

Relations among the Regional Price Index, Market Structures, and Capital Parameters of the Region

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Abstract

Purpose of the article: This paper focuses attention on regional price indices (RPI) that reach across regions, respectively Czech regions, and different levels.

Methodology/methods: The article mainly analyses the relation between the RPI and the particular form of market structures at the regional level, while also looking at the link between the RPI and capital parameters of each region. The methodology used is in the case of the first relation based on graphical models; in the second case selected statistical methods – correlation and regression analysis – were applied.

Scientific aim: The aim of the article is to verify the existence of the link between the RPI and the market structures, but also the RPI and the capital parameters of the region.

Findings: The results of correlation analysis confirm the assumption that RPI growth can also be observed in regions where the capital parameters are at a higher level, than in regions with lower values of capital parameters. On the contrary, the regression analysis points to low statistical importance of the dependence of the RPI on the capital assets of the region as demonstrated by the evaluation of 13 regions in Czech Republic (excluding Prague). However, for 14 regions this dependence is already statistically significant, but the figure for Prague is so distant from all of the others that it may be described as a typical case of so-called distant observation.

Conclusions: A reliable and universally verifiable relation between the RPI and the particular form of the market structures most likely does not exist. For further research, it would be interesting to reverse the link between RPI and regional capital characteristics, and ask whether a low RPI can be a factor for a subsequent capital inflow.

Keywords: regional price index, market structures, monopoly, oligopoly, monopolistic competition, regional capital parameters

JEL Classification: L11, R32

Introduction

The level of the regional price level is determined by a number of factors, the influence of which has a range of factors including the agglomeration effect (Bednářová, Laboutková, 2014). It is desirable to explore the regional price index (hereinafter “RPI”) itself as it may significantly affect the real purchasing power of the same sums of money in different regions. This fact has been confirmed in the Czech Republic, (Čadil *et al.*, 2012; Čadil *et al.*, 2014; Zdeněk, Lososová, 2014) but it is also highly probable that this is the case even in other developed economies. The regional price index, based on the classic consumer price index (CPI), expresses the difference in price levels in individual regions within the state (Kraft *et al.*, 2015) The RPI is still a much-neglected economic phenomenon; it has only been systematically examined in two world economies, in the German NUTS 3 regions, (Kosfeld *et al.*, 2008; Kosfeld, Eckey, 2010; Schultze, 2003) and in the United Kingdom (Rice, Venables, 2006; Anastassova, 2006). One of the factors considered below is the reality of market structures, the second of which represents the regional capital parameters.

The term market structure can be represented by the classic division into perfect and imperfect competition with all three of its basic forms, *i.e.* monopoly, oligopoly in its several forms and monopolistic competition (Baldwin, Scott, 1987; Chamberlin, 1950; Robinson, 1954). Such division has its logic and considerable importance, and it can be assumed that the level and change in the price index can be affected. However, at the same time, the opportunity to perceive the market structure more quantitatively cannot be ignored, nor the respectively distinguished level of capital parameters. In this case, the issue is not whether a monopoly is resident in the monitored region, or whether there are more companies making up the oligopoly, if both these entities have about

the same level of capital parameters (Kraft, 2008). Under the phenomenon called capital parameters, capital strength, capital resources and capital efficiency can be perceived (Kraftová, Prášilová, Matěja, 2011; Kamien, Schwartz, 1982). Both concepts of market structures are related, because a monopoly is a high degree of capital strength, as one of the significant capital parameters, rather than, for example, a set of companies of monopolistic competition (Retz, 1990; Spence, 1975; Stigler, 1940).

In the above context, there are namely two opposing effects, which affect the market structure. The first one relates to the “classic” division of market structures (Viturka, 2008). The question is whether, in principle, and whether it can be graphically demonstrated that a monopoly compared with the oligopoly in any form, and even more so when compared with companies in the context of monopolistic competition leads to an allocation of higher product prices, thus affecting the price level of final products, forming a RPI, in relation to the relatively small quantity of the production output. The second effect, weighing the market structure and capital parameters, can show that whatever the market structure of the “classic” approach may be, provided in the context of imperfect competition as only this makes sense to deal with in particular, higher levels of capital parameters on one hand lead to wage increases, and thus to an increasing demand for products (Puga, 1999; Mlaker-Kac, Gorenak, Potocan, 2016), and on the other hand may also lead to an increase in the number of retailers who compete with each other (Baldwin, Forslid, 2001), which depresses the final product price level pushing the RPI down. Conversely, a lower level of capital strength leads to the opposite effect, resulting from a lower level of competition.

Capturing the reality in the Czech Republic is desirable to perceive as an example, while it is very likely that the situation in the RPI itself, its differences, but also the reality of

market structures, capital resources and capital strength will be very similar in all developed economies. Bistrova *et al.* (2011) also focus on the impact of the capital structure on the performance and profitability of enterprises in the Baltic countries in their paper. Even there we can see regions with different attractions for the realisation of economic activities related to population density, and the level of supply and demand.

The aim of the article is to verify the existence of the link between the regional price index and the market structures, but also the RPI and the capital parameters of the region.

1. RPI in relation to market structure

Theoretical aspects of the problem of market structures are known and it has been confirmed that they are even valid today despite the fact that these aspects were defined during the second half of the last century (Kraft, 2016). Market structures may fundamentally influence RPI in a dual way. The first way is

based on the fact that the “less perfect” the form of imperfect competition is (monopoly, oligopoly, monopolistic competition), the higher the price that is required for products of the particular manufacturer. The second way of influencing RPI in the same direction is based on the fact that the “less perfect” the form of the market structure is, the higher the wages are that the companies pay, which affects the consumer demand, which in turn also modifies the RPI.

Unfortunately, Czech statistics do not divide the concentration of such businesses by regions, thus causing proof by data unfeasible. Graphical analysis seems to be the most appropriate way to present and understand the problem. The following triad of graphs 1, 2 and 3 captures the reality of links between the regional price index and selected market structures, namely monopoly and oligopoly with a dominant company, cartel and monopolistic competition.

From Figure 1 it is evident that the monopoly requires a ceteris paribus higher price for the identical product and, for its

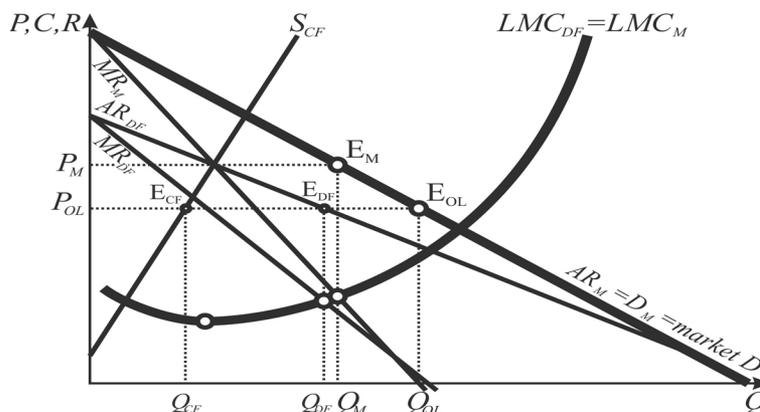


Figure 1. RPI and monopoly vs. oligopoly with a dominant firm. Source: Kraft, Kocourek, Bednářová, 2013, p. 90.

Explanatory notes:

P – price	Q – quantity	Index M – monopoly
C – costs	E – equilibrium	Index DF – dominant firm
R – revenue	AR – average revenue	Index CF – competitive fringe
S – supply	MR – marginal revenue	Index OL – oligopoly
D – demand	LMC – long-term marginal cost	

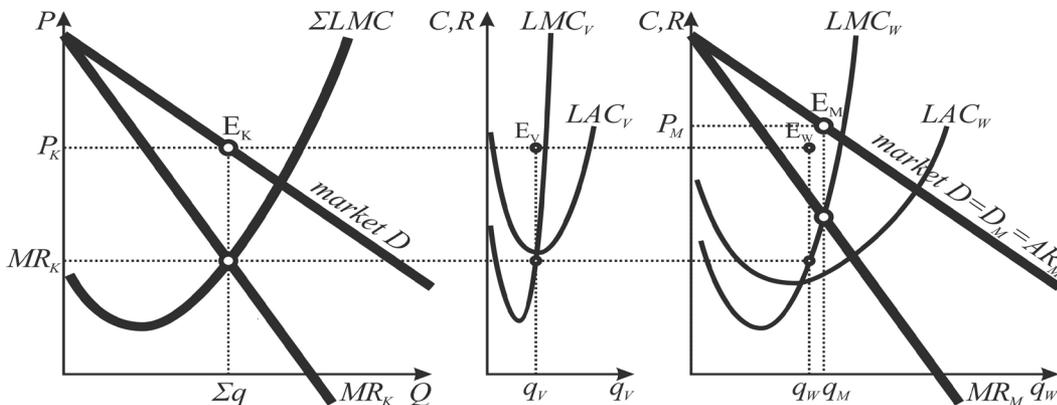


Figure 2. RPI and the closure of an unstable cartel. Source: Kraft, Kocourek, Bednářová, 2013, p. 87.

Explanatory notes: see Figure 1

index V, W – firm V, firm W

LAC – long-term average costs

index K – cartel

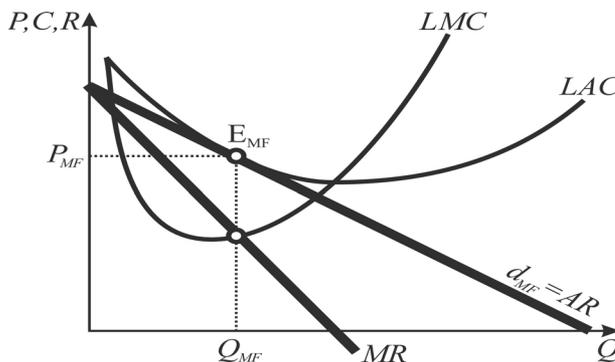


Figure 3. RPI and a monopolistic competition. Source: Kraft, Kocourek, Bednářová, 2013, p. 89.

Explanatory notes: see Figure 1, 2

index MF – a firm in the monopolistic competition

preservation, it produces a smaller amount than an oligopoly with a dominant firm, which leads to an increase in the price level in the case of an overall production monopolisation of the final products.

Based on Figure 2 it is obvious that the cartel collapse caused by the closure of one of the companies leading to a monopoly causes a price growth and a decrease of its production. The reality of a functional cartel produces consistently lower pressure on the price level than the destruction of the cartel, leading to its transformation into a monopoly.

The monopolistic competition (see Figure 3), mostly determined by the quality of the business environment (Virglerova *et al.*, 2017), in a long-term period tends to lead to zero economic profit, unlike in the cases of a monopoly and an oligopoly. In the condition of a monopolistic competition over a long-term period, it causes a drop in the product prices, for which there is no reason in the case of a monopoly (Schrieves, 1978). The pressure on the price level growth does not arise in this market structure.

The fact is that the impact on the RPI in the shown context is unlikely to be substantial

because the product prices of the monopolistic producers throughout the country will be almost the same. Some movement may occur in the different regional realities in the case of an oligopoly with a dominant company due to effects of the competitive fringe, and namely less so for cartels, the most among companies within monopolistic competition.

But one question still remains to be answered, and that is whether it is possible to verify the assumption that big companies and these can primarily be represented by monopoly firms, pay higher salaries to their employees than small firms. An example might be the company Skoda Auto in Mlada Boleslav. It is a controversial entity, especially from the economic theory point of view, due to the existence of the bilateral monopoly on the labour market, respectively the monopsony of employers, especially the large ones. A clear conclusion therefore cannot be reached.

2. Relationship between the regional capital parameters and RPI

If we start from Table 1 containing modified RPIs comparing the reality of indivi-

dual regions, which are presented by regions of the Czech Republic in this research, a comparison with the regional capital parameters can then be offered and answering of the question of whether they are related.

As an example, it is possible to compare the Liberec Region and the Vysocina Region. Moreover, their difference increases in time.

Nevertheless, not all authors may have the same approach to the concept of RPI. For instance, RPI differences cannot only be shown in terms of an administrative division, but also as in a regional space structure (Ericson *et al.*, 2013). Iordanov, Vassilev (2014) link the RPI stability with the size of the economy, respectively with the defined economic area that is under investigation. Guzman, Vassallo (2014) have considered the fact that a number of factors influence RPI including, for example, the functionality of the transport system. In addition, in their research of the final household consumption Kramulova, Musil (2013) use RPPS (Regional Standard of Purchasing Power) and RPPP (Regional Parity of Purchasing Power).

Table 1. Resulting RPI in the years 2009–2012 by regions of the Czech Republic.

Region/year	2009	2010	2011	2012
Prague	111.052	115.813	120.512	123.693
Central Bohemian Region	96.215	98.890	102.782	106.617
South Bohemian Region	93.205	96.365	99.962	104.161
Plzen Region	93.401	97.999	103.874	107.815
Karlovy Vary Region	99.183	102.591	105.688	108.711
Usti Region	96.337	100.340	105.124	109.146
Liberec Region	98.926	102.663	103.557	109.614
Hradec Kralove Region	94.616	98.005	101.950	106.024
Pardubice Region	93.212	96.819	99.281	102.330
Vysocina Region	92.225	94.377	98.260	101.376
South Moravian Region	97.931	101.251	104.999	109.997
Olomouc Region	92.869	95.716	100.355	103.388
Zlin Region	94.164	96.820	100.285	105.324
Moravian-Silesian Region	96.737	104.254	105.185	107.893

Source: Simanova, Kocourek, Kraft, 2014.

3. Methodology

The RPI, whose links to market structures and capital parameters of the region are being evaluated, was determined based on the methodology created using the 2009–2012 surveys of the Czech Statistical Office as part of a research project supported by the Technology Agency of the Czech Republic. (The following survey, based on which the RPI will be determined using this methodology, is scheduled for the time period starting in 2019).

The Bisnode database, which is accessible through the web application MagnusWeb, (Bisnode CR, 2014) has been used for modelling capital parameters and their performance for the regions of the Czech Republic. Selective input data are only the activity of the entity and its location (region). It should be noted here that the registered office of the company may be located elsewhere than its branches. This may affect the results to a certain extent. The following output parameters have been selected: identification number, name (while these two criteria rather play the registration and supervisory roles), followed by total assets (aggregate value of the property, respectively of the capital, *i.e.* both own and foreign, which covers the assets of the analysed subject), equity (own capital as part of the total capital) – while both these indicators present the state of the capital in the broad sense (total capital), respectively in the narrower sense (equity only) (Kraftova, Prasilova, 2013). The last of the selected output parameters is the turnover-income, whose purpose is to present the efficiency of the respective capital. Before processing, the obtained data were adjusted for items with zero values.

The research presented herein primarily focused on the values of regional capital parameters from 2014, which is the year of finalisation of the methodology for calculating the RPI and their calculation for the regions of the Czech Republic. Check calculations

are done using the values of regional capital parameters of 2016 (Bisnode CR, 2018) and the average value of RPIs from 2009–2012.

The investigating process of the problem was divided into three steps:

1. An overall assessment of variability of parameters for regional capital strength using dispersion.
2. Analysis and cross-regional comparison of descriptive regional characteristics using standardised values.
3. Correlation and regression analyses of the relationship between RPI and the parameters of the regional capital strength.

Ad 1. Dispersion in the Czech Republic was assessed by the following parameters: assets per capita (c), equity (e) and turnover-income (r) according to the formula (1).

$$D_c = \frac{100}{c} \sum_{i=1}^n |c_i - c| \cdot \frac{p_i}{p}, \quad (1)$$

where:

- D dispersion,
- c total assets value per capita,
- p regional population,
- i i -th region,
- P population of the Czech Republic,
- resp. e value of equity per capita (in modifying the formula),
- resp. r turnover (revenue) per capita (in modifying the formula).

The appropriateness of the use of dispersion indicators is underlined by its ability to not only capture the disparity of the evaluated regional parameters in the Czech Republic, but also to quantify these discrepancies “weighed” by the share of regional population.

Ad 2. The capital strength and its efficiency at individual regions are first analysed and compared inter-regionally, both in absolute and relative terms. Using standardised values (2) data of individual regions on the population size, the number of active entities, and data on the cumulative and average value of

equity, and turnover within each region are incorporated into the comparison.

$$h_{rj} = \frac{x_{rj} - \min_r(x_j)}{\max_r(x_j) - \min_r(x_j)}, \quad (2)$$

where:

- X indicator value to be adjusted,
 - H standardised value,
 - index r region,
 - index j indicator,
 - min minimum,
 - max maximum
- For the standardised value, the following relation is valid: $h_{rj} \in \langle 0; 1 \rangle$.

Ad 3. To verify the relationship between RPI and the regional capital parameters (capital, equity capital and turnover) the Spearman's correlation coefficient (3) has been applied, both for the overall accumulated values and the values of all three parameters per capita.

$$r = 1 - \frac{6 \sum (Rx_i - Ry_i)^2}{n(n^2 - 1)}, \quad (3)$$

where:

- r Spearman's correlation coefficient,
- n number of items,
- Rx_i order of the x_i values,
- Ry_i order of the y_i values.

The regression analysis was performed for 13 Czech regions excluding City of Prague (hereinafter "Prague"), and for all 14 regions including Prague. A single-factor regression analysis was performed for each of the evaluated parameters separately in relation to RPI.

Multiple regression analysis tried to find the optimum curve expressing the relationship between RPI, as the dependent variable, and the remaining evaluated parameters, as independent variables with concomitant application ANOVA, by performing the Fisher-Snedecor F test and securing the importance of the result using the p-value.

4. Results and discussion

4.1 Dispersion

The dispersion of 14 regions including Prague has been calculated to simulate the effect of Prague, and the dispersion of 13 regions without Prague. It must be emphasised that the dispersion values are not only affected by the extent at which the individual regions contribute to the values of the individual indicators, but also by the proportion of the population which is affected by this position in the region. The results are shown in Table 2.

The results demonstrate the significant effect of Prague, which is most evident in the value of assets per capita. The equity dispersion is approximately 20% lower, while the lowest effect of Prague on the results of the dispersion is in the turnover per capita. The dispersion of monitored indicators as capital strength and performance of 13 regions without Prague are relatively balanced and hover at approximately 30%. Compared with the portfolio of 14 regions to the corresponding value for the case without Prague, the highest disparity was achieved for turnover per capita.

Table 2. Dispersion of assets, equity and turnover per capita for the 14, respectively 13 regions in the Czech Republic (in %).

Indicator	D_c	D_e	D_r
14 regions of the Czech Republic	96.36 (93.21)	77.39 (26.39)	52.80 (50.09)
13 regions of the Czech Republic without Prague	31.95 (15.99)	30.01 (19.06)	33.59 (20.67)

Source: author's own calculations based on data from (Bisnode CR, 2014; 2018).

Notice 1: Explanatory notes see formula (1).

Notice 2: Results of check calculations with the values of capital parameters of 2016 are shown in parentheses.

The dispersion calculated with the values of regional capital parameters of 2016 is lower in all cases. The dispersion of total capital and turnover is very similar in all 14 regions; by contrast, the equity dispersion is much lower, which may be due to a positive economic trend in which firms stabilise their equity thanks to achieved retained earnings. All 13 regions without Prague reduce the dispersion much more markedly – by approx. half in the case of total capital and by approx. one-third in the case of equity and turnover, which means that these regions converge in terms of the evaluated parameters.

For comparison, even the value of the RPI dispersion was calculated (for the overall price index the average value was used), and this is much lower. For 14 regions, the value is 3.54%, for 13 regions it is then approximately 40% lower, a level of 2.08% has been achieved.

4.2 Comparison of standardised values

Standardised values (shown in Figure 4) can be divided into the general regional charac-

teristics (population, area, number of economically active subjects reported) and characteristics, which relate to capital strength and its performance. The bases for comparison of the Czech regions by means of standardised values of selected parameters are the available CZSO data and the Bisnode database, *i.e.* data of the year 2014. (Standardised values of 2016 show minimal shifts in relations between the individual regions of the Czech Republic as compared to 2014.)

Figure 4 shows that the uniqueness of Prague is confirmed both in the capital characteristics, where in all items the “max” position occurred, and in the surface area where on contrary, the “min” value is being recorded. The highest proportion of the population belongs to the Central Bohemian Region, followed by Prague, and then by the Moravian-Silesian Region and South Moravian Region. In regards to the generally dominant position of Prague, values exceeding 10% of the capital standardised parameters, respectively their values, are recorded in the

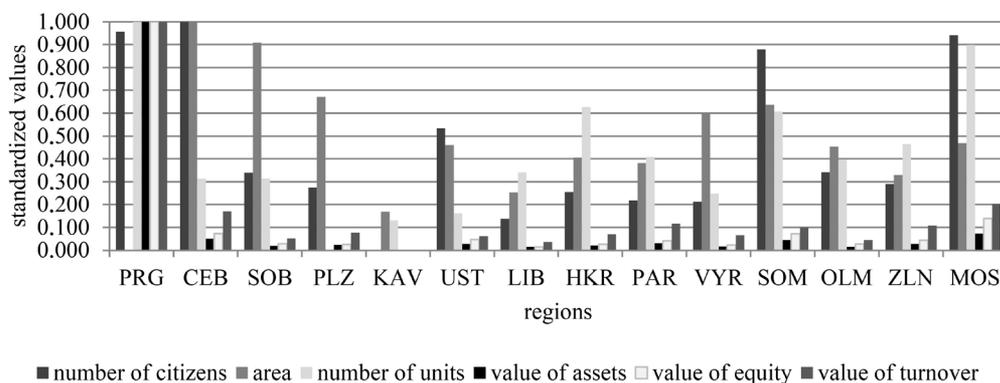


Figure 4. Standardised values of selected performance of the Czech regions. Source: author's own calculations based on data from (Bisnode CR, 2014) and (CZSO, 2014).

Explanatory notes:

- | | |
|-------------------------------|--------------------------------|
| PRG – City of Prague | HKR – Hradec Kralove Region |
| CEB – Central Bohemian Region | PAR – Pardubice Region |
| SOB – South Bohemian Region | VYR – Vysocina Region |
| PLZ – Plzen Region | SOM – South Moravian Region |
| KAV – Karlovy Vary Region | OLM – Olomouc Region |
| UST – Usti Region | ZLN – Zlin Region |
| LIB – Liberec Region | MOS – Moravian-Silesian Region |

Moravian-Silesian Region (turnover and equity), the Central Bohemian Region (turnover), the Pardubice Region (turnover), the Zlin Region (turnover), and the 10 percent limit in turnover indicator has been reached in the South Moravian Region. In all 13 regions without Prague the following relationship between the standardised capital parameters, respectively their values are valid:

$$h_C < h_E < h_R,$$

while for the “generic” characteristics the relation is precarious.

4.3 Correlation

From the evaluation of the correlation between RPI and the capital characteristics of regions (see Table 3) it is apparent that the correlation is statistically significant, both in relation to the particular years and to the average RPI value. (For $n=14$ at the significance level $\alpha=0.05$, the critical value of the Spearman’s correlation coefficient achieves the value of 0.534.)

Therefore, the assumption shown in the introduction that RPI growth can also be observed in regions where the capital parameters are at a higher level can be confirmed, and to a higher level than in regions with lower values of capital parameters. However, the development of correlation between RPI and regional capital characteristics during time periods cannot be ignored.

4.4 Regression

The performed single-factor regression analysis reached relatively low values in the F test – for RPI being dependent on assets

$F=0.4112$, for RPI being dependent on own equity $F=0.4624$, and for RPI being dependent on revenues $F=0.0059$. In all cases, the p -value points to a statistically insignificant, rather accidental dependence.

Multiple regression analysis of 13 Czech regions without Prague provided a straight line equation (4), the F test gives $F=3.3646$ and the p -value of 0.0686 indicates its weak statistical significance. The line determination coefficient (4) is only at 0.5286.

$$Y = 101.5796 + 0.1309 \cdot X_1 - 0.0712 \cdot X_2 - 0.0638 \cdot X_3, \quad (4)$$

where:

- Y RPI,
- X_1 assets,
- X_2 equity,
- X_3 turnover.

In the case of multiple regression analysis of the entire set of all 14 regions, including Prague, the line equation (5) changes. In this case, the value $F=13.3319$ with a strong statistical significance of the p -value=0.0008. The line determination coefficient (5) reaches 0.8000.

$$Y = 107.1625 - 0.0056X_1 + 0.0606X_2 - 0.0228X_3, \quad (5)$$

where symbols correspond with (4).

However, please note that, in this case, the correlations look very significant, but the figure for Prague is so distant from all of the

Table 3. Correlation between RPI and the capital characteristics of regions in the CR.

Relation	RPI 2009	RPI 2010	RPI 2011	RPI 2012	average RPI
correl. coeff RPI vs assets	0.880	0.851	0.898	0.866	0.884 (0.880)
correl. coeff RPI vs equity	0.879	0.861	0.902	0.867	0.888 (0.804)
correl. coeff RPI vs turnover	0.852	0.839	0.877	0.839	0.862 (0.857)

Source: author’s own calculations.

Notice 1: Results of check calculations with the values of capital parameters of 2016 are shown in parentheses.

others that it may be described as a typical case of so-called distant observation, which will “draw-in” the entire line. As if only two points – Prague and the cluster of other regions – were connected together. This so-called “Prague effect” in regional analyses of the Czech Republic does not occur infrequently (Kraftová, Kraft, 2014).

5. Conclusions

The amount of RPI exists in relation to a particular level of incomes; however, incomes in Prague are significantly higher than in other regions. Moreover, it is also linked to the relatively low supply of workers in Prague (in practice almost a zero unemployment rate in the capital city), which causes the growth of the capital parameters to immediately lead to an increase in wage rates that subsequently raise the RPI through the growing demand. Moreover, there is not much space in Prague to open new stores to satisfy demand; thereby the increasing competition on the product supply side is limited. In other regions, where there is a large supply of workers, the same growth of capital parameters as in Prague does not cause an adequate price level increase because there is no pressure to increase the wage level for hiring additional staff. On the product supply side, there is on the contrary so much room to set up new stores and, therefore space to raise the product supply and thus increase competition, that it can create pressure on a lower price level growth than it is *ceteris paribus* in Prague.

A possible explanation could also be seen in the phenomenon called elasticity of demand. It can be proven that the elasticity of demand decreases (*ceteris paribus*), together with increasing income. Therefore, the higher incomes of Prague inhabitants, even during a high level of competition on the product supply side, enable increasing product prices without this prompting reduction of demand for them. In regions with

lower income levels, business operators are aware of the dangers of a reduced demand that would initiate a product price increase. In reality, with a high level of elasticity of demand it is, moreover, likely that the increase in capital parameters in such region is only reflected in income growth for some of the region’s inhabitants, as the labour market supply is more dispersed outside Prague.

It is possible to state other similar links. However, it can be considered a significant conclusion that shows that it was not reliably and universally proven that there is a link between RPI and a particular form of market structures, probably because it does not exist at all. In the same way – when the reality of the capital city of Prague is not included – there is no proven link between RPI and the capital parameters of a region.

Unproven links between RPI and market structures may help to at least diminish the “demonization” of the impact of market structures on the economies, especially monopolies, but this is not meant as a basis for challenging the promotion of small and medium-sized enterprises by the European Union and its member states.

The very fact that awareness of far from insubstantial regional price differences is being spread among the population may lead to a market solution of the migration problem and deter people from leaving the country for better paid work, which subsequently leads to the depopulation of some parts of the country, as is the reality in certain localities of the Czech Republic, the Federal Republic of Germany and also in other countries. The population realises that, for instance, prices of houses, apartments, rent, water, electricity are in less attractive regions considerably lower than in attractive ones, and that it could be advantageous only to commute for work rather than to move. A sufficient number of the remaining population in less developed regions can then be the basis for an influx of capital and for creating new jobs without a necessarily growing RPI, as is apparent from the research presented.

For further research, it would be interesting to reverse the link between RPI and regional capital characteristics, and ask whether a low RPI can be a factor for a subsequent capital inflow when the prices of real estate properties, water, energy, *etc.* of all aspects are the important items for RPI differences.

The scientific contribution of the paper can particularly be seen in exploring the bounds of RPI, which has not been the object of interest either of the national statistical offices or of Eurostat within the scope of the newly certified methods, and other important economic phenomena affecting the macroeconomic reality.

Practical benefits can be seen in the assistance for decision-making bodies

implementing the economic policy in the context of regulatory actions, whether involving the regulation of market structures or the support of businesses operating in areas with both low incomes and low RPI, and vice versa.

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