Asian Journal of Agriculture and Rural Development

journal homepage: http://aessweb.com/journal-detail.php?id=5005

# Effects of Socio-economic and Demographic Variables on Meat Consumption in Vietnam

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## Abstract

This study relates social-demographic characteristics of Vietnamese households to their consumption of meat. Pork and poultry constitute the majority of meat consumed in Vietnamese households. Hence, pork and poultry consumption have great influence on the total amount of meat consumed. Increasing pork and poultry consumption has strongly contributed to the total meat consumption growth. Tobit models are estimated drawing on the latest Vietnamese Household Living Standard Survey in 2010. The analysis of demand for pork and poultry in Vietnamese households demonstrates that meat demand in Vietnam is significantly affected by socio-economic and demographic factors of households. Understanding meat consumption patterns will help the Vietnamese government to implement policies to ensure food security. The policies may affect food redistribution between rural and urban areas, ethnic groups, the poor and the rich. In addition, food firms who wish to invest in the food market in Vietnam have to understand meat consumption patterns and meat demand to develop suitable business strategies and thereby contribute to increasing food security. This opens possibilities for domestic meat supply chains like feed producers and other livestock input suppliers, agricultural producers, processors, traders and the retail sector to take advantage of this dynamic markets sector.

**Keywords:** Vietnam, meat consumption, household consumption, Tobit model, VHLSS

## Introduction

Worldwide, meat consumption has attracted much attention of study for nutritionists but also agricultural and food economists in recent years (Schroeter *et al.*, 2013; Ishdorj *et al.*, 2013; Mergenthaler *et al.*, 2009; Rae, 1999). Reasons are that changing meat consumption patterns have effects on the nutritional and health status of people but also on different food markets and the involved supply chain actors. Growing meat consumption also impacts indirectly

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on other food markets via higher demand for animal feeds and thus having an impact on food prices and food security. Much of previous research on meat consumption has provided a better understanding of how meat demand responds to changes in price, income but also socio-demographic variables. Rae (1998) studied the effect of expenditure growth and urbanization on food consumption in East Asia, in particular in the case of animal products. Delgado *et al.* (1999) used data of 78 developing and developed countries to illustrate how per capita meat consumption increases with increasing per capita income. Bansback (1995), Huston (1999) argued that non-economic factors have been becoming more important in recent years in meat consumption patterns while Garcia-Jimenez and Mishra (2011) analyzed socio-economic factors using Probit regressions to find major factor**s** influencing the decisions to purchase meat products in U.S. consumer market. Mejia and Peel (2012) estimated the effects of demographic variables and income variable**s** on the demand for cereals and meat in Mexico.

Vietnam is one of the developing countries with considerable changes in meat consumption patterns. Annual GDP has achieved a comparatively high growth rate of approximately 6% over the last years. Income per capita has increased rapidly over the last two decades (GSO, 2013). There are nearly 87 million people in Vietnam making up about 26 million households (GSO, 2013). In terms of expenditure, meat is one of the most important food groups consumed as families spent 20.9% of their food expenditure for meat. And pork is the most popular meat consumed by Vietnamese households, followed by poultry. Furthermore, meat demand, especially for pork and poultry, has been rapidly increasing (Tisdell, 2009) and Vietnam's demand for meat has grown more rapidly than the domestic production. This has resulted in the real price for pork's rapid rise over the last years. Vietnamese's strong and persistent preference for fresh pork (Lapar *et al.*, 2009; Tisdell, 2010) has made it difficult for imported pork to fulfill the shortfall. In addition, the meat and poultry industry is positioned as one of Vietnam's most important manu-facturing industries. In 2010, livestock husbandry has contributed about 23% of total agricultural products (GSO, 2011). So understanding meat demand is important for Vietnamese producers, traders and agricultural policy makers. Investigating pork and poultry consumption and their determinants in Vietnam provides insights that might apply to other countries being on a similar path of economic, social and cultural transformation.

In Vietnam, several studies on household's consumption have been conducted by using the Vietnam Household Living Standard Survey (VHLSS). Minot and Goletti (2000) used data from 1998 to estimate household food demand in Vietnam. Dien *et al.* (2004) investigated Vietnamese food consumption patterns and examined how food was influenced by the demographic and socio-economic status of Vietnamese based on VLSS 1998. Thang and Popkin (2004) utilized data from 1993 and 1998 to analyze the change in food consumption. Le (2008) investigated food consumption in VHLSS 2004 data. Hoang (2009) used data of VHLSS 2008 to analyze food consumption patterns of Vietnamese households. While these studies analyzed food consumption in general based on previous rounds of the VLSS, no specific attention was given to the growing importance of meat consumption.

The major objective of this study is to analyze the consumption patterns of pork and poultry in Vietnam based on the most recently available data of the Vietnamese

VHLSS 2010 and to assess the viability of this data source for meat consumption analysis.

**Income and meat expenditure in Vietnam**

According to data of GSO, the national, monthly average income per capita in current prices is nearly 1.39 million VND in 2010, an increase of 39.4% in comparison to 2008. Real income (income which is controlled for price changes) in the period 2008-2010 increased 9.3% per year. This increase is higher than the real income increase of 8.4% per year in the period 2006-2008, 6.2% in the period 2004-2006, but lower than the increase of 10.7% in the period 2002-2004. The rise in household income in 2010 was mainly due to an increase in salaries, wages, self-employment in the construction; in addition self-employment in the trade in rural areas (GSO, 2012). Especially, the income per capita of the richest group increased approximately four times over the period from 2002 to 2010. The poorest group's income started from a low level and grew three times in the considered time period. These results show that the income gap between rich and poor has widened (Figure 1).

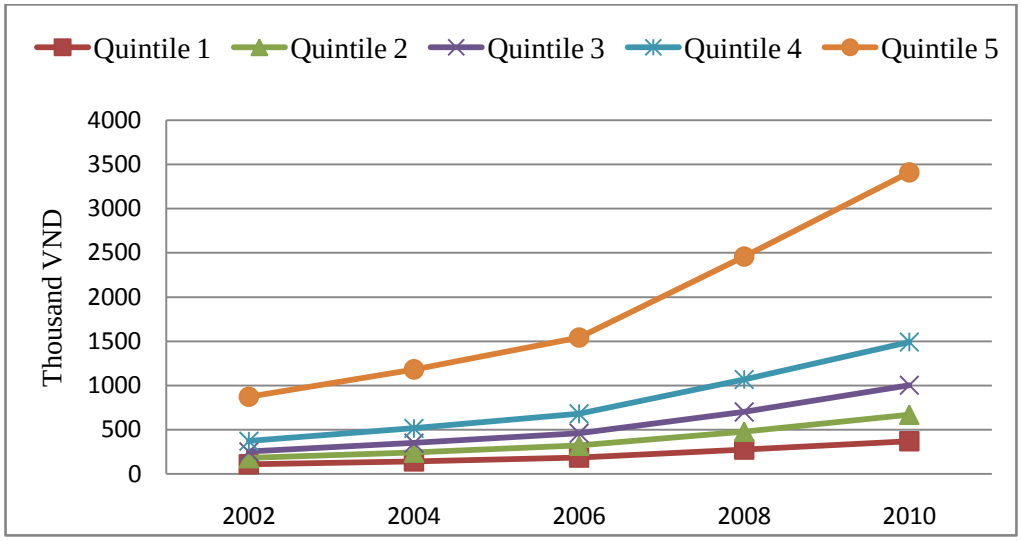



**Figure 1: Monthly income per capita by quintile (thousand VND)**
**Note:** Exchange rate on 1st Dec. 2010, Ministry of Finance, Vietnam (1 USD = 18.932 VND)
**Source:** VHLSS, 2002-2010

In 2010, the monthly average expenditure per capita across the nation in current prices rose to 1.21 million VND, increasing 52.8% in comparison to 2008, and the annual increase was 23.6% (GSO, 2012). Vietnamese households spend a considerable proportion of their income on food consumption. Basic foods (e.g. rice, salt, sugar, vegetable, meat, oil, and sauces) account for more than half of total food expenditures of the households. In particular, households in rural areas have a higher share of food expenditure (58%) than those in urban areas (47%) as can be seen in figure 2. More importantly, it is indicated from the results in figure 3 that the share of meat in food expenditure of both rural and urban families are approximately 21% on average. This implies that Vietnamese households spend a considerable amount on meat.

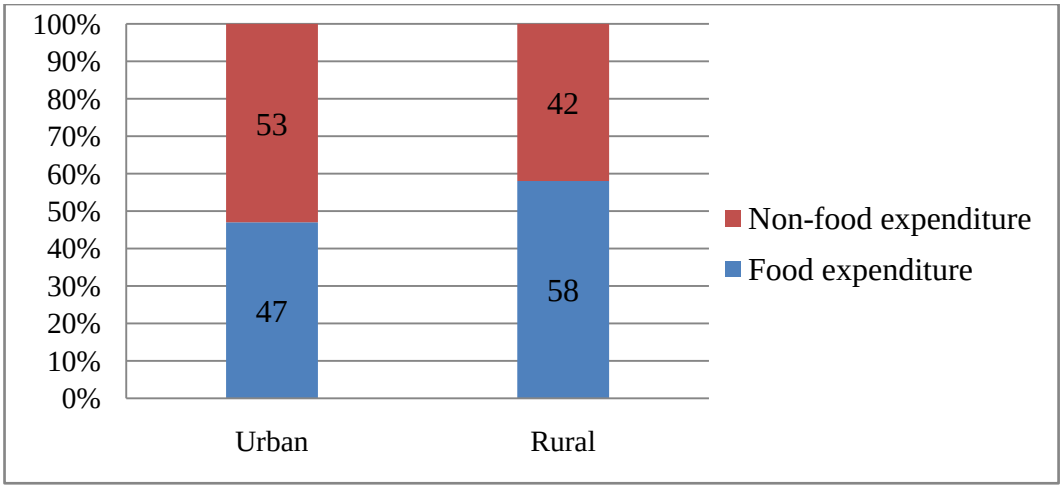
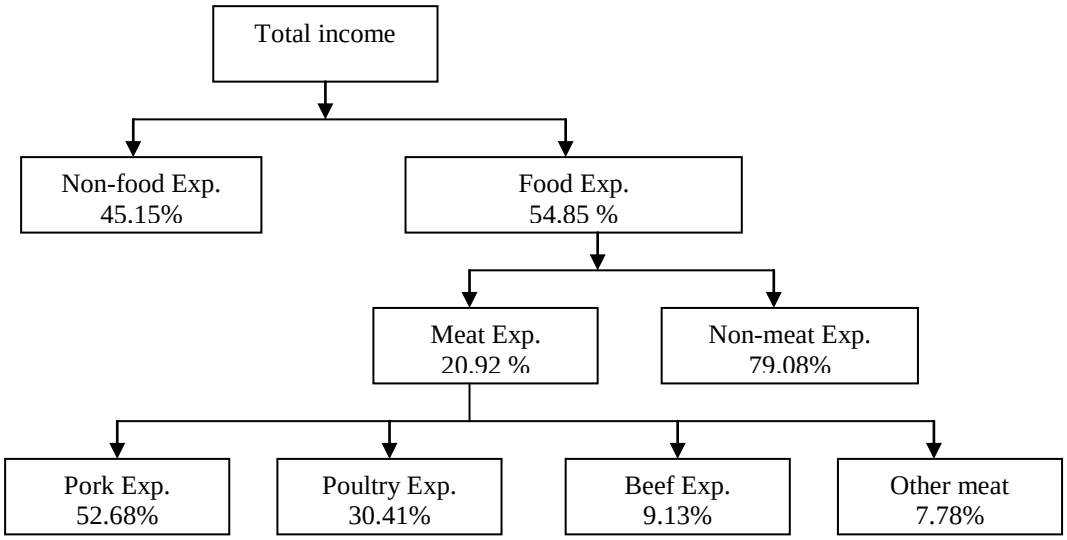



**Figure 2: Share of household's income spent on food in urban and rural**
**Source:** VHLSS, 2010

Figure 3 shows household expenditure food share in total income. It also summarizes the share meat consumed in total meat expenditure. Nationally, in average Vietnamese families spent 54.85% of their income on food. Like many other countries in the world, pork is still the most widely spread meat consumed in Vietnamese families (52.6%), followed by poultry and to a much lesser degree by beef. This number is higher than the pork's share of world meat consumption (43.4%) (Barnard, 2005) and emphasizes the importance of this meat type in Vietnam. Furthermore, the percentages of beef and processed meat consumed are low compared to pork and poultry.




**Source:** VHLSS 2010
**Figure 3: Household expenditure share in Vietnam**

Table 1 show that almost all Vietnamese households consume pork (99.6%) and poultry (94.7%), whereas only 52.4% of households consume beef. This is different compared to meat consumption in many other parts of the world where beef has been the second most important type of meat being consumed since 1980 after being overtaken by pork (Barnard, 2005). At the same time, households reporting zero-consumption of processed meat such as grilled chopped meat, traditional sausage, grilled meat, etc. and other meat types are 36% and 85% respectively. This clearly shows that pork and poultry are the most important meat types consumed in Vietnamese households.

**Table 1: Share of households consuming meat surveyed in VHLSS 2010 (in %)**

| Pork | Poultry | Beef | Processed meat | Other meat |
|---|---|---|---|---|
| 99.6 | 94.7 | 52.4 | 63.8 | 15.1 |

**Source**: VHLSS, 2010

**Meat consumption in Vietnam over time**

Rapid income growth, urbanization and globalization have led to considerable changes of Asian food consumption patterns. The Westernization of Asian countries' diets is characterized by less calorie intake from rice and more from meat and dairy products, fruits and vegetables (Pingali, 2007). It is well known that aggregate meat supply has reached a higher level over the last 2 decades. Since 1990, meat consumption per person in Vietnam has increased. Especially in the 2000s, the average supply per capita of meat in Vietnam has increased faster than in the region and the world. It was approximately 20 kg/capita/year in 1999 and after 10 years this number increased to nearly 50 kg/capita/year in 2009. Although this number is higher than the average supply of other South-Eastern Asian countries and the world, it is still lower than in some countries in the region such as China (58.2 kg/person/year) and Malaysia (52.3 kg/person/year) (FAOSTAT, 2013).

Figure 4&5 compare average pork and poultry supply in Vietnam, South Eastern Asia and the world. Pork supply per capita of South Eastern Asia and the world has increased steadily during the analyzed period of the years 1990 - 2009. However, unlike that trend, pig meat supply per capita in Vietnam has increased rapidly since the 1980s, especially in last decades. On the other hand, starting at low level in 1990, per capita poultry supply in the world and South Eastern Asia increased steadily and faster than pork, while Vietnamese poultry consumption increased slightly in the period 1990-1998 and then has risen fast since 1999 up to now. Especially from 2006 to 2009, poultry consumption doubled to 10.2 kg/person/year. Slight decreases occurred in the years 2004, 2005 when Vietnam was affected by avian flu (bird flu).

Poultry consumption rebounded in 2006. Comparing with the average of the region and the world, the Vietnamese have eaten less poultry. However, especially since 2006 Vietnam's poultry supply per capita has increased rapidly, has almost caught up with South Eastern Asia and is on a trend closing the gap to the average per capita consumption in the world.

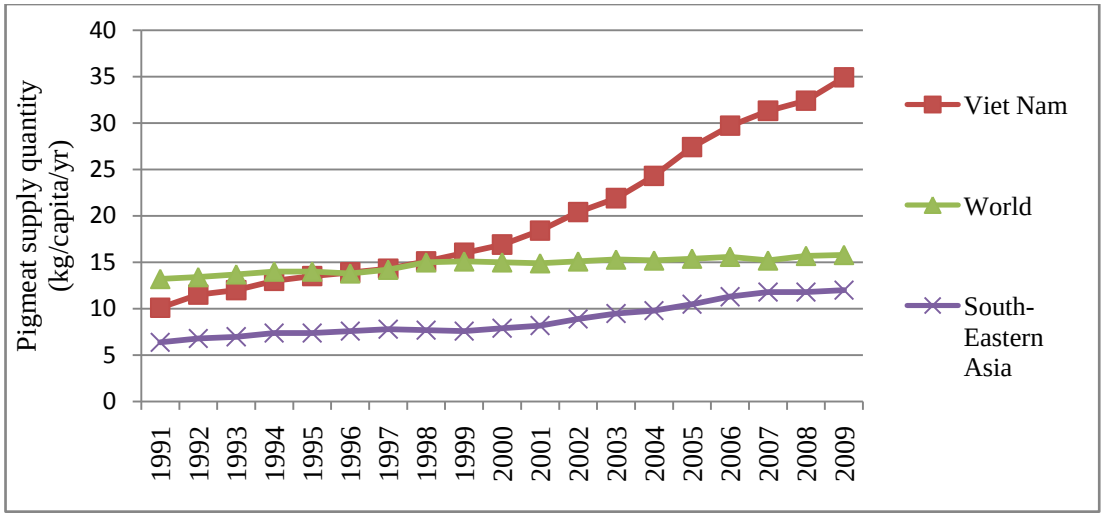



**Figure 4: Annual per capita pork supply quality of Vietnam, the world and South Eastern Asia, 1990-2009**
**Source:** FAOSTAT, 2013

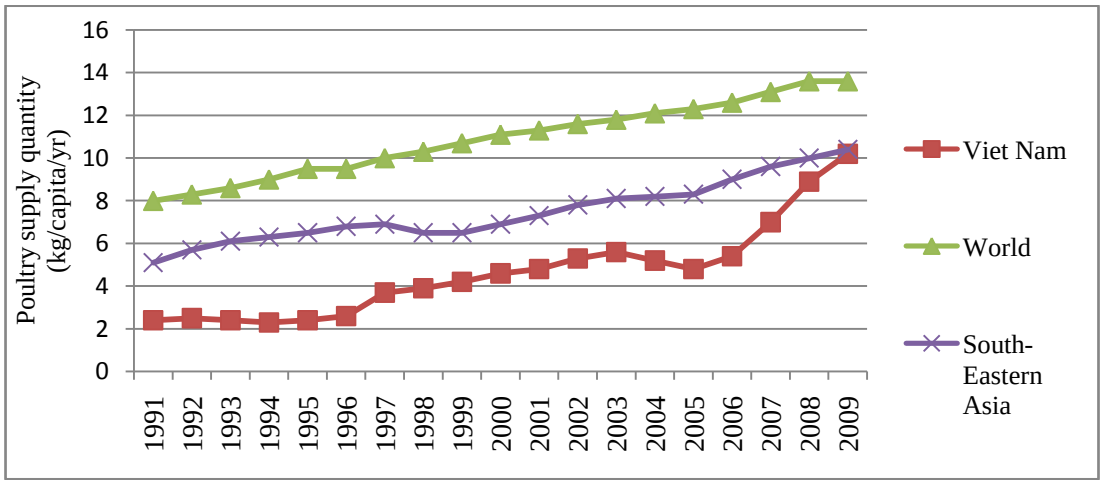



**Figure 5: Annual per capita poultry supply quality of Vietnam, the world and South Eastern Asia, 1990-2009**
**Source:** FAOSTAT, 2013

## Data

Food demand can be analyzed based on either time-series data or cross-sectional data with consumer or household surveys. However in many developing countries, reliable time-series data on consumption and demand is limited. In contrast, there are many household consumption surveys conducted in these countries. Using household survey data to analyze food consumption patterns has been increasingly employed over the last years (e.g. Reynolds, 1990; Yen and Jones, 1997; Newman *et al*., 2003; Hoang, 2009; Zhang and Goddard, 2010; Mejia and Peel, 2012).

The data analyzed in this study is from the Vietnamese Household Living Standard Survey (VHLSS), which was conducted by the Vietnam General Statistical Office (GSO). VHLSS records the expenditure and quantities consumed of households for

certain products and product groups, as well as regional and socio-demographic characteristics such as income, region, size and composition of the household, and age of household members.

The model used in this paper is based on data from VHLSS 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).

To provide a context for the regression results in the next section, this section shows a series of descriptive statistics on household's characteristics as well as pork and poultry consumption over the years surveyed for the difference area groups.

Based on the result of VHLSS in 2010, an independent - samples T-test was conducted to compare socio-economic factors and demographic factors in rural and urban Vietnam. The result of the T-test shows that the difference in two groups' means is statistically significant with P-value at 1%. The number of people who live in urban families is less than in rural families. In particular, age of rural household heads' is lower than in urban areas due to the lower wedding age in rural than urban areas. Furthermore, urban household head's education is higher than in rural areas. Income in urban households is always more than nearly twice as high as in rural households. On average, the income per person of urban households is 27.09 million VND per year, while this figure for rural families is 14.79 million VND per year (table 2).

**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 |
| Age of household head | 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 |
| Annual total income per person | million VND | 27.09 | 26.12 | 14.79 | 38.48 | 12.82 | .000 |

**Source:** Based on VHLSS 2010 (GSO)

Quantity of pork and poultry consumption per person per year by income quintiles in 2010 is shown in table 3. The difference between income quintiles in consuming meat is pronounced: the quantity of pork and poultry consumption increases with income quintiles. Per capita pork consumption in the richest quintile is more than twice as much as in the poorest quintile. While, on average a person in the richest quintile ate 3 times more poultry than persons in the poorest quintile (table 3). These results give a first indication that income growth is a major driver of increasing meat consumption in Vietnam.

**Table 3: Quantity of meat consumption per capita per year by quintile income 2010**

| Income groups | Pork consumption | | Poultry consumption | |
|---|---|---|---|---|
| | Mean (Kg per capita) | SD | Mean (Kg per capita) | SD |
| Quintile 1 | 8.71 | 7.34 | 4.31 | 5.94 |
| Quintile 2 | 11.87 | 8.93 | 5.98 | 6.65 |
| Quintile 3 | 13.59 | 9.76 | 7.77 | 7.68 |
| Quintile 4 | 15.69 | 11.17 | 9.51 | 9.68 |
| Quintile 5 | 17.78 | 12.70 | 12.08 | 10.32 |

**Source:** Based on VHLSS 2010 (GSO)

**Econometric model**

It is noticeable that most Vietnamese household consume pork and poultry for their daily meal. However, with cross-sectional data in VHLSS 2010, there is a considerable number of households that do not consume meat, particularly no poultry. Hence, there is a large number of zeros in the dataset. Using ordinary least square (OLS) estimates to model household meat consumption is biased toward zero (Greene, 2002). Therefore, one method to deal with both zero and non-zero values of the dependent variable is to employ a Tobit model.

The maximum likelihood estimation of censored regression models has been named 'Tobit' after Tobin (1958). The Tobit model has been widely employed to estimate expenditure and consumption with censored data (e. g. Tobin, 1958; Melenberg and Soest, 1996; Song et al, 2012). The Tobit model can be specified as follows:

$$y_i^* = x_i'\beta + u_i, \quad \text{i= 1, 2, 3,..., N}$$
$$y_i = y_i^* \quad \text{if } y_i^* > 0$$
$$= 0 \quad \text{if } y_i^* \le 0$$

Where, N is the number of observations, $y_i$ is the dependent variable, $x_i$ is a vector of independent variables, $\beta$ is a vector of unknown coefficients, and $u_i$ is error term that is assumed to be independently normally distributed with zero mean and constant variance $\sigma^2$. Thus the model assumes that $y^*$ is observed only when it is positive, otherwise values of $y^*$ less than zero are unobserved, hence, $y_i$ is censored at zero.

The log likelihood function of the standard Tobit model is given by:

$$\text{Log (L)} = \sum_o log\left(1 - \boldsymbol{\Phi}_i(w)\right) - \frac{1}{2} \sum_1 2\pi \frac{1}{2} \sum_1 log(\sigma^2) - \sum_1 \frac{(y_i - x_i\beta)^2}{\sigma^2}$$

Where $\Phi$ is the standard normal distribution function evaluated at $W_i = \frac{x_i\beta}{\sigma}$.

Meat consumption is potentially influenced by factors such as demographic characteristics and household structure (Verbeke *et al.*, 2000; Reynolds-Zayak, 2004; Zhang and Goddard, 2010). In particular, in demand analysis with cross-sectional household budget data it was found that household size and composition have a significant impact on food consumption (George and King, 1971; Thiele and Weiss, 2003, Moon *et al.*, 2010). Household size is also expected to have impact on meat consumption as household size includes children, economically active persons and retired people (old people). Many large households have more than one generation. Households that are larger and have different generations under one roof are expected to display a different

household behavior. Furthermore, household size also is expected to show economies of scale in consumption.

Knowledge and experience in food consumption and changing preferences lead to changes in choosing food products (Moon *et al.*, 2010). So education and age are expected to have an influence on meat consumption. The gender of the household head was found to impact on meat demand, too (Lazaridis, 2003). In addition, meat consumption is hypothesized to differ across geographic regions and ethnic groups because of differences in cultures and availability. And of course, household income is expected to be an important driver for the purchasing power of households. Age squared and income squared is included in the analysis to capture the possibility of a non-linear relationship between household head and meat consumption, income and meat consumption.

In several studies using cross-section household data, researchers assumed that prices are constant (Prais and Houthakker, 1955; George and King, 1971; cited in Cox and Wohlgenant, 1986). Since price information was not collected in the VHLSS, we treat the surveys as cross-sections and all of households are assumed to face the same price. Therefore prices are not included in the Tobit model.

**Table 4: Variables names, definition and descriptive statistics of data used for model estimation**

| Variable | Description | Sample mean | Standard deviation |
|---|---|---|---|
| $Y_1$ | Quantity of pork consumption (kg/capita/year) | 13.525 | 10.615 |
| $Ln(Y_1)$ | Natural logarithm of pork consumption | 2.247 | 1.015 |
| $Y_2$ | Quantity of poultry consumption (kg/capita/year) | 7.929 | 8.661 |
| $Ln(Y_2)$ | Natural logarithm of Quantity of poultry consumption | 1.360 | 1.511 |
| Hsize | 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 minority | Ethnic minority equals one if minority and zero otherwise (Vietnamesse or Kinh) | 0.821 | |
| Age | Age of household head | 48.345 | 14.245 |
| Age2 | Age square | 2540.178 | 1505.398 |
| Edu | Years of schooling of household head | 7.142 | 3.732 |
| Income | Per capita annual income of household ('100 million VND) | 0.183 | 0.359 |
| Income2 | Income squared | 0.162 | 8.604 |
| $REG_{ij}$ | 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)

The demand equation can be written as:

$$\text{Ln}(Y_i) = \beta_0 + \beta_{i1}\,\text{Hsize} + \beta_{i2}\,\text{Urban} + \beta_{i3}\,\text{Female} + \beta_{i4}\,\text{Ethnic} + \beta_{i5}\,\text{Age} + \beta_{i6}\,\text{Age2} + \beta_{i7}\,\text{Edu} + \beta_{i8}\,\text{Income} + \beta_{i9}\,\text{Income2} + \sum_{j=2}^{6}\beta_{ij9}\,\text{Reg}_{ij}$$

Where Y is the quantity of meat consumed by household i; Urban is a binary variable indicating the location of household in an urban area (rural as reference). Hsize denotes number of members in the household. Female and Age denote the gender and age of household head respectively; Ethnic denotes if the household belongs to an ethnic minority in Vietnam. Edu represents years of schooling of the household head; Income denotes income per capita per year of households; Reg denotes the geographic location of households. It is included as zero-one dummy variables for the 6 regions of Vietnam (Red river delta, Northern midland and mountain area, North Central area and Central coastal area, Central highlands, South East, Mekong river delta). Particular information about variables is described in table 4.

One of the major econometric problems in modeling household consumption is that households might not consume some kinds of food during the survey period. In the models, we work with values of the natural logarithm pork and poultry consumption as the dependent variables. These variables are originally set to missing if these are zero consumption. So they need to be set to non-missing values to run the Tobit model. We set all censored observations of pork and poultry consumption to very small value that is smaller than the minimum non-censored value of pork and poultry consumption. In this way, zero consumption data become left-censored observations.

The interpretation of the model is different in the alternative variables of the model: (1) for continuous variables in the form $\ln(y) = \beta_0 + \beta_1 x + \varepsilon$, $\beta_1$ is interpreted as a one unit change in x will cause $\beta_1$ (100)% change in y. (2) for dummy variables in the form $\ln(y) = \beta_0 + \beta_1 x + \varepsilon$, $\beta_1$ is interpreted as the value of y is approximately $\beta_1(100)\%$ than base variable.

## Regression results

To identify the factors affecting pork and poultry consumption, two demand functions were estimated and the results are presented in table 5. The table summarizes the parameter estimates of the Tobit model for household's pork and poultry consumption. The results are consistent with prior expectations concerning household's characteristics for almost all coefficients. Almost all coefficients are significant at the 0.01 and 0.05 level.

**Table 5: Estimated Tobit model of pork and poultry consumption**

| Variables | Pork | Poultry |
|---|---|---|
| Intercept | 1.758*** | 0.075 |
| | (0.108) | (0.167) |
| Income | 0.551*** | 1.337*** |
| | (0.058) | (0.090) |
| Income squared | -0.020*** | -0.046*** |
| | (0.002) | (0.004) |
| HHsize | -0.091*** | -0.042*** |
| | (0.007) | (0.010) |
| Edu | 0.034*** | 0.079*** |
| | (0.003) | (0.005) |
| Female | -0.057** | -0.078** |
| | (0.024) | (0.037) |
| Ethnic minority | -0.186*** | -0.202*** |
| | (0.032) | (0.050) |
| Age | 0.027*** | 0.037*** |
| | (0.004) | (0.006) |
| Age squared | -0.0002*** | -0.0003*** |
| | (0.000) | (0.000) |
| Urban | 0.028 | -0.050 |
| | (0.024) | (0.037) |
| Northern midland and mountain areas | 0.215*** | 0.153*** |
| | (0.036) | (0.056) |
| North Central area and Central coastal area | -0.405*** | -0.896*** |
| | (0.030) | (0.047) |
| Central highlands | -0.359*** | -0.489*** |
| | (0.044) | (0.068) |
| South east | -0.469*** | -0.443*** |
| | (0.036) | (0.056) |
| Mekong river delta | -0.546*** | -0.448*** |
| | (0.032) | (0.049) |
| Log likelihood : | -12857.9 | -16779.2 |
| LR chi2(12) : | 1520.25 | 1545.14 |
| Prob > chi2 : | 0.000 | 0.000 |
| Pseudo R2 : | 0.0558 | 0.044 |
| No. of left-censored observations: | 90 | 499 |
| No. of uncensored observations : | 9312 | 8903 |

**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. Standard errors are in parentheses.

**Source:** Based on VHLSS 2010 (GSO)

There are several clear results from the pork and poultry analysis. Table 5 clearly indicates that the coefficients of income appear to be positive and significant at 1%. In the second place, the parameters of income squared are clearly negative and again significant at 1%. So the results suggest that meat consumption is a nonlinear function of income. We have log of pork and poultry consumption

increasing with income, but at a decreasing rate that we have decreasing returns. In particular, the coefficients of income and income squared are 0.551 and -0.020 in the pork consumption model and 1.337 and 0.046 in the poultry model, respectively that means that quantity of pork and poultry consumption seems to follow a growing trend with a steep slope for low income value. As income increases, the slope turns more gently until an annual per capita income of 1.378 billion VND with pork and 1.453 billion VND with poultry, from that moment a continuous fall can be seen. In fact, the mean per capita annual income is 16.68 million VND that is very small compared to the numbers 1.378 billion VND and 1.453 billion VND. So if continued income growth is assumed for the future the meat consumption can expect further growth induced by income growth. Only at very high income levels, meat consumption would start to decrease.

With respect to household characteristics, it can be seen that a negative impact of household size is found in the models, i.e. the quantity of both pork and poultry consumed decreases by 9.1 % for pork and 4.2 % for poultry if household size increases by 1 person. The negative impact that was expected for the coefficient of household size indicates economies of scale in consumption (Reynolds, 1990), i.e. when the number of people in households increase, meat consumption per capita will be reduced. According to data of VHLSS from 2002 to 2010, the average number of people in families has decreased from 4.44 persons per household in the year 2002 to 3.89 people/household in the year 2010. Therefore continued household and family restructuring could contribute to increased demand for pork and poultry as smaller household consume more meat on a per capita basis.

In addition, the model results suggest that pork and poultry consumption are influenced by other socio-demographic characteristics. Factors such as household head's education and gender were found to have significant impacts on pork and poultry consumption.

In particular, the education level is positively related to pork and poultry demand. This means that households where the head has a higher education level tend to have higher meat consumption. Consumption per person increases by 7.9% for poultry and 3.4% for pork when household head's education increases by one year. These findings are contrary with results of Su and Yen (1996) and Newman *et al*. (2003) who found a negative relationship between education and US pork consumption and between education and Irish prepared meals expenditure, respectively indicating major differences in meat consumption patterns between developed countries and an emerging country like Vietnam. Moreover, the negative coefficient of female heads reflects that households with female heads consume less pork and poultry than other households. Concerning the household's ethnicity, families that are Vietnamese consume more pork and poultry than ethnic minority families. We suppose that this is caused by the differences in culture (Hai, 2010).

However, the regressions model also include, along with age, an age squared term which turned out to be significant. The results are suggestive of nonlinear function and imply that per capita pork and poultry consumption seems to increase with a steep slope for young household heads. As in households that have older heads, the slope turns gentler until the age of household heads of 67.5 year old with pork consumption and 61.7 year old with poultry consumption, from that point, quantity of pork and poultry

consumption decreased with the higher age of household heads.

It is surprising that parameter estimations of urban in both equations are not significant. It means that there is no statistically significant difference between urban and rural households in pork and poultry consumption. This indicates that there are no significant differences in pork and poultry consumption between rural and urban areas in Vietnam and that differences that might be observable in simple comparisons can be attributed to the factors that we included in our models as described above, i.e. it is not urbanization per se that drives the increasing amounts of meat consumption but rather the accompanying socio-economic and demographic changes.

Finally, we find significant differences between six regions of the country. With the Red river delta region being the base variable, the results show that there is a significant difference between the Red river delta region and other regions of the country. In particular, the coefficients for the dummy Northern midland and mountain areas mean that these households consume 20% more pork and 15.3% more poultry than households in the Red river delta. The negative signs of the other dummy regional variables are in contrast. Especially, households that live in the Mekong river delta consume 54.6% less pork compared to households in the Red river delta. Households that are located in the North Central area and the Central coastal area consume less poultry. The coefficients indicate that per capita poultry consumption of households is 89.6 % less than in the Red river delta. Possible reason of this fact may be differences of culture and differences in the social-economic situation not covered by the other variables included in our models.

## Conclusion

Vietnam's economy has been developing rapidly over the last two decades and Vietnamese diet patterns have changed. Vietnam's meat consumption has become more important. The focus of this study has been an attempt to better understand meat consumption patterns in Vietnam. The article presents analyses of descriptive statistics of pork and poultry consumption by demographic groups. Two Tobit models for pork and poultry consumption have been estimated. The analysis of demand for pork and poultry in Vietnamese households demonstrates that meat demand in Vietnam is impacted by many factors. The econometric results indicate that pork and poultry are necessity goods in Vietnam and socio-economic, demographic and geographic variables are important indicators of future Vietnamese meat consumption.

The study results show that for a long time, rising income is still one of the major determinants which had impacts on increasing meat consumption in Vietnam. Increasing incomes have resulted in a higher demand for meat products. The average meat consumption per capita in Vietnam is about 40kg per year and is projected to increase to 57kg per capita by 2020 (GSO, 2010). The study findings also suggest that the per capita meat consumptions with different demographic variables of the household sample show an increasing trend of meat consumption per capita with respect to household size where households' structure have been changing household size has been decreasing over the years (GSO, 2010).

The change in food consumption occurs for the whole country (cf. Thang and Popkin, 2004). This has implications for Vietnamese policy makers but also private actors in meat supply chains. The structure of meat consumption is different among poor and rich, female and male headed

households, and minorities and Vietnamese (Kinh) ethnic groups. Understanding meat consumption patterns will help policy makers to implement measures to ensure food security. These policies may be based on food redistribution between different areas, ethnic groups, the poor and the rich. Improvement of infrastructure, especially the transportation system can support production and exchanges between regions. In addition, food firms who wish to invest in the food market in Vietnam have to understand meat consumption patterns and meat demand to develop suitable business strategies and thereby contribute to increasing food security. Indeed the growing shortfall in Vietnam's domestic supply of meat has resulted in opportunities for foreign exporters. However, the preference of Vietnamese consumers for fresh (i.e. warm) meat has become a barrier for meat imports into Vietnam. This opens possibilities for domestic meat supply chains like feed manufacturers and other livestock input suppliers, agricultural producers, processors, traders and the retail sector to take advantage of this dynamic markets sector.

## Reference


Ishdorj, A., Crepinsek, M. K., & H. H. Jensen (2013). Children's consumption of fruits and vegetables: Do School Environment and policies affect choices at school and away from school? *Appl. Econ. Perspect*, 35(2), 341-359.

Barnard, P. (2005). *Global trends in the Beef Industry*, Presentation at the Northern Cape red meat producer's organization. Upington, South Africa, March 8.

Bansback, B. (1995). Towards a broader understanding of meat demand. *Journal of Agricultural economics*, 46(3), 287-308.

Cox, T. L., & M. K. Wohlgenant (1986). Prices and quality effects in cross-sectional demand analysis. *American journal of agricultural economics*, 68, 908-919.

Schroeter, C. S. A., & Carlson (2013). The economics of health and vitamin consumption. *Appl Econ. Perspect*, 35(1), 125-149.

Delgado, C., M. Rosengrant, H. Steinfield, S. E., & C. Courbois (1999). *Livestock to 2020: The next revolution*. Food, Agriculture and the environment discussion paper, 28, International food policy research institute, Washington DC.

Dien, L. N., Thang, N. M., & M. E. Bentley (2004). Food consumption patterns in the economic transition in Vietnam. *Asia pacific journal clinical nutrition*, 13(1), 40-47.

FAOSTAT (2013). Different databases. Accessed March 2013.

Garcia-Jimenez, C. I., & A. K. Mishra (2011). Determinants of meat purchasing Behavior by Ethnic Groups. *Journal of food distribution research*, 42(3), 96-105.

General Statistics Office of Vietnam (GSO) (2010, 2011, 2012, 2013). Different databases. Accessed March 2013.

George, P. S., & G. A. King (1971). *Consumer demand for food commodities in the United States with projections for 1980.* Giannini Foundation Monograph No. 26, University of California, Berkeley.

Hai, A. D. (2010). *Vietnam - A widening poverty gap for ethnic minorities.* Indigenous peoples, poverty and development. Research dissemination workshop. Dec. 20. 2010. Washington DC.

Hoang, L. V. (2009). *Estimation of food demand from household survey*

*data in Vietnam.* DEPOCN working paper series No. 2009/12, Institute of policy and strategy for agriculture and rural development.

Huston, J. L. (1999). Beef marketing challenges in the US. *IMS Newsletter*, No. 207, March 31.

Lapar L., Toan, N. N., Que, N. N., Jabbar M., Tisdell, C. A., & S. Staal (2009). *Market outlet choices in the context of changing demand for fresh meat: Implications for smallholder inclusion in pork supply chain in Vietnam*. Paper presented at the 27th triennial conference of the International Association of Agricultural Economists, Beijing, China, 16-22 August, 2009.

Lazaridis, P. (2003). Household meat demand in Greece: A demand systems approach using micro data. *Agribusiness*, 19(1), 43–59.

Le, C. Q. (2008). An empirical study of food demand in Vietnam." *Journal of Southeast Asian Economies*, 25(3), 283-292.

Melenberg, B., & A. V. Soest (1996). Parametric and semi-parametric modelling of vacation expenditures. *Journal of applied econometrics*, 11(1), 59-76.

Mergenthaler, M., Weinberger K., & M. Qaim (2009). Consumer valuation of food quality and food safety attributes in Vietnam. *Appl. Econ. Perspect*, 31(2), 266-283.

Mejia M., & D. S. Peel (2012). Modeling Household Preferences for Cereals and Meats in Mexico. *Journal of food distribution research*, 43(1), 59-64.

Minot, N., & F. Goleti (2000). *Rice market liberalization and poverty in Vietnam.* Research report 114, International food policy research institute, Washington D. C.

Moon, W., Florkowski, W. J., Beuchat, L. R., Resurreccion, A. V., Paraskova P., Jordanov, J., & M. S. Chinnan (2010). Demand for food variety in an emerging market economy. *Applied economics*, 34(5): 573-581.

Newman, C., Henchion, M., & A. Matthews (2003). A double-hurdle model of Irish household expendi ture on prepared meals. *Applied economics*, 35, 1053- 61.

Pingali, P. (2007). Westernization of Asian diets and the transformation of food systems: Implications for research and policy. *Food Policy*, 32(3), 281–298.

Prais, S. J., & H. S. Houthakker (1955). *The analysis of family budgets. Cambridge*: Cambridge University Press, 1955.

Rae, A. N. (1998). The effects of expenditure growth and urbanization on food consumption in East Asia: A Note on Animal Products. *Journal of the international association of agricultural economists*, 18(3), 291-299.

Rae, A. N. (1999). Food consumption patterns and nutrition in urban Java households: the discriminatory power of some socioeconomic variables. *Australian journal of agricultural and resource economics*, 43(3), 359-383.

Reynolds-Zayak, L. (2004). Under-standing consumer trends can present new opportunities. Agri-processing branch, business & innovation, Alberta agriculture, Food and rural development.

Reynolds, A. (1990). Analyzing fresh vegetable consumption from household survey data. Southern agricultural economics association, 22(02): 31-38.

Song, N., Aguilar, F. X., Shifley, S. R., & M. E. Goerndt (2012). Factors affecting wood energy consumption by U. S. households. *Energy economics*, 34, 389–397.

Su, S. J. B., & S. T. Yen (1996). Microeconometric models of infrequently purchased foods: an application to household pork consumption. *Empirical economics*, 21, 513-533.

Thang N. M., & B. M. Popkin (2004) Patterns of food consumption in Vietnam: effects on socioeconomic groups during an era of economic growth. *European journal clinical nutrition*, 58(1), 145-53.

Thiele, S., & C. Weiss (2003). Consumer demand for food diversity: evidence for Germany. *Food policy*, 28(2), 99-115.

Tisdell C. A. (2009). Trends in Vietnam's pork supply and structural features of its pig sector. *The open area studies journal*, 2, 52-64

Tisdell C. A. (2010). *The growing shortfall in Vietnam's domestic supply of pork: Significant research and policy findings from an ACIAR-sponsored Study and their Limitations*. Brisbane, Qld. School of economics, university of queensland, Working Paper No. 63

Tobin, J. (1958). Estimation of relationships for limited dependent variables. *Econometrica*, 26, 24–36.

Verbeke, W., Ward, R. W., & J. Viaene (2000). Probit analysis of fresh meat consumption in Belgium: Exploring BSE and television communication impact. *Agribusiness*, 16(2), 215-234.

Yen, S. T., & A. Jones (1997). Household consumption of cheese: An inverse hyperbolic sine double-hurdle model with dependent errors. *American journal of agricultural economics*, 79, 246-51.

Zhang, X. and E. Goddard (2010) *Analysis of value-added meat product choice behavior by Canadian households*. University of Alberta, Department of rural economy, Project report 10-04.