0431** (0.0248)	0.0552* (0.0304)
<i>region3</i>	0.0094 (0.0237)	0.0368 (0.0289)
<i>region4</i>	0.2752*** (0.0269)	0.1984*** (0.0312)

Note: ***, ** and * indicate significance level at 1%, 5% and 10%, respectively

Table 3 Average Marginal effect on participation and conditional consumption

Variable	Participation ^a	Consumption ^b
<i>exp</i>	0.0006*** (0.0001)	0.0016*** (0.0000)
<i>inc2</i>	-0.0309 (0.0235)	0.0235 (0.0919)
<i>inc3</i>	0.0012 (0.0219)	-0.0261 (0.8524)
<i>inc4</i>	0.0217 (0.0214)	0.0220 (0.0834)
<i>inc5</i>	0.0185 (0.0214)	-0.0225 (0.0832)
<i>inc6</i>	0.0450** (0.0214)	0.1023 (0.0837)
<i>inc7</i>	0.0601*** (0.0215)	0.0677 (0.0841)
<i>inc8</i>	0.0695*** (0.0203)	0.0839 (0.0807)
<i>inc9</i>	0.1021*** (0.0202)	0.1324 (0.0815)
<i>size</i>	-0.0010 (0.0025)	-0.0444*** (0.0085)
<i>age2</i>	-0.0627*** (0.0143)	-0.1549*** (0.0456)
<i>age3</i>	-.00937*** (0.0142)	-0.3631*** (0.0460)
<i>educ2</i>	0.0384*** (0.0091)	0.0794** (0.0351)
<i>educ3</i>	0.0661*** (0.0087)	0.2359*** (0.0332)
<i>child6</i>	0.0421** (0.0166)	0.1188** (0.0468)
<i>race2</i>	-0.0446*** (.0108)	-0.0444 (0.0391)
<i>race3</i>	0.0278 (0.0175)	0.0770 (0.0513)
<i>race4</i>	-0.0079 (0.0149)	0.1042** (0.0499)
<i>urban</i>	0.0492*** (0.0084)	0.1389*** (0.0237)
<i>region2</i>	0.0152* (0.0087)	0.0552* (0.0304)
<i>region3</i>	0.0033 (0.0083)	0.0368 (0.0289)
<i>region4</i>	0.0972*** (0.0092)	0.1984*** (0.0311)

Note: ***, ** and * indicate significance level at 1%, 5% and 10%, respectively

^a Average marginal effect on the participation probability

^b Average marginal effect on the consumption level given participation