Food Demand in Slovenia

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FOOD DEMAND IN SLOVENIA

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Abstract

The objective of this research is to analyse food consumption patterns in Slovenia for households segmented by quartile income levels and for whole Slovenian population. Food items are divided into seven commodity groups. Cross-sectional household data from Household Budget Survey 2001 were used. We apply the linearly approximated Almost Ideal Demand System (LA/AIDS). Empirical results show positive expenditure elasticities being close to one where in general demands for dairy products and for vegetables have expenditure elasticities higher than unity. All Marshallian and Hicksian own price elasticities are negative and less than one. Demand for meat and fish is quite price inelastic whereas demand for vegetables is pretty sensitive to its own price changes. Results indicate that Slovenia is losing consumption characteristics typical for countries in transition however, some unique food habits persist.

Keywords: food demand system, LA/AIDS, expenditure and price elasticities, Household Budget Survey

1. Introduction

Some studies estimating demand for goods and services have ignored required connections between theory and empirical analysis (e.g. exclusion of price terms) and concentrated on the estimation of single demand equations. Given the doubts of the results of such an approach,

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empirical work has been directed towards the estimation of complete demand systems derived from consumer theory. Thus, modern studies calculate responsiveness of individual consumer behaviour to prices faced by households and to income they earn (Blanciforti et al., 1986).

Until 1990 food demand studies for Slovenia applied Engel curves (Frankovič et al., 1958; Verk, 1969; Kranjec, 1981; Kebrič 1981; Šumi, 1986; Regoršek, 2002). Erjavec and Turk (1998) carried out the first study which estimated the effect of income and prices on food demand simultaneously. They estimated food demand functions as a system and demand elasticities for Slovenian transition period that is in years 1988 and 1993.

Our study updates earlier demand studies for Slovenia in two ways. First and foremost, we present recent estimates of income and price elasticities for seven main food commodity aggregates. Secondly, this is the second study in Slovenia, which estimates food demand as a system. We use Linear Approximate Almost Ideal Demand System (LA/AIDS) method which is usually applied on time series data. In Slovenia, these time-series data are not available. However national statistics regularly collects household survey data on expenditures therefore we use data from Household Budget Survey 2001.

2. Model

AIDS model was introduced by Deaton and Muellbauer (1980). It is derived from a flexible expenditure function that is extremely useful for estimating a demand system with many desirable properties. This model automatically satisfies aggregation restriction (Muellbauer, 1975) and simple parametric restrictions, homogeneity and symmetry can be imposed. It has a functional form that is consistent with known household-budget data. Owing to its simplicity LA/AIDS is very popular in empirical studies (Deaton and Muellbauer, 1980a; Phlips, 1990;

Alston, 1994; Peterson and Cotterill, 1998). Its estimation is much simpler while linear estimation procedures can be used. LA/AIDS demand functions have the form:

$$w_i = \alpha_i + \sum_j \gamma_{ij} \ln p_j + \beta_i \ln\left(x/P^*\right) \tag{1}$$

where $\alpha_i, \beta_i, \gamma_{ij}$ are parameters, w_i is budget share of good i ($i = 1,2,...,n$), p_j is price of good j ($j = 1,2,...,n$) and x is total expenditure. P^* is Stone's price index:

$$\ln P^* = \sum_j w_j \ln p_j \tag{2}$$

On the parameters in AIDS model the following restrictions can be imposed (Jehle, Reny, 2001):

1. *Adding-up* implies: $\sum_{i=1}^{n} \alpha_i = 1 \quad \sum_{i=1}^{n} \beta_i = 0 \quad \sum_{i=1}^{n} \gamma_{ij} = 0$.

   Hence it follows that $\sum w_i = 1$ as it is clear from (1).

2. *Homogeneity* requires that, $\sum_{i=1}^{n} \gamma_{ij} = 0$.

3. *Symmetry* is satisfied if $\gamma_{ij} = \gamma_{ji}$ for any two goods i and j.

4. *Negativity* is not automatically introduced, but by estimating all the compensated own-price elasticities one can test for their negativity.

According to Green and Alston (1990), elasticities in LA/AIDS can be expressed as $\eta_i = 1 + \beta_i / w_i$ for income elasticity and $e_{ij} = -\delta_{ij} + \gamma_{ij} / w_i - \beta_i\left(w_j / w_i\right)$ for uncompensated (Marshallian) price elasticity where $\delta_{ij} = 1$ if $i = j$ and $\delta_{ij} = 0$ if $i \neq j$. A total price change effect is a sum of price effect and income effect which together affect on quantity demanded. When we are interested only in income effect of a price change assuming constant price

effect, compensated (Hicksian) price elasticities are calculated. In LA/AIDS model that are as $e_{ij}^{*} = e_{ij} + w_j \eta_i$ (Hahn, 1994).

In equation (1) parameter β_i determines the effect of a change in expenditure on the budget share of good i and implies, whether this good is a luxury, necessity or inferior good. For luxury good $\beta_i > 0$, expenditure elasticity is larger than unity ($\eta_i > 1$) and w_i increases with rising total expenditure (x). For a necessary good $\beta_i < 0$, expenditure elasticity lies between zero and unity ($0 < \eta_i < 1$), w_i decreases when x increases. And for an inferior good $\beta_i < -1$ with expenditure elasticity smaller than zero ($\eta_i < 0$). In addition, it is possible to examine all complementary and substitutive relations between pairs of goods by estimating compensated and uncompensated cross price elasticities (Varian, 1992).

3. Data

Study uses sample household data derived from Slovenian Household Budget Survey annually conducted by Statistical Office of the Republic of Slovenia. Annual sample of approximately 1200 households is not large enough to provide accurate estimates. To avoid this problem a Danish model of data combining is applied according to which all reported data across households from three consecutive yearly surveys are gathered into one sample (app. 3600 households). Implicitly, before data combining households' value data (expenditures, income, etc.) are deflacionated to the middle year which is used as reference year for interpretation. We use Household Budget Survey with the reference year 2001 which was carried out in years 2000, 2001 and 2002 and covered 4986 households, of that 3816 households responded (Statistical Yearbook of the Republic of Slovenia 2004).

Among others, survey gathers data on total food expenditure, quantity and value of specific food items consumed by a household. In this study a two-stage budgeting model is employed using a weak separability concept[3]. The basic idea is that when planning their budget allocation households first decide how much to spend on food, clothes, etc. Conditional on that, households proceed budget planning until reaching the least aggregated level where the choice concerns more elementary items, in our case main food categories (Varian, 1992). Our complete food demand system consists of the following aggregated food categories: bread and cereals, meat and fish, dairy products, oils and fats, fruit, vegetables and confectionary. Focus of analysis on allocating food consumption expenditure across these food commodity groups is proper, mainly because survey data permit us to separate food consumption expenditure into different food categories.

To successfully apply LA/AIDS methodology to Household Budget Survey 2001 data some data limitations had to be solved. A household may report no consumption of a particular food item in the survey. Aggregation process across food commodities revealed households which did not consume certain main food group(s). To overwhelm this problem an average quantity consumed and an average expenditure of that particular aggregate food group(s) were assigned. Reason for missing data might be its cost or personal preferences or because that food was not purchased during the short survey period. Thus, it is possible that consuming and non consuming households may react differently to changes in market conditions. Therefore each aggregated food category average was calculated from the reported household data.

[3] A weak separability concept is necessary as it determines the type of preference according to which consumer distributes commodities into disaggregated commodity groups/items (Varian, 1992).

Further on, food groups' unit values calculated from survey data were adopted as price indicators. Deaton (1988) states that household surveys contain information on spatial distribution of prices and thus, by recovering this information in a useful form, one can easily obtain the impact of prices on quantity demanded. However, Deaton's methodology could not be used in our study due to the limitations of available survey data so we applied demand model as suggested by Deaton and Muellbauer in equation (1) by replacing unit values for prices (Stavrev, Kambourov, 1999; Conforti et al., 2000; Huang, Lin, 2000). Food group unit values were calculated across households as weighted averages of each food item in the corresponding food group consumed and of its quantity. Weights represent relative consumption share of each food item in the total consumption of aggregated food group it belongs to.

Households are classified into quartile income groups according to the value of average annual disposable income per household member. First quartile income group includes 25% of all Slovenian households with the lowest average annual disposable income per household member in the reference year 2001. Households in the forth income group consist of 25% Slovenian households with the highest average annual disposable income per household member in the same reference year. All entry data for further analysis are calculated per household member.

4. Results

LA/AIDS methodology is applied to five samples: four quartile income groups and Slovenia total. These five models are estimated as systems of linear equations, using system linear regression (SYSLIN) procedure in SAS computer program (Zellner, 1962). Parametric constraints of homogeneity and symmetry conditions across equations are imposed. Adding

up constraint ($\sum w_i = 1$) implies a singular variance-covariance matrix. To avoid singularity problem one equation is deleted from direct estimation in each demand model (in our case "confectionary" equation). Parameter estimates of confectionary equation are derived further on using homogeneity, symmetry and adding-up conditions. Share of estimated demand coefficients, whose *p*-value is less than 0.1 varies between 70% and 81% according to the model.

However, of interest to researchers and policy makers is the knowledge concerning elasticities of demand for food. It can be seen from Table 1 that all expenditure elasticities are of expected sign and close to 1. Values in parentheses are *p*-values testing $H_0 : \eta_i = 1$. Demands for dairy products and vegetables are very elastic ($\eta_i > 1$) and both statistically significant at 5 percent level. All other food groups are regarded as relatively elastic. Estimates of expenditure elasticities segmented by income level show that bread and cereals whose expenditures represent about 20% of total food expenditures could also be regarded as fairly elastic food category in low income households. Yet this estimate is not statistically significant it is worth mentioning this higher bread and cereals expenditure elasticity in comparison to noticeably lower expenditure elasticity for meat and fish. This rarity could be assigned mainly to specific Slovenian consumption patterns. Plausible explanation could be that consumption preferences and supply of meat have not changed significantly in the past years. On the contrary, consumption patterns for bread and cereals food group have altered significantly. A broader variety of sorts of bread and other goods in this group supplied has most probably caused a demand shift inside this food category which led to higher overall bread and cereal expenditure elasticities. Trend of growing expenditure elasticities for bread and cereals demand can be seen since 90s (Erjavec, Turk, 1998). The second and the forth income groups are less expenditure sensitive when demanding bread and cereals yet again this

is not statistically significant. Another interesting example is fruit demand for high income households with expenditure elasticities higher than 1 and again not statistically significant. This, however could also be explained with the assumption that wealthier consumers buy more and also buy more expensive fruits and therefore almost instantly react to food expenditure changes.

Table 1: Expenditure elasticities for main food categories (η_i) and their expenditure in total food expenditure (w_i, in %) for four household quartile income groups and Slovenia total, 2001

i	*1st (low) income households*		*2nd income households*		*3rd income households*		*4th (high) income households*		*Slovenia total*	
	w_i	η_i	w_i	η_i	w_i	η_i	w_i	η_i	w_i	η_i
1	20.4	1.026 (0.2098)	18.2	0.994 (0.4198)	17.5	0.929 (0.0100)	16.4	0.966 (0.4426)	18.1	0.961 (0.0041)
2	26.4	0.924 (0.0099)	30.5	0.938 (0.0153)	29.9	0.930 (0.0109)	29.2	0.968 (0.1291)	29.0	0.952 (0.0005)
3	21.5	1.093 (0.0046)	21.8	1.141 (<0.0001)	22.0	1.170 (<0.0001)	23.6	1.063 (0.0173)	22.2	1.121 (<0.0001)
4	5.4	0.729 (<0.0001)	5.2	0.670 (<0.0001)	5.1	0.677 (<0.0001)	5.0	0.726 (<0.0001)	5.2	0.708 (<0.0001)
5	8.4	0.897 (0.0240)	8.1	0.841 (0.0005)	8.5	1.023 (0.3204)	9.2	1.004 (0.4653)	8.6	0.967 (0.0830)
6	9.9	1.234 (<0.0001)	9.3	1.226 (<0.0001)	9.8	1.141 (0.0038)	9.7	1.150 (0.0005)	9.7	1.180 (<0.0001)
7	8.0	0.939	6.8	0.976	7.2	0.953	6.8	0.912	7.2	0.927

Source: Estimated

Legend
i: Food group
1: Bread and cereals
2: Meat and fish
3: Dairy products
4: Oils and fats
5: Fruit
6: Vegetables
7: Confectionary

According to the results presented in Table 2, all uncompensated own price elasticities (e_{ii}) are negative and less than 1. Demand for bread and cereals and demand for meat and fish seem to be the least sensitive to its own price changes. On the other hand, households tend to response rapidly to price changes in dairy products and in vegetables when demanding them. Uncompensated own price elasticities do not vary systematically across income groups.

Table 2: Uncompensated (e_{ii}), and compensated (e_{ii}^{*}) own price elasticities for main food categories for four household quartile income groups and Slovenia total, 2001

i	*1st (low) income households*		*2nd income households*		*3rd income households*		*4th (high) income households*		*Slovenia total*	
	e_{ii}	e_{ii}^{*}	e_{ii}	e_{ii}^{*}	e_{ii}	e_{ii}^{*}	e_{ii}	e_{ii}^{*}	e_{ii}	e_{ii}^{*}
1	-0.539	-0.330	-0.479	-0.291	-0.467	-0.287	-0.438	-0.269	-0.474	-0.299
2	-0.206	0.038	-0.374	-0.092	-0.340	-0.064	-0.397	-0.128	-0.332	-0.056
3	-0.842	-0.607	-0.821	-0.583	-0.817	-0.576	-0.766	-0.508	-0.814	-0.565
4	-0.596	-0.556	-0.630	-0.592	-0.512	-0.475	-0.539	-0.502	-0.570	-0.534
5	-0.579	-0.503	-0.508	-0.436	-0.578	-0.502	-0.412	-0.329	-0.520	-0.437
6	-0.901	-0.779	-0.924	-0.809	-0.785	-0.664	-0.794	-0.674	-0.852	-0.737
7	-0.596	-0.521	-0.645	-0.581	-0.535	-0.468	-0.551	-0.487	-0.576	-0.509

Source: Estimated

Legend
i: Food group
1: Bread and cereals
2: Meat and fish
3: Dairy products
4: Oils and fats
5: Fruit
6: Vegetables
7: Confectionary

Compensated own price elasticity estimates (e_{ii}^{*}) in Table 2 show similar trend but smaller values than uncompensated ones which is theoretically consistent. The estimates of Hicksian own price elasticities for bread and cereals, dairy products and especially for meat and fish demand are obviously smaller than Marshallian ones indicating that income effect on their own quantity demanded is very significant when purchasing these food groups. Demand for meat and fish is now actually inelastic to its own price changes. It is rather unusual that the lowest income households increase their purchases of meat and fish when these prices rise (positive sign of its own price elasticity). Again, the compensated own price elasticity for vegetables has the highest value.

Our study provides uncompensated and compensated cross and own price elasticities although only the latter are represented in this paper (Table 2). With cross price elasticities close to zero most of the food groups seemed to be unrelated. Uncompensated cross price elasticities

are mostly negative indicating complementary relationship of food groups whereas Hicksian ones are mostly positive, suggesting substitution relationship of aggregated foods.

5. Conclusion

To investigate the Slovenian consumer purchasing habits, demand elasticities for whole population and/or for targeted households have to be studied. In our study we modelled five food demand systems for four household quartile income groups and Slovenia total by applying LA/AIDS method. By weak separability and two stage expenditure budgeting the demand for each main food category was represented as a function of total food consumption expenditures and a vector of prices for various food categories. Data limitations e.g. missing data for some food group(s) and absence of price variations had to be solved.

Applied models give reasonable results of expenditure, conditional and unconditional price elasticities in comparison with the previous Slovenian studies (Erjavec and Turk 1998; Regoršek, 2002) as well as in comparison with the results of other similar studies (Stavrev, Kambourov, 1999; Conforti et al., 2000; Huang, Lin, 2000). The results show how the consumption patterns of Slovenian consumers gradually adapted to general consumption patterns in the developed countries in the last 15 years. Trends like high expenditure and own-price sensitivity for vegetable demand support these findings. Additionally, some typical national consumer patterns like moderate meat demand response to its price and to food expenditure changes despite its higher supply and its relatively high consumption could also be derived from this analysis. Another specific Slovenian consumption pattern is relatively greater vegetable demand sensitivity than fruit demand sensitivity which is in general less common (Stavrev, Kambourov, 1999; Conforti et al., 2000; Huang, Lin, 2000).

Lack of time series data and/or inability to identify food quality in cross-sectional data gives limitation to these estimates concerning price terms. According to Deaton (1988) the most probable reason for the unit value variations among households is different quality of food. Further examinations should focus on identifying food quality and consequently food quantity regardless of quality which together define proper unit values. Further studies should also be extended in the field of household characteristics.

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