

The spatial differentiation of Polish household food expenditures

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Abstract:

The aim of the paper is to analyse spatial differentiation of food expenditures in Poland in the years 1998÷2006. The study is based upon the data collected by the Central Statistical Office. In order to evaluate an influence of the determinants that differentiate the level of the food expenses, the error component regression models are estimated. The results of the statistical analysis of household food expenditures are presented as well.

Key words:

household expenditures, error component regression model, fixed effects model, random effects model;

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Introduction

The article deals with the analysis of spatial differentiation of food expenditures in Poland in the years 1998÷2006. The aim of the paper is:

- to compare the food expenses of the Polish households in different regions of the country,
- to settle the mechanism of changes of the food expenditures,
- to test the statistical significance of the determinants that differentiate the level of the food expenses,
- to verify whether the differentiation of the food expenditures between the regions of Poland is fixed or random.

The study is based upon the data collected by the Central Statistical Office. In order to enable the comparisons, all the nominal values of incomes and food expenditures were transformed to real values, calculated in constant prices of 1998.

1. Household expenditures on food

The subject of the consumption process, i.e. the process of supplying current needs, is an individual who is a part of a household which condition the way of resulting that process. A household is „the most common and the most stable economic unit basing its activity on its own material means and the labour force of its members”¹.

The aim of a household is to supply combined and individual needs of its members. It is the base of all decisions and choices made by the household. In order to achieve the goal the household has to manage its own monetary resources as well as the resources of material goods. The management process includes the planning of the household budget and decision making process regarding the level and the structure of the household consumption.

The expenditures on food play a significant role in the structure of the total household expenses. First of all, they supply the vital needs of the household members. Because of that the food expenditures affect the level and the structure of other household expenses. The food expenditures are very sensitive to market conditions so their share in total expenses on consumer goods and services is considered a measure of economic situation of a household.

The level of household expenditures depends on the level of their real incomes. In case of growth, the drop in the share of food expenses means the increase of household level of living. The income growth brings the increase of expenditures on food as well as other consumer goods.

¹ KRAMER J. (ed.): *Zachowania podmiotów rynkowych*. Warszawa: PWE, 1999, ISBN 83-208-1220-8, p. 34.

Since the change rate of food expenses is lower than the growth rate of other expenditures, the share of food expenses in total expenditures decreases².

On the other hand, if the incomes drop, the households reduce their savings in order to keep the level and the structure of consumption. Further decrease of income affects the limit of the other expenses, so the share of food expenditures in total expenses increases.

However, in many cases the drop in the share of food expenditures is caused not only by the increase of real incomes. Change rate of food prices lower than consumer price index causes the share of food expenses in total expenditures to be decreasing. The same effect can be caused by the high increase of expenses on housing, gas, electricity, health care.

The household expenditures on food are determined not only by incomes and prices. They also depend on demographic, social and psychological factors. The combined influence of all determinants appoints the level and the structure of the food expenses. Separating their individual impacts seems to be impossible.

2. Statistical analysis

In the period under investigation, the food expenses in Poland differed depending on the location of the household. In the years 1998÷2006, variation coefficients of the expenditures per capita amounted to 4÷5%.

The highest level of expenditures was achieved by households placed in Mazowieckie province. They were ca. 8÷13% higher than the average expenses in Poland. Mazowieckie province was the only region of Poland where the food expenditures were higher than average, in the whole period under investigation.

Tab.2.1 The relation of the food expenditures in provinces to average in Poland

province	1998	1999	2000	2001	2002	2003	2004	2005	2006
dolnośląskie	101%	101%	98%	98%	100%	99%	100%	99%	100%
kujawsko-pomorskie	96%	95%	94%	95%	96%	96%	95%	95%	96%
lubelskie	92%	95%	90%	90%	94%	96%	95%	92%	92%
lubuskie	102%	103%	101%	98%	101%	100%	99%	101%	102%
łódzkie	100%	100%	103%	101%	99%	99%	98%	100%	97%
małopolskie	100%	99%	101%	101%	99%	97%	98%	99%	100%
mazowieckie	108%	109%	110%	111%	110%	112%	112%	109%	111%
opolskie	98%	98%	95%	99%	97%	100%	101%	105%	101%
podkarpackie	91%	91%	93%	92%	95%	95%	94%	93%	91%
podlaskie	99%	101%	98%	103%	103%	101%	98%	102%	106%
pomorskie	101%	99%	100%	100%	101%	100%	102%	101%	103%
śląskie	104%	103%	103%	102%	102%	101%	101%	102%	100%
świętokrzyskie	93%	95%	99%	100%	99%	96%	96%	98%	99%
warmińsko-mazurskie	96%	96%	95%	94%	93%	98%	94%	97%	96%
wielkopolskie	99%	99%	99%	98%	97%	97%	96%	96%	95%

² See: KIEŻEL E. (ed.): *Rynkowe zachowanie konsumentów*. Katowice: Wydawnictwo AE, 2000, ISBN 83-7246-185-6, p.169.

zachodniopomorskie	101%	101%	99%	100%	97%	100%	100%	102%	102%
Poland	100%	100%	100%	100%	100%	100%	100%	100%	100%

Source: Own calculations based upon the data of the Central Statistical Office.

Depending on the year, the households located in Lubelskie, Warmińsko-mazurskie or Podkarpackie attained the lowest value of the food expenses. Their expenditures were lower than average in Poland, respectively by 7÷10%, 6÷7% and 5÷9%. Also in Kujawsko-pomorskie, Świętokrzyskie and Wielkopolskie the household expenditures per capita remained lower than average. The expenses of households placed in the other nine provinces approximated to the average in Poland.

Table 2.2 presents the growth rate and the average annual rate of change of the food expenditures in every province of Poland.

In the years 1998÷2006 the households of all of the investigated regions increased their nominal expenditures on food. The average expenses per capita grew by 19%, from 169,54 PLN to 202,11 PLN, which means the average growth per year on the level of 2,2%.

The real expenditures on food in Poland, evaluated in prices of 1998, dropped in the above mentioned period, by ca. 13% on average. The mean rate of change of the household expenses per capita amounted to -1,7% per year.

The greatest trend of decrease of the real food expenditures in the period under investigation was achieved by Wielkopolskie province. Its expenses per capita dropped by ca. 17%, which means the average yearly change rate of -2,2%.

Tab.2.2 The growth rate and the average annual rate of change of the food expenditures

province	growth rate		average annual rate of change	
	nominal	real	nominal	real
dolnośląskie	18,4%	-13,4%	2,1%	-1,8%
kujawsko-pomorskie	19,4%	-12,6%	2,2%	-1,7%
lubelskie	19,2%	-12,8%	2,2%	-1,7%
lubuskie	19,7%	-12,4%	2,3%	-1,6%
łódzkie	15,5%	-15,5%	1,8%	-2,1%
małopolskie	18,5%	-13,2%	2,1%	-1,8%
mazowieckie	22,3%	-10,5%	2,5%	-1,4%
opolskie	22,8%	-10,1%	2,6%	-1,3%
podkarpackie	18,7%	-13,1%	2,2%	-1,7%
podlaskie	27,0%	-7,0%	3,0%	-0,9%
pomorskie	20,9%	-11,5%	2,4%	-1,5%
śląskie	14,8%	-15,9%	1,7%	-2,1%
świętokrzyskie	26,9%	-7,1%	3,0%	-0,9%
warmińsko-mazurskie	18,8%	-13,1%	2,2%	-1,7%
wielkopolskie	14,0%	-16,6%	1,7%	-2,2%
zachodniopomorskie	20,4%	-11,9%	2,3%	-1,6%
Poland	19,2%	-12,8%	2,2%	-1,7%

Source: Own calculations based upon the data of the Central Statistical Office.

The lowest drop in the real expenditures on food was observed in Podlaskie and Świętokrzyskie. The expenses of the households placed in that regions decreased on average by 0,9% every year. In 2006, in comparison with the year 1998, they were lower by 7%.

Table 2.3 presents the share of food expenditures in total expenses on consumer goods and services.

One of the measures of economic situation of households is the share of their food expenditures in total expenses on consumer goods and services. In Poland, in the period under investigation, the mean share of the food expenditures amounted from 35,1% in 1998 to 28,4% in 2006. Values above the average were observed in six regions of the country, i.e.: Kujawsko-pomorskie, Lubelskie, Podkarpackie, Podlaskie, Świętokrzyskie and Warmińsko-mazurskie. The share of food expenses in total expenditures in provinces: Lubuskie, Małopolskie, Pomorskie and Wielkopolskie approximated to the mean in Poland. In others the values were lower than the average.

In the year 1998, Podkarpackie had the highest share of food expenditures in total expenses (39,5%). At the same time, the lowest share, at the level of ca. 32%, was observed in Dolnośląskie and Mazowieckie.

In the year 2000 Mazowieckie province achieved the lowest share of food expenditures in total expenses at the level of 25,9%. The highest one amounted to 34,2%, appeared in Świętokrzyskie.

Tab.2.3 Share of food expenditures in total expenses on consumer goods and services

province	1998	1999	2000	2001	2002	2003	2004	2005	2006
dolnośląskie	32,3%	29,6%	31,0%	31,6%	30,8%	28,9%	29,3%	28,4%	27,8%
kujawsko-pomorskie	38,0%	35,5%	33,3%	32,7%	31,3%	30,7%	31,2%	32,0%	30,0%
lubelskie	38,2%	34,7%	34,0%	34,3%	32,4%	31,3%	30,2%	30,2%	29,3%
lubuskie	34,7%	30,8%	32,1%	31,9%	31,9%	30,3%	29,3%	28,6%	27,9%
łódzkie	34,6%	31,0%	31,1%	32,0%	29,6%	28,7%	28,2%	27,8%	26,8%
małopolskie	35,8%	32,9%	33,3%	32,1%	31,3%	29,9%	29,3%	29,7%	29,7%
mazowieckie	32,4%	30,3%	30,1%	30,8%	28,5%	27,0%	26,5%	27,0%	25,9%
opolskie	33,6%	31,5%	31,5%	31,8%	31,1%	29,2%	28,6%	27,8%	28,4%
podkarpackie	39,5%	34,6%	35,1%	35,0%	34,4%	32,0%	32,2%	32,1%	30,9%
podlaskie	37,9%	37,6%	35,6%	35,2%	33,6%	32,2%	32,3%	32,2%	31,7%
pomorskie	36,4%	33,8%	30,6%	31,7%	29,2%	28,4%	28,7%	29,2%	27,5%
śląskie	33,0%	30,1%	30,5%	30,1%	30,1%	29,0%	29,5%	29,2%	27,9%
świętokrzyskie	37,5%	35,7%	36,5%	36,3%	35,1%	31,9%	33,7%	34,1%	34,2%
warmińsko-mazurskie	39,2%	35,9%	33,4%	34,2%	32,1%	32,2%	32,2%	32,2%	31,1%
wielkopolskie	36,2%	34,3%	32,6%	33,0%	31,7%	30,4%	29,7%	29,1%	28,3%
zachodniopomorskie	33,4%	31,0%	31,0%	32,0%	29,2%	28,7%	28,8%	30,9%	28,4%
Poland	35,1%	32,4%	32,0%	32,2%	30,8%	29,5%	29,3%	29,4%	28,4%

Source: Own calculations based upon the data of the Central Statistical Office.

From 1998 till 2006 the share of the household food expenditures in total expenses on consumer goods and services decreased in Poland by ca. 7%. The same trend was observed in

the regions where the share of food expenditures declined by 4,5%÷9%. The highest drop was observed in Dolnośląskie, while Podkarpackie and Pomorskie attained the lowest decrease.

Świętokrzyskie province was the only region of Poland where the downward tendency was stopped in the year 2003 and since then the share of the food expenses in total expenditures slightly increased.

3. Econometric analysis

In order to verify the hypothesis that the location of household has a significant influence on the level of food expenditure, one-way error components regression models were estimated. All the calculations were based upon the data of the Central Statistical Office. The dependent (endogenous) variable was defined as the real household food expenditure per capita. The household real incomes per capita and time performed the role of the independent (exogenous) variables. The decomposition of the error term and/or the constant term were based on the location of households. The models were estimated as:

- pooled regression model,
- one-way error components model with dummy variables (fixed effects model),
- one-way error components model with the decomposition of the error term (random effects model).

All of them had a linear or semi-log functional form. The estimated equations were as follows:

$$\text{expense} = \alpha + \beta_1 \text{income} + \beta_2 \text{time} + \mu_i + \nu_{it}, \quad (4.1)$$

$$\ln(\text{expense}) = \ln \alpha + \beta_1 \ln(\text{income}) + \beta_2 \text{time} + \mu_i + \nu_{it}, \quad (4.2)$$

The dummy variables that specified the location of households were marked as follows: *du_1*–Dolnośląskie, *du_2*– Kujawsko-pomorskie, *du_3*– Lubelskie, *du_4*– Lubuskie, *du_5*– Łódzkie, *du_6*– Małopolskie, *du_7*– Mazowieckie, *du_8*– Opolskie, *du_9*–Podkarpackie, *du_10*– Podlaskie, *du_11*– Pomorskie, *du_12*– Śląskie, *du_13*– Świętokrzyskie, *du_14*– Warmińsko-mazurskie, *du_15*–Wielkopolskie, *du_16*– Zachodniopomorskie.

The estimated models were verified. All independent variables were significant. The degree of statistical fit of the estimated equations was sufficient. The residuals were tested. On the results of the statistical and economic verification the best models were chosen.

Table 3.1 presents the parameters of the fixed and random effects models estimated in semi-log form.

The parameters of exogenous variables of the fixed effects model, were evaluated to ‘0,625’ and ‘-0,027’ respectively. It meant that the increase of the income per capita by 1%, while the other variable was held constant, would cause the growth of the expenditures by 0,625% on average. The ‘time’ coefficient informed that the household food expenses were decreasing by ca. 2,7% per year, *ceteris paribus*.

The fixed effects model was estimated with 16 dummy variables. The dummies implied constant term, specific for each region of Poland. Their coefficients varied from 3,295 in Mazowieckie province, to 3,672 in Podlaskie. The Chow test³, for the significance of location-specific effects, yielded an observed F-value of 7,33. This was distributed as $F_{15,126} = 1,746$, under the null hypothesis of zero location-specific effects. The null hypothesis was rejected. It meant that the Within estimator was preferred to the OLS estimator and the location-specific effects were statistically significant.

Table 3.1. Coefficients of one-way error component model (semi-log form)

variable	fixed effects model		random effects model	
	coefficient	t-value	coefficient	t-value
constant term	-	-	2,001	8,3
du_1	1,206	4,51	-	-
du_2	1,229	4,68	-	-
du_3	1,236	4,75	-	-
du_4	1,253	4,73	-	-
du_5	1,213	4,54	-	-
du_6	1,240	4,68	-	-
du_7	1,192	4,33	-	-
du_8	1,230	4,63	-	-
du_9	1,276	4,95	-	-
du_10	1,301	4,97	-	-
du_11	1,198	4,46	-	-
du_12	1,211	4,51	-	-
du_13	1,300	5,02	-	-
du_14	1,248	4,78	-	-
du_15	2,211	4,56	-	-
du_16	1,219	4,57	-	-
ln(income)	0,625	14,5	0,501	12,9
time	-0,027	-22,7	-0,026	-24,0
R ²	0,884	-	0,805	-
var (μ_i)	-	-	0,0004	-
var (v_{it})	0,0006	-	0,0006	-

Source: Own calculations

The parameter of the ‘income’ variable of the random effects model was estimated to ‘0,501’ and the ‘time’ coefficient to ‘-0,026’. It meant, that each year, real household food expenditures per capita were decreasing by ca. 2,6%, while the other variable was held constant. The ‘income’ parameter informed that the growth of the variable by 1% would involve the increase of the household expenses by 0,501% on average, ceteris paribus.

The random effects model was tested using the Breusch and Pagan Lagrange Multiplier test⁴. This yielded a χ^2 value of 109,66, which was distributed as $\chi^2(1) = 3,841$, under the hypothesis of zero random effects. The hypothesis H_0 was rejected. It meant that the random effects were statistically significant and the GLS estimator was preferred to the OLS estimator.

³ See: SUCHECKI B. (ed.): *Dane panelowe i modele wielowymiarowe w badaniach ekonomicznych*. vol. I: DAŃSKA B.: *Przestrzenno-czasowe modelowanie zmian w działalności produkcyjnej w Polsce. Zastosowanie modeli panelowych*. Łódź: Absolwent, 2000, ISBN 83-86840-98-6, p.40.

⁴ See: MADDALA G.S.: *Ekonometria*. Warszawa: PWN, 2006, ISBN 13:978-83-01-14638-2, ISBN 10:83-01-14638-9, p.649.

Finally, for a choice between the fixed and the random effects models, the Hausman test⁵ was performed. The test was based on the difference between the Within and GLS estimators and yielded a χ^2 value equal to 8,741. This was distributed under H_0 as $\chi^2(2) = 5,991$ and led to the rejection of the null hypothesis. It meant that the Within estimator was preferred to the GLS estimator and the individual effects were fixed.

Since the location-specific effects were fixed, the level of food expenditures depended on the region of Poland where the household was placed. So the location is one of the determinants of household food expenses.

Conclusions

The statistical analysis, presented in the paper, confirmed the spatial differentiation of the household food expenditures in Poland.

Each region of the country was different not only in the level of the expenses per capita. They had individual expenditures change rate as well as share of food expenses in total expenditures on consumer goods and services.

During the estimation process, it was settled that the level of the food expenses depend on incomes, overall economic situation and the region where the household was placed.

The econometric analysis confirmed the statistical significance of all determinants which performed the role of the regressors at the estimated equations. It was also proved that the location of household affects the level of its food expenditures.

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⁵ See: BALTAGI B.H.: *Econometric Analysis of Panel Data*. Chichester: John Wiley & Sons Ltd.,2001, ISBN 0-471-49937-4, p. 65.

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