REGIONAL AND STRUCTURAL DIFFERENTIATION OF HOUSING COST IN THE CZECH REPUBLIC

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Abstract

The aim of this paper is to evaluate housing cost burden according to the social status of households in each region in the Czech Republic. For estimation of housing costs, data from a survey on income and living conditions are used and expenditure on housing of households is considered as an explained variable. Among the explanatory variables are considered household size, disposable income of households, type of households according to social status and economic activity, region and size of municipalities and type of residence. It is necessary to make a test of dependence of these costs on region and other variables and then to find some relationship between the ratio of housing cost to household type in each region. It should confirm the hypothesis of significant fluctuations of housing cost burden from average among all the regions in the Czech Republic in comparison to Prague and also among different types of households according to their social status in society and economic activity of household members. An appropriate model describing the dependence of housing costs on region, household type and other variables is found by regression analysis. The obtained regression coefficients are a valuable base assessment of impact of price regulation in the housing sector on each household type in the regions of Czech Republic.

Key words: *housing costs, price regulation, household cost burden, regional differentiation of housing cost.*

1. Introduction

The different level of housing costs between regions or specific household groups requires the reflection by assessment of household conditions. The monitoring of influence of some factors on housing cost burden could be important base for some political regulations. Regard to Charette and Herbert (2015) it is critical for policymakers at all levels of government to prioritize the preservation and development of affordable rental housing. Housing affordability became the most reiterated housing issue and policy target long ago (Lux, 2009).

The common indicator named Housing cost overburden rate measures the percentage of the population living in a household where total housing costs (net of housing allowances) represent more than 40 % of the total disposable household income (net of housing allowances). In the Czech Republic it means 10.5 % while the European average is on level of 11.4 %[1]. For the national conditions the valuable information is rather about housing cost

[1] Available at http://epp.eurostat.ec.europa.eu/data/database (accessed April 1, 2016).

burden in more detailed structure. The different level of housing costs among each region by consideration of municipality size, household size and type of household should be evaluated and quantified. Housing costs cover expenditures of households to rent, electricity, gas, hot water, heat energy, water supply, sanitation, other utilities (connected to housing), solid and liquid fuels.

A lot of studies about housing costs were provided and some of regional differences proved, but the causes are still investigated. According to (Sunega and Mikeszová, 2008) the trend in regional disparities in housing affordability appears to be independent from the trend in regional disparities in economic performance.

The measurement of housing costs burden is the important base for allowance system of Czech Republic. In the Czech model of housing allowances the normative rate of burden is established by one flat coefficient and by size and compositions of a household. Regard to Kemp (2007) the consideration of the income level as is used in Polish model helps to meet the criteria of efficiency and equity. The basic principle of housing allowances is to provide eligible households from the rental or owner-occupied housing sectors with benefit equal to the difference between the actual and the normatively set level of household housing-cost burden (Hegedüs et al., 2013). Because of this reason it is important to assess the differences of level of housing costs between specific households and regions.

The aim of the paper is to evaluate the housing cost burden in each of region in the Czech Republic considering the social status of households. The hypothesis of significant fluctuations of housing cost burden from average among all of regions in the Czech Republic comparison to Prague is expected as well as among the different types of households according to their social status in society and economic activity of household members.

This paper provides the analysis of level of housing cost in dependence of various types of variables affecting the total expenditures on housing of Czech. The aim is to find some model describing the differences among the categories of some variables while the most of variability is explained. It is necessary to provide the test of dependence of this costs on region and other variables and then to find some relationship between the ratio of housing cost to household type in each region. For this purposes the model of regression function with factors is used.

The paper is organized as follows. Firstly, we present data and methods used in our analysis, then the results are set and finally we make some findings. In conclusion the possible limitations are discussed.

2. Data and Methodology

The analysis describing current housing cost burden uses the data from the Survey Income and Living Conditions provided by Czech Statistical Office. This survey collects information about the income and social conditions of Czech households and could provide also the burden of housing costs of Czech households (Czech Statistical Office, 2016).

Regression model used in the paper analyses dependent variable the total housing cost household in CZK per month. As the fix variable in this analysis the region is considered because in each of its categories the differences among housing costs are observed. It is important to examine the household conditions between each of eight regions labeled as NUTS 2 in the Czech Republic, for which the sufficiently detailed data are available (Czech Statistical Office, 2016).

To the higher level of explained variability can be helpful some information about type and condition of housing. The explanatory variables are size of municipality and type of residence. According to Sunega (2014) the physical attributes of the housing should be

taken into account. The higher size of municipality and rental housing in comparison to personal ownership could indicate the higher costs burden for households.

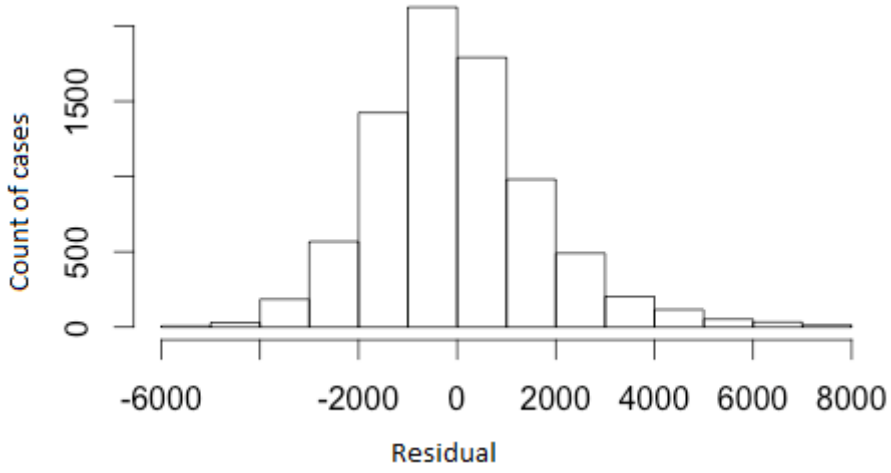
The variables which define the household should be taken into account and are included in model. In each of households the net disposable income is the important factor affecting condition of the household and beside this also the number of household members participating on this income, consequently on household expenditures. The total yearly net disposable income of household is given in CZK per month and this is related to the household size – the multi household could realize the economies of scale (Gravelle and Ress, 2004). It is also needed to explore different social and economic groups of households. The economic activity of the household members can be considered as the appropriate classification, which distinguishes the employees, unemployed, pensioners and other economically inactive persons where students and people on parental leave are counted. Final explanatory variables of household are household size, net income and household type.

The ambition of the paper is to find an appropriate regression model describing the dependency of housing costs on various variables by the most possible share of explained variability. First it is necessary to detect the extreme and influential observations. By using Bonferroni Outlier Test the 33 outliers was detected at significance level of 5 % and eliminated. Further two observations were identified by Cooks distance as influential, so these were removed from the sample. The final random household sample includes 8018 observations.

After that the quality of regression model has to be tested. The model should meet certain conditions such as normality of residues, no multicollinearity of variables (Grewal et al., 2011), homoscedasticity (Harrison, 1981) and no autocorrelation of dataset (Bruggemann, 2006). Under these assumptions and providing of the test of robustness the significance of variables should be observed.

Firstly the test on multicollinearity was provided and after synthesis of categories municipality size to four categories no more multicollinearity of variables was indentified. For observation of autocorrelation the Durbin-Watson test was used and at the level of significance 10 % no autocorrelation (Durbin-Watson statistic close to 2) was found. The Harrison-McCabe tested the heteroscedasticity of data and at level of significance 10 % the homoscedascticity was not rejected.

Figure 1: Histogram of residues of regression analysis



Source: the authors.

The normality of residues was tested by two normality tests: Lilliefors (Kolmogorov-Smirnov) normality test and Anderson-Darling normality test and the results are not that simple. Nevertheless the histogram of residues (Figure 1) shows that the distribution of residues is optically close to normal. For a deeper discussion of this issue we performed 20 times repeated random sample of 100 residues which were repeatedly tested for normality by two tests. At the 10 % significance level the normality were not rejected by 18 cases and just two cases would reject the hypothesis of normality of residuals. The normality is further assumed because of generally known property of tests that by increasing number of observations this test is more stringent and more susceptible to the long end.

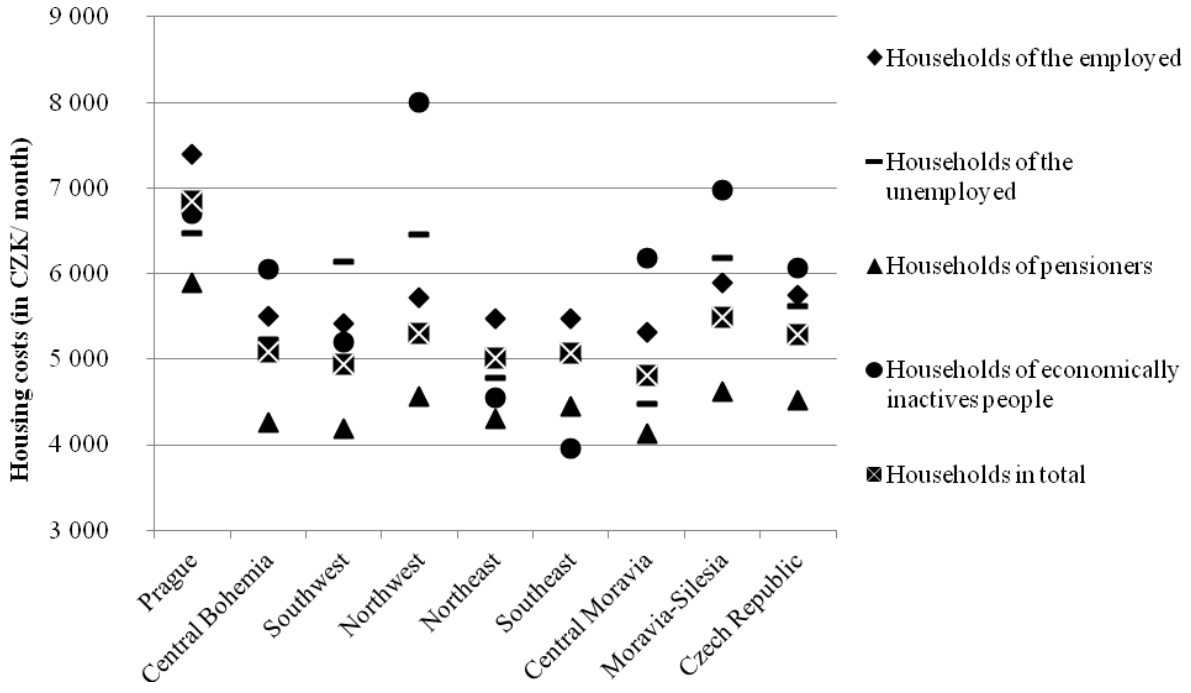
Finally the test of robustness was conducted by choosing a random sample of half of initial sample and there was applied the same regression. Results indicate rather the robustness of estimates. The average change of coefficient is 1.5 %.

3. Results

The aim of this paper is to quantify the differences of housing costs between regions by consideration of various factors affecting these costs. Especially the different housing cost burden by household type in each of region in Czech Republic should be estimated.

The overview of the average housing costs by type of household and region could be described by using the data about household from the sample survey. The average monthly costs by household type in each of region are observed in Figure 2.

Figure 2: Average housing costs by household type and region



Source: the authors.

Total average of housing costs of household according to data from sample is 5291 CZK, while for household of pensioners it means less. In regions Southwest and Central Moravia are average costs lower than the total average in Czech Republic. Contrary households in Prague have housing costs much higher than the households in other Czech regions. Even the

households of pensioners in Prague have higher housing costs burden than is the total average of all household in Czech Republic. The highest housing costs could be observed by household of economically inactive people in region Northwest. The regional differences are monitored in detail by Ministry of regional development.

The regression analysis provided results about significance of input variables and influence of each of factors on housing costs and finally also the quantitative assessment of differences among all of categories within each of variables. The insignificant variables are not involved in this analysis and only these increasing the total share of explained variability are retained. The final regression linear function is described as followed:

$$\textit{Housing costs} = f\,(\textit{factor (region), factor (size of municipality), factor (household type), factor (type of residence), household size, net income}). \quad (1)$$

By examination of whole dataset of 8018 households the structural distribution of this household's sample and its descriptive statistics of all of used variables are presented in the Table 1.

The categories with small number of observation are insignificant, but all the others are important in this model. The adjusted R^2 is on level of 41.11 %, what presented the total share of variability, which can be explained by this model. This share is pretty high, so this regression model has good explanatory power and it could describe all dependences great credibility. The differences between categories are quantified and so effect of each category on the housing costs could be evaluated.

The final regression model is as followed:

$$\begin{aligned}\textit{Housing costs} = {} & 3789 - 746\,\textit{Central Bohemia} - 987\,\textit{Southwest} - 732\,\textit{Northwest} - 962\,\textit{Northeast} - 940\,\textit{Southeast} - 990\,\textit{Central Moravia} - 1000\,\textit{Moravia-Silesia} + 252\,\textit{Municipality (1000-5000)} + 655\,\textit{Municipality (5000-50000)} + 885\,\textit{Municipality (>5000)} - 356\,\textit{Household of the unemployed} - 271\,\textit{Household of the pensioners} - 219\,\textit{Household of inactive people} + 80\,\textit{Personal ownership} + 504\,\textit{Cooperative} + 2734\,\textit{Rental housing} - 1049\,\textit{Entire residence rent} - 759\,\textit{Staff housing} + 443\,\textit{Household size} + 0.0013\,\textit{Net income}. \end{aligned} \quad (2)$$

The differences of housing costs among each household according to type, size and region are huge. Regional differentiation is observed especially between Prague and west Bohemia regions and Moravia with east Czech regions. In comparison to Prague five regions have by almost 1000 CZK per month lower housing costs on average. The housing costs of Central Bohemia and Northeast are about 700 CZK per month lower. The region influences the housing cost burden as the most. After that it is the size of municipality what affects the level of expenditures, the higher size the higher level. Costs in municipality with more than 50000 residents are by 885 CZK higher than in municipality till 1000 residents. The higher housing expenditures are expected in rental housing compared to own house, difference is about 2700 CZK per month.

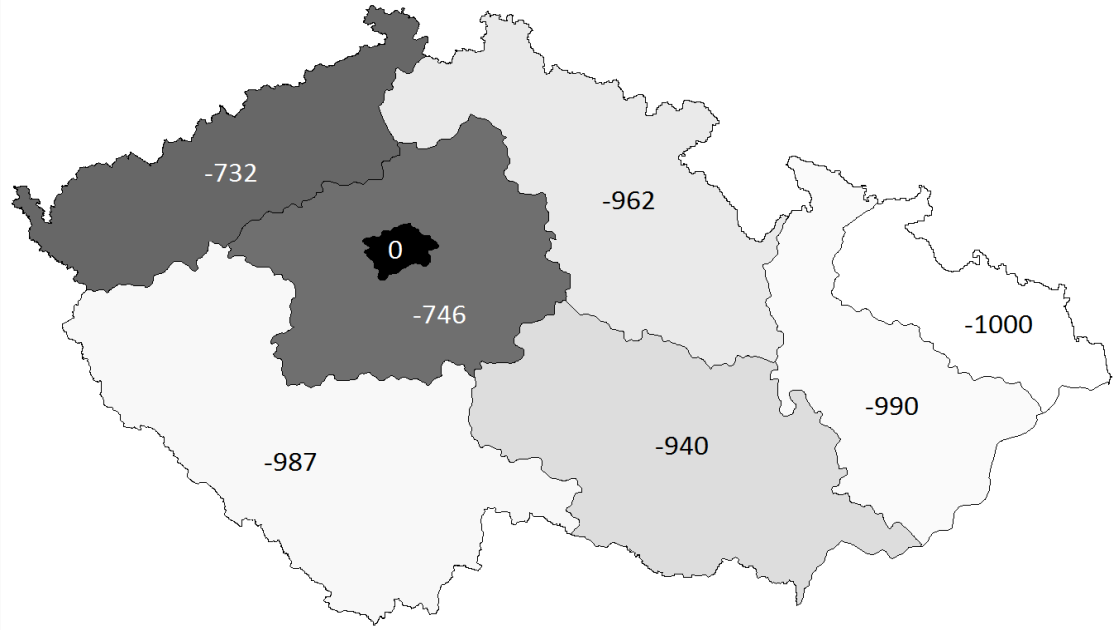
Table 1: Statistical distribution of variables and estimate of regression coefficients

		Distribution	Estimate of coefficients	Std. error	Pr(>|t|)
	Intercept	-	3 789.0	109.3	0.000
Region	Prague	11.4%	0.0	0.0	0
	Central Bohemia	11.4%	-745.8	94.7	0.000
	Southwest	13.1%	-986.8	88.8	0.000
	Northwest	9.8%	-731.7	93.7	0.000
	Northeast	14.2%	-961.7	88.5	0.000
	Southeast	15.9%	-939.6	84.9	0.000
	Central Moravia	12.1%	-989.6	92.3	0.000
	Moravia-Silesia	12.0%	-999.1	86.0	0.000
Size of municipality	Municipality (<1000)	17.8%	0.0	0.0	0.000
	Municipality (1000-5000)	21.8%	251.8	62.9	0.000
	Municipality (5000-50000)	29.6%	654.8	64.4	0.000
	Municipality (>50000)	30.8%	884.9	74.6	0.000
Household type	Household of the employed	59.5%	0.0	0.0	0.000
	Household of the unemployed	2.2%	-326.1	135.1	0.016
	Household of pensioners	37.4%	-271.2	49.3	0.000
	Household of inactive people	0.9%	-219.0	205.8	0.287
Type of residence	Own house	43.0%	0.0	0.0	0.000
	Personal ownership	27.3%	80.0	55.5	0.149
	Cooperative	8.4%	504.0	79.3	0.000
	Rental housing	16.1%	2 734.0	64.2	0.000
	Entire residence rent	0.1%	-1 049.0	549.8	0.056
	Staff housing	5.1%	-759.4	92.3	0.000
	Household size	2.26	442.8	21.0	0.000
	Net income	28 878	0.0013	0.0001	0.000

Source: the authors.

The housing costs vary according to household characteristics. The further household member presents about 443 CZK per month higher expenditures. The costs of household of economically active persons could be higher approximately by 200 CZK than for household of inactive people. The household of unemployed shows by 300 CZK lower housing expenditures. It depends on region where the specific household live. The combination household type and region is the important factor affecting the housing cost burden. The differences between regions could be observed even by consideration of various factors affecting the level of housing costs. The differentiation of level of housing costs each of region according to results of regression analysis could be observed in the map of the Czech Republic in Figure 3.

Figure 3: Map of the different level of housing costs in regions of Czech Republic (in CZK/month)



Source: the authors.

4. Discussion

Existence of differences among types of households could be caused by many factors but regional differences correspond with different price levels in regions. Čadil et al. (2014) proved that the highest price level is in region Prague, where price level is 120 % of average price level in the Czech Republic, other regions do not vary too much. In Prague region also level of wage is higher but as we know in our analysis 50 % of households are households of pensioners, unemployed and inactive persons. Those households' income is defined by law and is applied to all regions constantly (Čadil et al., 2014). This could cause that household expenditures for housing are much higher in relative expression and not only in absolute value than in other regions. Structure of households' consumption where expenditures to housing are significant part is changing in time. Sixta et al. (2014) discussed developing of household consumption in long term period and housing as one of the biggest part is growing dramatically in last years. Nowadays in average covers housing more than 20 % of expenditures and is higher than expenditures to Food and non-alcoholic beverages.

According to Broxterman (2015) the factors such as class rank, college quality, effort, health, etc., have a positive correlation with the housing cost. In the city with higher housing cost, these factors should be higher in there.

5. Conclusion

It is clear that households in any economy are not similar, they are very heterogeneous and many of factors which could cause those differences were mentioned in this paper. Also estimation of its impact was quantified here.

The aim of the paper was to find some model describing the differences between the categories of some variables while the most of variability is explained. For this purposes the model of regression function with factors was used. The adjusted R^2 of the model is on level of 41.11 %, what presented the total share of variability, which can be explained

by this model. This share is very high, so this regression model has good explanatory power. We found that there are significant differences among regions in the Czech Republic where Prague region has the highest housing costs in average. Also effect of size of municipality is significant (households in bigger municipalities have higher housing costs) and type residence of household has impact to housing costs too (especially households with rental housing have those costs higher). Effect of household size shows that one additive person in household increases housing costs by 443 CZK in average. On other hand housing cost elasticity is lower than one because higher net income causes increase of housing costs but not in the same proportion.

Acknowledgements

The paper has been prepared under the support of the University of Economics. Prague – Internal Grant Agency; project No. IGA 39/2015 "Estimate a reasonable rate of price regulation of housing expenditures".

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