CONSUMERS' PREFERENCES: STRUCTURAL CHANGES IN DEMAND FOR MEAT AND POULTRY IN UKRAINE

by

Kalambet Tetiana

A thesis submitted in partial fulfillment of
the requirements for the degree of

MA in Economic Analysis
.

Kyiv School of Economics

2015

Thesis Supervisor: _____ Professor Elena Besedina

Approved by _____
Head of the KSE Defense Committee, Professor Irwin Collier

_____

_____

_____

Date _____

Kyiv School of Economics

Abstract

CONSUMERS' PREFERENCES: STRUCTURAL CHANGES IN DEMAND FOR MEAT AND POULTRY IN UKRAINE

by Tetiana Kalambet

Thesis Supervisor: Professor Elena Besedina

Meat as a base for food consumption plays significant role in determining health state of population as well as overall welfare and macroeconomic prospects for agricultural industry. Issue of consumer choice between different types of meat is important both for trade and health economics, as well as policy design within these areas. Current paper is dedicated to meat demand in Ukraine, where the most popular types of meat are poultry, beef and pork. Using Quadratic Almost Ideal Demand System approach the model for meat demand was built, and expenditure and price elasticities of demand were obtained, as well as their changes over time. There were found demographic and social characteristics affected consumer choice, and differences in demand of urban and rural consumers were investigated. Following the results obtained, comparison of Ukrainian meat demand with those of other countries was made in order to define potential directions for development.

TABLE OF CONTENTS

LIST OF FIGURES

Number *Page*

LIST OF TABLES

Number *Page*

LIST OF ABBREVIATIONS

AIDS	Almost Ideal Demand System
BMI	Business Monitors International agency
CPI	Consumer Price Index
HH	Household head
PS	Paper sample
QUAIDS	Quadratic Almost Ideal Demand System
SS	Survey sample
SSSU	State Statistical Service of Ukraine
UH	Ukrainian household survey
WHO	World Health Organization

Chapter 1

INTRODUCTION

Meat as a primary source of energy is one of the main and most consumed product in our everyday ration. The overwhelming majority of people consider meat as the basis for their food consumption: families plan their spending from the perspective of consuming a necessary amount of meat, whether it would be poultry, pork or beef.[1] However, given the diversity of meat products, consumers would prefer one kind of meat to another, which poses an issue of consumer choice over different kinds of meat. Given this choice, we could consider the tastes and changes in them as well as their impact on overall health, spending and welfare.

During recent years Ukrainian meat market[2] demonstrated non-homogenous dynamics (see Figure 1): while total production of meat in natural terms grew, total meat consumption switched from growth to decline and vice versa. In 2010-2013 meat consumption of Ukrainians were higher than domestic production, and therefore the export was needed. However, in 2014, due to geopolitical crisis evolved and following local currency devaluation, purchasing power of Ukrainians decreased, and as a result, consumption levels deteriorated, while production continued to grow.

---

[1] Given the 50% share of Ukrainian households' expenditures on food products in 2013, 23% of them went to meat. This translated into consumption of meat on the level of 5 kilos per person per month. (SSSU)

[2] Hereinafter we would use "meat market" for market of beef, pork and poultry products as the focus of our research. Together these products comprised 82% of meat sales in 2014. (SSSU)

Main livestock products in Ukraine are poultry, pork and beef. Historically, poultry was the most popular in natural terms, with 964 tones thousand consumed by Ukrainians in 2014. Lower rates of consumption were occupied by pork, with 810 tones thousand consumed. Beef consumption in 2014 were at the level of 422 tones thousand. Only poultry consumption in 2014 demonstrated growth, that is supposed to be caused by the lower poultry prices in comparison with prices for beef and pork, which, in light of common price increase (meat prices grew by 27.5% in 2014, in comparison with 12.1% CPI change), affected consumer choice over different types of meat.

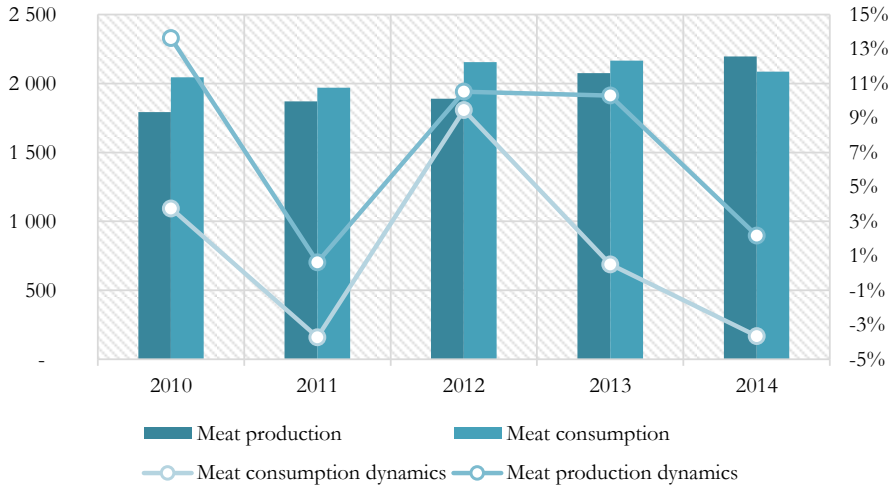

Figure 1. Ukrainian meat market and its dynamics, tones thousand

As price and income effects definitely occur on the Ukrainian meat market, it is particularly interesting to look at the income and price elasticities of meat demand over different meat types and their changes over time. Additionally, it would be useful to compare Ukrainian demand characteristics to those in different countries and get an insight about possible potential directions for development.

Health concerns

Besides primary issues of determining meat demand parameters, additional concerns regarding the consumption of meat types variety lay in different effects of meat on the people health. Having different fat content, meat could be compared in terms of health impact: higher the fat content of product, less beneficial it would be for the human's health, moreover, fat excess could cause a list of diseases, from the cardiovascular ones to even a cancer.[3] Therefore, nutritionists all over the world kindly advice people to avoid consumption of meat with higher fat content.[4] This ultimately reflects in shifts of consumption, for example, from red meat and pork to poultry. Recent research from Business Monitors International shows strong belief in the growth of poultry segment against pork and beef[5], "given lower corn prices and its [poultry] preferred status as a cheaper and healthier alternative to red meat".

Thus, for appropriate health and nutritionists policy to be performed it would be crucial to understand, whether these 'health' moves could be observed in Ukraine or not, and what are exact directions of consumer preferences shifts if any.

Policy implications

Demand characteristics are also importnant for policy development, as they are needed to assess effects of potential regulatory activities on the market. Thus, to assess consumer welfare gains and losses from concrete steps in livestock industry regulation (like taxes or quotas), one should knows demand elasticities both with respect to consumer's income and prices change.

---

[3] According to World Health Organization, at least 20% of cancers in developing countries are caused by dietary factors.

[4] The WHO recommends that a maximum of 10% of the daily energy intake should come from saturated fatty acids, which with 2,250 kcal per day ration corresponds to 9.3 kilograms of them per year.

[5] There is expected growth in poultry consumption from 2014 to 2019, by 8.5%, to 925,600 tones per year. Unlike pork and beef, poultry segment is believed to grow even in recessionary 2015. (BMI)

Moreover, given complicated nature of the consumer choice and preferences, to provide appropriate treatment for tax and other regulatory policy actions with respect to different social and demographic groups, we need to define, what household characteristics affect the choice of one meat over another and what differences in demand this impact leads to.

Paper objectives and tasks

Summarizing issues presented previously in this chapter, with this paper we are trying to proceed with the following fundamental tasks of applied demand theory:

- To develop demand model for different types of meat for Ukrainian livestock market;
- To obtain demand elasticities for different types of meat with respect to income (expenditures) and prices changes;
- To analyze changes in consumer preferences for different types of meat over time;
- To identify, what household characteristics influence consumer choice and in what way;
- To compare results with those previously obtained for other countries in order to determine potential way for development of Ukrainian meat market.

Chapter 2

LITERATURE OVERVIEW

This chapter is dedicated to the most relevant studies on the demand structure estimation and, in particular, on the research of the demand for different kinds of meat. The essential amount of studies on the demand theory was undertaken whereas the empirical applications are limited to develop the full approach to shifts in demand problem investigation.

The issue of the demand for different kinds of meat interrelation arises because of the dynamic nature of consumer preferences. The early steps in this direction were made by Clawson (1943), where the intuition behind the study is connected with the fact that for complementary to some degree commodities with the change in relative prices, the change in relative quantities consumed occurs, leading to the change in the consumption structure. Thus, he considers the evolution of demand for beef, pork, lamb, veal, and chicken, with respect to the comparative prices changes.

The approach of the demand interrelations evaluation lies in the bivariate comparison of prices and quantities ratios with respect to the dynamic evolution. As a result, several time trends were approximated for every bivariate couple with corresponding demand elasticity computed. However, the changes being observed in demand were not structural, as they were estimated as a response to the price changes. Moreover, the data were processed within quite poor tools, allowing only to approximately consider the evolution of ratios; the approach for clustering time trends is very intuitive based on the visual distinguishing of trends.

Another approach was used in the analysis of demand for pork and beef, performed by Fox (1954). Given the unchanged structure of demand the single-equation method was performed, bringing more theory to the estimation process, but leaving the open questions about limitations on the linear demand function used, no interrelations accounted for, and further dynamic applications of models.

More advanced study on the demand elasticity was done by Court (1967). Using the multivariate statistical analysis of beef, mutton, and pork per-capita consumption for eleven years, as well as corresponding prices he developed the model, which allows to obtain the demand elasticity estimates, and to test the utility maximization hypothesis within the model.

Despite the fact that predictions based on the model are more correct than those made by standard approaches, however, his paper also contains several limitations. First, the limited number of observations (eleven) used in study points to the problem of incomprehensiveness of estimations. Next, partially due to the lack of data, this framework does not include the dynamic evolution of demand parameters. And finally, the drivers of change in the demand are still the prices of goods, which mitigates the structural nature of demand evolution.

Following establishment of Almost Ideal Demand Systems (AIDS) developed by Deaton and Muellbauer (1980), this approach became essentially popular for demand systems estimation. Thus, using AIDS, Golan et al. (2001) studied the multivariate effects of endogenous factors on the share of beef, pork, chicken, processed meat and fish consumption in total consumption of the households in Mexico. The paper also defines the multivariate price and expenditure elasticity of consumption for meats.

AIDS approach was extended in order to account for non-linear nature of expenditure growth effects, as could be seen with Engel curves analysis. As curve suggested quadratic shape of dependency, then Banks et al. (1997) proposed to use quadratic term as well, and developed Quadratic Almost Ideal Demand Systems (QUAIDS). QUAIDS possesses all the desirable characteristics, while being more flexible, thus replaced the standard AIDS approach very soon. Later there was proposed extension of QUAIDS with demographic variables included in order to control for social and demographic effects (the way similar to Ray's (1983) scaling effect).

Today there is a list of demand studies use QUAIDS for description of the demand behavior and changes. Essential part of them dedicated to meat demand (e.g. Xi (2004)). There are meta-studies, assessing effect of different research features and methodologies on the meat demand characteristics (e.g. Gallet (2009)). However, no studies being performed for Ukrainian meat demand.

In this paper we tried to extend existing researches by combining static and dynamic analysis, including demographic effect accounting and its interpretation. Also we applied the research to Ukrainian data and compared estimated results to those previously found for other countries (primarily, to Slovakia, that has massive research base on meat demand).

The issue of the structural change in preferences for meat has many crucial points, which could hurt the applicability of the approach. The modern techniques, such as AIDS and QUAIDS Models, would allow to take them aside and develop the tool, which will indeed be useful for demand patterns and prospects estimation in the policy design.

Chapter 3

METHODOLOGY

4.1. Theoretical demand models

Almost ideal demand system

Since the introduction of almost ideal demand system (AIDS) concept by Deaton and Muellbauer (1980), these systems became the main tool for demand systems research and have been developed essentially. As background, AIDS theory suggests that target and all other goods are separable in the utility function. Thus for the meat demand research we could estimate a three-equation system of demand for meats only (accounting for beef, pork and poultry).

The main idea of AIDS is maximization of consumer's utility implicitly within the cost, or expenditures, function, which for rational consumer will correspond to the certain utility level achieved.

Basic (linear) AIDS consists of the set of budget-share equations:

$$s_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \ln p_j + \beta_i \ln\left(\frac{E}{a(p)}\right), \qquad (1)$$

where s_i (≥ 0) is the budget share of meat product i (throughout the paper we attribute i=1 to beef, i=2 to pork, and i=3 to poultry products), p_i is the price of product i, E is the total expenditure on meats, $a(p)$ is a price index (regarding cost of subsistence), α_i, γ_{ij} and β_i are constant parameters.

The corresponding nonlinear price index, in theory a cost of subsistence, is

$$\ln a(p) = \phi + \sum_{i=1}^{n} \alpha_i \ln p_i + \frac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} \gamma_{ij} \ln p_i \ln p_j , \tag{2}$$

where ϕ is a constant. Also there is a standard practice of adding an error term, $\in_i$, to each budget-share equation. Thus, the model becomes as (3):

$$s_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \ln p_j + \beta_i \ln\left(\frac{E}{a(p)}\right) + \in_i . \tag{3}$$

The AIDS is a flexible, complete demand system: it allows to check the adding up of budget shares (4), homogeneity (5), and symmetry (6) properties:

$$\sum_{i=1}^{n} s_i = 1, \tag{4}$$

$$\sum_{i=1}^{n} \alpha_i = 1, \ \sum_{i=1}^{n} \gamma_{ij} = 0, \ \sum_{i=1}^{n} \beta_i = 0, \ \sum_{j=1}^{n} \gamma_{ij} = 0, \tag{5}$$

$$\gamma_{ij} = \gamma_{ji} . \tag{6}$$

Given its form, AIDS could be simply interpreted: in the absence of changes in relative prices and "real" expenditure $\left(\frac{E}{a(p)}\right)$ the budget shares are constant and this is the natural starting point for predictions using the model.

Quadratic AIDS

Following the applications and results obtained, AIDS was extended with respect to the real expenditures growth inclusion. Banks et al. (1997) generalized the

AIDS model by demonstrating that the appropriate form for some consumer preferences is of a quadratic nature contrary to the linear form in the basic AIDS. Thus, QUAIDS has the following form:

$$s_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \ln p_j + \beta_i \ln\left(\frac{E}{a(p)}\right) + \frac{\lambda_i}{b(p)}\left(\ln\left(\frac{E}{a(p)}\right)\right)^2 + \in_i, \qquad (7)$$

where $b(p) = \prod_{i=1}^{n} p_i^{\beta_i}$. In addition, the QUAIDS model maintains the theory consistency and the desirable demand properties of the AIDS model.

QUAIDS with demographics

In order to control demographic features, which affect consumer's choice (Olorunfemi (2013)), QUAIDS model has been extended in order to account for socio-demographic effects. In this study we used Ray's (1983) 'demographic scaling' method: following it, the effects of a change on the demographics are closed to the effects of a change in prices.

Considering z as a vector of k household characteristics (in this study we accounted for household size, educational level of the household head and settlement). Let $e^R(p,u)$ represent the expenditure function of a reference household in base case. Then with different household characteristics, the household expenditure function could be considered as the result of scaling:

$$e(p,z,u) = m_0(z) * e^R(p,u), \qquad (8)$$

where scaling function $m_0(z)$, according to Ray (1983) parametrized as

$$m_0(z) = 1 + \rho z, \qquad (9)$$

where ρ is a vector of parameters to be estimated.

With additional accounting for the impact of household socio-demographic features on the marginal effect of expenditures, the expenditure share equation takes the following form:

$$s_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \ln p_j + (\beta_i + \eta_i z) \ln\left(\frac{E}{m_0(z)a(p)}\right) + \\ + \frac{\lambda_i}{b(p)c(p,z)}\left(\ln\left(\frac{E}{m_0(z)a(p)}\right)\right)^2 + \in_i, \tag{10}$$

where $c(p,z) = \prod_{i=1}^{n} p_i^{\eta_i z}$. The model's adding-up condition requires that

$$\sum_{j=1}^{k} \eta_{rj} = 0 \text{ for all } r = 1,..,n. \tag{11}$$

Elasticities

Following this specification of model, price elasticities (both uncompensated and compensated) and expenditures elasticities could be found.

The uncompensated price elasticity for the i meat type with respect to changes in the price of j type is (here δ_{ij} is a Kronecker delta):

$$\varepsilon_{ij} = -\delta_{ij} + \frac{1}{s_i}\left(\gamma_{ij} - \left[\beta_i + \eta_i z + \frac{2\lambda_i}{b(p)c(p,z)} \ln\left\{\frac{E}{m_0(z)a(p)}\right\}\right] \times \right. \\ \left. \times\left(\alpha_j + \sum_l \gamma_{jl} \ln p_l\right) - \frac{(\beta_j + \eta_i z)\lambda_i}{b(c)c(p,z)}\left[\ln\left\{\frac{E}{m_0(z)a(p)}\right\}\right]^2\right). \tag{12}$$

The expenditure (income) elasticity for the i meat type is:

$$\mu_i = 1 + \frac{1}{s_i}\left[\beta_i + \eta_i z + \frac{2\lambda_i}{b(p)c(p,z)} \ln\left\{\frac{E}{m_0(z)a(p)}\right\}\right] \quad (13)$$

The compensated price elasticities are derived from Slutsky equation:

$$\varepsilon_{ij}^c = \varepsilon_{ij} + \mu_i s_i. \quad (14)$$

4.2. Econometric overview

Econometric tools

To perform QUAIDS modeling, we used the STATA program *quaisd*, developed by Poi (2012), which uses maximum likelihood (ML) approach to find estimated coefficients. The approach is proven to be effective in several similar works (e. g. by Rizov et al. (2014)) and has the similar performance in comparison with more complicated methods like general maximum entropy (GME), simultaneous unrelated regressions (SUR), etc.

The program also allows for testing the statistical significance of coefficients obtained and testing joint significance (which we did for coefficients near demographic variables). Moreover, it provides users with both price and expenditures elasticities, which is particularly a subject of our work.

One of the contentious points of the model is coefficient ϕ from the price index equation (2). Economically this coefficient is supposed to be the cost of subsistence if the prices were equal to unity. There is no common practice in its determining: some papers just use value of 0 (e.g. Blacklow et al. (2008)), another apply the least value of ln(*E*) as a least increment of expenditures (like Xi et. Al

(2004)). In our work we found out, that as meat consumption is technically not necessary for survival (or, at least, *buying* meat), then there is enough to set ϕ equal to zero.

Dynamic effects

As the main task of the paper is not just estimate demand system, but also look into the dynamic changes of the consumer preferences and demand itself, we performed annual cross-section estimations within QUAISD and looked at the dynamics of model coefficients, as well as price and expenditure elasticities obtained. To obtain the most comprehensive values of demand parameters we also performed pool estimation within the whole time period observations available.

Tests

To perform the full analysis of models estimated besides the Wald test for coefficient significance, we also tested, whether demographic variables should be included in the model. Thus, initial hypothesis for demographic variable z was that $\rho_z = \eta_{1z} = \eta_{2z} = \ldots = \eta_{nz} = 0$ (no effect on demand). Hypothesis was tested on the 5% significance level.

Chapter 4

DATA OVERVIEW

5.1. Data source and structure

For this paper we use data from Ukrainian household surveys (UHS) for 2005-2010 performed by the State Statistic Service of Ukraine. These data describe life conditions, features and expenditures' structure of households in Ukraine during the period under review with annual frequency. The expenditures were selected as the basis of surveys, because of incentives for households to hide the actual level of income. The data covers the whole of Ukrainian citizens in terms of regional citizenship and is proved to be representative for Ukrainian population description.

For purposes of the paper, we use the following variables out of the survey:

- s_{1i}, s_{2i}, s_{3i} — shares of total meat budget of household i, spent on beef, pork or poultry, respectively.

- p_{1i}, p_{2i}, p_{3i} — prices for beef, pork and poultry, respectively. Prices were obtained as household's expenditures on beef, pork or poultry divided by corresponding quantities (in kg) bought. Thus, the prices are household-specific[6] and nominal[7].

[6] This could be explained by the difference in social, demographic and economic circumstances of the households.

- E_i — total expenditure on meat of the household i.

- Additionally, to control for different social and demographic features of households and to define, which of them are more important for consumer choice, we used following variables:

    - Household size. Given the survey sample (SS), this indicator varies from 1 to 13 household members.

    - Educational level of household head (HH). Corresponds to the education obtained by HH (e.g. completed higher one).

    - Settlement type. Household lives either in urban area (large or small cities) or in rural one.

In order to understand what households in terms of meat consumption[8] and demographical factors are in the survey sample, we looked at the survey sample structure (see Figures 2a-2d). Thus, we understood that in 2010 the most part of the sample households lived in the urban area (41% out of sample lived in large cities and 27% in small ones) and consisted from 2 persons (31%). Most household heads had complete secondary education (39%). In terms of meat consumption, most of them consumed only one type of meat (39%). Households not consuming (not buying) meat comprised for 14% of the survey respondents.

More statistics about SS with respect to the year of survey is presented in the Appendix A.

---

[7] This poses an issue of inclusion prices into pool regressions. In order to avoid biases for pool regressions we used deflated prices for years 2006-2010, obtained by division on the annual CPIs published by SSSU.

[8] In paper we will frequently use "consumption" instead of "purchasing", not accounting for eating home-made meat, as we are looking on the meat demand from the market point of view.

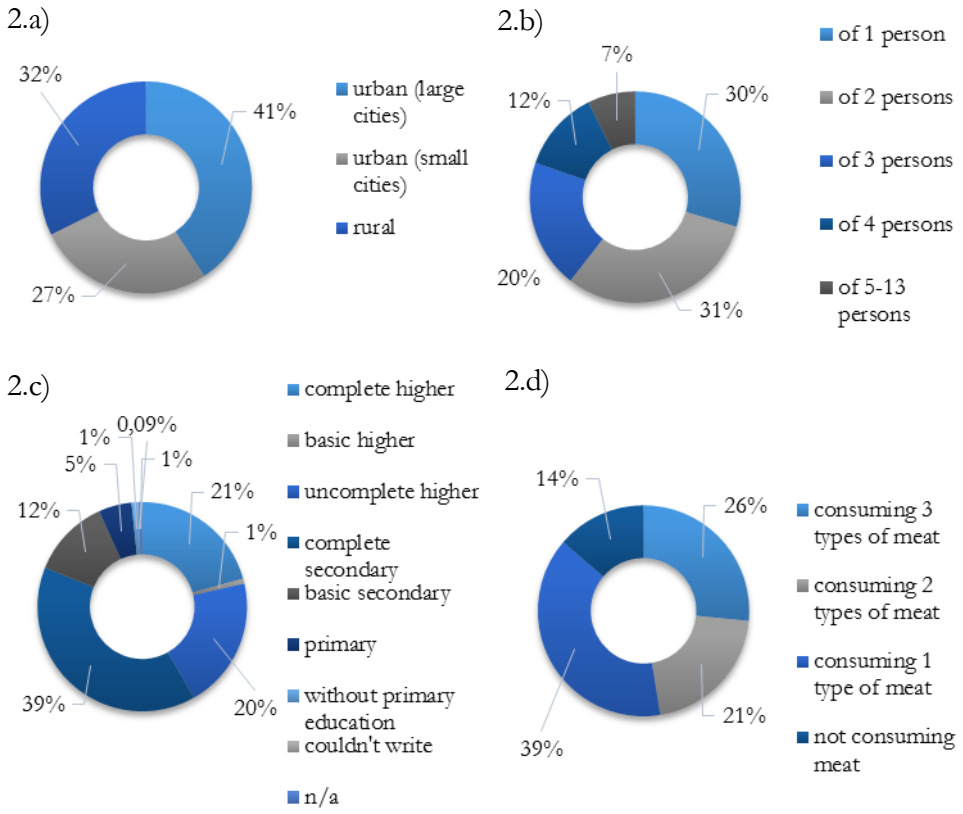

Figure 2. SS structure in 2010:

a) by settlement; b) by size; c) by HH education; d) by meat consumption.

As we can see, there is essential part of households among the respondents, who consume (or buy) none, one or two types of meat, while, given our model, in order to estimate demand for different types of meat, we need households to consume both beef, pork and poultry (which comprised only for 26%, or 2,767 households in 2010).

Thus, we need to define sub-sample (or paper sample, PS), in which all the households consume (buy) all three types of meat. Further we look at the results of such a sampling.

5.2. Sampling

Our sub-sample is just those respondents, who consume both beef, pork and poultry. In order to ensure, that such a sample is enough representative, we compared several PS variables with those of whole SS and Ukraine itself (latter data we obtained from SSSU). In the Table 1 we could see the results for observation of year 2010:

Table 1. Sampling comparison (2010 data)

Variable	SS (initial)	PS (sub-sample)	Ukraine
Household size	2.41	2.57	2.59
	(1.33)	(1.23)	n/a
Expenditures for meat	2,129	3,534	3,700
	(2,006)	(2,306)	n/a
Educational level	8.95	9.32	n/a
	(74.06)	(80.11)	

Note: There are stated means and standard deviations in parentheses.

Thus, comparing these statistics, we could treat such a sampling as representative.

5.3. Data description

Following sampling, we could closer look at the values of variables, used in the QUAIDS (see Table 2 with descriptive statistics) and analyze, what changes in the meat consumption was observed for 2005-2010 given sample statistics.

During 2005-2010 meat expenditures among three types we analyze (beef, pork and poultry) were distributed more or less equally (with shares varied from 24.8% to 41.5%). However, historically low level of beef expenditures (27.6% in 2005) decreased to 24.8%. There was also observed decrease in share spent on poultry: from 35.4% to 33.7%. These shifts in expenditure were offset by increasing share of pork expenditures: already being the most, it raised from 37.0% to 41.5%.

Table 2. PS descriptive statistics

Variable	2005		2010	
	Mean	S.D.	Mean	S.D.
Shares of budget spent on				
Beef	27.6%	17.8%	24.8%	16.4%
Pork	37.0%	20.8%	41.5%	20.8%
Poultry	35.4%	20.1%	33.7%	18.8%
Prices of (per kilo)				
Beef	20.86	3.34	40.44	7.46
Pork	24.29	3.54	41.81	6.81
Poultry	13.61	1.96	20.90	4.82
Total meat expenditures *for informational purposes*	1 714	1 129	3 534	2 307
Household size	2.75	1.21	2.57	1.23

Nominal prices of meat changed sharply during 2005-2010, however, their dynamics were quite different (see Figure 3): while beef and pork demonstrated increase in prices of 93.9% and 72.1%, respectively, reaching almost the same level in nominal terms, poultry prices increased by 53.6%, being in 2010 almost two times cheaper than its substitutes.

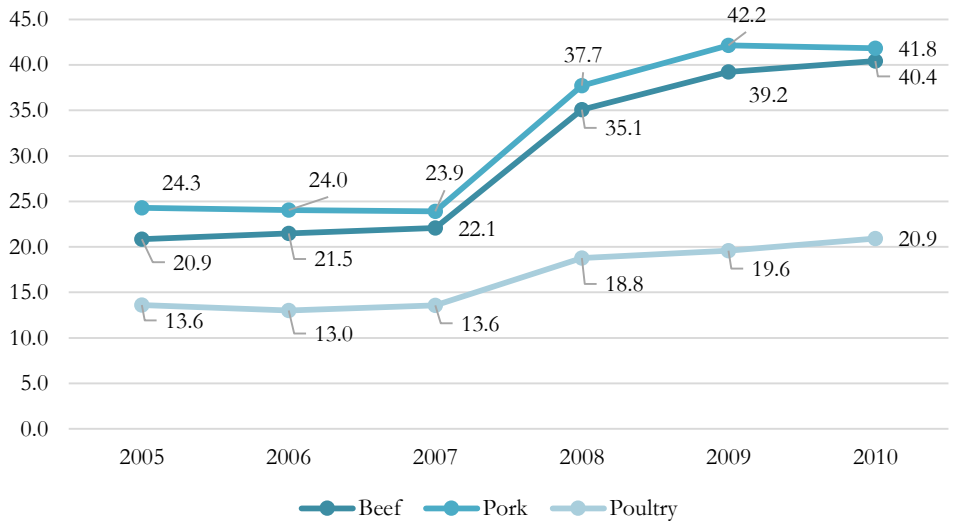

Figure 3. Nominal meat prices dynamics

As was mentioned earlier, the fact that we use nominal prices brings the issue of inflation impact on the prices used in estimations. Firstly, within the cross-section estimations, which we perform for every single year, such a problem does not occur (as they are anally consistent each other). However, turning to pool model for comprehensive dynamic demand characteristics estimation, problems arise (as inflation impact slightly changes the relative increase in prices). In order to avoid biases, for pool estimation we deflated nominal prices by CPI values from SSSU to bring them to constant 2005 terms.

5.4. Socio-demographic factors of the model

As we stated for informational purposes in Table 2, there was some gradual reduction in the mean of household size from 2005 to 2010. From the economic point of view, such movement could be explained by future uncertainty caused by transition state of country and by the consequences of financial crisis in 2009.

Besides household size, we would like to consider the values of other demographic factors, which we include into the model, but could not describe within the descriptive statistics, as they are categorical. Thus, the number of household falling in categories are shown in Table 3.

Following the data, we could conclude, that vast majority of households settled in the large cities, and their number increased over 2005-2010 by 64.5%, while number of households, living in small cities increased by 32% and still far from the large cities share of respondents. Representing the lowest group, respondents from rural areas were in the amount in range of 173-220 households over the whole period.

As for educational levels, with increase in large cities citizens number, their education also enhanced, especially both higher and complete secondary education.

Table 3. PS demographic structure

Group	2005	2006	2007	2008	2009	2010
Total households	1 848	2 080	2 454	2 315	2 579	2 767
by settlement						
urban (large cities)	1 137	1 320	1 497	1 440	1 747	1 871
urban (small cities)	538	577	737	663	646	712
rural	173	183	220	212	186	184
by household head educational level						
complete higher	547	613	736	707	836	931
basic higher	10	16	17	16	25	22
incomplete higher	448	557	582	567	644	631
complete secondary	635	673	863	785	855	936
basic secondary	148	147	173	170	145	182
primary	48	57	61	50	51	40
without primary education	7	3	8	8	13	7
couldn't write	-	-	-	-	-	-
n/a	5	14	14	12	10	18

Summarizing, we would like to mention, that paper survey covers wide range of population in terms of socio-demographic features, which, expectedly, would affect the consumption over the meat. Thus, people from the urban area would be more price-sensitive than those, who gather livestock by themselves. Moreover, people with higher educational level could become to care about healthiness of their food and thus carrying out "too fat" meat.

Chapter 5

ESTIMATED RESULTS

5.1. Demand modeling

Following the QUAIDS, specified in (10), we estimated demand system parameters for 2005-2010 years on the annual basis and also performed the estimation for pool data (latter was made with accounting for deflated prices). The results of the estimation are presented in the Table 4.

Estimated coefficients are in general statistically significant through most of the years and in pool regression as well.

Thus, intercept coefficients are mostly significant and all of them are positive, while betas, reflecting linear effect of growth in real expenditure on the budget share spent for meat type, are different in sign and sometimes insignificant for beef. While for beef and pork all significant betas are negative in sign, betas for poultry remain positive and statistically different from zero for the whole period.

Statistical significance of the log-price coefficients has interesting pattern: further we go in time, more significant terms become. It would be explained, as with increase in prices (which we have observed in Figure 2, starting from 2007-2008), price changes became to play more important role in the consumer choice.

Table 4. QUAIDS estimation results (total PS)

	2005	2006	2007	2008	2009	2010	Pool
ALPHA (constant, meat-specific)							
α1	.1930*	.3870**	.2852**	.3496**	.3089**	.2946**	.3257**
α2	.7993**	.3270**	.3829**	.3009**	.3163**	.3108**	.3457**
α3	.0077	.2860**	.3320**	.3495**	.3748**	.3946**	.3286**
BETA (linear expenditure term, meat-specific)							
β1	.0568	-.0701**	.0055	-.0630	-.0383	-.0181	-.0148
β2	-.2908**	-.0693*	-.1157**	-.0985**	-.1294**	-.1472**	-.1212**
β3	.2340**	.1394**	.1103**	.1615**	.1677**	.1653**	.1360**
GAMMA (log-price term, meat-specific)							
γ11	.1096**	.0823**	.1313**	.1127**	.1206**	.1013**	.1029**
γ21	-.0353	-.0567**	-.0809**	-.0976**	-.0920**	-.0597**	-.0830**
γ31	-.0743**	-.0256	-.0504**	-.0151	-.0286**	-.0416**	-.0199**
γ22	-.0386	.0475*	.0606**	.1613**	.1372**	.1135**	.1025**
γ32	.0739	.0091	.0203	-.0637**	-.0452**	-.0538**	-.0194**
γ33	.0004	.0165	.0301*	.0787**	.0738**	.0954**	.0393**
LAMBDA (squared expenditure term, meat-specific)							
λ1	-.0071	.0136**	.0067	.0151**	.0120**	.0076	.0044**
λ2	.0354**	.0122*	.0230**	.0239**	.0283**	.0346**	.0247**
λ3	-.0283**	-.0258**	-.0297**	-.0390**	-.0403**	-.0422**	-.0291**
ETA (demographics, meat-specific)							
Household size							
η1	-.0018*	-.0019	-.0077**	-.0030*	-.0044**	-.0065**	-.0039**
η2	.0007	-.0015	.0000	.0046	.0015	.0098**	.0023*
η3	.0010	.0034*	.0077**	-.0016	.0030	-.0033	.0016
Education of the household head							
η1	.0001	.0000	-.0001	.0000	.0000	-.0001	.0000
η2	-.0004*	.0000	.0000	.0000	.0002	.0001	.0000**
η3	.0002	.0001*	.0000	.0001	-.0002	-.0001	.0000**
Settlement type							
η1	-.0035*	-.0068	-.0134**	-.0111**	-.0095**	-.0144**	-.0139**
η2	.0181**	.0455**	.0652**	.0393**	.0575**	.0551**	.0520**
η3	-.0147**	-.0387**	-.0518**	-.0282**	-.0480**	-.0407**	-.0380**
RHO (demographics, effect on expenditures)							
Household size	.0986	-.1657	-.0063	1.7447	1.4826	2.6946**	1.4576**
Education of the household head	.0181**	-.0045*	.0540*	-.0051*	.0462	.0437*	-.0090**
Settlement type	-.1254	4.4066	10.3413**	3.4681	5.5389*	3.5483*	7.4221**

Note: by * and ** statistical significance on the level of 10% and 5%, respectively, denoted.

Coefficients near real expenditures squared are naturally lower in magnitude than those of linear expenditure terms. Further, representing marginal effect of expenditures, all the deltas are opposite in sign to corresponding betas. Moreover, statistical significance of squared terms follows the same patterns as linear one: insignificant values are obtained only for beef. This would mean, that beef consumption is not very sensitive to expenditures, being other things equal. However, more precisely we will see that from the estimated elasticities.[9]

5.2. Elasticities

We have obtained expenditure and price (both cross- and own-) elasticities using the formulas (12)-(14) and in-built program evaluator. The expenditure and own-price elasticities are presented in Table 5, while cross-price elasticities are presented in Tables 6a-6b, with respect to different periods of estimations.

Table 5. Expenditure and own-price elasticities (total PS)

	2005	2006	2007	2008	2009	2010	Pool
Expenditures							
Beef	0.93	0.90	0.91	0.88	0.90	0.86	0.90
Pork	1.19	1.18	1.19	1.22	1.22	1.28	1.17
Poultry	0.83	0.87	0.84	0.83	0.82	0.77	0.88
Own-price (compensated)							
Beef	-0.30	-0.39	-0.23	-0.28	-0.26	-0.34	-0.33
Pork	-0.33	-0.47	-0.45	-0.18	-0.25	-0.30	-0.33
Poultry	-0.38	-0.59	-0.57	-0.39	-0.42	-0.35	-0.52
Own-price (uncompensated)							
Beef	-0.54	-0.62	-0.47	-0.51	-0.50	-0.56	-0.57
Pork	-0.81	-0.94	-0.92	-0.67	-0.73	-0.81	-0.79
Poultry	-0.66	-0.89	-0.86	-0.67	-0.69	-0.61	-0.82

[9] We will proceed with the demographic variables effects further after elasticities behavior description, as this requires further investigation.

In accordance with theory, own-price elasticities, both compensated and uncompensated, are negative for all meat types. Expenditure elasticities are positive and differ for different types of meat: expenditure elasticity of pork is higher, than the one of beef, which in turn is higher, than poultry's one (which, actually, mitigates issue of expenditure insignificance for beef). Moreover, we definitely see, that demand for pork is income-elastic, while demand for poultry and beef is income-inelastic.

Compensated own-price elasticity essentially differs from the uncompensated one, which possesses the high impact of the income (expenditure) elasticity.

Dynamics of expenditure, uncompensated and compensated elasticities are depicted in Figures 4a-4c.

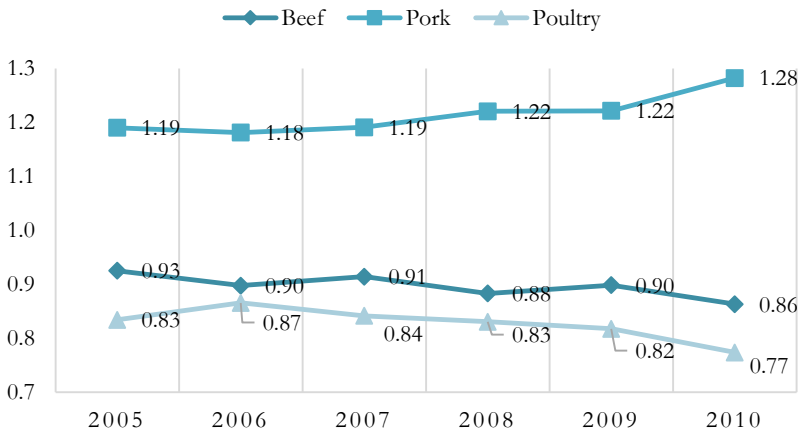

Figure 4a. Expenditure elasticity dynamics

As we can see, expenditure elasticities demonstrate clear dynamics: elasticity of demand for pork is tend to increase with time, while poultry and beef elasticities go down. Thus by Ukrainians pork in 2005-2010 was considering as a luxury good, while poultry and beef were treated as the goods of necessity, which

ignores health motives in their preferences. Moreover, this approach evolves with time.

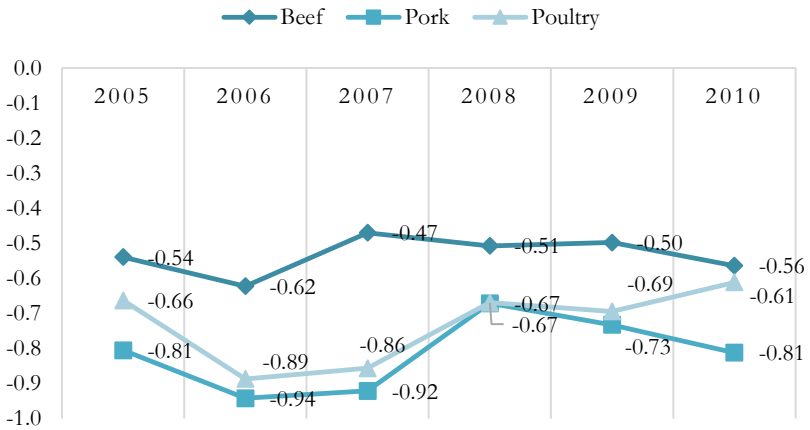

Figure 4b. Uncompensated price elasticity dynamics

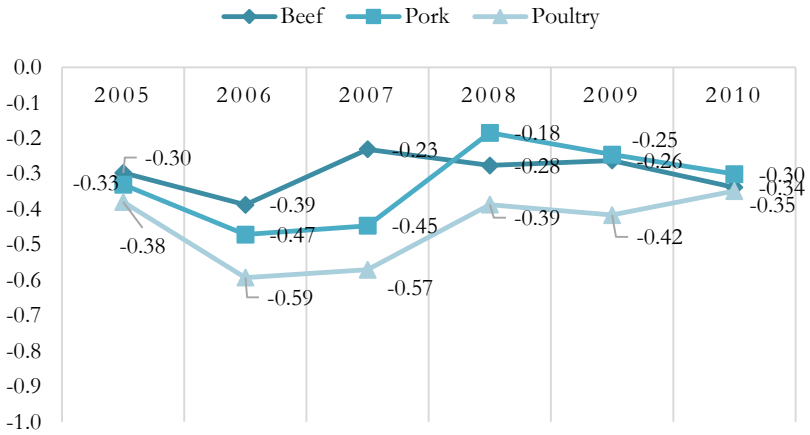

Figure 4c. Compensated price elasticity dynamics

Price elasticities dynamics is more complicated: it is clear, that after sharp change in prices (both nominal, real and relative) elasticities changed their directions of development, from growth to oscillating around each other. Further, in terms of

compensated elasticity, pork demand is more elastic for changes in own price, than others. However, taking into account income effect, poultry became more elastic than other meat types throughout all the period.

Cross-price elasticities obtained within QUAIDS are presented in Tables 6a-6b.

Table 6a. Cross-price elasticities, 2005 (total PS)

	Compensated			Uncompensated		
	Beef	Pork	Poultry	Beef	Pork	Poultry
Beef price	-0.2975	0.1579	0.1394	-0.5395	-0.2109	-0.1749
Pork price	0.0995	-0.3308	0.2321	-0.2119	-0.8054	-0.1723
Poultry price	0.1124	0.2666	-0.3797	-0.1059	-0.0660	-0.6631

Going from 2005 to 2010, with increase in prices, we could see, that, given values of cross-price elasticities obtained, beef and pork, as well as beef and poultry became more substitutable goods (evidenced by increase in beef-pork, pork-beef, beef-poultry, and poultry-beef elasticities), while pork and poultry became to compete less. However, pork and poultry remain the strongest competitors in terms of consumer choice over meat types, having the largest magnitude among cross-price elasticities.

Table 6b. Cross-price elasticities, 2010 (total PS)

	Compensated			Uncompensated		
	Beef	Pork	Poultry	Beef	Pork	Poultry
Beef price	-0.3384	0.1647	0.1725	-0.5642	-0.1794	-0.1207
Pork price	0.1136	-0.3011	0.1840	-0.2218	-0.8124	-0.2517
Poultry price	0.1272	0.2265	-0.3488	-0.0752	-0.0821	-0.6117

5.3. Demographic effect

Turning back to the impact of socio-demographic features of households, we could simply see from Table 4, that most significant was the settlement type of

the household. Household size had lower impact, and vast majority coefficients at educational level are very close to zero. From the meat demand point of view, such results are truly expectable: the most influences on the consumer choice is made by settlement, as in correspondence to that the meat supply really differs[10]. Next, consumer choice is really influenced by the size of household, taking into account effect of scale, etc.

In order to ensure the importance of selected demographics, we performed joint Wald tests on coefficients significance (separately for all the variables). Results are listed in Table 7.

Table 7. Demographics significance testing

Variable	2005	2006	2007	2008	2009	2010	Pool
Household size	-	-	+	-	+	+	+
Educational level of HH	-	-	-	-	-	-	+
Settlement type	+	+	+	+	+	+	+

Note: with "+" denoted joint significance variable's coefficients on the 5% significance level, with "-" – vice versa.

Thus, the test proves the significance of settlement type all over the period and partial significance of household size. The educational level is significant only within the pool model. Further, in order to look deeper into the settlement type effect, we estimated QUAIDS for urban and rural citizens separately and compared results.

Differences in meat demand of urban and rural households

As settlement type occurred to be important for consumer choice over meat types, we decided to look deeper into these differences. Coefficients of QUAIDS performed for separately urban and rural citizens are listed in Appendix B, while

[10] Living in the rural area, you by yourself could be a meat producer frequently. Thus, it affects a lot not just your consumption, but rather your purchasing habits (which we account for in this paper).

here we are trying to understand difference in preferences in terms of demand elasticities.

Thus, looking at the expenditure elasticities comparison (Table 8), we could found out, that, in general, expenditure elasticities of urban demand are higher for beef and poultry and lower for pork. This is in line with 'health' motives of choosing the meat type. Also, pork demand is still income-elastic for both urban and rural, while beef and poultry are not.

Table 8. Expenditure elasticities comparison: urban v.s. rural

	2005	2006	2007	2008	2009	2010	Pool
Beef elasticities							
Urban	0.9584	0.9744	0.9696	0.9396	0.9466	0.9010	0.9125
Rural	0.9685	n/a	0.8542	0.7346	0.7697	0.8099	0.8109
Pork elasticities							
Urban	1.1137	1.1436	1.1485	1.1855	1.1650	1.2283	1.1571
Rural	1.1691	n/a	1.2138	1.3540	1.2215	1.3553	1.2450
Poultry elasticities							
Urban	0.8986	0.8513	0.8492	0.8288	0.8475	0.8084	0.8830
Rural	0.8258	n/a	0.8613	0.7889	0.9173	0.7294	0.8581

Note: As rural households form a small group, estimations for 2006 and 2010 were unrepresentative. Thus, we used AIDS, which enhanced 2010 estimations, but had no effect on results for 2006.

Comparison of compensated own-price elasticities is presented in Table 9.

Table 9. Compensated own-price elasticities comparison: urban v.s. rural

	2005	2006	2007	2008	2009	2010	Pool
Beef elasticities							
Urban	-0.3020	-0.4177	-0.2505	-0.3003	-0.2761	-0.3410	-0.3427
Rural	-0.3436	n/a	0.4245	-0.1858	-0.2946	-0.4302	-0.2729
Pork elasticities							
Urban	-0.3410	-0.4721	-0.4498	-0.1637	-0.2270	-0.2981	-0.3298
Rural	-0.5017	n/a	-0.3878	0.0020	-0.3914	-0.1515	-0.2601
Poultry elasticities							
Urban	-0.3869	-0.5584	-0.5578	-0.3505	-0.3921	-0.3454	-0.5156
Rural	-0.2971	n/a	-0.6346	-0.3453	-0.4715	-0.1517	-0.4833

Note: Estimations were enhanced in the same way as in income elasticities case.

Most of own-price elasticities obtained are negative in line with theory, excepting several for rural households in 2007 and 2008 years, which could be caused by price shocks, which are delayed for rural areas. As there is no clear pattern for comparison of elasticities, we could look at the pool estimation results, which show, that urban citizens are more price-sensitive for all the meat types, and this is basically natural: urban citizens have less consumer power in terms of setting the price, than rural citizens have. Again, poultry demand is occurred to be more price-elastic than pork demand, and pork demand is more elastic than beef. However, as all the elasticities are less than unity in magnitude, meat demand in Ukraine could be treated as price-inelastic, which is following from the fact, that meat is base for food consumption in majority of households, whatever directions prices go.

5.4. Comparison across countries

Given the variety of studies on meat demand, we could compare results obtained for meat demand in Ukraine with those recently found for other countries (Table 10). Among primary reasons for that, besides verifying results, could be also comparison of consumer behavior of Ukrainians and population of different economic zones in order to provide controling agencies with insights about potential demand tracks.

Comparing expenditure elasticities across countries, we could conclude, that Ukrainian demand for beef is less income-elastic, while demand for pork is more elastic, than ones of the countires described. As for demand for poultry, comparing to European neighbor Slovakia, it is less elastic. Roots of such differences could lie in production differences across countries. As for price elasticities, Ukrainian demand looks like less elastic compared to other countries.

Table 10. Comparison of demand elasticities across different countries

Country	Ukraine	Slovakia	Australia	USA	Japan	China
Stage	Developing	Developed	Developed	Developed	Developed	Developing
Period	2005-2010	1993-2007	1965-2010	1982-2007	1965-1999	cross-study
Source	Author's estimations	Bielik et al.	Mounter et al.	Mintert et al.	Xi et al.	Woltjer
Area	Europe	Europe	Australia	America	Asia	Asia
Economic block	none	EU	none	NAFTA	none	BRIC
Expenditures						
Beef	0.90	0.91	1.49	0.91	1.04	1.19
Pork	1.17	0.23	0.48	0.02	0.68	0.97
Poultry	0.88	1.09	0.09	-0.58	0.57	1.16
Own-price (compensated)						
Beef	-0.33	-0.47	-0.99	-0.42	-1.38	-0.58
Pork	-0.33	-0.98	-0.36	-0.74	-0.69	-0.42
Poultry	-0.52	-1.00	-0.27	-0.10	-0.62	-0.67

Thus, there could be expected increase in expenditure elasticity of beef, corresponding decrease for pork demand, and increase in own-price elasticity for all the meat types, as far as the state will continue its development. These movements are also in line with 'health' direction of the preferences development.

Chapter 6

CONCLUSIONS

In this paper we estimated demand system for different types of meat in order to learn Ukrainian consumers preferences over the meat diversity and their changes over time. We applied recently developed theory of quadratic almost ideal demand systems to Ukrainian household expenditures behavior over 2005-2010, based on the household survey. This allowed us to obtain values for income and price elasticities of meat demand, both annual (and thus, dynamically changing) and pool one (those could be used as more precise estimations for policy design).

Following the results we obtained, we could conclude, that meat products in Ukraine are normal goods. Demand for meat differs in terms of income elasticity: pork is income-elastic (thus, treated as a luxury good), while poultry and beef are income-inelastic (considering as necessity); this tendency evolves with time, which mitigates 'health' concerns within the Ukrainian demand for meat in 2005-2010.

Both beef, pork and poultry are price-inelastic, with poultry as more price-sensitive good (which is following from the fact, that poultry was essentially cheaper, than other meat). With time the situation does not essentially changed, however, all meat types converged in terms of their own-price elasticity.

During 2005-2010 the most competition occurred between poultry and pork (consumers treated them as the most substitutable). However, with time their competition became to deteriorate, while beef became to compete more both with pork and with poultry. Nevertheless, poultry and pork remained the strongest substitutes among meat types.

Among social and demographic factors the most impact on the meat demand was made by settlement type of the household (urban or rural). This naturally follows from the differences in meat market functioning within urban and rural areas. Household size had less impact on the consumer choice over meat types, while education level of the household head had practically no effect.

In general, expenditure elasticities of demand of urban population were higher for beef and poultry, and lower for pork, than of rural ones, which in particular shows some 'health' movement of preferences against pork for urban citizens. However, for both social group pork demand remained income-elastic, while poultry and beef were inelastic in terms of expenditures. Also, urban citizens during 2005-2010 were more price-sensitive, which is a consequence of difference in price-setting mechanism for urban and rural areas.

Comparing to other countries (and especially to neighboring Slovakia, member of EU with developed economics), Ukrainian demand for meat significantly differs: beef and poultry income-elasticities are lower, pork income-elasticities are higher (which shows more 'healthy' attitude in Slovakia to meat consumption). In the same time all price elasticities of Ukrainian demand are substantially lower, which could be interpreted as signs of underdeveloped meat market.

The results we obtained provide useful insight for both policy design and health regulation of Ukrainian market. Thus, among potential implications of this study are assessing impact of regulatory policies in the livestock market on consumer welfare, price regulation and tax reforms applications, and also development of the health policy, targeted on the 'health' motives implementation in day-to-day consumer choice of Ukrainians.

WORKS CITED

Bielik, Peter, and Daniela Hupkova. 2011. Modeling Structural Changes in the Poultry Meat Demand – the Case of Slovakia. *Agricultural Economy* 57 (August): 363-369.

Chalfant, James, and Julian Alston. 1988. Accounting for Changes in Tastes. *Journal of Political Economy* 96 (April): 391-410.

Chang, Hui-shyong. 1977. Functional Forms and the Demand for Meat in the United States. *The Review of Economics and Statistics* 59 (August): 355-359.

Clawson, Marion. 1943. Demand Interrelations for Selected Agricultural Products. *The Quarterly Journal of Economics* 57 (February): 265-302.

Court, Robin. 1967. Utility Maximization and the Demand for New Zealand Meats. *Econometrica* 35 (July-October): 424-446.

Deaton, Angus, and J. Muellbauer. 1980. An Almost Ideal Demand System. *American Economic Review* 70 (June): 312-326.

Fast Market Research. Ukraine Agribusiness Report Q3 2015. Published on May 7, 2015. *http://www.fastmr.com/prod/ /991633_ukraine_agribusiness_report.aspx?afid=101.*

Fox, Karl. 1954. Structural Analysis and the Measurement of Demand for Farm Products. *The Review of Economics and Statistics* 36 (February): 57-66.

Gallet, Craig. 2010. The Income Elasticity of Meat: Meta-Analysis. *The Australian Journal of Agricultural and Resource Economics* 54: 477-490.

Golan, Amos, Jeffrey Perloff, and Edward Shen. 2001. Estimating a Demand System with Nonnegativity Constraints: Mexican Meat Demand. *The Review of Economics and Statistics* 83 (August): 541-550.

Kane, Gilles Quentin, Gwladys Laure Mabah Tene, Jean Joel Ambagna, Isabelle Piot-epetit, and Fondo Sikod. 2015. The Impact of Food Price Volatility on Consumer Welfare in Cameroon. *WIDER Working Paper* 13 (January): 1-16.

State Statistics Service of Ukraine. Statistical information. Last modified on May 25, 2015. *http://www.ukrstat.gov.ua.*

Physicians Committee for Responsible Medicine. Meat Consumption and Cancer Risk. Last modified on May 25, 2015. *https://pcrm.org/health/cancer-resources/diet-cancer/facts/meat-consumption-and-cancer-risk.*

Poi, Brian. 2008. Demand-System Estimation: Update. *The Stata Journal* 8: 554-556.

Wong, Lucille, E.A. Selvanathan, and Saroja Selvanathan. 2013. Changing Pattern of Meat Consumption in Australia. *Australian Conference of Economists.*

Xi, Jing, Ron Mittelhammer, and Thomas Heckelei. 2004. A QUAIDS Model of Japanese Meat Demand. *American Agricultural Economics Association* – Selected Papers: 29.

APPENDIX A: SURVEY SAMPLE

Table. Survey sample (SS) structure, persons

Group	2005	2006	2007	2008	2009	2010
Total households	10,354	10,499	10,615	10,622	10,459	10,428
by settlement						
urban (large cities)	3,595	3,672	3,754	3,707	4,251	4,248
urban (small cities)	2,929	2,974	2,986	3,016	2,826	2,810
rural	3,830	3,853	3,875	3,899	3,382	3,370
by household size						
of 1 person	2,722	2,781	2,988	3,104	2,915	3,080
of 2 persons	3,123	3,200	3,284	3,323	3,091	3,231
of 3 persons	2,176	2,271	2,208	2,168	2,250	2,059
of 4 persons	1,536	1,435	1,350	1,281	1,367	1,298
of 5-13 persons	797	812	785	746	836	760
by household head educational level						
complete higher	1,807	1,875	1,855	1,924	2,104	2,156
basic higher	60	79	58	61	87	83
incomplete higher	2,035	2,069	2,092	2,150	2,157	2,122
complete secondary	3,899	3,979	4,172	4,061	4,116	4,094
basic secondary	1,467	1,470	1,506	1,467	1,248	1,270
primary	819	789	719	712	564	533
without primary education	173	151	136	160	115	103
couldn't write	24	20	16	21	13	9
n/a	70	67	61	66	55	58
by consuming meat						
consuming beef	3,272	3,432	3,654	3,197	3,512	3,577
consuming pork	4,640	5,403	6,158	6,022	5,935	6,523
consuming poultry	6,592	6,524	6,888	7,701	8,251	8,044
consuming 3 types of meat	1,848	2,080	2,454	2,315	2,579	2,767
consuming 2 types of meat	454	700	1,148	1,668	2,081	2,182
consuming 1 type of meat	5,608	5,389	4,916	4,841	4,375	4,047
not consuming meat	2,444	2,330	2,097	1,798	1,424	1,432

APPENDIX B: QUAIDS FOR URBAN AND RURAL HOUSEHOLDS

Table. QUAIDS estimation results for urban households

	2005	2006	2007	2008	2009	2010	Pool
ALPHA (constant, meat-specific)							
α1	.2029*	.5181**	.3540**	.6300**	.7303**	.4906**	.4646**
α2	.7526**	.4678**	.6035**	.2769**	.4640**	.4563**	.5843**
α3	.0445	.0141	.0425	.0931	-.1943*	.0531	-.0488
BETA (linear expenditure term, meat-specific)							
β1	.0372	-.1160*	-.0279	-.1775**	-.1966**	-.1076**	-.0634**
β2	-.2098**	-.1025	-.1423**	-.0459	-.1146**	-.1520**	-.1540**
β3	.1726**	.2185**	.1703**	.2235**	.3113**	.2596**	.2175**
GAMMA (log-price term, meat-specific)							
γ11	.1106**	.0575	.1245**	.0550	.0408	.0801**	.0924**
γ21	-.0428	-.0699**	-.0859**	-.1023**	-.1319**	-.0821**	-.0995**
γ31	-.0678**	.0124	-.0386	.0473	.0911**	.0021	.0072
γ22	-.0088	.0271	.0125	.1622**	.1140**	.0760**	.0526**
γ32	.0516	.0429	.0734*	-.0599**	.0179	.0061	.0469**
γ33	.0162	-.0553	-.0347	.0125	-.1091**	-.0082	-.0541**
LAMBDA (squared expenditure term, meat-specific)							
λ1	-.0048	.0141*	.0032	.0207**	.0200**	.0118**	.0049**
λ2	.0269**	.0191**	.0219**	.0136**	.0190**	.0288**	.0221**
λ3	-.0221**	-.0332**	-.0251**	-.0343**	-.0390**	-.0405**	-.0270**
ETA (demographics, meat-specific)							
Household size							
η1	-.0006	-.0021*	-.0039**	-.0022**	-.0025**	-.0042**	-.0023**
η2	-.0031**	.0018	.0007	.0041*	.0006	.0073**	.0018**
η3	.0037**	.0003	.0032**	-.0019	.0019	-.0031*	.0005
Education of the household head							
η1	.0001	.0000	.0000	.0000	.0000	.0000	.0000
η2	-.0003	.0000	-.0001**	.0000	.0000	.0000	.0000
η3	.0002	.0000	.0001**	.0000	.0000	.0000	.0000
RHO (demographics, effect on expenditures)							
Household size	-.1042**	.4260	.0879	.4188	.1283	.6071*	.1970**
Education of the household head	.0158*	-.0003	-.0010**	.0088	-.0006	.0044	-.0005

Table. QUAIDS estimation results for rural households

	2005	2006	2007	2008	2009	2010	Pool
ALPHA (constant, meat-specific)							
α1	1.5544**	1.2806**	.8491**	.0246	.1051	0.4447	.4364**
α2	-.4080	-.2463	-.0432	1.3391**	1.3286**	-0.2846	.4494**
α3	-.1464	-.0343	.1941	-.3637	-.4337*	0.8399	.1142
BETA (linear expenditure term, meat-specific)							
β1	-.5094**	-.3589**	-.2418	.1548	.1068	-0.0594	-.0395
β2	.2851	.2320*	.1611	-.5556**	-.4404**	0.1724	-.1019*
β3	.2243	.1269	.0808	.4008**	.3337**	-0.1130	.1414**
GAMMA (log-price term, meat-specific)							
γ11	-.5059	-.1866	.1761	.0993	.1067**	0.0699	.1135**
γ21	.3182	.1073	-.1031	.0193	-.0128	-0.0127	-.1002**
γ31	.1878	.0793	-.0730	-.1186*	-.0938	-0.0573	-.0133
γ22	-.1413	-.0926	.0207	-.3057	-.2407	0.0899	.1053**
γ32	-.1769	-.0147	.0825	.2865*	.2536*	-0.0772	-.0050
γ33	-.0108	-.0646	-.0095	-.1678	-.1598	0.1345	.0183
LAMBDA (squared expenditure term, meat-specific)							
λ1	.0494**	.0329**	.0228	-.0249**	-.0130	-	-.0004
λ2	-.0203	-.0149	-.0078	.0777**	.0511**	-	.0235**
λ3	-.0290**	-.0181	-.0150	-.0528**	-.0381**	-	-.0230**
ETA (demographics, meat-specific)							
Household size							
η1	-.0022	-.0026	.0007	-.0001	.0005	0.0037	-.0022
η2	-.0039	.0011	-.0025	-.0002	-.0096**	-0.0117	.0011
η3	.0061**	.0016	.0018	.0003	.0091**	0.0080	.0011
Education of the household head							
η1	.0000	-.0003	-.0001	.0000	-.0044*	0.0000	-.0001
η2	.0001	-.0046*	.0000	.0000	.0057	0.0000	.0000
η3	-.0001	.0048**	.0001	.0000	-.0014	0.0000	.0000
RHO (demographics, effect on expenditures)							
Household size	-.1237**	.0110	.0552	.3703	-.1307**	-0.1424	.4903
Education of the household head	-.0003	-.1434**	-.0012	-.0001	.0487	0.0009	.0031