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DAIRY PRODUCTS EXPENDITURE PATTERN IN VIETNAM: EFFECTS OF HOUSEHOLD CHARACTERISTICS ON EXPENDITURE FOR DAIRY PRODUCTS

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DAIRY PRODUCTS EXPENDITURE PATTERN IN VIETNAM: EFFECTS OF HOUSEHOLD CHARACTERISTICS ON EXPENDITURE FOR DAIRY PRODUCTS

Abstract

In this study, Vietnamese households' expenditure on dairy products for home consumption is analyzed using the latest Vietnamese Household Living Standard Survey datasets in 2010 (VHLSS 2010). Vietnam is the 20th most important importer of dairy products in the world and it is foreseeable that the demand continues rising. This makes Vietnam a highly potential market for dairy exporting countries and for investors in the dairy industry. The aim of the paper is to analyze the effects of socio-economic and demographic variables on Vietnamese households' decision to purchase dairy products and how much to spend per capita on these items. A double-hurdle model is estimated to accommodate non-normal and heteroskedastic errors for milk and milk products. The parameter estimates for the demand decision variables are presented in the paper. The results suggest that socio-economic and demographic variables effect household expenditure on dairy products. This may help policy makers to implement policies related to dairy industry, nutrition and food security. The results also are useful for dairy products marketers in planning and developing strategies.

Key words: Dairy products, double-hurdle model, household expenditure, VHLSS, Vietnam.

Introduction

Dairy production and trade is on the rise on a global scale (Beghin, 2006; More, 2009). Similar to many Asian countries, Vietnam's economic situation has improved and thereby the living standard of its population has increased. For this reason Vietnamese have shifted from staples and nowadays pay more attention to health aspects in their food choices. As a consequence, demand for high protein and energy dense food has increased, especially dairy products such as milk, cheese, and yogurt (Jaccar, 2008; Pingali, 2007; Dong, 2006). In recent years, the Vietnamese dairy industry has become one of the fastest growing in the food industry in Vietnam. Vietnamese dairy demand has increased rapidly over the last years (BMI, 2011; Cuong and Nga, 2011). According to report of Business Monitor International (2011), Vietnamese milk consumption has been driven by increasing domestic demand, as well as rising income. In fact, milk consumption per capita in Vietnam has doubled in the period from 2000-2009 to 12 kg/year. Euromonitor international (2013) reported that Vietnam's milk products market is potential and strong. The young population continues to create a stable demand for consuming dairy products, while awareness of consumer about health benefits related to milk products is increasing, especially the with older generation (Euromonitor international, 2013). However, compared with regional countries, Vietnamese per capita consumption is still relatively low (Anh et al. 2010).

The price of foreign milk in Vietnam is one of the highest in the world (Tuan et al., 2013; BMI, 2011). The price of imported milk is also higher than in other developing countries in the region such as Thailand, Malaysia or Indonesia (Tuan et al., 2013). Vietnam mainly depends on imports to meet domestic demand for dairy products. The country is the 20th most important importer of dairy products in the world and it is foreseeable that the demand continues to rise. Vietnam's dairy production is able to provide only 22% of domestic demand (Cuong and Nga, 2011). Most of imported dairy products are UHT (Ultra High Temperature) milk, yogurt, condensed milk, and formula (GSO, 2010). This implies that Vietnam's dairy products market has high potential for future growth, both through domestic production and imports (Dong, 2006; Cuong and Nga, 2011; Euromonitor international, 2013). High demand for milk and milk products in Vietnam also creates opportunities to investors. Yet, it is not clear which factors and the level of the individual household effect on expenditure behavior of dairy products.

Several studies used household data to examine socio-economic and demographic factors affecting food consumption and household expenditure on food products. Su and Yen (1996) utilized the data of the 1987-88 US Nationwide Food consumption survey to investigate pork households' consumption in the United States. Mihalopoulos and Demoussis (2001) used data from the 1993–1994 Household Budget Survey to analyze factors effecting on probability of participation and expenditure in the market for food away from home in Greece. Thiele and Weiss (2003) analyzed consumer demand for food variety in Germany by using Consumer Panel Research Data that record the expenditure behavior of households for certain product groups. Ates and Ceylan (2010) examined the effects of socio-economic factors on the consumption of milk, yoghurt, and cheese using their household survey in Turkey. In addition, many studies have also been found in Vietnam using data from household survey to analyze food consumption pattern. Minot and Goletti (2000) estimated household food demand in Vietnam based on data of Viet Nam Living Standard Survey 1998. Le (2008) used data of VHLSS 2004 to investigate food consumptions in Vietnam that focused on three categories of food: rice food, non-rice food and meat/fish. Meat consumption pattern in Vietnam is analyzed by Phuong et al. (2014) by using VHLSS 2010 data. However, no specific study is found that has paid attention on household's expenditure on dairy products in Vietnam.

The major objective of this study is to identify and examine factors that affect Vietnamese households' consumption behavior for dairy products. The study contributes to the understanding of Vietnam's dairy products consumption patterns.

Specific objectives consider in this study are:

- To examine the factors affecting the decision to consume dairy products.
- To determine the drivers of expenditure on milk products.

Methodology, data and variables

Data

In this study, we utilized data from the Vietnamese Household Living Standard Survey (VHLSS), which was conducted by the Vietnam General Statistical Office (GSO) in 2010. The VHLSS 2010 was conducted nation-wide with a sample size of 69,360 households (22,365 households for income survey, 37,596 households for income and other and 9,399 households for income, expenditure and other survey) in 3,133 communes/wards. The surveys were representative for the whole country, 6 regions of the country, urban and rural areas and provincial levels. Surveys collected information during 4 periods in 2010-2011 through face-to-face interviews conducted by interviewers with household heads and key commune officials (VHLSS 2010). VHLSS 2010 records the household expenditure for certain products and product groups, e.g. daily consumption of foods and drinks, daily consumption product etc. The variables used in this study are listed and described in table 1.

Table1. Descriptive Statistics

Variables	Definition	Mean	S.D.
Y	Expenditure on milk products (thousand VND/capita/year)	43.236	103.650
$Ln(Y_1)$	Natural logarithm of expenditure on milk products	1.744	2.130
Income	Per capita annual income of household ('million VND)	18.253	35.862
Income2	Income squared	1619.072	86040.71
HHsize	Number of household's members	3.937	1.566
Urban	Urban equals one if the household resides in an urban area and zero otherwise	0.282	
Female	Female equals one if household head is female and zero otherwise	0.248	
Ethnic	Ethnic equals one if Kinh (Vietnamesse) and zero otherwise	0.821	
Age	Age of household head	48.345	14.245
Edu	Years of schooling of household head	7.142	3.732
Child 1	Child 1 equals one if household has children below 7 and zero otherwise	0.220	0.417
Child 2	Child 1 equals one if household has children age 7-18 and zero otherwise	0.520	0.500
Geographic location of households			

REG1	Red river delta area (is base)	0.212
REG2	Northern midland and mountain area (1/0)	0.177
REG3	North Central area and Central coastal area (1/0)	0.220
REG4	Central highlands (1/0)	0.069
REG5	South east (1/0)	0.119
REG6	Mekong river delta (1/0)	0.203

Source: Based on VHLSS 2010 (GSO)

Variables

In our empirical model, the dependent variable of the participant equation is a dummy variable for dairy products' expenditures. The dependent variable of expenditure equation is the natural logarithm of the expenditure per capita of households on dairy products (thousand VND per year). The socio-economic variables of household are hypothesized to impact on dairy products expenditure in Vietnamese families.

Price is one important factor in demand analysis. Other studies using cross-section household data assumed that prices are constant (Prais and Houthakker, 1955; George and King, 1971; cited in Cox and Wohlgenant, 1986). Many behavioral factors apart from price may result in zero observations (Yen, 2005). Furthermore, neither price information nor purchased quantities for all dairy products were collected in the VHLSS. Therefore, we hypothesize that all of households face the same price and we do not include price in the models. We estimate the following expenditure equation:

Y = f(income, household size, urban area, household head gender, household head education, age of household head, ethnic, presence of children below 7 years old, presence of children from 7 to 18 years old, presence of old people over 55 years old, region)

The Model

In this paper, a double-hurdle model is used to analyze household expenditure patterns on dairy products. One of important sources of data to analyze consumption behaviors is household survey. The great issue with cross-sectional survey data is the significant proportion of households that report zero expenditure. Tobit and infrequency of purchase models must also be considered. However, these models are considered very restrictive. Many previous studies on food expenditure and consumption found that the double hurdle model outperformed the tobit model (Keelan, 2009; Yen et al, 1996; Cragg, 1971) This paper continues with this methodological approach. We assume that households made two decisions with regard to buy an item. Firstly, a Probit model is conducted to determine participation, the decision of whether households consume milk products or not. Secondly, a regression model is made to determine how much to spend on milk products. The double hurdle model was proposed by Cragg (1971), which allows separate stochastic deal with both participation and expenditure decisions. The same variables is used in both estimations. The double hurdle model can be written as (Yen and Huang, 1996):

$Z_i^* = W_i'\alpha + v_i$ participation decision

$Y_i^* = X_i'\beta + u_i$ expenditure decision

$Y_i = X_i'\beta + u_i$ if $Z_i^* > 0$ and $Y_i^* > 0$

$Y_i = 0$ otherwise

Where:

Z_i^* and Y_i^* are latent variables that describe the household's decision to participate in consuming milk products and household per capita expenditure on milk products. Y_i is the observed dependent variable. W_i and X_i are vectors of variables explaining the participation decision and the expenditure decision, respectively. α *and* β are coefficients estimated. v_i *and* u_i are the respective error terms assumed to be independent and normally distributed such as $v_i \sim N(0,1)$ and $v_i \sim N(0, \sigma^2)$.

The likelihood function for the double hurdle model can be written as (Jensen and Yen, 1996; Su and Yen, 1996; Yen and Jones, 1997):

$$L = \prod_{Y_{i=0}} [1 - \phi(W_i'\alpha)] \prod_{Y_i > 0} \phi(W_i'\alpha) \left[\phi\left(\frac{X_i'\beta}{\sigma_i}\right)\right]^{-1} \frac{1}{\sigma_i} \emptyset \left[\frac{T(Y_i) - X_t'\beta}{\sigma_i}\right] \frac{1}{(1 + \theta^2 Y_i^2)^{\frac{1}{2}}}$$

Where $\phi(\ldots)$ is standard normal density function, $\emptyset(\ldots)$ is cumulative distribution function and θ is an unknown parameter.

The elasticity of expenditure probability, conditional level and unconditional level are calculated by referencing to Yen and Huang (1996) formula. For the double hurdle model, the probability of positive observation is:

$$P(Y_i > 0) = \phi(W_i'\alpha)$$

The conditional mean of dependent variable that measures the average of dairy products expenditure given that $P(Y_i > 0)$ is computed as following formula:

$$E(Y_i/Y_i > 0) = \left[\phi\left(\frac{X_i'\beta}{\sigma_i}\right)\right]^{-1} \int_0^\infty Y_i \frac{1}{\sigma_i} \emptyset \left[\frac{T(Y_i) - X_t'\beta}{\sigma_i}\right] \frac{1}{(1+\theta^2 Y_i^2)} dY_i$$

The unconditional mean of dependent variable that measures the average household expenditure on milk products is formulated as:

$$E(Y_i) = E(Y_i/Y_i > 0)P(Y_i > 0)$$

The elasticity of probability, conditional and unconditional level are computed with continuous variables, but with dummy variables, the elasticity is interpreted as change in probability or level of expenditure when the value of dummy variables change from 0 to 1. To check for multicollinearity, we used the variance inflation factor (VIF).

Statistical analysis

Based on the result of VHLSS in 2010, an independent-samples T-test was conducted to find differences between rural and urban households. The result of the T-test shows that the difference in the two groups' means is statistically significant with P-value at 1%. The household size in urban is smaller than in rural area. The percentage of female that is household head in urban is higher than rural. Rural household heads' age is lower than in urban household and rural household head's education is lower than in urban areas. In particular, more ethnic minority families live in rural area and there are more children in rural families. These findings are not surprising because in general, rural areas are poorer and generally less developed. The wedding age is also lower in rural than urban areas (Phuong et al, 2014). Furthermore, income per capita is nearly twice as high as in rural area. On average, annual urban household income per person is 27.09 million VND per year, while this figure

for households in rural area is 14.79 million VND per year. There is no significant difference between rural and urban families that have children below 7 years old, but the percentage of households with children aged between 7 and 18 in rural areas is higher than in urban areas.

Table 2 : Households' socio-economic and demographic factors in rural and urban Vietnam

Characteristic	Units	Urban		Rural		T-test	Sig.
		mean	SD	Mean	SD		
Household size	Person	3.82	1.46	3.98	1.60	-4.71	.000
Female	*	0.35	0.48	0.21	0.48	13.24	.000
Age	Years old	49.73	14.07	47.8	14.28	5.93	.000
Education	Years of schooling	8.59	3.61	6.57	3.63	24.36	.000
Income	Million VND	27.09	26.12	14.79	38.48	12.82	.000
Ethnic	**	0.92	0.27	0.78	0.41	19.83	.000
Having children:							
Child 1(below 7)		0.22	0.41	0.23	0.418	-0.71	.476
Child 2 (7-18)		0.48	0.50	0.53	0.50	-4.80	.000

* Female equals one if household head is female and zero otherwise.

** Ethnic equals one if Kinh (Vietnamese) and zero otherwise.

Source: Based on VHLSS 2010 (GSO)

Table 3 indicates the share of families consuming dairy products in the survey of the VHLSS 2010. It can be seen that, the percentage of households consuming milk products is very low.

Table 3: Share of households consuming milk products surveyed in VHLSS 2010 (in %)

Powdered milk	Fresh milk	Other milk products	Total (Dairy products)
25.30	22.61	24.91	48.65

Source: Based on VHLSS 2010 (GSO)

In general, there are more than 50% of households that did not consume milk products. While nearly 80% of households confirmed that they did not drink fresh milk, approximately 75 % of households said that they did not spend money on powdered milk or other dairy products. This finding explains why milk consumption per capita in Vietnam is low and a binary model analysis is important to find factors affecting the probability of participation in the dairy products market.

The table 4 shows annual per capita expenditure on milk products per person by income quintiles in 2010. The results of an ANOVA analysis indicate that there is the significant difference between income quintile groups in expenditure on dairy products and that expenditure on all kinds of milk products increases with income quintiles.

Table 4 : Per capita expenditure on milk products by income quintile in 2010

(Unit: thousand per year)

Products	Powdered milk		Fresh milk		Other milk products		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Quintile 1	5.021	34.831	2.783	12.182	1.319	4.889	9.123	39.412
Quintile 2	10.355	32.307	6.554	23.776	2.851	9.430	19.760	43.801
Quintile 3	15.595	47.140	10.448	29.984	4.476	12.557	30.520	60.460
Quintile 4	27.650	72.393	15.503	40.883	9.002	21.416	52.155	93.269
Quintile 5	56.578	142.279	26.500	60.024	21.591	50.910	104.668	179.417
Total	23.035	79.539	12.355	38.004	7.846	26.788	43.236	103.650
F_test	132.374		115.701		190.553		280.565	
Sig.	0.000		0.000		0.000		0.000	

Source: Based on VHLSS 2010 (GSO)

In average, one person in the richest quintile spends more than 10 times more than a person in the poorest quintile. Especially, with other milk products this number is more than 15 times. These results give a first indication that income growth is a major driver of increasing expenditure on milk products in Vietnam.

Empirical Results

A double hurdle model was estimated by maximizing the logarithm of the likelihood functions corresponding to the above given equations. The same list of variables was used in the both the participation and consumption equation. Most of explanatory variables included in the models have statistically significant effects on the participation to consume milk products. Parameter estimates obtained from double-hurdle model are presented in table 6. All VIF values of independent variables are less than 5. Hence, we conclude that there is no major multicollinearity problem. In addition, the elasticity and effects of binary variables of participation, conditional and unconditional level of expenditure are calculated at sample means. The results are presented in table 6.

The coefficients of the income variables in both equations are positive which suggests that per capita income in families has a significantly positive effect on the probability of participation and the level of expenditure. The probability of dairy products market participation is 0.4%, which means that with one percent increase of income the probability that a household spends money on dairy products increases with 0.4%. In the same way, the amount of money spent on dairy products increases by 2.9% on unconditional level and by 14% on conditional level with a one percent increase of income. Expenditure levels increase at a decreasing rate though, as the negative quadratic term in table 5 shows, i.e. dairy products expenditure is a nonlinear function of income. However, the coefficients of the income squared variable are very small compared with the coefficients of the linear income variable. So for a long time it can be expected that the probability of milk product consumption and expenditure on these products continues to rise with increasing incomes.

Household characteristics are important variables that determine milk products consumption patterns and quantities consumed (cf. Njarui et al, 2011). With respect to demographic characteristics of households, household size has a significantly positive affect on participation in dairy market and on the conditional level in the expenditure model. However,

the household size variable is significant and negative in the milk products expenditure model with an elasticity of -5.1% on the unconditional level, i.e. when the number of people in the household increases, they spend less on milk products. This suggests that the number of household members has positive effect on milk products buying decision but at the same time has a negative effect on how much households spend for these products. Several studies also found that larger households spend or consume less on food products, suggesting that such households benefit from economies of scale in food consumption (Stewart et al, 2004; Keelan et al, 2009).

Table 5: Parameter Estimates of Double-hurdle Censored Models for dairy products expenditure

Variables	Participation		Expenditure		Heteroskedasticity	
	Parameter	S.E.	Parameter	S.E.	Parameter	S.E.
Intercept	-1.928***	0.098	2.514***	0.108	0.843***	0.059
Income	0.013***	0.001	0.028***	0.002	0.005***	0.001
Income squared	-4.57e-06***	4.5e-07	-0.00007***	0.00001		
HHsize	0.029***	0.011	-0.174***	0.013	0.013*	0.007
Urban	0.275***	0.034	0.328***	0.035		
Female	0.179***	0.035	0.149***	0.036		
Ethnic	0.538***	0.047	0.300***	0.056		
Age	-0.0001	0.001	0.007***	0.001		
Edu	0.059***	0.005	0.039***	0.005		
Child1	1.044***	0.040	0.952***	0.036		
Child2	0.475***	0.035	0.122***	0.036		
REG2	-0.107**	0.052	-0.277***	0.058		
REG3	0.142***	0.043	-0.089**	0.045		
REG4	0.168***	0.063	-0.025	0.064		
REG5	0.306***	0.053	0.135***	0.053		
REG6	0.129***	0.045	-0.009	0.048		
Number of observations	9402					
Log likelihood	-11873.382					
Wald chi2(16)	1883.11					
Sig.	0.000					

Notes: the dependent variable is the natural logarithm of the meat consumption per capita in kg/year; *** p<0.01; **p<0.05; *p<0.1

Source: Based on VHLSS 2010 (GSO)

Urban households tend to participate more than rural households in dairy products' markets. The urban variable also appears to effect household expenditure on milk products. The effects of the urban variable in the models are 8.9% on the probability of entering into the market. The numbers on conditional and unconditional level are 27.2% and 46.7%, respectively, i.e. the probability of urban households to consume dairy products is more than in rural areas and per capita in urban households spend on dairy products is more than in rural households. The results indicate that the degree of urbanization plays an important role in determining the probability of participation in the milk products market and urbanization also contributes increase expenditure for dairy products.

Table 6. Elasticity of continuous and binary variables: Dairy products expenditure.

Variable	Probability	Conditional Level	Unconditional Level
Income	0.004	0.140	0.029
HHsize	0.009	0.029	-0.051
Urban	0.089	0.272	0.467
Female	0.058	0.177	0.273
Ethnic	0.175	0.532	0.453
Age	-0.000	0.000	0.003
Edu	0.019	0.058	0.327
Child1	0.338	1.031	1.631
Child2	0.154	0.470	0.592
REG2	-0.035	-0.106	-0.254
REG3	0.046	0.141	0.117
REG4	0.054	0.116	0.176
REG5	0.099	0.302	0.408
REG6	0.042	0.128	0.141

Source: Based on VHLSS 2010 (GSO)

Interestingly, the results also suggest that gender and education of household heads have a positive effect on the probability to consume and the expenditure for dairy products. In particular, households having female household heads and higher education household head would increase the dairy product consumption probability and expenditure. In recent years, the role of women is becoming more important and there are more families that have female

household heads. At the same time, increased schooling contributes to raise educational attainment levels in Vietnam (Anh et al, 1998). These results contribute in explaining increasing of milk product consumption in Vietnamese families.

Meanwhile, the age of the household head is not significant in determining participation but has significant and positive effects on expenditure on dairy products sector. These results reflect important characteristics of household heads' variables in dairy products' consumption patterns in Vietnam.

The ethnic variable has a significant effect on both market participation and how much the families spend for milk products. Vietnam has a total of 54 ethnics groups that live in the whole country. Still, Kinh ethnic (Vietnamese) is with a share of 87% the largest ethnic category in Vietnam (GSO, 2013). The result suggests that being a Kinh's family, increases the probability of milk products consumption by 17.5% compared with being an ethnic minority family. Moreover, the results show that in Kinh' households spent more than ethnic minority families by 53.2% on conditional level and 45.3% on unconditional level. We suppose that this is caused by most ethnic minority households' residence in mountain areas where transportation and market access is difficult – an influence not captured by the urban and regional dummies. In addition, differences in living standards might be reflected that are not capture in the income variable.

Children variables show the difference between age groups of children in the families. Variables of the children have been found to be positive and statically significant in both equations and effects of children variables are also positive. In particular, effects of young children (below 7 years old) are 33.8% on the probability of participation, and more than 100% on both conditional and unconditional level. It is the same trend with older children on the probability of market participation or conditional level and unconditional level, i.e. that dairy products are consumed more in families having children, especially in families that have children aged below 7 years old. This result indicates that children variables, especially infants, are important to explain milk consumption patterns in Vietnam.

We also found significant differences in milk expenditure across regions. For example, the probability of participation of the households that live in Northern midland and mountain areas are negative, i.e. that the probability of participation in dairy markets in Northern midland and mountain areas is lower than in the Red river delta. In the meanwhile, probability of dairy consumption of families in other areas is higher than in the Red river delta. The results of expenditure equation shows that Northern midland and mountain areas and North Central area and Central coastal area spent less than in Red river delta, while families that live in South East tend to spend more on milk products than others. South East is also the place where the biggest city of Vietnam is located (Ho Chi Minh City). The result also shows that there is no significant difference between dairy expenditure in households in Central highlands and Mekong river delta. Above differences are due to differences in the social-economic situation and other variables not included in our models.

Conclusions

In micro-data, zero observations are common and theoretical and empirical models with the dependent variable truncated at zero have continued to increase (Yen and Jose, 1997, Yen and Huang, 1996,). The present study utilizes a Double-Hurdle model to analyze the effects of social and demographic variables on the Vietnamese households' decisions on whether to consume dairy products and their levels of expenditure.

The study has explained households' behavior in participating in milk markets or not, assuming that some reasons for not consuming milk products are socio-economic, demographic and geographic variables. For long time, rising income is still expected to increase expenditure on milk products. This outcome is consistent with previous dairy

consumption behavior research by Dong (2006) who suggested that income growth is expected to boost milk product demand in Asian countries.

The result also suggests that most individual social demographic factors play a key role in determining both the probability of participation and the amount spent for dairy products. Household characteristics are found to be significant in affecting dairy products' expenditure. For instance, urban households, female-headed households, and households with children, all have a greater preference than other households as illustrated in their expenditure patterns on dairy products. Age and education have positive effects on the probability of consumption and quantity of products consumed.

The results of this study help to understand how the changing socio-economics and demographics of the Vietnamese population impacts on households' dairy products expenditure. This understanding may help policy makers to implement policies related to the dairy industry, healthy nutrition and national food security. Especially, policies should concentrate on food redistributing between the rich and the poor, areas and ethnic groups (Phuong et al., 2014). The results also are useful for dairy products marketers in planning and developing strategies, because they will understand the influence of household characteristics on the decision if products are consumed and how much is consumed.

According to US department of Agriculture, "Vietnam's dairy market is rich with opportunities" due to growing population with a rapidly increasing income per capita and the number of women who join the workforce has increased, led to an increase in bottle feeding (Agrimoney, 2011; Industrysourcing, 2012). This has created the good opportunity for domestic producers and importers in participating and promoting their business in Vietnam's market.

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