CORVINUS UNIVERSITY OF BUDAPEST
DOCTORAL SCHOOL OF LANDSCAPE ARCHITECTURE AND LANDSCAPE ECOLOGY

Thesis for PhD dissertation

SZIGETI JUDIT

WELFARE EFFECTS AMONG THE HUNGARIAN FOOD-CONSUMERS

SUPERVISOR:
Dr. Szilárd Podruzsik
senior lecturer

BUDAPEST
2012

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      Corvinus University of Budapest

supervisor:

      Dr. Szilárd Podruzsik
      senior lecturer
      Corvinus University of Budapest

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1. INTRODUCTION AND OBJECTIVES

1.1. Antecedents of the research

The importance of increasing food demand on prices and consumers makes the topic actual. Strategic relevance of food production is highly emphatic because the supply and demand influence the food prices hereby the consumers' choices.

One of the most important tasks of a country's agriculture is to produce sufficient quality and quantity of agricultural products to meet consumers' needs. In the 1990's decline of agricultural production resulted in increased food prices.

Beyond food-prices and incomes, inflation, changes in price of substitutional products and other factors may also vary the consumer's choices. Economic and political actions like market liberalization, introducing new reforms, subvention, liquidation of export-supervision, a country's accession to an economic organization, union may also lead to alteration of food prices. After Hungary's EU and Common Market accession the Hungarian food consumers were facing to a new situation. In recent years, price of staple foods increased from 100 to 300 percent. One-third of the consumers' income is spent on food, but food prices have altered the structure of consumer basket.

The most common method to evaluate consumer welfare is served by welfare economics. Welfare economics not only formulates the economic and political recommendations for maximizing consumer welfare but able to help in estimating of policies and reform outcomes. Defining the difference between the terms of welfare and well-being is complicated. Well-being is the measure for poverty and gender inequality (Inzelt - Szerb, 2003), while welfare refers to social, economic or institutional consideration (Rabár, 1999).

The concept of welfare economics was worked out by Pareto (The New Theories of Economics, 1897) and Pigou (The Economics of Welfare, 1920). The theory was broadened by Arrow and Debreu (1954) due to their research in the field of general equilibrium (CGE). Welfare analysis uses mathematical models and econometric approximation for the impact estimations. In most cases the dependent variable is food consumption or expenditure. In some experiments macro-level economic indicators are used (such as in the general equilibrium theory), while in other cases consumers and micro-level indicators are analyzed (such as AIDS

model). Significant part of the case studies originate from Africa (Ackah and Appleton, [2007]; Obayelu et al. [2009] Kraay, [2007]) and Asia (Ravallion, [1990]; Minot and Goletta, [2000], Friedman and Levinsohn, [2001]), but welfare studies are also prepared in developed countries. In Americas Porto (2003) and Nicita (2004) conducted researches. In Europe Aasness et al. (1996) and Gregg et al. (2005) have achieved significant results. In Hungary, among others, Lorincz et al. (1999), Hubbard and Podruzsik (2006) and Cseres and Molnar (2008) dealt with welfare studies. The studies from different continents resulted similarly in many cases. The reforms and economic actions caused negative impacts on households in the short-run, especially the poorer families' well-being was affected. Another common result of the investigations is that higher food prices primarily affected the urban poor, because food consumption from self production is not possible in their case.

1.2. Study objectives

My research concentrates on Hungarian households' food consumption and their influencing factors. The study provides opportunity to estimate consumer welfare effects of food prices and cost of food basket. I try to answer to the question weather Hungarian consumer welfare has changed in the past 10 years, and did the country's EU integration caused any significant effect on them. I also try to examine, which of the economic factors played role in the purchased food consumption? Is food expenditure affected by medicine, education or housing expenditures? Or the decrease in food consumption can be explained with the increase of meals outside the house?

During my research I try to answer to the following specific questions:

- Has the Hungarian consumers' (economic) welfare changed in the 21 century?
- Is there any difference between food basket expenditures of the different social classes?
- Should there be a financial compensation in order to eliminate the changes of prices?
- Is the demand shifting due to price and income changes? Are the "other household expenses" responsible for reduced food consumption?

Compiled with the above questions I set up my hypotheses that are tested by mathematical and econometric methods.

1.3. Hypotheses of the study

1. hypothesis: consumers' economic welfare was affected by the changes in food prices.

I assume that although nominal salaries of consumers rose, higher food prices and food expenditures caused negative impact on consumer welfare. The same food basket costs more than before the prices have changed. The drastic increase in prices occurred in the years following Hungary's EU accession, while the real income of consumers has hardly changed. If I assume that the consumer's taste does not change during the years and they purchase identical consumer goods, changing economic environment may affect prices of basic foodstuffs and thus, consumer welfare.

2. hypothesis: the different social and income classes were unevenly affected by food price changes.

As the meaning of "average consumer" lost its' value I assume that the marginalized, poor and elderly population is the most exposed to the negative welfare effects of price changes.

If the price change caused indeed negative effects on the Hungarian consumers, I try to estimate the amount of compensation they would need in order to remain as well off as before the price have changed.

3. hypothesis: expenses of purchased food depend primarily on the rising cost of housing and meals outside the household.

According to data from the Hungarian Central Statistical Office (HCSO) food consumption of all three social classes (low and high income, middle-class) is decreasing. According to my assumption one reason for the decline is the increase of meals away from home. Increasing "other costs" (housing, health-care) could also result in reduced food costs for consumers.

4. hypothesis: relationship between income and consumption in the "five basic food-product model" is negative and depends mainly on the price of substitutional and complimentary products.

Engel's (1895) first law about the relationship between food expenses and income says that the

money spent on food by the consumer and his income are in negative relationship, thus ratio of food expenses in total expenditure can function as a proxy of welfare. Consumer income growth results smaller, proportional increase in food consumption. If the tests justify positive relationships between income and food consumption, it contradicts Engel's law and the hypothesis should be rejected.

In addition, I analyze own- and substitutional price-effect of basic food products. I evaluate the consumption of staple foods, so I assume that own price of food does not affect it's demand. If food prices increase, consumption of basic food products reduced slightly.

2. MATERIALS AND METHODS

2.1. Data for the index calculations

The consumption data were derived from the Household Budget Survey, collected by the Hungarian Central Statistical Office. HCSO regularly conducts this extensive household consumption survey in which the households are representative for the population. Recent income and price data were also supplied by the HCSO. The data contain yearly average price observations for 19 counties throughout the country. The year 2003 is the first survey before the onset of the EU accession, while year 2010 is the most recent one. In order to eliminate the effect of inflation, an index value is used as a deflator. Instead of Consumer Price Index (CPI), which reflects the prices of a representative basket of goods and services, the GDP deflator is chosen for the calculations, as it refers to prices of all goods and services produced in the country. The value of the GDP deflator between 2003 and 2010 (where 2003=100%) originates from the Economic Statistics Database. Prices of the chosen food products were deflated as from the year 2004.

2.2. Methodology

In response to the research questions and to test the hypotheses I use different methods:

2.2.1. Consumer price index and compensating/equivalent variation

    a. Cost comparison of an own-built food-basket with Laspeyres and Paasché indexes;

    b. With the help of price indexes estimation of compensating/equivalent variation.

Price indexes are the weighted average of prices for a given class of goods or services that help to measure the economy's price level or cost of living. For price index calculations basic formulas, like Laspeyres and Paasché indexes are often used. Laspeyres index is using base year prices with current quantities. This is a price index was developed to measure changes in the cost of living and to determine the amount of additional wage to maintain the consumer's constant welfare. It defines a basket of goods in a base period, and uses recent prices for the selected goods to examine changes over time. It reflects new prices and old utility level. Paasché index is taking the bundle of goods using current quantities with basic and current prices.

$$P_{Laspeyres} = \frac{\sum_{i=1}^{n}\left(\dfrac{E_{i0}}{p_{i_0}} * p_{i_1}\right)}{\sum_{i=1}^{n} E_{i0}} * 100 \qquad \text{és} \qquad P_{Paasché} = \frac{\sum_{i=1}^{n} E_{i1}}{\sum_{i=1}^{n}\left(\dfrac{E_{i1}}{p_{i1}} * p_{i0}\right)} * 100$$

<div align="right">(1-2)</div>

Where:

q_{i_0} = purchased quantity of item i in the base period,

q_{i_1} = purchased quantity of item i in the current period

p_{i_0} = price of product i in the base period,

p_{i_1} = price of product i in current period.

To calculate the economic welfare effects, Slutsky technique based on the construction of Laspeyres index was employed. An increase in the food prices, *ceteris paribus*, means that the initial bundle of goods is obtained at a higher cost. The compensating variation as a measure of change in welfare is computed as follows:

$$CV = c(u_0, p_1) - C(u_0, p_0) \tag{3}$$

CV is able to measure and to determine the amount of additional wage that is needed to maintain the consumer's standard of living.

Equivalent variation measures the amount of money that a consumer would pay to avert the price increase due to the EU accession. Equivalent variation uses old prices and new utility levels:

$$EV = e(p_1, u_1) - e(p_1, u_0) \tag{4}$$

2.2.2. Multivariate regression analysis

    c. To estimate factors influencing food demand;

    d. To calculate shifts in demand.

With the help of a demand model I analyze effects of price and income changes on food consumption.

$$\overline{w_i} = \alpha_i + \sum_j \gamma_{ij} \log\left(\frac{q_j * p_j}{P}\right) + \beta_i \log\left[\frac{\overline{x}}{P}\right] + \varepsilon$$

(5)

Where:

w = proportion of i_{th} a in the total expenditure,

q * p / P = expenditure of i_{th} product in real terms,

x / P = total income, equivalent to total expenditure, real terms,

α, β, γ = coefficients

To estimate the coefficients I use the "ordinary least squares" (OLS) technique. The OLS method is based on minimizing the amount of square differences.

2.2.3. Notes to the research

1. I focus on the consumers. I examine household level (micro-environment) instead of national level (macro-environment).

2. I do not suppose that Hungary's EU accession caused structural break in prices and consumption. My aim is to analyze medium-run tendency after the accession.

3. Differences in tastes of households and preferences for food products are assumed to be constant.

3. RESULTS

3.1. Laspeyres-index and compensating variation according to income groups

The estimated results for the medium-run impact due to the EU accession are indicated in Table 1. Laspeyres indices give the changes in cost of living for each tercile as a result of changes in food prices due to the accession, *ceteris paribus*. If $L_I > 1$, consumer welfare loss, if $L_I < 1$, consumer welfare gain can be recognised. Laspeyres index exceeded 100 per cent for all consumer terciles in the examined years except in 2005. The increasing food prices mean a negative impact on overall consumer welfare. The low values in 2005 might be a reflection of the price fall of agricultural products in 2005.

1. Table. Laspeyres index for different household types (%)

Year	Low income	Middle class	High income
2004	103.60	103.34	103.08
2005	99.66	99.42	99.10
2006	103.85	103.42	102.67
2007	111.01**	110.33**	109.60**
2008	118.67**	118.14**	117.56**
2009	115.84**	115.07**	114.34**
2010	109.31**	108.65**	108.22**

Source: author's calculations according to HCSO (2011) data
** Significant on 5 percent level

The results of the CV calculation are summarised in Table 2, which shows the yearly and monthly CV values in HUF that a person from each tercile should receive to remain at the same welfare as before the food prices changed. The average amount of the compensation varies between 13 and 66 thousands HUF for the low income, 20-108 thousand HUF for the middle class and 27-183 thousand HUF for the high income group. The highest compensation should be added to the rich in order to remain as well off as in 2003. However it does not mean, that this group is the most hard hit. The reason, why the persons in the lowest income groups are the most affected, is that they spend a higher proportion of their income on food.

2. Table. Amount of CV for different household types

(HUF)	Low income		Middle class		High income	
Year	**/év**	**/hó**	**/év**	**/hó**	**/év**	**/hó**
2004	12.804	1.067	20.025	1.669	32.164	2.680
2005	0	0	0	0	0	0
2006	13.689	1.141	20.511	1.709	27.834	2.320
2007	39.113	3.259	61.988	5.166	100.260	8.355
2008	66.320	5.527	108.819	9.068	183.321	15.277
2009	56.248	4.687	90.392	7.533	149.747	12.479
2010	33.075	2.756	51.915	4.326	85.810	7.151

Source: author's calculations according to HCSO (2011) data

3.2. Paasché-index and equivalent variation according to income groups

The only difference in the formulas of Paasché and Laspeyres index is that the former uses period *n* quantities, whereas the latter uses base period quantities. Paasche index is a ratio that compares the total purchase cost of a specified bundle of current-period commodities with the value of those same commodities at base-period prices. Results of the calculations are shown in Table 3.

3. Table. A Paasché-index for different household types (%)

Year	Low income	Middle class	High income
2004	103.08	102.70	102.22
2005	98.64	97.99	97.78
2006	104.79	104.92	104.47
2007	110.33**	109.63**	108.81**
2008	117.43**	116.75**	115.91**
2009	113.93**	112.89**	111.82**
2010	108.72**	107.84**	106.98**

Source: author's calculations according to HCSO (2011) data
** Significant on 5 percent level

Paasche indexes were needed to estimate equivalent variation for the consumer groups. It is a measure of how much more money a consumer would pay before a price increase to avert the price increase. It is called equivalent variation because it causes equivalent harm as that of the price increase. Table 4. presents the results of EV calculations. For the low income group 77

thousand HUF, the high income group 225 thousand HUF should be taken in 2008 to harm the individual as much as the price-increase.

4. Table. Amount of EV for different household types

Year	Low income	Middle class	High income
2004	11.757	17.714	26.145
2005	0	0	0
2006	21.704	37.401	59.789
2007	48.498	76.845	122.169
2008	77.408	132.734	225.053
2009	61.852	102.157	164.538
2010	39.039	65.556	109.532

Source: author's calculations according to HCSO (2011) data

In terms of percentage of total income this amount varies between 16-18 percent between the poor and rich groups

3.3. Laspeyres and Paasché-index according to age groups

Household results from different age groups showed different outputs for the Laspeyres and Paasché indexes in 2005. Calculations with the Laspeyres index proved the increasing costs in the food basket, while calculations with the Paasché index proved its' decreasing costs.

The analysis of households according to their marital status and children resulted in similar discrepancy. While Laspeyres indexes exceeded 100 percent in 2005 for all five groups, results of the Paasché index calculations did not even reach the level experienced in 2003. This difference between the two indexes can be explained by their different weights. Laspeyres index is using base year prices with current quantities, while Paasché index is taking the bundle of goods using current quantities with basic and current prices.

According to the results it can be set out, that increasing costs of the food basked could impact the consumer welfare in the different years analyzed. The first and second hypothesis can be proved by the calculations, i.e. consumer welfare was influenced by food prices, however exposal to the new prices was different by the examined social and age groups. Thus the amount

of compensating variation that a person should receive in order to remain as well of as before the accession is different too.

3.4. Results of the demand model

3.4.1. Influencing factors on food consumption.

Table 5. summarizes the effects of some factors on food demand. According to the results only income effect can be verified for all consumer groups. As it was expected, this income effect is negative, i.e. increase in consumers' income does not necessarily result in increase of food demand. This is true for normal goods only, justifying Engel's law this way. According to Engel's law the consumption of basic food products does not depend on the increase of consumer income.

Significant and positive relationship can be observed between the consumption of alcohol/tobacco and food products among the elderly and childless households. It means that these groups consume more alcohol and tobacco than the other categories examined.

Relationship between housing and energy is significantly positive for households between 40-64 years. The effect of education can not be proved for any of the groups, while consumers above 40 years are more exposed to health-care expenses.

As it was expected, expenses on hotel and catering services are significant on food demand in the case of young households, however the relationship is positive. It means, that increasing proportion of these services is not responsible for the decreasing proportion of shopped food products. An opposed case can be observed among the elderly consumer group, where the negative impact on decreased food shopping habits can be justified. It is not clear however, that "catering" or "hotel services" caused this negative influence.

Thus my third hypothesis has to be rejected, i.e. expenses of purchased food depend primarily on the rising cost of housing and meals outside the household. Effect of income on food expenses can be proved, this impacts is negative however, thus increase in consumers' income does not necessarily result in increase of food demand. Meals outside the home influences expenses on purchased food products, but only for households above 65 years and only on 5 percent level of

significance. Furthermore it is not possible to prove which part of this independent variable caused the negative effect, the "catering" or the "hotel services" part.

3.4.2. Price and income effects

By estimating income effects of basic food products I proved significantly negative relationship. As it was mentioned above, increase in consumers' income does not necessarily result in increase of food demand (ceteris paribus). It was not expected however, that only the own-price effect of poultry meat was significantly negative on food consumption. An increase of a product's own price supposes a decrease in it's consumption. In this case the own price effect of the other examined products was positive. It means, that consumption of these products did not decrease due to their price increase. Rise in price of poultry meat resulted in descending consumption.

Poultry and pork meat can substitute each other on the market. If one of these product's price increases, the consumption of the other product increases too, ceteris paribus. As it was expected, cross-price effect of pork meat was positive with the consumption of poultry meat. When the price of pork increased, consumption of poultry increased too. Oppose to this, increase in prices of poultry meat did not have positive effect on pork demand. High price of poultry meat in the examined period lead to decrease of pork meat consumption.

Potatoes and bread can also substitute each other in the food basket. Price change of bread can not be proved significantly on the consumption of potatoes. Price change of potatoes has however significantly positive effect on bread consumption.

Potatoes and bread can function as a complementary product for pork and poultry meat. Price change of the complementary product –ceteris paribus- has negative impact on the consumption of the completed product and vice versa. According to the results increase of bread price might lead to decrease of pork meat consumption.

Price effect of vegetable oil is positive, that means that increasing oil prices do not result in decrease pork meat consumption. The positive price effect is similar in the case of poultry meat. Pork and poultry meat can function as a complimentary product for bread, potatoes and vegetable oil. Negative price effect of poultry meat can be observed for the consumption of bread, potatoes and vegetable oil. It means that consumption of these three products increase if

the price of poultry decreases, and vice versa. Price effect of pork meat is positive on bread consumption, that means that pork and bread are substitutional products for each other. If price of pork meat increases, consumption of bread increases too.

According to Table 6. I prove the 4. hypothesis, i.e. relationship between income and consumption in the five basic food-product model is negative and depends mainly on the price of substitutional and complimentary products. The food consumption did not increase as a result of increase in consumers' income in the examined period. Ratio of expense on the five basic food product from the total income depends on the price of substitutional and complimentary products. Significantly negative price effect of poultry meat determined the consumption of all other studied products.

5. Table. Results of the demand model between 2000-2010

	α	β income	γ alcohol, tobacco	γ housing, energy	γ health-care	γ education	γ meals outside the household, hotel services
All households	5.13	-0.723***	-0.98	-0.858	1.513	0.056	0.245
Households under 39 years	1.373***	-0.296***	-0.009	-0.005	0.043	-0.033	0.122***
Households between 40-64 years	1.678***	-0.467***	0.116	0.121***	0.061**	-0.015	-0.015
Households above 65 years	1.523***	-0.443***	0.152***	0.022	0.146***	0.005	-0.036**
Households without children	1.306***	-0.452***	0.214***	0.122	0.043	-0.02	-0.028
Households with children	1.495***	-0.309***	0.03	0.015	0.058	-0.034	0.043

Source: : author's calculations according to HCSO (2011) data
*** significant on 1 percent level, ** significant on 5 percent level, * significant on 10 percent level.

6. Table. Results of the demand model between 1999-2008

	α	β income	γ pork	γ poultry	γ bread	γ potatoes	γ vegetable oil
Pork	0.329***	-0.005***	0.027***	-0.183***	-0.025**	0.012	0.071***
Poultry	0.260***	-0.003***	0.007**	-0.142***	-0.002	0.005	0.055***
Bread	0.446***	-0.005***	0.010***	-0.281***	0.039***	0.013***	0.092***
Potatoes	0.116***	-0.001***	0.002	-0.067***	-0.005	0.015***	0.022***
Vegetable oil	0.046***	-0.001***	0.001	-0.035***	0.001	0.001	0.021***

Source: : author's calculations according to HCSO (2011) data
*** significant on 1 percent level, ** significant on 5 percent level, * significant on 10 percent level.

3.5. New and novel results

I presented and systemized models used for equilibrium and demand analysis. I reviewed studies from the national and international literature.

I prepared estimations focusing on Hungarian food consumers with the help of the modified version of Laspeyres and Paasché indexes. These versions may help to avoid mistakes coming from typing and calculating errors. Thus the received results describe more efficiently the households' reactions on increased costs of the food-basket.

Aggregating consumer income deciles to terciles I gained an opportunity to differentiate among households. Thus I found balance between "average households" and "income deciles".

With the help of significance test I pointed out, that rising food prices in the short run (1-3 years) did not cause any significant change in the cost of the food basket. However in the medium run (5-7 years) increasing food prices had negative impact on the consumer welfare.

I used index-calculations to estimate compensating and equivalent variation for Hungarian consumption data. With secondary data I interpreted economic theory to practical measures.

I estimated a demand model to analyze effects of consumption complementary and substitution products on basic food products. Another reason of the calculations was to gain information about the impact of non-food consumption on the food-consumption.

4. FURTHER RESEARCH POSSIBILITIES

Although welfare changes were negligible after the EU accession in the medium-term, a forthcoming study might focus on changes in the 10-15 year long-term.

Method of OLS regression can be changed to "Panel data estimation" that might result in a more efficient and informative result content.

Inserting a dummy variable into the model in order to represent the effect of Hungary's EU accession can help to estimate it's impact on the household's food-demand.

Beyond income terciles, age groups and persons with different marital status the study should be expanded to other social groups like active and pensioner households or people from different regions of Hungary like North- and Southern-Hungary. Aggregation according to localization can be performed in regional, national or international level to compare welfare effects on Hungarian food consumers with households from Europe.

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