Preferences for high-value agricultural products in developing countries:

Demand analyses for livestock products in Vietnam.

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Kurzfassung

Präferenzen für hochwertige Agrarprodukte in Schwellenländern: Ergebnisse aus

Nachfrageanalysen für Produkte tierischer Herkunft in Vietnam.

Die vorliegende Arbeit analysiert in drei Artikeln die Nachfrage nach hochwertigen Agrarprodukten in Schwellenländern. Als Fallstudie wird das Land Vietnam betrachtet und das dort bestehende Verbraucherinteresse an Produkten tierischer Herkunft untersucht.

Die in Kapitel 2 verwendeten Daten basieren auf der vietnamesischen Haushalts- und Lebensstandarderhebung (VHLSS) aus 2010, in die 9.399 Haushalte einbezogen waren. Mithilfe verschiedener deskriptiver und ökonometrischer Methoden wurden die Ausgaben vietnamesischer Haushalte für Milchprodukte analysiert. Um die bestimmenden Faktoren der Kaufbereitschaft für Milchprodukte zu ermitteln, wurde das DoubleHurdle Modell angewendet - jeweils in Bezug auf die Entscheidung zur Marktteilnahme sowie zur Ausgabenhöhe.

Kapitel 3 verwendet neben den VHLSS-Daten aus 2010 zusätzlich Daten zum Fleischverbrauch. Auf Basis dieser Daten wurde unter Verwendung von Maximum-Likelihood-Schätzungen (MLE) und Censored-Regression-Modellen (Tobit-Modell) das Verbraucherverhalten in Bezug auf Schweine- und Geflügelfleisch in Vietnam untersucht.

Die Ergebnisse beider Artikel zeigen signifikante Zusammenhänge zwischen dem Verbrauch der beschriebenen Lebensmittelgruppen und den Merkmalen vietnamesischer Haushalte. Diese Merkmale beziehen sich auf sozioökonomische und demografische Daten der Untersuchungsobjekte. Die Ergebnisse bilden die Grundlage für eine Abschätzung der zu erwartenden zukünftigen Nachfrage nach Fleisch- und Milchprodukten in Vietnam und vergleichbaren Ländern. Globalisierung, wirtschaftliches Wachstum und Urbanisierung haben in den vergangenen Jahren zu erheblichen Veränderungen im Lebensmittelkonsum

geführt. Die vorgestellten Ergebnisse können der Politik eine Hilfestellung geben, die Lebensmittelversorgung der Bevölkerung zu sichern und die Lebensmittelverteilung zwischen städtischen und ländlichen Regionen zu verbessern. Dabei sind vor allem auch gesundheitliche Aspekte der Ernährung und der allgemeine Gesundheitsstatus der Bevölkerung, insbesondere in ärmeren Regionen, Thema für die Entscheidungsträger. Als besondere Herausforderung wird eine Verbesserung der Infrastrukturangesehen, insbesondere im Transportsektor. Im vierten Kapitel werden die Verbraucherpräferenzen für Fleisch von heimischen Tierarten in Vietnam als sehr spezifischem Marktnischensegment einer hedonischen Preisuntersuchung auf Einzelhandelsebene unterzogen. Basis bildet die Erfassung von Preisinformationen (Verkaufszeitpunkt, Marketing- und Qualitätsaspekte) für Schweinefleisch der einheimischen Rasse Ban. Insbesondere die Betrachtung des Verkaufszeitpunkts ermöglicht ein besseres Verständnis der Preisentwicklung und saisonaler Einflüsse bei der Vermarktung von Ban Schweinefleisch. Die Ergebnisse der hedonischen Preisuntersuchung zeigen deutlich, dass Verbraucher eine höhere Zahlungsbereitschaft für Ban Schweinefleisch haben, wenn dieses bestimmte Vermarktungs- und Qualitätskriterien aufweist. Hier beeinflussen die Zuchtrasse, das Lebendgewicht, der Fettgehalt, die Zerlegung des Fleisches, der Verkäufer und Käufer sowie die Lage des Verkaufsortes und die Saison die Kaufentscheidung. Das Verständnis dieser spezifischen Verbraucherpräferenzen kann für Produzenten und Händler hilfreich sein, um höhere Preise für Ban Schweinefleisch zu erzielen. Darüber hinaus ergeben sich für die Politik Ansätze zur Förderung langfristiger Verpflichtungen zwischen Ban Schweinefleischproduzenten und Restaurantbetreibern. Neben der Vermarktung qualitätsgesicherten Fleisches regionaler Herkunft und nachhaltiger Nutzung kann so ein Beitrag zum Erhalt der wertvollen lokal vorhandenen genetischen Vielfalt erreicht werden.

Die Ergebnisse dieser Arbeit geben eine Hilfestellung zur Gestaltung der Rahmenbedingungen im vietnamesischen Lebensmittelsektor und können positive Effekte für die Ernährung und Gesundheit der Bevölkerung Vietnams und vergleichbarer Schwellenländer liefern.

Abstract

Preferences for high-value agricultural products in developing countries: demand analyses for livestock products in Vietnam.

This thesis comprises three papers that aim to analyze demand for livestock products in Vietnam as a case study for preferences for high value agricultural products in developing countries.

Chapter 2 is based on the dataset from Vietnamese Household Living Standard Survey (VHLSS) in 2010 that included 9,399 households. Vietnamese households' expenditure on milk products for home consumption is analyzed by using different descriptive and econometric analyses. With the help of a double hurdle model, the drivers of expenditure on milk products in both decisions on market participation and amount of expenditure are determined.

Chapter 3 is based on the same dataset used in chapter 2 and uses additional meat consumption data. A maximum likelihood estimation of censored regression models named tobit model is employed and combined with other statistical analyses to analyze the consumption patterns of pork and poultry in Vietnam based on data of the VHLSS 2010 and other resources.

The results of the two articles mentioned in chapter 2 and 3 show significant effects of household characteristics on food consumption in Vietnam. These characteristics include socio-economic and demographic variables of households. The results are used to assess future demand for meat and dairy products in Vietnam as well as other emerging markets with similar situations. Globalization, economic development and urbanization, lead to considerable changes in food consumption patterns in developing countries. These results may help policy makers to implement measures to ensure food security, such as food

redistribution between regions and between urban areas, improving infrastructure. Especially the transportation system can support production and exchange between regions in the country. Policy makers should consider policies to improve the nutritional and health status in poor population sectors.

In chapter 4, in order to analyze consumer preferences for indigenous animals in Vietnam as a very specific niche segment of the meat market, a hedonic price analysis at the retail level is conducted. Price information on Ban pork was collected considering several attributes such as time of sale, marketing and quality aspects of Ban pork. In particular, time of sale serves to better understand price variations and seasonal marketing effects of Ban pork. The results of the hedonic price model indicated that the customers are willing to buy at a higher price for Ban pork that has preferable attributes as marketing and quality factors. These marketing and quality factors include type of breed, live weight of animals, fat level of meat, type of meat cut, buying arrangement, type of seller, market location and seasonality. The findings of the price analysis can help producers and traders understanding how to achieve higher prices for Ban pork and how they can produce and sell their products to better meet consumers' preferences. Moreover, policy makers should consider promoting transactions based on long-term contractual arrangements between producers and restaurant owners and safeguarding appropriate benefits of the rural poor from a systematic and sustainable marketing of quality-controlled pork of regional origin. At the same time, these policies would contribute to safeguarding and promoting the sustainable utilization of valuable local genetic resources.

The results of the three studies may help policy makers to implement policies related to the food sector, nutrition, health and food security in Vietnam, as well as in other developing countries in a similar situation.

Abbreviations

ANOVA	Analysis of variance
BMI	Business Monitor International
BRIC	Brazil, Russia, India and China
CBP	Community-based breeding program
CBMP	Profitable, self-sustained breeding and marketing program
CGIAR	Consultative Group on International Agricultural Research
CIAT	International Center for Tropical Agriculture
ERS	The Economic Research Service and Foreign Agricultural Service of the United State Department of Agriculture
Exp.	Expenditure
FAS	Foreign Agricultural Service
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	The Statistics Division of Food and Agriculture Organization
GDP	Gross Domestic Product
GFAR	The Global Forum on Agricultural Research
GIA	Global Intelligence Alliance
GSO	General Statistics Office of Vietnam
HVAP	High value agricultural products
IFPRI	The International Food Policy Research Institute
OLS	Ordinary least square
SD	Standard deviation
S.E.	Standard error
Sig.	Significant
UHT	Ultra High Temperature
UNFPA	United Nations Population Fund

USDA	United State Department of Agriculture
USITC	United State International Trade Commission
U.S.	United States
VHLSS	Vietnamese Household Living Standard Survey
VIF	variance inflation factor
VND	Vietnam Dong

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1. Introduction

In developing countries, the importance of high value agricultural products (HVAP) is rising (Gulati et al., 2007, Birthal et al., 2007). Demand for HVAP is increasing rapidly in developing countries due to a rise in real income levels, urbanization, globalization and changes in consumers' preferences (IFPRI, 2014; Hellin et al. 2011). Food composition is changing towards HVAP which is creating opportunities as well as challenges for food producers, especially smallholders (Birthal et al., 2007).

According to Gao and Schroeder (2009), preferences of consumers for certain food attributes are important for producers and traders as well as policy makers. An assessment of consumers' preferences for HVAP will help policy makers in drafting and implementing more effective agricultural and food policy regulations as the development of markets for HVAP has been coupled with the emergence of new institutional arrangements along food supply chains.

1.1   Definition of HVAP

Several organizations and researchers have made attempts to define the term HVAP. In particular, since 1985, the Economic Research Service and Foreign Agricultural Service of the United State Department of Agriculture (ERS) has defined high-value products as semi-processed products, highly processed products and high-value unprocessed products (USITC, 1985). In a report by CGIAR's (2004) and by IFPRI (2014), HVAPs are also defined as products that are typically perishable, of high quality and of specific high value such as having special taste or special smell or coming from rare breeds. These products can be sold through specialized markets.

Commonly HVAP include livestock products, dairy products, fish, fruits, vegetables, spices and ornamental products. According to Temu and Temu (2005), the term HVAP refers to high value crops and high value livestock and fishery products. High value livestock and fishery products refer to non-traditional food from animal products, such as beef, poultry, pork, milk eggs and fish. While, high value crops include vegetables, fruits, flowers, house plants, spices, there are also non-traditional food products. HVAPs have higher higher monetary value than traditional products. Ševela (2003) argued that HVAPs have higher unit values than agricultural products such as grain or soybeans.

HVAPs also include non-traditional products which do not belong to the customary diet of the local production area, thus are mainly produced for high value domestic and export markets. Compared with traditional agricultural products, export of HVAPs can create higher levels of employment, gross economic output and income. Moreover, globalization of markets for HVAPs has been creating dynamic markets for producers and traders at national, regional and international levels (GFAR-CGIAR, 2005).

1.2 Changing consumer demand and demand growth for HVAP

In many countries, food consumption patterns have been undergoing rapid changes toward HVAP (Rae and Hertel, 2002; Popkin, 2006; Mergenthaler et al., 2009b; Popkin et al., 2012). Popkin et al. (2012) discuss the term "Western diet" describing that consumers have a lower calorie intake from coarse grains and other vegetables on the one side and consume more animal-source food, oils and caloric sweeteners on the other side. They state that most of the global increase in animal-sourced foods has been in low and middle-income countries. In particular, China has had a major increase in the consumption of pork and eggs, while India has had a major increase in the consumption of dairy products.

In recent decades, an increasingly important role in the diet has been attached to additional food types. Consumers' awareness and demand for better quality, tastier and safer food products is increasing. Food products that are derived from indigenous breeds such as fruits, vegetables, chickens, pigs are preferred choices of consumers in certain niche markets. These food products serve many functions at the production level: they not only provide food for home consumption, but also these products can create sales income for farmers. Many food products from indigenous breeds are considered as high nutritional value products and are assumed to have health benefits for people (Kongkachuichai et al., 2014; Shajib et al., 2012). Thus, preference for some kind of indigenous animal products such as meat and eggs is high in many areas (Bett et al., 2013). This shows that studies on the consumption of food from indigenous breeds can be an interesting case of preferences for HVAP.

Rising incomes and urbanization are changing the preferences of consumers in emerging markets towards HVAP (Popkin et al. 2012; Gulati et al., 2007; Birthal, 2005). These changes have led to new market opportunities for HVAP (Hellin, 2011) indicated by increasing global trade for livestock products such as meat, poultry and dairy products (Rae and Hertel, 2002; Kumar, 2010; Muhammad el al., 2014). In addition, demand growth for HVAP is also driven by population growth as well as an increasing productivity in the livestock sector (Muhammad el al., 2014).

However, there is a large difference in the consumption of livestock products in developed countries and developing countries: Demand for HVAP in developing countries is increasing rapidly. Yet compared with developing countries in static terms, people in developed countires consume more than three to four times the amount of meat products and more than five to six times the amount of dairy products (Maltsoglou, 2007). Dynamically seen, meat consumption growth in developing countries has increased three times as much as in

developed countries over the last years (FAOSTAT, 2014; Delgado, 2003). A growing demand for HVAP in developing countries is projected for the next years (FAO, 2009; Wright, 2005).

1.3   Impacts of changing demand on supply chains for HVAP

Changing consumer preferences towards HVAP can attribute to increased income for supply chain actores in both developed countries and developing countries (Pingali, 2007). Demand for HVAP has been rising thereby creating competition in the global food market. Diet diversification and rising demand for better quality of food has resulted in an increase in imports of HVAP in developed countries. Fast income growth in developing countries has resulted in increased demand for meat products and increased livestock feed import in these countries (Regmi, 2001). Therefore, globalization of HVAP markets is creating dynamic market for traders and producers at the domestic, regional and global level.

The transformation of preferences of consumers toward HVAP has impacted on food supply chains as it has created new opportunities for traders, producers, especially smallholder farmers (Birthal et al., 2007). In order to coordinate the supply and demand of HVAP improved linkages between farmers, processors, traders and retailers are required (Gulati et al., 2007). Critical differences between supply chains for traditional products and HVAP are listed by Henson (2007) (see table 1.1). Pingali (2007) argued that the change of consumers' preferences lead to a food system transformation, because changing preferences force actors in food supply chains to adapt in order to comply with new consumption patterns.

Table 1.1. Nature of traditional and HVAP food supply chains

Traditional	High-Value
➢ Low own-price elasticity of demand	➢ High own-price elasticity of demand
➢ Trader or processor-led supply chains	➢ Retailer-led supply chains
➢ Low value to volume ratio	➢ High value to volume ratio
➢ Quality defined by basic grades	➢ Quality defined by multi-layered and multidimensional standards
➢ Limited need for quality and safety assurance infrastructure	➢ Quality and safety assurance infrastructure critical
➢ Many products have low perishability	➢ Many products highly perishable
➢ Low levels of product processing and transformation prior to export	➢ Can be high levels of product transformation and processing prior to export
➢ Limited coordination of supply chains	➢ High levels of supply chain integration or coordination
➢ Historically, high levels of state intervention in supply chains	➢ Little or no government intervention in supply chains
➢ Numerous specialist small businesses	➢ Limited numbers of specialized businesses
➢ Little or no traceability/identity preservation through supply chain	➢ Enhanced need for traceability/ identity preservation through supply chain
➢ Need for basic logistical capacity	➢ Need for advanced logistical capacity

Source: Henson 2007

Supply chains for HVAP can help to improve income increasing potentials for farmers (Birthal et al. 2005; Eaton and Sheperd 2001). Farmers can diversify towards agricultural products that have a strong potential for higher returns to their resources such as capital, land, labor (Birthal et al., 2007).

Despite markets for HVAP are emerging, many farmers in developing countries still continue to produce low value agricultural products such as rice and other staple crops products, due to variety of constraints, including a lack of information on quality and safety requirements and difficulties to access emerging supply chains. In developing countries, most of small farmers belong to the poor and the percentage of poor in rural population is higher than in urban areas. For this reason it is important to understand demand for HVAP as it will help policy

makers to pay more attention to high profit products and to provide marekt inform to farmers so they can choose what kind of animal or crop products can improve their income and living standard.

1.4   Methodological approaches to analyze consumer demand

Several studies on food demand have been conducted by using household consumption or household expenditure data in both developed countries and developing countries. For example, Thiele and Weiss (2003) utilized a dataset from a survey with 4,632 households to analyze consumer demand for food variety in Germany. Davis et al. (2011) determined the effect of changes in demographic variables, retail prices and total milk products expenditure on at-home consumption by using data from Nielsen's 2007 Home scan survey including 63,031 households in the US. Furthermore, many studies in household consumption are found that were conducted in developing countries. For example, Yen et al. (2008) investigated household food consumption in urban China, using data from the survey of Urban Households in 2000, Vassilopoulos et al. (2012) used the data of the 2004-2005 Household Budget Survey for meat and fish products to examine the factors affecting quality choice by Greek households. By using data from the Turkey Household Expenditure survey, Bilgic and Yen (2013) investigated demand for sixteen food products in Turkey. The results generally suggest that several socio-economic factors affect quality demand for food products such as meat, fish and dairy products.

Previous studies have explored the impact of factors shaping the preferences of consumers for HVAP. Preferences for these products are often determined by estimating consumers' willingness to buy/to pay, their consumption demand, their expenditures for products with additional safety and quality attributes or the prices they pay for different products. For example, researchers have estimated willingness to pay for safe vegetables in Vietnam

(Mergenthaler et al., 2009a) and in Thailand (Posri et al., 2006). Wu et al. (2014) have explored the determinants of urban at-home consumption demand for powdered milk in one province of China. Newman et al. (2001) have examined the effect of households' socio-economic characteristics on consumers' expenditure on meat products. These characteristics are hypothesized to shape consumers' preferences. Ojogho et al. (2013) have examined hedonic demand analysis for beef in Benin Metropolis based on data of beef prices. These studies have contributed to the literature on the determinants of preferences for HVAP. However, socio-economic and other demographic variables have been changing rapidly in developing countries. Hence, future studies on HVAP demand in many developing countries are necessary to refelct the new situations in these countries.

1.5   HVAP in emerging markets - the case of Vietnam.

In the past decades, developing countries and emerging countries, also known as emerging markets, have been becoming more important in contributing to global economic growth. Developing countries have grown faster than developed countries like U.S., Japan, Germany, and they are expected to grow two to three times faster than those nations (Forbes, 2014). Global Intelligence Alliance (GIA) reported in the Business Perspectives on Emerging Markets 2012-2017 that Brazil, Russia, India and China (BRIC) are predicted to retain their leading positions as the global top emerging markets in period 2012-2017. After BRIC, emerging markets in Asia or Latin America also include Indonesia, South Africa, Vietnam, Mexico, Turkey and Argentina. These countries are ranked highest amongst secondary emerging markets (GIA, 2012). Thus, Vietnam can be considered as a typical case study for economic development and changes in consumers' preferences.

Vietnam is one of the emerging markets located in Southeast Asia. The country is a large market with approximatly 90 million people. Therefore it has attracted much attention in the

global economy. Many investors from other countries and regions want to invest in Vietnam because of the market potential. Vietnam's market structure has changed rapidly after its economic reforms (Doi Moi) in 1986. Vietnam has transformed itsself economically from a highly-centralized planned economy to a socialist-oriented market economy. Since the launch of economic reforms, the economy of Vietnam has become basically a market economy, which has got many sectors. Vietnam has made considerable achievements in many fields, especially with regard to the socio-economic development. In particular, the average GDP annual growth rate has been 5-8% for many year. GDP per capita (current US$) increased from 606.9 USD in 2004 to 1,910.5 USD in 2013 (Worldbank, 2014; GSO, 2014). The socio-economic changes not only improved the living standards and welfare among the Vietnamese but also created trade opportunities for domestic and foreign investors. In order to take advantage of the market opportunities, it is crucial to understand the factors which affect the market and consumption patterns in Vietnam.

Agriculture still plays an important role in Vietnam's economy, which contributes 18.38% to the GDP and generates about 46.8% of employment in 2013 (GSO, 2014). Livestock production is an important source in the livelihoods of farmers in developing countries, because livestock products are a source of high quality food and a source of income (K'Oloo et al, 2014). In Vietnam, livestock husbandry has been more and more important and contributed 26.3% to the total agricultural output value in 2013 (GSO, 2014). The production and marketing of HVAP, such as meat and dairy products has been also an important source of income for small-scale farmers. However, there is an increasing domestic and international competition. Given structural disadvantages of farmers in Vietnam it will be difficult to achieve and maintain a competitive position in the HVAP market.

There are several attributes of products such as health attributes (e.g., level of pesticide residues and antibiotic, pathogens from animals), different tastes (e.g., breeds of indigenous livestock), different times (e.g. off-seasonal products) or processing characteristics (e.g., slaughtering, packing, storing, etc.) that could be promising alternatives for farmers. Quality and safety characteristics play an increasing role in domestic and international food trade. The additional value generated could contribute to ensure sustainable income growth in small-scale farms. The additional value can only be generated when they meet consumer demand regarding quality and safety attributes. Thus, the importance to study preferences of consumers for HVAP (e.g., meat, dairy products and indigenous breeds) increases.

Dairy products are not traditional products in Vietnam. In recent years, the Vietnamese living standard has increased and has led to a change in preference for high protein products such as meat, milk, cheese and yogurt (Jaccar, 2009). The dairy sector in Vietnam has become one of the fastest growing food industries (Khoi, 2013). However, most of milk products in Vietnam are produced in small-scale farms and the dairy market has been dominated by large companies that import high amounts of milk products to meet domestic demand (Saenger et al., 2013). Although the demand for dairy products in Vietnam has increased rapidly over the last years (BMI, 2011, Cuong and Nga, 2011), the amount of milk products consumed per capita is still relatively low compared with other countries in South-East Asia (Anh and Duong, 2010).

In term of meat consumption, meat is important in the daily meal of Vietnamese families. According to data of VHLSS 2010, Vietnamese households spent 20.9% of their food expenditure for meat. Thereby pork is the most popular meat consumed by the Vietnamese, followed by poultry. Furthermore, demand for meat in Vietnam has been rapidly increasing over the last years (Tisdell, 2009). As this demand has grown more rapidly than domestic

meat production, it has resulted in a shortfall in the domestic meat supply. In addition, Vietnam's strong preference for fresh meat is one of of the barriers to enter into the Vietnam's market (Mergenthaler et al., 2013; Lapar et al., 2009).

Along with the development of the economy, some consumers prefer indigenous animal-sourced products. This is assumed to be due to health concern of consumers and the nutritive value and special tastes of the products. In Vietnam, there are many indigenous animal breeds such as indigenous chicken breeds (Ri chicken, Ho chicken, Dong Tao chicken, etc.) and indigenous pig breeds (Ban pig, Man pig, Mong Cai pig, etc.) which are highly valued. These indigenous animals have attracted many Vietnamese and international researchers (Hoan, 2008; Dat et al.,2008, Lemke et al., 2004; Olivier et al., 2002; Lung et al., 2001).

In some mountainous areas in northern Vietnam, Ban pig is one of common indigenous breeds kept by smallholders. Vietnam's pig sector is affected by many factors (Lemke et al., 2008), making it an interesting case for more research. Ban pork prices at the retail level can change significantly, partly reflecting quality attributes and marketing factors of Ban pork. Furthermore, consumer preferences can be reflected by analyzing retail prices. Therefore, studies in prices at retail level of Ban pig breed, its marketing channels and quality attributes are very interesting (Huong et al., 2009).

1.6   Research questions

Based on the general background of the market for HVAP and specific situation in Vietnam as well as in other developing countries, this study is guided by an overall research question: what are the determinants of the preferences of consumers for HVAP in Vietnam? This question is of particular interest for livestock products such as meat and milk. There may be household characteristics that have an effect on demand for food products. In this respect, the demand for livestock products in Vietnam is analyzed as an examples for the changes of

preference for HVAP in emerging markets. Investigating the demand for livestock products is important for Vietnamese producers, traders and agricultural policy makers. It also can provide insights that might apply to other emerging markets. Therefore, the overall research question is subdivided into two analyses of household's consumption and expenditure and an analysis of preference for indigenous animal-sourced food. This leads to the following three specific research questions:

1. What are the factors that affect Vietnamese households' consumption behavior for dairy products?

2. What are the determinants of meat consumption in Vietnam, especially pork and poultry?

3. What are important marketing factors and animal characteristics effecting consumer preference for pork from an indigenous pig breed?

1.7   Structure of the thesis

Following this introduction chapters 2, 3, 4 will address to the three specific research questions that are addressed in three papers with N.V. Phuong as first author as follows:

Chapter 2 is based on an earlier version of a paper submitted to the journal "Agribusiness". The first research question about Vietnamese households' consumption behavior for dairy products is addressed in the paper entitled "Effects of Household Characteristics on Expenditure for Dairy Products in Vietnam", which is based on the dataset from Vietnamese Household Living Standard Survey (VHLSS) in 2010, that included 9,399 households. Vietnamese households' expenditures on milk products for home consumption is analyzed by using different statistical and econometric analyses. With the help of the double hurdle model, the drivers of expenditure on milk products in both market participation and expenditure decisions were determined.

Chapter 3 is based on an article published in the "Asian Journal of Agriculture and Rural Development". The second research question is addressed in the article entitled "Effects of socio-economic and demographic variables on meat consumption in Vietnam". Based on the dataset from Vietnamese Household Living Standard Survey (VHLSS) in 2010, a maximum likelihood estimation of censored regression model named tobit model has been employed. In addition other statistical analyses were utilized to analyze consumption patterns of pork and poultry in Vietnam based on data of the VHLSS 2010 and other resources.

The results of two articles mentioned above show effects of households' characteristics on food consumption in Vietnam. These characteristics include socio-economic and demographic variables of households. The results are used to assess future trends in markets for meat and dairy products in Vietnam as well as other emerging markets with similar situations.

Chapter 4 of this doctoral thesis is based on an article published in the Journal of "Livestock Research for Rural Development". The third research question addressed the article entitled "Impact of quality attributes and marketing factors on prices for indigenous pork in Vietnam to promote sustainable utilization of local genetic resources". Here, in order to analyze consumer preferences for indigenous animals in Vietnam, an hedonic price analysis at the retail level was conducted. Price information on Ban pork was collected considering several attributes such as time of sale, marketing and quality of Ban pork. In particular, time of sale serves to better understand daily price variations and seasonal marketing effects of Ban pork. This helps to adjust the supply of Ban pork to market demands. Marketing attributes serve to better understand the relative profitability of different supply chain coordination mechansims and to better adjust the marketing strategies of producers and traders. Quality attributes serve to better adjust the production of Ban pork to market requirements and optimize breeding and

husbandry strategies to meet market requirements. In this analysis, price observations were compared across the different categories to infer on consumer preferences for different attributes.

In a final chapter of this cumulative dissertation, the main findings and implication for producers, traders and policy makers of the three papers are summarized.

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2. Effects of household characteristics on expenditure for dairy products in Vietnam

Abstract

In this study, Vietnamese households' expenditure on dairy products for home consumption is analyzed using the latest Vietnamese Household Living Standard Survey datasets from 2010. A double-hurdle model is utilized 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. Our results suggest that several socio-economic and demographic variables affect household expenditure on dairy products. In particular, young and old household members increase dairy expenditures. The results may help policy makers to implement policies related to the dairy industry, to nutrition for children and older people, to health and food security.

2.1 Introduction

Dairy production and trade is on the rise on a global scale (Beghin, 2006; More, 2009; Ray et al., 2012). 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 – particularly in urban areas. As a consequence, demand for high protein and energy dense food has increased, especially dairy products such as milk, cheese, and yogurt (Jaccar, 2009; Pingali, 2007; Dong, 2006). In recent years, the Vietnamese dairy industry has become one of the fastest growing in the food industry of the country (Khoi, 2013). However, most of Vietnam's domestic milk production comes from small-scale farms. Currently, the Vietnamese dairy market is dominated by few, large companies that import high amounts of powdered milk to meet local demand (Saenger et al., 2013a).

Vietnamese dairy demand has increased rapidly over the last years (Saenger et al., 2013a; BMI, 2011; Cuong and Nga, 2011). According to a report of the Business Monitor International (2011), Vietnamese milk demand has been driven by increasing domestic consumption due to rising incomes (BMI, 2011), by increasing welfare levels, and by urbanization (Saenger et al., 2013a). In fact, milk consumption per capita in Vietnam has doubled in the period from 2000-2009 to 12 kg/year and to 15 kg per/year in 2011 (USDA, 2011; Saenger et al., 2013b). Vietnam's milk products' market is potential and strong. The young population continues to create a stable demand for consuming dairy products, whilst awareness of consumers about health benefits related to milk products is increasing, especially with the older generation (Euromonitor, 2014). However, compared with regional countries, Vietnamese per capita consumption is still relatively low (Anh et al. 2010).

The price of foreign milk in Vietnam has been one of the highest in the world (Tuan et al., 2013; BMI, 2011). The price of imported milk has also been 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 demand continues to rise. Vietnam's milk production is able to provide only 22% of the domestic demand (Cuong and Nga, 2011). Most of imported dairy products are UHT (Ultra High Temperature) milk, yogurt, condensed milk, and formula (GSO, 2014). This implies that Vietnam's dairy products' market has a high potential for future growth, both through increased domestic production and imports (Dong, 2006; Cuong and Nga, 2011; Euromonitor, 2014). High demand for milk and milk products in Vietnam creates incentives for different private actors to take advantage of the emerging opportunities. 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 households' pork consumption in the United States. The results have had an important policy implication for US' pork industry. Bittencourt et al. (2007) found affects of household characteristics on food consumption in Japan over life-cycle periods by using data from Japanese household survey in 1997. While Shiptsova et al. (2004) examined the impacts of household demographic factors on the expenditures for potatoes, bread, flour, rice and pasta. Schröck (2012) analyzed demand for organic and conventional milk by using household panel dataset of 20,000 German households. Wu et al. (2014) used data included 8188

households distributed in 15 cities and prefectures of Guangdong province to explore the determinants of urban at-home consumption demand for powdered milk. Results show the effect of socio-economic and demographic factors on food consumption behavior. These findings are useful to policy makers in developing products for national markets, ensuring food security, and improving nutritional and health policies.

In addition, several studies in Vietnam using data from household surveys, have analyzed food consumption patterns. Minot and Goletti (2000) estimated household food demand in Vietnam based on data of the Vietnam Living Standard Survey 1998. Le (2008) used data of VHLSS 2004 to investigate food consumption in Vietnam that focused on three categories of food: rice food, non-rice food and meat/fish. Meat consumption patterns in Vietnam have been analyzed by Phuong et al. a (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. On the background of Vietnam's dynamic dairy market this is rather surprising and thus the paper can contribute to narrow this research gap. Therefore, the major objective of this study is to identify and examine factors that affect Vietnamese households' consumption behavior for dairy products and to derive policy implications to guide the development of the dairy sector in Vietnam.

Specific objectives considered in this study are:

- To examine the factors affecting the decision to consume dairy products.

- To determine the drivers of expenditure on milk products.

- To derive policy recommendations to develop the Vietnamese dairy sector in line with demand patterns.

2.2   Dairy production in Vietnam over time

Income growth, urbanization, globalization and changing lifestyles have been associated with transformations in food consumption pattern of developing countries (e.g. Mergenthaler et al., 2009; Pingali, 2007). The westernization of diets in Asian countries implies that consumers use less calorie intake from cereal and more from meat, dairy products, vegetables and fruits (Phuong et al., 2014a; Pingali, 2007). This has led to a rapid development of the dairy industry of Vietnam in production and consumption over the last years.

For Vietnamese farmers, dairy cattle are not traditional animals and rather new in their farms. Almost all dairy cattle are kept by smallholders in Vietnam. Smallholders have dominated the dairy industry, contributing about 90 percent of total domestic milk yield (Hostiou et al. 2012; Lam, 2011; Huyen et al., 2006). Small-scale dairy farms have low outputs per animal and produce poor quality milk (Lam, 2011; Falvey and Chantalakhana, 2001). Furthermore, animal-keeping smallholders are associated to the increasing production costs and spread of animal diseases (Phuong et al. b, 2014). Still, dairy production in Vietnam has grown significantly over the last years (Lam, 2011). From 2001 to 2012, Vietnam's milk production grew rapidly by approximately 10 percent annually, from 64.7 thousand tons in 2001 to 382 thousand tons in 2012 (see details in table 2.1). This growth has been the result of increased milk demand and government's policies to promote efforts developing domestic dairy industry (Garcia et al., 2006).

Table 2.1. Population and domestic milk production in Vietnam, period 2001-2012

Year	Population (million people)	Milk production (.000 tons)	Domestic milk production/capita (kg/capita/year)
2001	78.6	64.7	0.8
2002	79.5	78.5	1.0
2003	80.5	126.7	1.6
2004	81.4	151.3	1.9
2005	82.4	197.7	2.4
2006	83.3	216.0	2.6
2007	84.2	234.4	2.8
2008	85.1	262.2	3.1
2009	86.0	278.2	3.2
2010	86.9	306.7	3.5
2011	87.8	345.4	3.9
2012	88.8	382.0	4.3

Source: GSO, 2014

Figure 2.1 compares average dairy products supply quantities in Vietnam, South Eastern Asia and the world average from 1990 to 2009. Compared to worldwide milk consumption per capita, dairy consumption in Vietnam and other countries in South Eastern Asia are comparatively low. In 2009 milk products supply quantities per capita of the world was 87.3 kg, whilst these numbers are 15.3 and 11.5 in South Eastern Asia and Vietnam, respectively. However, starting at low level, milk products consumption per person in Vietnam has increased from 1.4 kg in 1990 to 11.5kg in 2009 (increased 8.22 times compared with 1990) over the last two decades. This number is still lower than in other countries in South Eastern Asia indicating further potential for sustained growth.
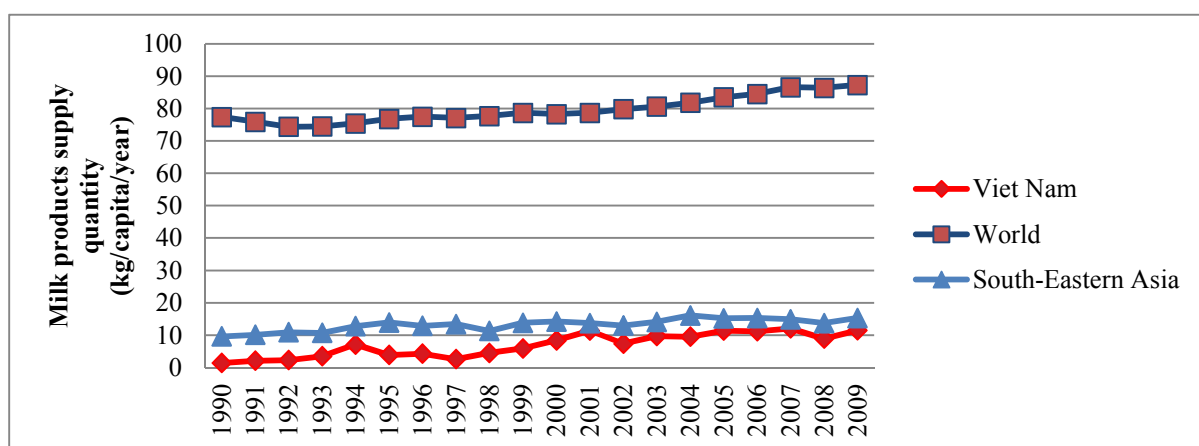
Figure 2.1. Annual per capita milk products supply quantity of Vietnam, the world and countries in South Eastern Asia, 1990-2009

Source: FAOSTAT, 2014

2.3 Methodology, data and variables

2.3.1 The Model

In this paper, a double-hurdle model is used to analyze household expenditure patterns on dairy products. One of the important sources of data to analyze consumption behavior is household survey data. 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; Dong and Gould, 2000; Yen et al, 1996; Cragg, 1971) This paper continues with this methodological approach. We assume that households make two decisions with regards to buying an item. Firstly, a Probit model is employed to determine participation and the decision of whether households consume milk products or not. Secondly, a regression model is used to determine how much households spend on milk products. The double hurdle model was proposed by Cragg (1971), which allows separate stochastic variables dealing with both participation and expenditure

decisions. The same variables are used in both estimations. The double hurdle model can be written as (Su and Yen, 1996):

(1) $\qquad Z_i^* = W_i'\alpha + v_i$ $\qquad$ participation decision

(2) $\qquad Y_i^* = X_i'\beta + u_i$ $\qquad$ expenditure decision

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

(4) $\qquad Y_i = 0$ $\qquad$ 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. $\alpha\ and\ \beta$ 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 double hurdle model is estimated based on assumptions of the normality of the error terms $v_i\ and\ u_i$. However, the usual ML estimates which assume normality are inconsistent when normality assumption is violated (Arabmazar and Schmidt 1982). One way to allow for nonnnormal errors, one way is to transform the dependent and latent variables to accommodate the nonnormal error structure. The latent expenditure equation canbe written as:

(5) $\qquad T_{(Y_i^*)} = X_i'\beta + u_i$

Where $T_{(Y_i^*)}$ is form of transformation such that:

(6) $T_{(Y_i)}$ = $T_{(Y_i^*)}$ if $Z_i^* > 0$ and $Y_i^* > 0$

(7) $T_{(Y_i)}$ = $T_{(0)}$ otherwise

Yen (1993) estimated the double hurdle model based on the Box-Cox transformation and his findings suggest nonnormal errors. However, there are some problems with the Box-Cox transformation. Such as, normality assumption is violated and the transformation can not be used on rrandom variables that can take on zero or negative value (Jensen and Yen, 1996, Su and Yen, 1996). To overcome these problems, the inverse hyperbolic sine (IHS) transformation is considered and the IHS transformation of random variable is defined as following equation (Jensen and Yen, 1996; Su and Yen, 1996; Burbidge et al. 1988).

(8) $T_{(v)} = \dfrac{\log\left|\theta v + (\theta^2 v^2 + 1)^{\frac{1}{2}}\right|}{\theta} = \dfrac{sinh^{-1}(\theta v)}{\theta}$

Where θ is an unknown parameter. The transformation is linear when θ approaches zero and behaves logarithmically for large valuas of v over a wide range of θ (Burbidge et al. 1988). More importantly, this transformation can be performed on random variables that can take any values (Su and Yen, 1996).

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

(9)

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

Where $\phi(\dots)$ is standard normal density function, $\phi(\dots)$ is cumulative distribution function.

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

(10) $\quad\quad\quad P(Y_i > 0) = \varphi(W_i' \alpha)$

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:

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

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

(12) $\quad\quad\quad E(Y_i) = E(Y_i/Y_i > 0)P(Y_i > 0)$

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

2.3.2 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.

2.3.3 Variables

Previous findings on food demand showed that food consumption is influenced by household's characteristics and structure (Verbeke et al., 2000; Mihalopoulos and Demoussis, 2001; Thiele and Weiss, 2003; Reynolds-Zayak, 2004; Zhang and Goddard, 2010; Moon et al, 2010, Phuong et al., 2014). Income, household size, characteristics of household head and resident household has a significant impact on food consumption. Furthermore, households with children and older people are expected to have an influence on milk expenditure (Mergenthaler et al. 2013). 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. While Davis et al. (2011) utilized purchase data from Nielsen 2007 Homescan (ACNielsen, New York, NY) data to determine the effects of changes in demographic variables, retail prices, and total dairy expenditure on at-home consumption of dairy products (cf. Davis et al., 2011).

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 households are hypothesized to impact on dairy products expenditure in Vietnamese families.

Table 2.2. Descriptive Statistics

Variables	Definition	Mean	S.D.
Y	Expenditure on milk products (thousand VND/capita/year)	43.236	103.650
Ln(Y)	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 (persons)	3.937	1.566
Urban	Household in urban area (1/0)	0.282	
Female	Household with female head (1/0)	0.248	
Ethnic	Household belonging to Kinh (Vietnamesse) ethnicity (1/0)	0.821	
Age	Age of household head (years)	48.345	14.245
Edu	Schooling of household head (years)	7.142	3.732
Child 1	Household with children below 7 (1/0)	0.220	
Child 2	Household with children age 7-18 (1/0)	0.520	
Older	Household with members older than 55 years (1/0)	0.383	
Geographic location of households			
REG1	Red river delta area (base category)	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)

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 variables used in this study are listed and described in table 2.2.

2.4   Bivariate 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 areas is smaller than in rural areas. The percentage of female household heads in urban areas is higher than in rural areas. Rural household heads' age is lower than in urban household and rural household heads' education is lower than in urban areas. In particular, more ethnic minority families live in rural areas 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. a, 2014). Furthermore, income per capita is nearly twice as high in urban areas as compared to rural areas. On average, annual urban household income per person is 27.09 million VND per year, while this figure for households in rural areas 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. On the contrary, the percentage of

households with people older than 55 years is higher in urban areas than rural areas (see details in table 2.3).

Table 2.3. Households' socio-economic and demographic factors in rural and urban Vietnam

Characteristic	Units	Urban		Rural		T-test	Sig.
		mean	SD	Mean	SD		
Income	Million VND	27.09	26.12	14.79	38.48	17.82	.000
Household size	Person	3.82	1.46	3.98	1.60	-4.71	.000
Female	0-1	0.35	0.48	0.21	0.4	13.23	.000
Age	Years	49.73	14.07	47.8	14.28	5.93	.000
Education	Years	8.59	3.61	6.57	3.63	24.36	.000
Ethnic	0-1	0.92	0.27	0.78	0.41	19.83	.000
Household composition:							
Child 1(0-7)	0-1	0.22	0.41	0.23	0.418	-0.71	.476
Child 2 (7-18)	0-1	0.48	0.50	0.53	0.50	-4.80	.000
Older (older 55)	0-1	0.41	0.49	0.37	0.48	3.30	.001

Source: Based on VHLSS 2010 (GSO)

Table 2.4 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 rather low. 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.

Table 2.4. Share of households consuming milk products surveyed in VHLSS 2010 (in %)

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

Source: Based on VHLSS 2010 (GSO)

Table 2.5 shows annual per capita expenditure on milk products per person by income quintiles in 2010. The results of an ANOVA analysis indicate that there are significant differences between income quintile groups in expenditure on dairy products and that expenditure on all kinds of milk products increases with income quintiles.

Table 2.5. Per capita expenditure on milk products by income quintile in 2010 thousand VND 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)

On 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 e.g. cheese, butter, milk ice-cream, etc., 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.

2.5   Multivariate analysis

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 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 2.6. 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 2.7.

Table 2.6. 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	-1.942***	0.103	2.631***	0.113	0.836***	0.059
Income	0.013***	0.001	0.028***	0.002	0.005***	0.001
Income squared	-4.57e-06***	4.5e-07	-0.0001***	0.00001		
HHsize	0.026**	0.011	-0.180***	0.013	0.013*	0.007
Urban	0.275***	0.034	0.331***	0.035		
Female	0.175***	0.035	0.141***	0.036		
Ethnic	0.544***	0.047	0.306***	0.056		
Age	-0.003*	0.001	0.003**	0.001		
Edu	0.059***	0.005	0.039***	0.005		
Child1	1.041***	0.040	0.951***	0.036		
Child2	0.484***	0.035	0.138***	0.036		
Older	0.114***	0.40	0.162***	0.043		
REG2	-0.106**	0.052	-0.276***	0.058		
REG3	0.143***	0.043	-0.089**	0.045		
REG4	0.171***	0.063	-0.021	0.064		
REG5	0.309***	0.053	0.138***	0.053		
REG6	0.129***	0.045	-0.012	0.048		
Number of observations	9399					
Log likelihood	-11862.368					
Wald chi2(16)	1887.46					
Sig.	0.000					

Notes: the dependent variable of expenditure equation is the natural logarithm of expenditure on milk products (thousand VND/capita/year);

*** p<0.01; **p<0.05; *p<0.1

Source: Based on VHLSS 2010 (GSO)

The coefficients of the income variables in both equations are positive which suggests that per capita income in families has a significant 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 (table 2.7). Furthermore, 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 of further income growth it can be expected that the probability of milk product consumption and expenditure on these products continues to rise with increasing incomes.

Table 2.7. Elasticity of continuous and binary variables: Dairy products expenditure

Variable	Probability	Conditional Level	Unconditional Level
Income	0.004	0.140	0.029
HHsize	0.008	0.026	-0.052
Urban	0.089	0.272	0.469
Female	0.057	0.173	0.265
Ethnic	0.176	0.538	0.457
Age	-0.001	-0.002	-0.001
Edu	0.019	0.058	0.327
Child1	0.337	1.029	1.626
Child2	0.157	0.478	0.609
Older	0.037	0.112	0.206
REG2	-0.035	-0.105	-0.252
REG3	0.046	0.141	0.119
REG4	0.056	0.169	0.182
REG5	0.100	0.305	0.413
REG6	0.042	0.127	0.139

Source: Based on VHLSS 2010 (GSO)

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 -5.2% on the unconditional level, i.e. when the number of people in the household increases, they spend less on milk products on a per capita basis. This suggests that the number of household members has a positive effect on milk products buying decision but at the same time has a negative effect on how much households spend for these products on a per capita basis. Several studies also found that larger households spend or consume less on food products on a per capita basis, suggesting that such households benefit from economies of scale in food consumption (Stewart et al, 2004; Keelan et al, 2009).

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.

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 the increase of milk product consumption in Vietnamese families and they 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 17.6% compared with being an ethnic

minority family. Moreover, the results show that in Kinh' households spent more than ethnic minority families by 53.8% on conditional level and 45.7% 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, further differences in living standards might be reflected that are not captured in the income variable.

Meanwhile, the age of the household head is significant in both determining participation and dairy expenditure. 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 33.7% 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 but with lower percentage, 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.

An interesting finding in this study is the significant effect of older people on dairy products expenditure. Like the children variables, the estimates of binary variables' elasticity for older people variable are presented in table 6. Compared to families with no older people (more 55 years old), families having older people are about 3.7% more likely to consume milk product and conditional on expenditure, spend about 11.2% more per year than the families without older people. This number on the unconditional level is 20.6%. This finding can explain increasing milk demand in Vietnam when fertility rates are decreasing and the share of older

people in the population increases (UNFPA, 2011; GSO 2011). Similar to consumption of milk products with children, the attributed positive health effects of dairy products induce higher probability and higher expenditure levels for household with older people (Mergenthaler et al., 2013).

We also found significant differences in milk expenditure across regions. For example, the probability of participation of 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. Meanwhile, the probability of dairy consumption of families in other areas is higher than in the Red river delta. The results of the expenditure equation shows that Northern midland and mountain areas and North Central area and Central coastal area spend less than in the Red river delta, while families that live in the South East region tend to spend more on milk products than others. South East is also the region 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 socio-economic situation and other variables not included in our models. In addition, cultural diversity in the regions is an important factor effecting on food consumption (Ates and Ceylan, 2010; Valli and Traill, 2005).

2.6   Conclusions

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 Double-Hurdel model is used as in cross-sectional micro-data, zero observations are common (Yen and Jose, 1997, Yen and Huang, 1996,). 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 a 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 products demand in Asian countries. Therefore, income policies that aim to increase households' incomes could become more important in promoting milk product consumption and production. However, they might be associated with considerable leakage effects. .

The result suggests that most household-level socio-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 and female-headed households 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. If current trends are continuing, they will support further demand growth for dairy products putting even more pressure on supply side policies.

With regard to household composition, the results of multivariate analysis indicate that children and older people are important factors for household dairy consumption, implying that Vietnamese families value healthy nutrition for children and for older people. This applies especially in families that have infants. On the background of Vietnam entering into an aging population, this result has important implications that have not been considered in previous studies. Although current demand for dairy products is strongly supported by the high share of children in the population, future demand growth will more strongly build on the growing share of older people in the Vietnamese population.

The results also help to understand how the changing socio-economics and demographics of the Vietnamese population impacts on households' dairy products expenditure. The understanding of demand side factors may help policy makers to implement policies related to the dairy industry, to nutrition for children and older people, and to health and national food security. Especially, policies should concentrate on improving child nutrition in areas with low milk consumption e.g. through school milk programs and food redistributing between the rich and the poor, areas and ethnic groups (Phuong et al. a, 2014) to ensure food security and nutritional status of Vietnam's population.

The study is 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. This applies equally for domestic and foreign dairy businesses. 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). While foreign dairy companies have started to tap into the Vietnamese growing and immensely potential dairy market, domestic dairy companies are few.

In order to supply the growing demand of Vietnamese consumers for dairy products, growth and development perspectives for domestic dairy producers emerge. While still in their infancy stage, the primary production sector is challenged to expand and to adapt to quality and quantity requirements of the dairy processing companies. For this purpose, well designed agricultural policies have to be implemented in order to facilitate the development of this emergent production sector. Training and education for current and future milky producers should be strengthened to qualify them for the production of high quality raw products.

Linked to this, also extension services should be developed. Producer organizations could be the organizational setting to facilitate dairy specific know-how development. At the sectorial level, applied research should be supported to strengthen locally adapted production technologies in the area of dairy cow housing, feeding regimes, milking equipment and milk cooling facilities. Breeding should be supported in order to develop breeds that are adapted to the local climatic and production conditions.

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3. Effects of socio-economic and demographic variables on meat consumption in Vietnam

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.

3.1   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 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 factors influencing the decisions to purchase meat products in U.S. consumer market. Mejia and Peel (2012) estimated the effects of demographic variables and income variables 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 manufacturing 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.

3.2   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 3.1).
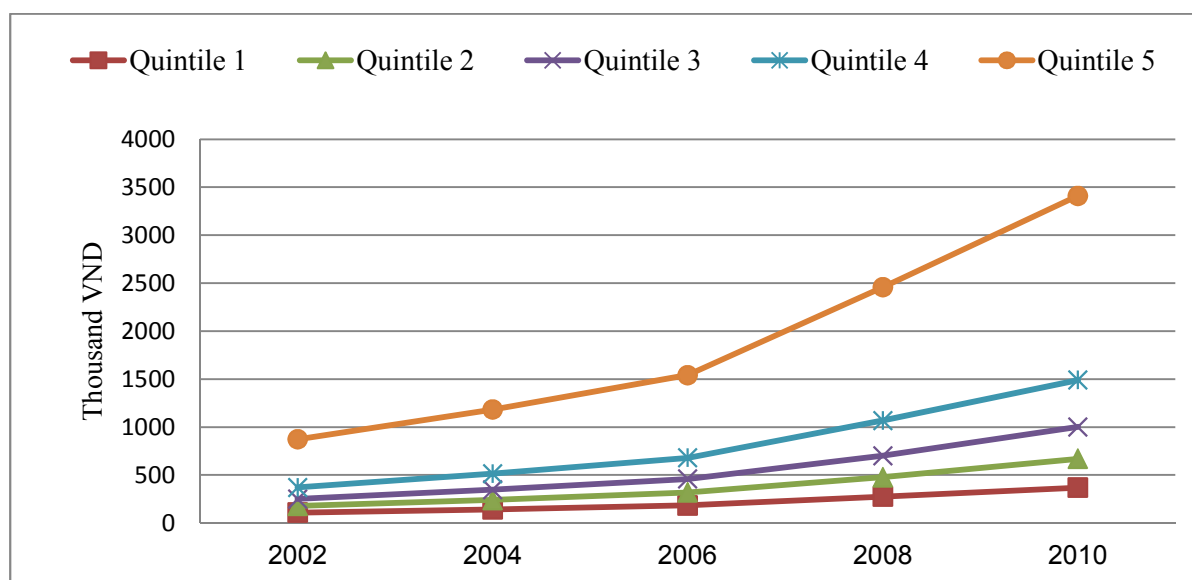
Note: Exchange rate on 1st Dec. 2010, Ministry of Finance, Vietnam (1 USD = 18.932 VND)

Figure 3.1. Monthly income per capita by quintile (thousand VND)

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 3.2. More importantly, it is indicated from the results in figure 3.3 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 3.2. Share of household's income spent on food in urban and rural

Figure 3.3 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.
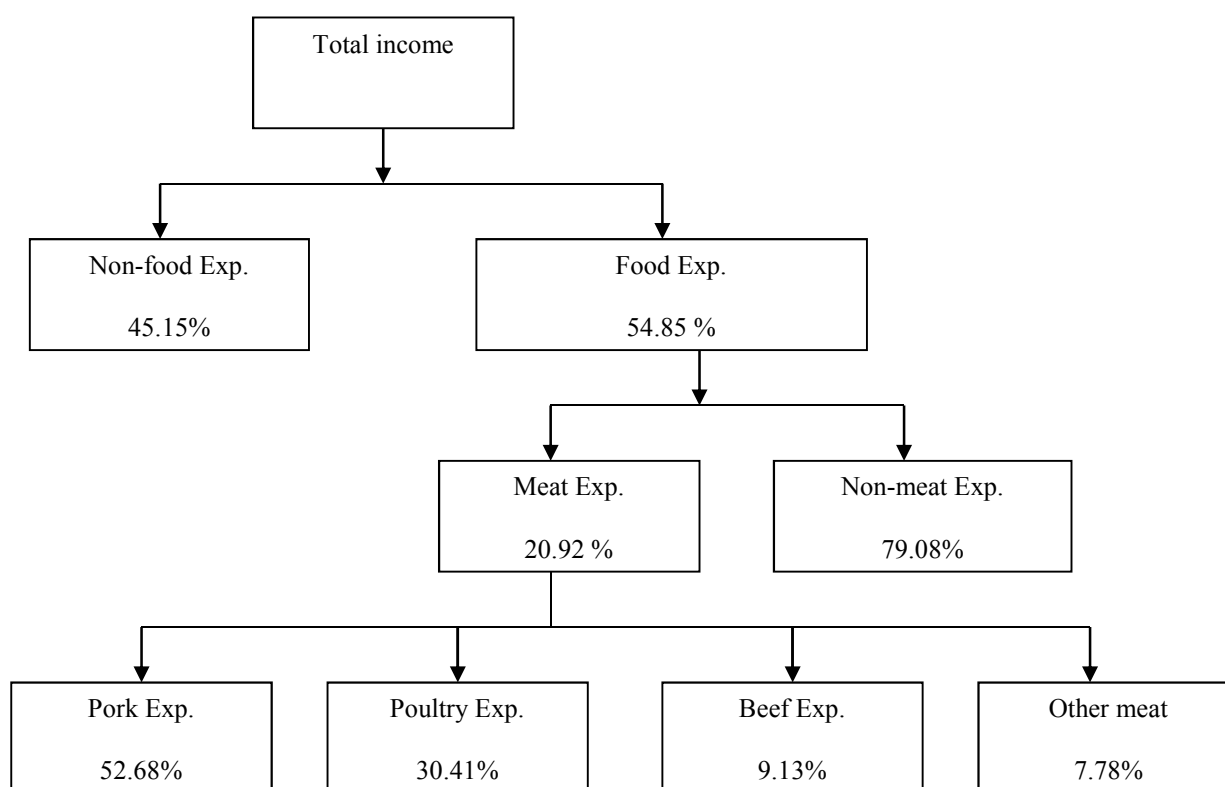
Source: VHLSS 2010 (GSO)

Figure 3.3. Household expenditure share in Vietnam.

Table 3.1 shows 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 3.1. 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 (GSO)

3.3   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 3.4 & 3.5 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.
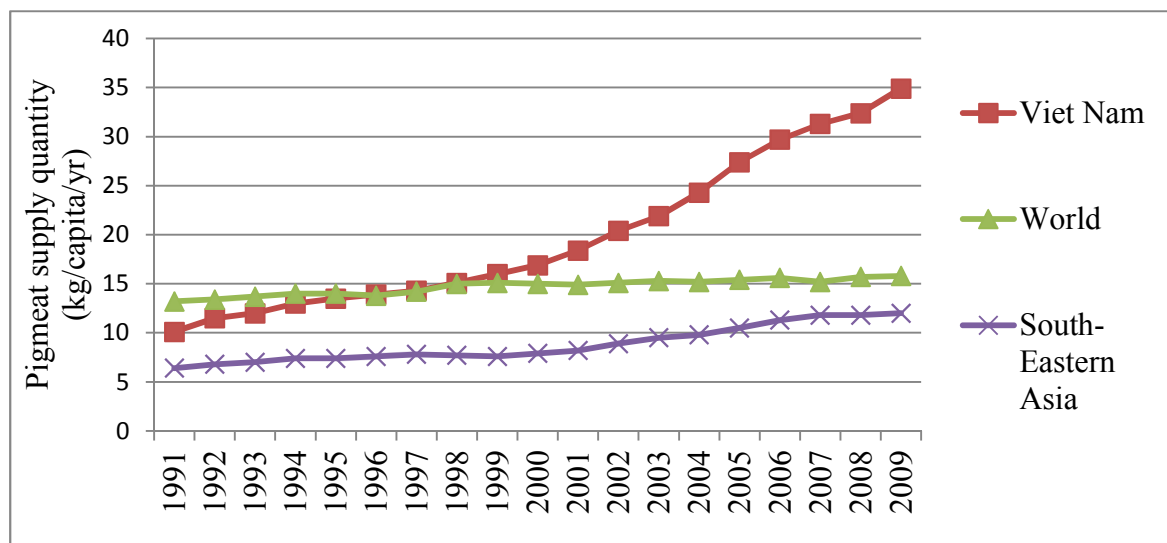
Figure 3.4. Annual per capita pork supply quality of Vietnam, the world and South Eastern Asia, 1990-2009 (Source: FAOSTAT 2013)
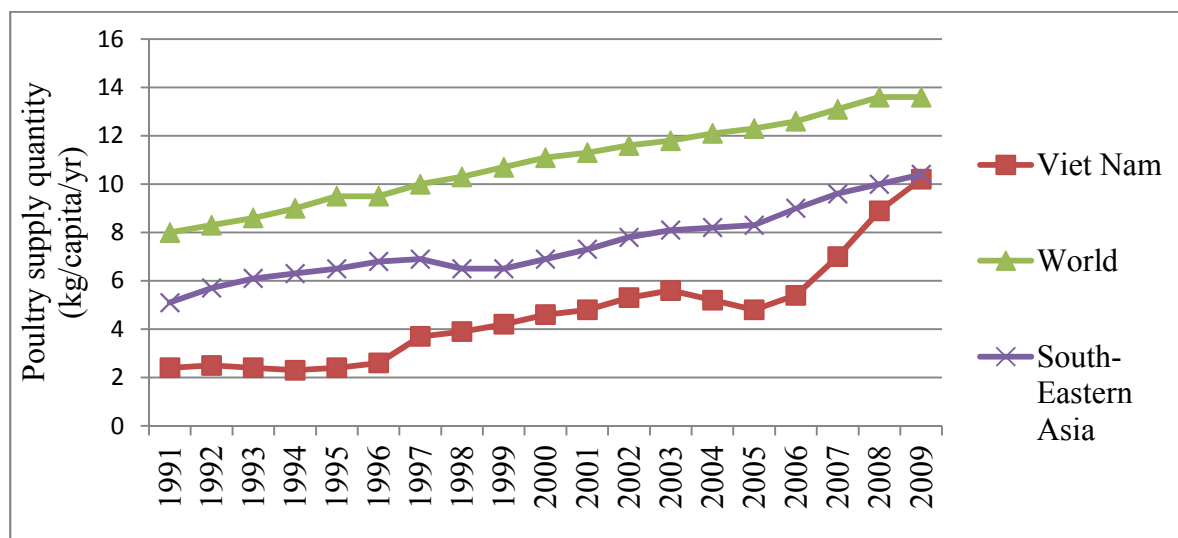
Figure 3.5: Annual per capita poultry supply quality of Vietnam, the world and South Eastern Asia, 1990-2009 (Source: FAOSTAT 2013)

3.4   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 3.2).

Table 3.2. 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	-4.53	.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	24.29	.000
Annual total income per person	Million VND	27.09	26.12	14.79	38.48	15.14	.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 3.3. 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 3.3). These results give a first indication that income growth is a major driver of increasing meat consumption in Vietnam.

Table 3.3. Quantity of meat consumption per capita per year by quintile income 2010

Income groups	Pork consumption		Poultry consumption	
	Mean	SD	Mean	SD
	(Kg per capita)		(Kg per capita)	
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)

3.5 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:

$$y_i^* = x_i^{'}\beta + u_i, \quad i = 1,2,3,\dots, N$$

$$y_i = y_i^* \qquad \text{if } y_i^* > 0$$

$\quad = 0 \qquad$ if $y_i^* \leq 0$

Where, N is the number of observations, y_i is the dependent variable, x_i is a vector of independent variables, β 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 σ^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:

$$Log(L) = \sum_0 \log(1 - \Phi_i(w)) - \frac{1}{2}\sum_1 2\pi - \frac{1}{2}\sum_1 Log(\sigma^2) - \sum_1 \frac{(y_i - x_i\beta)^2}{\sigma^2}$$

Where Φ 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.

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

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highlands, South East, Mekong river delta). Particular information about variables is described in table 3.4.

Table 3.4. 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)

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 $\ln(y) = \beta_0 + \beta_1 x + 3$, β_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 $\ln(y) = \beta_0 + \beta_1 x + 3$, β_1 is interpreted as the value of y is approximately $\beta_1(100)\%$ than base variable.

3.6   Regression results

To identify the factors affecting pork and poultry consumption, two demand functions were estimated and the results are presented in table 3.5. 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.

There are several clear results from the pork and poultry analysis. Table 3.5 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.

Table 3.5. 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)

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 a 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.

3.7   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.

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4. Impact of quality attributes and marketing factors on prices for indigenous pork in Vietnam to promote sustainable utilization of local genetic resources

Abstract

Within the food system transformation in developing countries, demand for high quality products increases. In Vietnam pork demand is rapidly growing, leading to supply shortages of high quality pork. The major objective of this study is identification of important factors affecting indigenous pork prices. Meat from Ban pigs – an indigenous pig breed in Vietnam – is mainly sold through specialized restaurants. Therefore 1944 detailed weekly transaction data for one year period from October 2010 to September 2011 from 33 restaurants in four provinces in the north of Vietnam were analyzed by using a hedonic price model to identify factors influencing Ban pig prices. The empirical results indicate that marketing factors and quality attributes of Ban pig have significant effects on Ban pig prices. An effective method to ensure benefits of increasing Ban prices to smallholders can be seen in the formation and development of a professional breed and marketing organization that link public and private institutions with an organized farmers association. The latter would safeguard appropriate benefits of the rural poor from a systematic and sustainable marketing of quality-controlled pork of regional origin. At the same time, this would contribute to the sustainable utilization of valuable local genetic resources.

4.1   Introduction

Rising incomes, urbanization and globalization lead to profound changes in the consumption patterns of an increasing number of people in developing and transition countries, particularly in Asia (Phuong et al 2014; Gerbens-Leenes et al 2010; Kearney 2010). These changes are often referred to as the "Westernization" of diets and result in greater consumption of more high-value agricultural products including animal products like seafood, dairy products and meat (Lipoeto et al 2013; Pingali 2007). Due to such profound transformations of national and international food systems, agricultural producers are challenged to adapt to more commercialized commodity markets and to diversify into new products and markets.

Given its rapid economic development and recent policy reforms, Vietnam is an interesting developing country to study details of the food system transformation. The restructuring process of food supply chains in Vietnam is observed in the context of ongoing economic liberalization (Mergenthaler et al 2009). Agriculture plays an important role in Vietnam's economy, contributing 21% to the GDP and generating about 58% of employment (GSO 2010). Livestock production accounts for 23% of the agricultural output value and receives special attention and priority from the Vietnamese government. In the livestock sector, pigs are one of the most important livestock species (Singh et al 1996; Lemke et al 2008). Pig production remarkably contributed to the success of the government's poverty alleviation policies, especially in rural and remote areas. However, in recent years the number of pig-keeping smallholders has decreased remarkably (Tisdell 2010). This can be attributed to the increasing production costs, particularly feed costs, as well as the spread of diseases, which threatens livestock farming of many poor households, but can also reflect increases in agricultural productivity which favour a transition towards a less agricultural-based economy.

Meanwhile, the demand for meat – particularly pork – has been rapidly increasing (Lapar and Toan 2010) and pig production in Vietnam is far from meeting domestic demand, not to mention demand from regional or global markets, particularly regarding quality and safety attributes (Vu 2003). The shift in domestic demand towards safer and better quality products has likewise become more apparent for fruits and vegetables (Mergenthaler et al 2009), but also for meat (Cuong 2004; Lapar et al 2010; Pedregal et al 2010). Due to increasing urbanization and the associated effect of higher incomes, customers in Vietnam are becoming more sensitive to food safety of animal products and potential health-related issues. Their awareness and demand for better quality, tastier and safer products are increasing. Indigenous pig breeds are thus increasingly becoming a preferred choice of pork consumers in Vietnam, the Ban breed being the most prominent example. Ban pork is perceived to be tastier, more tender and healthier than pork from other local and exotic breeds. Consumers of Ban pork are believed to be of a certain wealth segment, with higher purchasing power and a higher degree of education than the representative consumer. With Vietnam's rapid economic progress, the market for indigenous animal meat seems to offer a great potential for pig producers provided that specific market requirements are clearly understood and can be met by supply chain actors (Huong et al 2009).

For farmers in remote areas of northern Vietnam, the Ban pig has also several advantages. The Ban pig is a native breed that has been domesticated by local people in the northern uplands of Vietnam. Ban pigs also are known as the 'Cap Nach' breed (meaning very small), 'Man' breed (name of an ethnic group), 'Meo' or 'H'mong' (Lemke et al 2008). Considerable research has been conducted in order to characterize and conserve this indigenous pig breed, thereby contributing to sustain a valuable source of biodiversity (Lemke et al 2008). Research results indicate favorable meat quality traits of this breed compared to crossbreds or exotic

pig breeds (Cuong 2004). The feeding requirements of the local Ban pig are lower, while disease tolerance is higher compared to other breeds (Lemke et al 2006, 2007).

However, most research on Ban pigs has been limited to technical aspects, and market information for Ban pig producers, or assessments of the market potential of Ban pigs, which is still limited. Therefore, the present study evaluates the market potential for Ban pigs in northern Vietnam and seeks to address crucial issues from a smallholder perspective, i.e. which markets could be effectively served by Ban pork producers and whether different product requirements exist in different markets. In particular, this study is guided by the following specific objectives:

(i) Describe the current situation and general characteristics of Ban pig markets in northern Vietnam,

(ii) Identify important marketing factors and Ban pig characteristics affecting pork prices, and

(iii) Present recommendations for producers, traders, and policy makers to sustainably develop the Ban pig market and to improve the incomes and livelihoods of smallholder farmers, as well as other market participants.

4.2   Methodology

4.2.1 Study area and data collection

Ban pigs are mainly raised under smallholder conditions in mountainous areas of northern Vietnam. The primary market for Ban pork comprises restaurants in provinces of the lowland areas, which are the fastest growing in the country. Therefore, restaurant owners were chosen as an entry point for data collection on market issues. In fact, Ban pork is rarely found in wet markets due to its high value and final customers consume Ban pork almost exclusively in restaurants. Thus, these restaurants can be considered as key component in the Ban pork

value chain. Restaurant owners have experience in searching and developing Ban supply sources, as well as meeting customer expectations.

Data collection started by making a shortlist of restaurants offering Ban pork in the lowland surroundings of the capital Hanoi and its neighboring provinces. Based on expert knowledge and a snowball sampling procedure, a shortlist of 145 restaurants selling Ban pork was compiled. Based on the list, 40 restaurants were randomly chosen. If cooperation for the survey period of one year could not be assured, random replacements were selected. After the survey period, data from 33 restaurants could be used for analysis. They were located in the following provinces: Hanoi, Hung Yen, Hai Duong, Ninh Binh (see details in Tables 4.1).

Table 4.1. Distribution of restaurants by province

	No. of restaurants	%
Province:		
- Hanoi	7	21.2
- Hai Duong	10	30.3
- Hung Yen	9	27.3
- Ninh Binh	7	21.2
Restaurant area:		
- Delta	16	48.5
- Mountainous	17	51.5
Total	33	100.0

A structured questionnaire was designed to collect data covering general information on restaurants, restaurant owners' perceptions of their customers, general information on purchase arrangements (buying type – for details see model description) and the activities of

transporting, slaughtering and storing Ban pigs. In addition, the importance of quality attributes of Ban pork and other pork were assessed on a rating scale by the restaurant owners and information relating to marketing activities of stakeholders in the Ban supply chain was collected. Most importantly, weekly transactions for Ban pigs were recorded on a separate sheet, which additionally included details on quantity, price and quality attributes of Ban pigs for each transaction.

Surveyed restaurants are scattered in each of the four provinces. Often, restaurants are clustered in a specific so-called 'special food area'. The most important group of restaurants is located in the mountainous area of each province. Those restaurants have the advantage of approaching nearby and cheap Ban supplying sources of high quality. The size in terms of customer area of these restaurants is relatively large and many types of dishes also from different wild animals are offered. The restaurants that are located in the delta area are farther from supply sources and, hence, Ban pigs are often purchased from traders at considerably higher prices.

4.2.2   Empirical Model

In a competitive market, the implicit price of a product is a function of its attributes alone and not also of the characteristics any individual consumer or supplier of the product. However, empirical studies show that prices are also related to the characteristics of the buyers and sellers or marketing factors, implying some non-competitiveness in the market (Andargachew and Brokken 1993; Oczkowski 1994; Jabbar 1998). For this reason, a hedonic price model was used to evaluate the impact of different marketing and quality factors on the price of Ban pigs. The hedonic price analysis is based on the hypothesis that products have many attributes that confer utility and that the values of each attribute contributes to the final price of the

product. The observed price is therefore a composite of the implicit prices of the products' and marketing channels' attributes (Rosen 1974; Lucas 1975).

The hedonic price approach was first devised by Court (1939) and then further developed (see Becker, 1965; Lancaster, 1966 and Rosen, 1974). There are several studies that have applied the hedonic model for food and agricultural products: Brorsen et al (1984) analyzed rice prices in the U.S. market; Tronstad et al (1992) used the hedonic model to the describe the U.S. apple industry; Harris (1997) employed a hedonic analysis for Frankfurter sausages; Misra and Bondurant (2000) focused on the effect of quality attributes on price of cotton-seed; Karipidis et al (2005) and Kim and Chung (2011) analysed how retail egg prices are affected by product attributes; Ojogho et al (2013) conducted a hedonic demand analysis for beef in Benin metropolis; Mendis and Edirisinghe (2013) estimated a hedonic price model to study willingness to pay for rice traits in Sri Lanka.

Our questionnaire was designed to elicit information from restaurant owners on the attributes and the specific criteria that they consider when they purchase Ban pigs. The key question was to appreciate whether such attributes have any relationship with, or influence on the price of Ban pigs.

If we assume that any unobservable are uncorrelated with observed product characteristics, the hedonic price model can be written as:

$$Ln(Price_{it})n = \beta_0 + \left[\begin{array}{c} \sum_{i=1}^{3} \beta_1^j .BreedType_{it} \\ \sum_{i=1}^{2} \beta_2^j .Weight_{it} \\ \sum_{i=1}^{2} \beta_3^j .Fat_{it}] \end{array}\right] + \left[\begin{array}{c} \sum_{i=1}^{2} \beta_4^j .CutType_{ti} \\ \sum_{i=1}^{2} \beta_5^j .SellerType_{it} \\ \sum_{i=1}^{2} \beta_6^j .BuyingType_{it} \\ \sum_{i=1}^{3} \beta_7^j .MarketLocation_{it} \end{array}\right] +$$

$$\underbrace{\phantom{\sum_{i=1}^{3} \beta_1^j .BreedType_{it}}}_{Quality\ factors} \quad \underbrace{\phantom{\sum_{i=1}^{2} \beta_4^j .CutType_{ti}}}_{Marketing\ factors}$$

$$+ \sum_{i=1}^{3} \beta_8^j .Season_i + \varepsilon_{it}$$

The variables in this model are explained in Table 4.2. Accordingly, the dependent variable is Ln(Price$_{it}$) in which Price$_{it}$ is the tth wholesale price observation for the ith restaurant. Price is expected to be explained by seasonality, as well as marketing and quality factors. Breed type includes Ban purebreds, exotic purebreds and Ban crossbreds, where the price for Ban purebreds is expected to be higher than for other breed types. Apart from breed type, weight and fat are the meat quality factors included in the model. For the specific case of Ban pork, pigs with heavier slaughter weights as well as higher levels of fat are expected to be cheaper. As marketing factors, cut type, seller type, buying type and market location entered the hedonic price model. The price for a whole live pig is expected to be lower than for a slaughtered pig (carcass or retail cuts). Seller type refers to the supply source of Ban pork to restaurants and is classified into three categories, i.e. traders without slaughtering, traders with slaughtering and direct supply from pig producers. The price is expected to be cheaper, if Ban pigs are bought directly from the producer. Accordingly, the variable buying type is also classified into three groups, i.e. purchases on a case-by-case basis (often single, one time transactions with a specific supplier), by verbal (informal ex-ante) contracts and on basis of

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long-term relationships. Thus, the variable describes the type of contract made for business transactions between the restaurant and the supplying source. Case-by-case contracts are commonly used for initial transactions, or one time transactions. Verbal contractsare nonwritten agreements between suppliers and Ban restaurants and are considered as a bilateral exchange of promises to conduct business. In this way, Ban suppliers will promise to deliver Ban pigs for restaurants, while the characteristics of the required pigs are specifically clarified beforehand. If the requirements are not met, buyers have the right to return those pigs to the suppliers. This kind of contract is popular among small or medium restaurants. In contrast, long-term contractual relationships are based on trust, mutual-understanding and empathy and therefore the partners may not need to specify the requirements of the pigs beforehand. Here, long-term contractual relationships were expected to increase prices compared to purchases made by informal agreements or on case-by-case basis. The variable market location compiled four provinces that are corresponding to the areas where the current research was conducted, i.e. Hanoi, Hai Duong, Hung Yen and Ninh Binh. We assumed that the closer the restaurants are to the supplying source, the lower the price. Ban prices are also expected to vary by season, with higher prices obtained during spring when Lunar New Year, the most important national event in Vietnam, is taking place and lower prices in the hot season when the demand for meat is low.

Table 4.2. Definitions of variables for hedonic models

	Definition
Dependent Variable	
Price$_t$	*The wholesale price of Ban pig per kg for the t_{th} restaurant*
Independent Variables	
Breed Type$_{it}$	*Dummy variable for the i_{th} type of breed in the t_{th} restaurant: i = 1 (exotic purebred), 2 (Ban crossbred), base=Ban purebred*
Weight$_{it}$	*Dummy variable for the i_{th} range of weight per pig in the t_{th} restaurant: i = 1 (< 12 kg), 2 (12-17 kg); base = > 18 kg*
Fat$_{it}$	*Dummy variable for level of fat in the i_{th} of the t_{th} restaurant: i = 1 (lean), 2 (medium fat); base= high fat*
Cut Type$_{it}$	*Dummy variable for the i_{th} type of meat cut in the t_{th} restaurant: i = 1 (whole slaughtered pig), 2 (half slaughtered pig); base = live pig*
Seller Type$_{it}$	*Dummy variable for the i_{th} type of seller in the t_{th} restaurant: i = 1 (trader without slaughtering), 2 = (trader with slaughtering); base=pig producer*
Buying Type$_{it}$	*Dummy variable for the i_{th} type of buying in the t_{th} restaurant : i = 1 (case-by-case), 2 (verbal contract); base=long-term relationship*
Market Location	*Dummy variable for the i_{th} survey market; i = 1 (Hanoi), 2 (Hai Duong), 3 (Hung Yen); base=Ninh Binh*
Seasonality$_{it}$	*Dummy variable for the i_{th} season in one year in the t_{th} restaurant: i = 1 (spring), 2 (summer), 3 (autumn); base = winter(previous year)*

For the present analysis, 1944 price observations of a whole year from 33 restaurants were available. In order to estimate the effects of the different quality and marketing factors on Ban prices, we estimated a regression model with a semi-logarithmic functional form. Semi-log specifications are easily interpreted as the slope coefficient measures the relative change in the value of the dependent variable for a given absolute change in the value of the explanatory variables. In our case all independent variables in the model are dummies (coded as 0 and 1) and therefore, the percentage change in price compared to the base variable is $(e^{\beta_t^i}-1)*100\%$ (Chang et al 2010).

4.3   General descriptive analysis of Ban pig markets

4.3.1   Characteristics of Ban restaurants

General characteristics of the surveyed restaurants are summarized in Table 3. Restaurants in the delta area are often smaller in comparison to those in the mountainous areas. Tables in the delta restaurants are often arranged close together in order to efficiently utilize the space and increase the number of seats, resulting in a higher capacity of the restaurants in the delta area compared to those in the mountainous area. The number of employees is higher in the mountainous restaurants, because in the delta, the limited area and the high costs for land and labour reduce the average scale of the restaurants, especially of those located close to the city centre. Besides serving food, the restaurants in the mountainous areas nowadays also offer ecotourism like travel information or picnics in mountains and forests. Thus, these restaurants offer a wider choice of services, which explains customers' preferences for these locations. Moreover, the close distance to supplying sources is another advantage for these restaurants. Only marginal differences could be found in the owners' demographic data.

Table 4.3. Characteristics of restaurants

Restaurant characteristics	Delta		Mountainous		Total	
	Mean	SD	Mean	SD	Mean	SD
						2058
- Area (sqm)	677	675	1083	2079	1316	
- No. of seats	280	154	179	75	205	117
- No. of employees	10.2	3.1	11.3	13.4	9.3	3.9
- Distance to other restaurant (km)	1.9	1.8	1.9	1.4	1.5	1.5
Owner						
- Age (years)	44.4	11.4	42.8	8.4	43.5	12.1
- Education (years schooling)	11.5	2.4	11.1	1.9	11.8	1.5

The higher number of customers found in restaurants in the mountainous area also resulted in

a higher number of Ban pigs sold per week in this area (Table 4.3).

4.3.2   Ban prices

Prices for Ban pigs considerably differed between restaurants in the delta areas and those in

the mountainous areas. As can be seen in Table 4.4, provenance was also reflected in prices

paid by restaurant owners.

Table 4.4. Wholesale prices of Ban pigs for restaurant owners ('000 VND/kg)

Supply source	Restaurant location					
	Delta		Mountains		All	
	Mean	SD	Mean	SD	Mean	SD
Mountainous area	95.3	13.8	90.6	17.3	93.1	15.7
Delta area	82.7	7.8	92.4	15.4	90.1	14.6

The restaurant owner's opinions on price fluctuations are shown in Table 4.5. Most of the restaurant owners stated that price fluctuations for Ban pigs throughout the year can be quite high, and influenced by season and special occasions, such as Tet holidays, Independence Day or other holidays. However, the restaurants in the delta area seem to experience higher price fluctuations than those in the mountainous area, as shown by the difference in ratings (1.4 vs. 1.1, respectively; Table 4.5). According to the restaurants, especially those in the delta area, price fluctuations are quite hard to manage, because they depend on many factors. In the mountainous area, the management of price fluctuations seems to be less difficult, which may be due to the fact that the owners have longer relationships with suppliers, who are mainly pig producers and not traders. However, price fluctuations do not seem to influence the range of dishes that are offered by the restaurants.

Table 4.5: Restaurant owner's opinions on Ban pig price fluctuations

Price fluctuations	Delta		Mountains		All	
	Mean	SD	Mean	SD	Mean	SD
Price for Ban fluctuates throughout the year.	1.4	0.7	1.1	0.7	1.2	0.7
Price fluctuations of Ban are difficult to manage.	1.3	0.7	0.6	0.7	1.0	0.8
If Ban prices were more predictable and stable, I would be able to increase my sales of Ban dishes.	0.1	1.0	-0.2	1.0	0.1	1.0

Note: Fully agree (+2); Partly agree (+1); Neutral (0); Partly disagree (-1); Fully disagree (-2)

4.4   Hedonic price model analysis

Table 4.6 summarizes the results of the hedonic price model for Ban pigs in each of the surveyed provinces, as well as for the whole sample. F-values range from 33.1 to 323, which corresponds to a significance level of 1%. The R^2 values of the models range from 54% for the Hanoi market to 90% for the Hung Yen market. The resulting coefficients show the expected signs and the statistics suggest that the models fit the data well, especially for Hung Yen market, where 90% of the variance in Ban pig price (per kg) is explained by the variables in the model. In sum, the model results indicate that quality attributes, marketing factors and season of sale were significant factors influencing the market price over one year in the study area.

Quality factors

In all provinces, Ban crossbreds received about 9% lower prices than purebred Ban. This price discount reflects the higher meat quality associated with pure Ban pork. Particularly in Hanoi, the percentage difference in price between crossbred and purebred Ban pork

accounted for 13%, implying that consumers in Hanoi have an even higher willingness to pay for high quality meat of pure Ban.

The regression results for each province indicate that exotic purebreds with high lean meat content were also purchased at a 11-22% lower price by restaurants in comparison to Ban purebreds. This considerable price difference in combination with information asymmetries on the quality of Ban pork tempted owners of small restaurants to mix pork of exotic pig breeds with pork from Ban pigs, particularly those with a low reputation regarding food quality. This practice has been confirmed by some owners of restaurants in our survey. After being processed into different meals, customers cannot distinguish mixed pork dishes from pure Ban pork dishes. In Hai Duong and Ninh Binh, where restaurants are mainly allocated in the mountainous areas, pork from exotics does not appear in Ban dishes, explaining customers' preference for restaurants in those areas. This is further supported by the plans of 71% of the restaurant owners in the mountainous areas to expand their business within the next 12 months, as compared to only 42% in the delta areas.

Due to the high price of Ban purebreds and the insufficient supply, only restaurants in the mountainous area such as in Ninh Binh province, regularly purchased purebred animals. In most of the surveyed restaurants, Ban crossbreds are the most regularly used breed type.

Other factors affecting Ban prices included the average weight per live pig. For analysis, the average weight per live pig was divided into three categories, i.e. less than 12 kg, 12-18 kg and more than 18 kg (base variable). From the results in Table 4.6 it can be seen that in all provinces Ban pigs with an average weight smaller than 12 kg were offered at 4-17% higher prices in comparison to pigs with an average weight of more than 18 kg, particularly in Ninh Binh province. This is due to the fact that the bigger and the older Ban pigs are, the higher the

fat content. In addition, it is believed that Ban pigs of high weight are fed on commercial concentrates. According to restaurant owner's opinions, the preferred average weight per live pig is below 15 kg. Surprisingly, the level of fat was not significantly affecting Ban pork prices in almost all provinces, except for Hai Duong. We suppose that this is a result of the low fat levels in pork from pure Ban pigs.

Marketing factors

Regarding the marketing factors, trading partner and cut type significantly influenced Ban pig wholesale prices. As expected, prices increased with the level of marketing services offered by traders, i.e. if traders slaughter pigs, prices will be higher compared to the wholesale price of live pigs. This is suitable for small restaurants, which cannot sell a whole pig in a day, and therefore buy a slaughtered pig or pork cuts. More interesting are the effects of buying arrangements. In comparison with transactions based on long-term contractual arrangements, prices for Ban pigs purchased on a case-by-case basis (initial or one time transactions) or by informal agreements were marginally higher. The restaurants only give way to non-recurring transactions, if their established long-term suppliers are out of stock or cannot deliver Ban pigs. Therefore, these buying arrangements are often due to supply shortages and involve higher prices in the range of 1-5%, depending on the province, in comparison to transactions on basis of long-term relationships. In Vietnam, a verbal contract illustrates high mutual trust between sellers and buyers, which should reduce transaction costs and therefore should lower prices. However, in contrast to established long-term contractual relationships, purchasing Ban through verbal contracts implies that the restaurants declare their requirements in advance. Therefore, Ban purchased through this arrangement has more specific requirements than for transactions within long-term relationships, which resulted in 6-9% higher prices, depending on the respective province.

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Table 4.6. Hedonic model estimation results for Ban pig prices

Variables	All	Hanoi	Hai Duong	Hung Yen	Ninh Binh
	n= 1946	n= 445	n= 554	n=570	n=377
Intercept	4.27*** (301)	4.36*** (126)	4.37*** (237.87)	4.36*** (237)	4.16*** (134)
Quality characteristics					
Exotic purebred	-0.19*** (-8.98)	-0.25*** (-5.05)	-0.19*** (-2.91)	-0.12*** (-7.41)	-
Ban crossbred	-0.09*** (-12.8)	-0.14*** (-7.88)	-0.08*** (-9.25)	-0.04*** (-3.99)	-0.014 (-0.85)
<12kg	0.02 (1.64)	0.003 (0.09)	0.02 (1.57)	0.04*** (3.01)	0.15*** (5.65)
12kg-18kg	0.05*** (4.94)	0.07* (2.52)	0.02 (1.61)	0.02* (1.90)	0.12*** (5.28)
Lean	-0.01 (-1.06)	-0.02 (-1.24)	0.003 (0.33)	0.007 (-1.09)	-0.06*** (-4.23)
Medium fat	-0.001 (0.08)	0.05 (1.37)	-0.03* (-2.08)	0.0003 (-0.02)	-0.01 (-0.66)
Marketing Factors					
Trader without slaughtering	0.08*** (11.9)	0.18*** (8.12)	0.04*** (3.29)	-0.005 (-0.51)	0.08*** (6.87)
Trader with slaughtering	0.06*** (5.46)	0.13*** (5.70)	0.15*** (3.07)	-0.08*** (-4.14)	0.07*** (3.11)

Case-by-case	0.01***	0.01	0.01	0.03***	0.05***
	(2.30)	(0.86)	(1.51)	(2.81)	(2.93)
Verbal contract	0.05***	0.07**	0.09***	-0.02**	0.06***
	(6.99)	(2.05)	(8.24)	(-2.36)	(4.79)
Whole slaughtered pig	0.23***	0.33***	0.14***	0.30***	0.19***
	(15.6)	(7.16)	(7.44)	(13.24)	(6.39)
Half slaughtered pig	0.25***	0.21***	0.11***	0.23***	0.37***
	(18.3)	(4.87)	(6.01)	(14.5)	(17.1)
Hanoi	0.08***	-	-	-	-
	(9.77)				
Hai Duong	0.06***	-	-	-	-
	(7.36)				
Hung Yen	0.06***	-	-	-	-
	(8.50)				
Seasonal factors					
Spring	0.16***	0.13***	0.17***	0.18***	0.16***
	(26.8)	(7.34)	(21.18)	(28.0)	(11.4)
Summer	0.26***	0.17***	0.28***	0.36***	0.25***
	(39.2)	(8.79)	(33.2)	(47.4)	(17.0)
Autumn	0.39***	0.32***	0.41***	0.47***	0.37***
	(55.2)	(15.5)	(46.9)	(57.7)	(23.1)
R-squared	0.69	0.54	0.85	0.90	0.73
F-value	237***	33.1***	200***	323***	71.1***

Notes: the dependent variable is the natural logarithm of the wholesale price paid by a restaurant owner in '000 VND/kg *** $p < 0.01$; **$p < 0.05$; *$p < 0.1$; - variable not included in the model. Numbers in brackets are values of t-statistics

The applied model also allowed a comparison of wholesale prices in different markets: Ban pigs in Ninh Binh were cheaper than compared to Hanoi, Hai Duong and Hung Yen provinces. A possible reason for the difference here could be the structure of the marketing channel, which is shorter and directly from producers. Therefore, as restaurants in Ninh Binh are located more upstream in the supply chain, their ability to access supply sources was easier and the lower price reflects lower transaction costs. In comparison to the other three provinces located closer to industrial centers, the purchasing power of restaurants in Ninh Binh province is also lower. Among the four provinces, the highest wholesale prices for Ban were offered in Hanoi. High transportation costs simply increase the prices for Ban and other products in Hanoi compared to other provinces.

Seasonal factors

All coefficients for season are significant at the 1% level. The results indicate that the wholesale price for Ban increases throughout the seasons, from winter through spring and summer to autumn. Indeed, the winter season was chosen as the base level to capture seasonality effects: the winter season corresponds to October-December 2010, followed by spring from January to April 2011, summer from May to July 2011 and autumn from August to September 2011.

Price increases of Ban pork within the survey period could indicate general price inflation and mask seasonality effects, because the consumer price index (CPI) of the country increased by approximatly 20% in the survey period (GSO, 2011). However, the coefficient for the autumn season shows that the price was higher by around 48% compared to the winter season, i.e. a price increase that is considerably higher than would be expected when only considering general price inflation. Conversely, prices increased more slowly in the summer by 29% as

compared to the winter reference period (a price increase of around 4% (GSO, 2011) could have been expected by general price inflation) indicating relatively lower demand for pork in the hot season. The strongest price increase compared to the previous season is from winter to spring. Strong seasonality effects of Ban pork prices indicate some mismatch of demand and supply along the seasons. Price increases of Ban pork that are higher than the general price inflation, indicate an increasing supply shortage of Ban pork within the considered survey period.

4.5   Discussion and conclusions

The results of the hedonic price model analysis indicate that farmers could gain higher prices, if they would be able to supply Ban pigs that possess preferred customer attributes with respect to marketing and quality aspects during the right time of the year (season). The results showed that significantly higher prices could be obtained for purebred Ban pigs with a low slaughter weight and moderate fat content. However, the currently high demand for Ban pigs cannot be met by purebreds and thus, crossbreds are used to fill the supply gaps. In addition, crossbred Ban pigs are increasingly fed on a commercial basis in order to increase live weights, resulting in the corresponding negative effects on meat quality and prices. Ban pigs that are extensively or semi-intensively raised on natural feedstuffs receive higher prices from both, restaurants and customers.

The results also indicated that the peak selling period of the year is spring, which coincides with the Lunar New Year, followed by the winter season. Accordingly, farmers could take advantage by fattening schemes that are adjusted to these seasons. The most important issue for the restaurant owners appears to be a secure supply source delivering high quality of Ban pigs. Among the four surveyed markets in Hanoi, Hai Duong, Hung Yen, Ninh Binh, restaurants in Ninh Binh province paid the lowest purchasing price, which is due to the fact

that their suppliers are mainly producers. These direct marketing links through short supply chains allowed restaurant owners in more distant provinces to offer their Ban dishes to customers at lower prices, partly at the expense of producers. Particularly for the uplands of northern Vietnam, Herold et al (2010) proposed a short food supply chain system to better organize pig breeding and marketing channels in remote areas. Moreover, promoting transactions based on long-term contractual arrangements between producers and restaurant's owners is an option that policy makers should consider to sustain growth through Ban pork production.

An alternative approach builds on long-term research in the northern mountainous region of Vietnam developing a conceptual and analytical framework for the initiation and implementation of a community-based breeding program (CBP) and its subsequent systematic transfer into a profitable, self-sustained breeding and marketing program (CBMP) for pork produced with local pig breeds (Valle Zárate and Markemann 2010). The currently implemented CBMP counts on the involvement of a private breeding company, the regional extension service and the national research institute. The organizational set-up is sought to safeguard a sustainable and cost-efficient transfer and is based on results of Roessler et al (2012), who identified breeder cooperatives as the most promising option for breeding management on communal level in North Vietnam. Moreover, from a theoretical background Herold et al (2012) showed that the current structural and organizational planning of the CBMP may increase the competitiveness of smallholder breeders on village level on the one hand, and provide an incentive system for a systematic conservation of the local pig breeds on the other hand.

Finally, it should be noted that the quality of Ban pork is the leading concern of both, restaurants and customers. The difficulty of some customers distinguishing between 'real' Ban pork and crossbreds of lower quality contributed to a free-rider problem caused by information asymmetries, which seriously compromises customer satisfaction and trust and could ultimately lead to market failure. Thus, the establishment of a quality control system within the marketing chain offers an effective measure to provide product traceability from the producer to the consumer level, as well as to achieve higher prices. Such quality control and traceability system is also an integral part in the set-up of the implemented CBMP mentioned above. The systematically organized exploitation of the special quality characteristics of the Ban pig (Hau 2008; Huong et al 2009) would concurrently result in appropriate benefits for the rural poor and a sustainable utilization of a valuable local genetic resource**.**

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5. General conclusions

The key objectives of this dissertation have been to estimate the impacts of factors on preferences for HVAP in Vietnam and their implications for policy makers in this country.

Rising demand for HVAP in emerging markets has created a new opportunities in food supply chains. Growing demand for HVAP has created opportunities for agricultural producers, especially smallholders. They can diversify towards products that have strong market potential and high economic efficiency. Demand for HVAP like meat products is predicted to grow in the next years in developing countries, where consumers' awareness for higher quality, tastier and safer food products is increasing. Understanding demand for HVAP may help policy makers to pay attention to high profit products and design policies that allow farmers choosing animals and crops which improve their income and living standard.

Vietnam has emerged as one of the most dynamic economies in Asia. The country has seen many achievements in its economic development over the last three decades and is considered a typical case study for the change in demand for food products, especially livestock products. Like other developing countries, with increased urbanization and rising household incomes, Vietnamese are changing their preference for HVAP such as meat and dairy products in their daily diet. The studies in this dissertation answered the research questions mentioned in chapter 1: (1) What are the factors that affect Vietnamese households' consumption behavior for dairy products? (2) What are the determinants of meat consumption in Vietnam, especially pork and poultry? (3) What are important marketing factors and animal characteristics effecting consumer preference for pork from an indigenous pig breed?

The average expenditure per capita across the nation increased fast and Vietnamese households spent a considerable proportion of their total income on food consumption, especially basic food such as rice, salt, vegetable, oil and sauces. More importantly, although having low consumption per capita compared with other countries and regions of the world, meat is one of the most important food groups in Vietnamese households. The result shows that the share of meat in total food expenditure is approximately 21 % in data of VHLSS 2010. Furthermore, pork is the most popular kind of meat consumed in Vietnam, followed by poultry. Thus, the analyses on pork and poultry consumption becomes a key case study for meat consumption in Vietnam.

Compared with other countries in the region, Vietnamese per capita consumption on dairy products is relatively low. However, demand of these products has increased rapidly over the last years. This has led to a Vietnamese dairy products' market with strong potential. In fact, the rich spent much more on dairy products than the poor and the price of imported milk is higher than in other developing countries. Thus dairy products are considered as luxurious product in many families in Vietnam. And together with meat products, dairy products are high value products.

The changes in Vietnamese food consumption patterns have been estimated in two articles at household level. Firstly, Vietnamese households' expenditure on dairy products for home consumption has been analyzed using a double-hurdle model to examine the effects of socio-economic and demographic variables on Vietnamese households' decision to purchase milk and milk products and how much they spent on these items. Secondly, these households' characteristics have been examined in view of the impact on meat consumption in families.

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The results show that for a long time, rising income is still expected to increase the demand of meat and milk products in Vietnam. These outcomes are consistent with previous studies on food products in other developing countries. The levels of meat and dairy products demand increase at a decreasing rate though, as the negative quadratic term in the meat consumption and dairy products expenditure models indicate. However, the coefficients of the income squared variable are very small compared with the linear income variable in these models. Thus only at very high income levels, demand of meat and milk products will start to decrease. Therefore, policies that aim to increase households' income could promote HVAP consumption and production. In addition, according to GSO (2014) in the year 2013, Vietnamese income per capita was 1,911 USD – an increase of approximately 3.6 times compared to ten years before (in 2003). However, the income gap between the rich and the poor has been widening over the last decade in Vietnam (Figure 3.1). So policy makers should consider policies to improve the nutritional and health status in the poor population sector in particular.

The models' results suggested that several socio-demographic factors at household-level play a key role in determining demand for HVAP in Vietnam such as meat and milk products. Households' heads' characteristics such as households heads' education, age and gender, household composition such as the presence of children and older people in the families, and other socio-demographic characteristics are found to be significant in influencing meat and dairy products consumption.

In particular, the educational level and gender of households' heads have significant impacts on both meat and milk products' consumption. Households where the head has a higher education and/or where the head is female tend to have higher milk products expenditures. However, families where the head has a higher education consume more meat, while the

families with a female head consume less meat products than others. The results have contributed in explaining the changing of meat and milk products consumption in Vietnamese households and they reflect important characteristics of household's heads' variables in HVAP consumption patterns in Vietnam. Therefore changing consumption patterns are linked to a changing role of women in society and an increasing educational level in the course of time. Household size was found to have a negative impact on meat and dairy products consumption. This negative impact may indicate economies of scale in consumption. As the size of households in Vietnam has a downward trend (Chapter 3), this result could contribute to an increase in demand for meat and milk products as on average.

The result shows that urban households tend to spend more on dairy products than rural households. That means that the degree of urbanization plays an important role in determining expenditures on dairy products and urbanization contributes on increasing dairy products consumption. Culture and the differences in the socio-economic situation and other factors between regions of the country have resulted in significant differences in meat and milk products consumption in Vietnam as well. These results may help policy makers to implement measures to ensure food security, such as food redistribution between regions and between urban and rural area. Improving infrastructure and especially the transportation system can support the production and exchange between regions in the country.

Children and older people are also important factors determining dairy products' demand patterns. Future demand growth for dairy products is higher when Vietnam is entering into an aging population as the share of older people in the Vietnamese population is increasing. This result helps policy makers to implement policies related to agricultural and food sectors, to nutritional and health policies for children and older people.

Also the study on retail proces for Ban pigs has important implications: With respect to marketing factors and animal characteristics, analyzing retail prices has shown preferences of consumers for indigenous breed pork. The results of the hedonic price model indicate that the customers are willing to buy at a higher price for Ban pigs that have preferable attributes with respect to marketing and quality factors. In particular, marketing and quality factors include type of breed, live weight of animal, fat level of meat, type of meat cut, type of buying, type of seller, market location and seasonality. An effective method to ensure benefits of increasing Ban prices to smallholders can be seen in the formation and development of a professional breeding and marketing organization that link public and private institutions with an organized farmers association. This finding can help producers and traders to understand how they can get a higher price for Ban pork and produce and sell their products to meet consumers' preferences. Moreover, policy makers should consider promoting transactions based on long-term contractual arrangements between producers and restaurants' owners and safeguarding appropriate benefits of the rural poor from a systematic and sustainable marketing of quality-controlled pork of regional origin. At the same time, these policies would contribute to safeguarding and promoting the sustainable utilization of valuable local genetic resources.

The results may help policy makers to implement policies related to the food sector, to nutrition, to health and to food security in Vietnam, as well as in other developing countries with a similar situation. However, rising incomes, urbanization and globalization are changing the preferences of consumers in emerging countries towards high-value products. Future research should be conducted to update and adapt to new situations. Another opportunity for further research might be to utilize time series data or panel data to analyze and assess future demand for a variety of HVAP.

Appendix

Questionnaire of Restaurants Survey for the investigations of Chapter 4

Interviewer:

Date: ____/____/_____ Starting time: Ending time:

Section 1. Information about the restaurant and the owner

1.1. Respondent and owner information

Name of Restaurant:

Street: …………………………………………………………….

Commune: …………………………………………………………….

District: …………………………………………………………….

Province/City:……………………………………………………………………

Tel:

Name of respondent:

Position of respondent in the business:

Name of the owner of the restaurant:

Gender (1=Male, 2=Female):.   Age (years):

Years of schooling:

1.2. General information about restaurant

Eating area of restaurant?. (m^2)

Number of regular seats for guests? 1.

Number of full-time workers in restaurant? :

Number of part-time workers in restaurant? :

They are (code):

Distance to next restaurant that offers dishes with ban pork? (km)

Distance to next wet market?   (km)

Distance to next supermarkt?   (km)

1.3 Information about dishes

How many dishes do you offer in the restaurant?

How many dishes do you sell in an average week?

How many dishes with Ban pork do you offer in the restaurant?

How many dishes with Ban pork do you sell in an average week?

Prices of dishes

		Min. price	Average price	Max. price
(a)	All dishes except ban dishes ('000 VND)			
(b)	Ban dishes ('000 VND)			

Section 2: Perceptions about customers

What do you think generally about your customers?

			1	2	3	4	5	
(a)	Is the majority male or female?	Male						Female
(b)	Is the mayority old or young?	Old						Young
(c)	Is the majority rich or poor?	Rich						Poor
(d)	Is the majority from the neighborhood or from far?	Neighbor						From far
(e)	Is the majority low or highly educated?	Low						High
(f)	Is the majority from a small or a big family?	Small						Big
(g)	Has the majority blue or white collar jobs?	Blue						White

What do you generally think about those customers that like to eat ban dishes?

			1	2	3	4	5	
(a)	Is the majority male or female?	Male						Female
(b)	Is the mayority old or young?	Old						Young
(c)	Is the majority rich or poor?	Rich						Poor

(d)	Is the majority from the neighborhood or from far?	Neighbor						From far
(e)	Is the majority low or highly educated?	Low						High
(f)	Is the majority from a small or a big family?	Small						Big
(g)	Has the majority blue or white collar jobs?	Blue						White

Appendix

What do you think why your customers like ban pork more than other pork?

		Fully agree (+2)	Partly agree (+1)	Neutral (0)	Partly disagree (-1)	Fully disagree (-2)
(a)	Ban pork is **tastier** than other pork					
(b)	Ban pork is **healthier** than other pork					
(c)	Ban pork is **fattier** than other pork					
(d)	Ban pork supports **small famers**					
(e)	Ban pork is **less damanging to environment** than other pork					
(f)	Ban pork contains **less antibiotics** than other pork					
(g)	Ban pigs are **fed more naturally** than other pigs					
(h)	Ban pork is better **suited for a family party** than other pork					
(i)	Ban pork is a **special food** of restaurants in the cities					
(j)	Eating Ban pork is a **status symbol** for wealthy people					
(k)	Others, (specify)					

Section 3: General information about purchase arrangements

How may kilogram of Ban pork did you buy to in 2009?................ Kg

How may kilogram of Ban pig did you buy to in 2009?................ Kg

How many different suppliers sell Ban pig to you in 2009? …………………………................

Please give the estimated percentage of your ban supply by origin in 2008 and 2009:

		2009	2008
(a)	Son La Province	%	%
(b)	Hoa Binh Province	%	%
(c)	Dien Bien Province	%	%
(d)	Lai Chau Province	%	%
(e)	Lang Son Province	%	%
(f)	Phu Tho Province	%	%
(g)	Quang Ninh Province	%	%
(h)	Lao Cai Province	%	%
(i)	Others, (specify)	%	%
(j)	Specification		

Do you bargain about price with seller ?

Yes   (1)   No   (0)

If yes, you want to reduce price of Ban pig up on:

Buying time   (1)

    Buying volume   (2)

Physical appeare of pig   (3)

Other   (4)

if no, why not:

Regular seller   (1)

Contracted price   (2)

Others   (3)

Where do you get price information?

Wholesaler   (1)

Other Retailer   (2)

Others   (3)

What kind of contract do you use when you buy Ban pig ?

formal   (1)   informal   (0)

If formal, please explain detail (what is on the contract? quantity, price, varieties, quality, etc)

....

Section 4: Transport, slauthering and storage

What is your transport mean? How may kilograms can you buy for each mean?

Carry with a shoulder pole   (1) …………..kg

Bicycle   (2) …………..kg

Motorbike   (3) …………..kg

Others   (4) …………..kg

Do you slaughter Ban Pig?

Yes   (1)   No   (0)

If Yes, where do you slaughter it?

Pig farm   (1)

Your home   (2)

Restaurant   (3)

Slaughtering center   (4)

How do you do slaughter?

One by one   (1)

Slaughter chain   (2)

Others   (3)

How many Ban Pig do you slaughter per week? …………per week

When do you usually slaughter?

At night   (1)

Early morning   (2)

Any time needed customers   (3)

Others   (4)

Do you store Ban pork ?

Yes   (1)   No   (0)

If yes, please explain detail:

....

....

....

Section 5: Quality attributes of ban pork and other pork

Do you assort ban pork when you buy/slaughter ?

Yes   (1)   No   (0)

Appendix

Do you assort other pork when you buy/slaughter ?

Yes   (1)   No   (0)

If yes, how important are the following criteria when you buy?:

	Attribute	Ban	Other pork
(a)	Price		
(b)	Seller type		
(c)	Origin		
(d)	Breed		
(e)	Cut		
(f)	Buying arrangement		
(g)	Health		
(h)	Weight		
(i)	Figure		
(j)	Kind of hair		
(k)	Tenderness		
(l)	Intra-muscular fat		
(m)	Softness		
(n)	Skin		
(o)	Taste		

Codes: 4 very important, 3 important, 2 less important, 1 not important

Section 6: Opinions about ban supply chains

		Fully agree (+2)	Partly agree (+1)	Neutral (0)	Partly disagree (-1)	Fully disagree (-2)
	Supply					
(a)	There is sufficient supply of ban in good quality throughout the year.					
(b)	It is diffult to manage supply shortages at some stages in the year.					
(c)	If supply of ban pork would be more stable, I could increase my sales of ban dishes.					
	Price fluctuations					
(d)	Price for ban fluctuate throughout the year.					
(e)	Price fluctuations of ban are difficult to manage.					
(f)	If ban prices would be more predicatble and stable, I could increase my sales of ban dishes.					
	Traceability					
(g)	It is important to know the origin of the ban in order to source good quality					
(h)	It is difficult to know the origin of the ban as my suppliers try to obscure their suppliers.					
(i)	If traceability in ban supply chains would be improved, I could increase my sales of					

	ban dishes.					
	Profesionalism in supply chains					
(j)	I have a professional relationship with my ban suppliers.					
(k)	Supply chains of ban are less professional than supply chains of other pork.					
(l)	If supply chains of ban pork would become more professional, I could increase my sales of ban dishes.					

Section 7: Economics of the restaurnat

4.1 Cost – Benefit (in 2009)

Total revenue …………………...………………….........(1,000VND/year)

Share of revenue from ban………………………………..%

Cost for buying Ban pig:...(1,000 VND/year)

Cost for transportation: .... (1,000 VND/year)

Market fee: ....(1,000VND/year)

Taxes: ....(1,000 VND/year)

Others:..…………………………................................... (1,000 VND/year)

Total cost: .... (1,000 VND/year)

Section 7: Economics of the restaurnat

Appendix

4.2 Future Plans

1. Did you expand your business during the last 12 months?	( )YES ( )NO
2. If Yes, indicate how (code a)	
3. Do you plan to invest in your business during the next 12 months?	( )YES ( )NO
4. If yes, indicate the **reasons for planned expansion** [code b]	
5. If no, indicate the **reasons why no plan of expansion** [code c]	

a. How was business expanded?	b. Reasons for planned expansion	c. Reasons why no plan of expansion	
1= increased number of customers 2= increased number of dishes 3=increased number of ban pork dishes 4 = others, specify.	1 = increased demand for dishes 2 = inputs more easily available 3 = inputs less costly 4 = policy environment more conducive to business 5 = increased demand for ban pork dishes 6 = ban pork more easily available Other, specify in cell	1 = demand for dishes stagnant 2 = inputs not available 3 = inputs too costly 4 = policy environment not conducive 5 = ban pork not available Other, specify in cell	

Section 8: Transactions for Pig

Please add all transactions during the designated week. If different pigy or cuts where included in one transaction, provide details for each pig or cut

	Time		Seller	Seller type	Origin	Breed	Cut	Quantity	Price	Transport	Buying type	Quality								
												Health	Weight	Figure	Hair	Tenderness	Intra-muscular fat	Softness	Skin	Taste
	Date	Hour	Name	1	2	3	4	*(kg*	*(VND/ kg)*	5	6	7	8	9	*10*	11	12	13	14	15
1																				
2																				
3																				
4																				
5																				
6																				
7																				

8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			

Codes

Attribute	Code	Levels
Seller type	*1*	*1-Trader without slaughtering, 2- trader incl. slaughtering, 3-other restaurants , 4- pig producer, 5-others, specify.*
Origin	*2*	*1-Son La Province, 2-Hoa Binh Province, 3-Dien Bien Province, 4-Lai Chau Province, 5-Lang Son Province, 6-Phu Tho Province, 7-Quang Ninh Province, 8- Lao Cai Province, 9- Others, (specify)*
Breed	*3*	*1- Exotic purebred, 2- Exotic-Ban crossbred, 3-Ban purebred, 4-Black American purebred, 5-Rung-Ban crossbred, 6-others, specify*
Cut	*4*	*1-live pig, 2-whole slaughtered pig, 3- half slaughtered pig, 4- neck, 5- others, (specify)*
Transport	*5*	*2- Carry with a shoulder pole, 2-bike, 3- motorbike, 4-car,5-lorry, 6- Others, specify*
Buying type	*6*	*1- longterm relationship, 2- case-by-case, 3- verbal contract, 4- written contract, 5- others, (specify)*
Health	*7*	*1- exellent, 2- good, 3- medium, 4- weak*
Weight	*8*	*1- <12 kg, 2- 12 – 18kg, 3- > 18 kg*
Figure	*9*	*1- tall, 2- medium, 3- low*
Kind of hair	*10*	*1- 3 hairs/hole, 2- 1 hair/hole,3- others, (specify)*
Tenderness	*11*	*1- tender, 2- humid, 3- others(specify)*

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Intra-muscular fat   *12*   *1-lean, 2- fat, 3-mixed*

Softness   *13*   *1- soft, 2- tough, 3- others(specify)*

Skin   *14*   *1- soft and thin, 2- clear skin color abnomal blemishes, 3- others(specify)*

Taste   *15*   *1- tasty, 2- bland, 3- others(specify)*