LATVIAN HOUSEHOLDS' DEMAND ELASTICITY
FOR THE MAIN FOOD GROUPS

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Abstract. Although the Latvian economy has returned to positive growth path since 2010, in society the problems remain: high long-term unemployment rate and relatively low average level of income. Government's reluctance to reduce VAT for certain food groups can be understood – although this may improve the level of welfare in low-income households, simultaneously it could reduce the social security benefits for the same households. However, as has been shown in other studies, the level of income affects the healthy food consumption and thus also public health, and via this the economic long-run growth, too.

Therefore, the aim of this study is to assess which food group consumption is more sensitive to the level of income and price changes. The study is based on „ Household Budget Survey 2010" by CSB which contains 3798 Latvia's household survey data. It was calculated three indicators: (1) the households' available income for consumption per equivalent consumers, (2) the average price of product or product groups, (3) real consumption of product or product group by equivalent consumer. For each of the product are evaluated two models. The first model is used to estimate elasticity of demand for product dependent on households' available income for consumption. The second, to estimate elasticity of demand dependent on product average prices.

Results show that if the introduction of the reduced VAT rate for certain food groups is politically supported, then they could be: bread, fruit and vegetables, fish and fish products.

Key words: *consumption expenditures, food demand elasticity, regression analysis, household survey*

JEL code: D12, H31, Q11

Introduction

Despite the fact that since the year 2010 Latvia's economy has resumed a positive growth, from year to year there increases the number of households with material deprivation. In the EU-SILC survey, material deprivation is defined as a set of reasons for a household denying access to material comforts. In the period from 2008 to 2011, in all cost groups there has increased the proportion of such households that cannot afford to pay for them. Including, by over 5 percentage points there has

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increased the proportion of such households that can afford to eat meat, poultry or fish every second day (see, Table 1). Therefore, although not without any interest to support local producers, farmers and food manufacturers' representative organizations call upon the Latvian Government to fix a reduced rate of VAT to food. They include Farmer Organizations' Cooperation Council and Latvian Federation of Food Enterprises. (Dieziņa, 2012).

Table 1

**The rate of households, which could not afford to cover certain expenses
due to the lack of money (%)**

	2008	**2009**	**2010**	**2011**
To pay arrears on mortgage or rent, utility bills or hire purchase instalments	13.0	20.0	23.8	24.0
To keep home adequately warm	19.1	17.9	21.4	24.0
To face unexpected financial expenses	61.0	73.4	79.0	81.4
To spend one week annual holiday away from home	56.7	59.8	61.8	63.3
To have a meal with meat, chicken, fish every second day	27.4	25.2	28.5	32.9

Source: Central Statistical Bureau of Latvia

The Government's dismissive attitude toward the possibility of introducing a reduced VAT rate for food is understandably related to the financial deficiency in the public finances, which can be caused by the tax reduction. Although, due to the economic growth, the total unemployment rate relatively rapidly decreases, a significant reduction in the number of long-term unemployed persons is not observed (see, Table 2). The Latvian economy highlights structural problems – the labour market demand does not comply with the offer which contributes to the society's further stratification by income levels. For the Government, placed in the situation when there remains a high demand for social assistance – to ensure citizens in at least the minimum level of income or provide them with support, for example, through education and return them as soon as possible in the labour market, it is necessary to ensure a large enough tax revenue.

Table 2

Number of registered unemployed persons at the end of year

	Unemployed persons	**Growth rate of the number of unemployed persons (y-to-y)**	**Long-term unemployed (over 1 year)**	**Growth rate of the number of long-term unemployed persons (y-to-y)**
2007	52321	–	9393	–
2008	76435	46%	8466	-10%
2009	179235	134%	24172	186%
2010	162463	-9%	61331	154%
2011	130296	-20%	56934	-7%

Source: Unemployed persons and Long-term unemployed – Central Statistical Bureau of Latvia; Growth rates – author's calculations based on respective data

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However, it should be noted that material deprivation can also change the food group consumption demand (Zheng & Henneberry, 2012) which may affect the health of the population and that, in turn, through the quality of life of the population changes may be reflected in the sustainable development of the economy. Therefore, the aim of this study is to assess which food group consumption is more sensitive to the level of income and price changes, so that if the Government will consider the opportunity for individual food groups to introduce a reduced VAT, there could be made a reasoned argument which health food group consumption it could affect positively.

In the study there are used data presented in "Household Budget Survey 2010" conducted by Central Statistical Bureau of Latvia and assessed a food product or group of products' consumer elasticity depending on income per an equivalent household member or depending on the price changes.

The study structure is as follows:
1) A healthy and functional food definition is examined;
2) The data used in the study and methodology are described;
3) Regression analysis results;
4) Discussions and conclusions.

1. Healthy and functional food definitions

Certain food products can be described as good or bad and healthy or unhealthy. With such category as "good" is meant food that is desired, in turn, "unhealthy" – food that should be avoided. In the preferred foods there are usually mentioned fresh fruit, berries, vegetables, rye and oats.

Healthy food is described by such words as "natural", "pure", "main dish", "home-made food", "raw". The underlying assumption is that the food, enriched with healthy additives, even if the supplements are derived from the plant kingdom, cannot provide the balance of such substances that gives raw food (Niva, 2007), i.e., by eating fresh fruit we consume the required amount of vitamins but using food rich in with vitamins, we can get hypervitaminosis.

Healthy food is not synonymous with functional food, which often refers to food that is not detrimental to health. However, this definition does not clearly distinguish between the concept of functional and healthy food. Unity is only a belief that healthy food is also functional but not all functional food is healthy. A distinction should be made between real and possible functional food products but it is not a straightforward thing to do. Healthy food is the food, the positive impact of which on health is confirmed by studies or previous experience. In general, enriching the food with vitamins and minerals, you can get food moving into the functional food category but it may also be only apparent functionality. The frequently mentioned example – rich in vitamins juices: despite healthy ingredients, their functionality is just at the marketing level but no evidence of true health improvement.

In order to most visibly and simply present the basics of healthy nutrition, nutrition specialists have developed the so-called nutritional pyramid. The pyramid shows the man's everyday diet proportions: what products are needed to consume in large/small quantities. The pyramid at level 1 (basic) includes products where the main nutrients are carbohydrates, protein, fibre, iron, calcium, B – group vitamins. They are dietary basic products to consume in large quantities, richly. This level contains flour, semolina, bread and other cereal products, rice, corn and potatoes. So, they are all porridges, oatmeal, pasta, quick breakfast made from grain.

The pyramid at level 2 includes fruits, berries and vegetables as well as green peas and beans in pods. Those products, particularly fresh, are rich in vitamin C, carotene, fibre, carbohydrates. They should be often used and richly, it is desirable to choose a variety of vegetables and fruits.

The pyramid at level 3 includes milk, milk products, meat, fish, and eggs. All of these products are a valuable protein and different fat source. No matter how this group is good, it cannot replace the pyramid's first and second levels; therefore, dairy products should be eaten regularly but in moderate amounts. Lean meat is a source of a good protein, vitamins of group B, especially B12, as well as an iron

source but you have to avoid fatty meats, sausages, fatty products. Fish is a very valuable source of protein, vitamin D, vitamin B group, it supplies the human body with essential fatty acids (Omega 3), the sea products give the body iodine but this level of products should also be consumed in moderate volumes.

The pyramid at level 4 includes fats, sweets and alcohol. These products may not be used at all, but, if used, preferably a little.

So, if you consider the decision to cut VAT on certain food groups, then more attention should be paid to the first three levels of the pyramid food demand elasticity.

2. A description of the data and methodology

The research is based on "Household budget survey 2010" database conducted by the Central Statistical Bureau of Latvia. The database contains 3798 Latvian households' survey data. Based on the available data, there were calculated three indices: (1) the funds held by households for consumption per the equivalent consumer; (2) the average price of the products for groups or products; (3) the product group or product real consumption per the equivalent consumer.

The indices to the equivalent consumer are obtained by dividing the specific indices with household size which is formed by using the modified OECD scale – for the first adult there is an equalized weight of 1.0, for any next member of the household aged 14 years and older – 0.5 but for each member aged 14 years and older – 0.5 and for any child younger than 14 years – 0.3. The derived indices are obtained as follows:
   (a) Household resources available for consumption per the equivalent consumer – the index is created by dividing two database parameters: the total consumption expenditure in cash (Ls per year) with the household modified size;
   (b) For the average price product groups or products – using a product group or product code table, from the database for each household there are pulled out and summed up the expenditure corresponding to them in cash (Ls per year); analogues from the database are pulled out according to the code table on the consumption expenditure in cash; if the units of the products are the same, then the average price is calculated by dividing the total expenditure with the total volume; if the units are different (part of the products is listed in kilograms, others in litres or pieces), then, first of all, the average prices are fixed for products with the same units of measurement, secondly, the average price of the group is calculated as the weighted average of the prices of products with different units of measurement where as the weights serve the proportion of expenditure for products with different units of measurement;
   (c) The product group or product real consumption per the equivalent consumer – the indicator is obtained at the total expenditure household level by dividing with the average price. The real consumption characterizes how many of which product group or product units per year are consumed by the equivalent consumer of a household.

Food products, depending on the aspect of production, are divided into the following groups:
   (a) Large product groups – Bread and cereal products; Meat and meat products; Fish and fish products; Dairy products, except butter; Oils, fats, butter; Fruits and vegetables; Other food.
   (b) A separate food product groups – Bread; Unprocessed meat; Unprocessed fish; Milk; Eggs; Fresh fruit; Fresh vegetables.

In order to assess the elasticity, there are used the log-log models where a parameter to the explanatory variable interpretation corresponds to the definition of elasticity: on what percentage the dependent variable will change if the explanatory variable value changes by one per cent. The analytical model is as follows:

$$\ln y_i = b_0 + b_1 \ln x_i \ , \tag{1}$$

where b_0, b_1 – parameters to estimate and b_1 is interpreted as elasticity of y depending on x.

In each of the product groups, two models are evaluated. The first model evaluates the real consumption elasticity of product groups depending on resources at the disposal of the household. The second model: elasticity depending on the average price of the product group. By analysing the results, a particular attention is paid to the demand elasticity depending on the price changes as it has a direct effect in connection with VAT. The elasticity after income suggests the household preference changes when there are changes in the level of income.

3. The results of the regression analysis

The model evaluation is based on the statistics and econometrics software package SPSS17.

If in the tables it is not marked otherwise, the models in general (concluded according to F-statistics) or elasticity coefficients (concluded according to – t statistics) are statistically significant at all the standard confidence levels: 10%, 5%, or 1% (see, Appendix). The econometric estimates of the elasticity parameters of the major food product groups for all the households are presented together in Table 3.

Table 3

The elasticity parameters of the major food product groups for all the households

	Demand elasticity depending on household income changes	Demand elasticity depending on price changes
Bread and cereal products	0.071	-0.464
Meat and meat products	0.251	-0.431
Fish and fish products	0.169	-0.641
Dairy products, except butter	0.499	-0.520
Oils, fats, butter	-0.096	-0.688
Fruits and vegetables	0.732	-0.571
Other food	0.481	-0.825

Source: author's calculations based on "Household budget survey 2010" database

The results of the estimates indicate that the demand elasticity depending on price changes in 2010 for all the households ranged from -0.431 to -0.825 that fully comply with the theory of elasticity for food products. The smallest demand elasticity parameters depending on the price changes were with the group of goods "meat and meat products, eggs" but the indices of this group were lowered by the pronounced low demand elasticity of the egg product group depending on price. The next product group with the lowest elasticity is "bread and cereal products" (0.464). For the product group "dairy products except butter", the demand elasticity depending on changes in price formed -0.520; for the group of goods "fruits and vegetables" -0.571; for the group of goods "fish and fish products" -0.641; for the group of goods "oils, fats, butter" -0.688. The highest elasticity indices are for the food group "other food" and they form -0.825.

It should be noted that in accordance with other studies (Muhammad, et al., 2011), the lowest elasticity as concerns price is inherent to bread and cereals, as well as fat. Such differences can be partly explained by different definitions of product groups. However, the Latvian household data analysis indicates that they are exactly the groups of goods "bread and cereal products" and "oils, fats, butter" that are characterized by a very low demand elasticity depending on income changes (significantly lower than

the corresponding indices of the other product groups). In addition, for the product group "oils, fats, butter" the demand elasticity depending on income is even with a minus sign and this means that with the increase in personal income, consumption of these products decreases. The greatest demand for elasticity depending on the income is created from fruits and vegetables as well as dairy products (except butter).

The econometrically calculated elasticity indicators for individual product groups to all the households together in Latvia are presented in Table 4. It should be noted that two of the 14 indices calculated are not statistically significant at all the standard confidence levels – they are the demand elasticity depending on the income changes of "unprocessed fish" and the demand elasticity depending on changes in the price of "eggs".

Table 4

The elasticity parameters of individual product groups for all the households

	Demand elasticity depending on household income changes	**Demand elasticity depending on price changes**
Bread	-0.052	-0.733
Unprocessed meat	0.258	-0.378
Unprocessed fish	-0.015*	-0.518
Milk	0.362	-0.687
Eggs	0.084	-0.083*
Fresh fruit	0.189	-0.651
Fresh vegetables	0.283	-0.607

* not significant at 10%, 5% and 1% level
Source: author's calculations based on "Household budget survey 2010" database

As regards the demand elasticity indices depending on price changes without eggs (where the index is not statistically significant, thus, it cannot be statistically stated that they are different from zero) the lowest index value is for unprocessed meat and unprocessed fish – respectively -0.378 and -0.518. The highest indices are for bread (-0.733), followed by milk (-0.687), for specific in Latvia fresh fruits (-0.651) and vegetables (-0.607).

Bread is classically considered to be a low elasticity good from the demand side both depending on the price and income changes. However, the data analysis of households in Latvia simultaneously reveals both relatively high demand elasticity depending on price changes and negative demand elasticity depending on income changes (this means that the household demand for bread in the case of income growth decreases). Very low demand elasticity depending on income is typical of the eggs (0.084). For other product groups, the demand elasticity indices depending on the income are in the range of 0.189 (fresh fruit) and 0.362 (milk).

Discussion and conclusions

At the basis of the food pyramid, level 1 large group's "bread and grain products" and just "bread" demand is characterized by low elasticity depending on the household income level which could be explained by the relatively high importance of the large products in the daily diet. However, if the large group's of "bread and grain products" elasticity in pricing is relatively lower than the other big group

products, then the individual product's "bread" demand elasticity in pricing is one of the highest. That means that

1. by fixing a reduced VAT rate, the reduction of prices could contribute to the demand increase for "bread".

The demand for the pyramid level 2 products-fruit, berries and vegetables, its large group "fruits and vegetables" is relatively elastic depending on the household budget revenue. This can be explained by in the group included not typical to Latvia products, such as citrus fruit. In contrast, the elasticity demand for typical to Latvia "fresh fruit" and "fresh vegetables" depending on the household income is relatively low which points to this product as the basic product of healthy food products in households. However, the demand for "fruit and vegetables", also "fresh fruit" and "fresh vegetables" is relatively flexible in relation to prices. Therefore,

2. given that it is recommended to use in the diet not only more fresh fruits and vegetables but also to diversify them so that through the price effect to promote their consumption, it might be possible to apply the reduced VAT rate to the large product group "fruits and vegetables".

Analysing the level 3 products, there was confirmed the basic finding in economics that the growth of meat and dairy product consumption over other products is contributed by an increase in household welfare. The difference is that the demand for "meat and meat products", relatively less than other food groups, is affected by price changes, while for "dairy products" the demand is very sensitive to price changes. Consequently, in the conditions when there increases the number of such households confronted with scarcity of funds, for these two groups of products, by the VAT changes only, the demand changes may not be achieved. However, from this level of the pyramid products, it would be advisable to consider the reduced VAT rate fixing for "fish and fish products", and especially for "unprocessed fish". The study shows that in Latvian households, with the changes in income level, the consumption of these products does not significantly change. At the same time, the demand elasticity in prices is relatively high. Therefore,

3. in order to contribute to the consumption of "fish and fish products" in households, thus supplying the human body with essential fatty acids, as well as to giving the body iodine, it is recommended for this product group to fix a reduced VAT rate.

In general, VAT rate reduction will have positive impact on consumption of "healthy" grocery products, such as bread, fruit and vegetables, fish and fish products.

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Appendix

Bread and cereal products (*y*) real demand elasticity depending on:

x	*n*	*F*	D-W	*b*$_1$	*t*-statistics
household income for consumption on equivalent consumer	3792	19.535	2.043	**0.071**	4.420
average prices		324.201	2.035	**-0.464**	-18.006

Meat and meat products (*y*) real demand elasticity depending on:

x	*n*	*F*	D-W	*b*$_1$	*t*-statistics
household income for consumption on equivalent consumer	3727	153.753	1.983	**0.251**	12.400
average prices		330.957	1.970	**-0.431**	-18.192

Fish and fish products (*y*) real demand elasticity depending on:

x	*n*	*F*	D-W	*b*$_1$	*t*-statistics
household income for consumption on equivalent consumer	2686	31.241	2.036	**0.169**	5.589
average prices		407.211	2.036	**-0.641**	-20.179

Dairy products, except butter (*y*) real demand elasticity depending on:

x	*n*	*F*	D-W	*b*$_1$	*t*-statistics
household income for consumption on equivalent consumer	3630	594.248	2.028	**0.499**	24.377
average prices		445.895	2.029	**-0.520**	-21.116

Oils, fats, butter (*y*) real demand elasticity depending on:

x	*n*	*F*	D-W	*b*$_1$	*t*-statistics
household income for consumption on equivalent consumer	3099	17.274	1.999	**-0.096**	-4.156
average prices		712.745	2.013	**-0.688**	-26.697

Fruits and vegetables (*y*) real demand elasticity depending on:

x	*n*	*F*	D-W	*b*$_1$	*t*-statistics
household income for consumption on equivalent consumer	3439	731.570	1.962	**0.732**	27.048
average prices		242.116	1.983	**-0.571**	-15.588

Other food (*y*) real demand elasticity depending on:

x	*n*	*F*	D-W	*b*$_1$	*t*-statistics
household income for consumption on equivalent consumer	3579	289.337	2.037	**0.481**	17.010
average prices		2381.993	2.041	**-0.825**	-48.806

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Bread (*y*) real demand elasticity depending on:

x	*n*	*F*	D-W	*b₁*	*t*-statistics
household income for consumption on equivalent consumer	3761	9.094	2.072	**-0.052**	-3.016
average prices		312.116	2.062	**-0.733**	-17.667

Unprocessed meat (*y*) real demand elasticity depending on:

x	*n*	*F*	D-W	*b₁*	*t*-statistics
household income for consumption on equivalent consumer	2958	87.841	1.990	**0.258**	9.372
average prices		76.504	1.979	**-0.378**	-8.747

Unprocessed fish (*y*) real demand elasticity depending on:

x	*n*	*F*	D-W	*b₁*	*t*-statistics
household income for consumption on equivalent consumer	1019	0.115*	2.014	**-0.015****	-0.339
average prices		205.628	1.959	**-0.518**	-14.340

* model is not significant at 10%, 5% and 1% level
** coefficient is not significant at 10%, 5% and 1% level

Milk (*y*) real demand elasticity depending on:

x	*n*	*F*	D-W	*b₁*	*t*-statistics
household income for consumption on equivalent consumer	3592	254.452	2.024	**0.362**	15.952
average prices		626.192	2.024	**-0.687**	-25.024

Eggs (*y*) real demand elasticity depending on:

x	*n*	*F*	D-W	*b₁*	*t*-statistics
household income for consumption on equivalent consumer	2623	20.328	1.974	**0.084**	4.509
average prices		1.730*	1.978	**-0.083****	-1.315

* model is not significant at 10%, 5% and 1% level
** coefficient is not significant at 10%, 5% and 1% level

Fresh fruit (*y*) real demand elasticity depending on:

x	*n*	*F*	D-W	*b₁*	*t*-statistics
household income for consumption on equivalent consumer	1648	13.481	2.035	**0.189**	3.672
average prices		236.647	2.032	**-0.651**	-15.383

Fresh vegetables (*y*) real demand elasticity depending on:

x	*n*	*F*	D-W	*b₁*	*t*-statistics
household income for consumption on equivalent consumer	2854	132.645	1.966	**0.385**	11.517
average prices		414.104	1.961	**-0.607**	-20.350