

True Regional Purchasing Power: Evidence from the Czech Republic

Jan Cadil^{1,3}, Petr Mazouch², Petr Musil², Jana Kramulova¹

¹University of Economics, Prague, Department of Regional Studies, W. Churchill sq. 4, Prague 3, 13067, Czech Republic

²University of Economics, Prague, Department of Economic Statistics, W. Churchill sq. 4, Prague 3, 13067, Czech Republic

³Banking Institute, Prague, Nárožní 2600/9, Prague 5, 158 00, Czech Republic

Jan Cadil, Associate professor, Department of Economics and Management, Banking Institute, Nárožní 2600/9, Prague 5, 15800; Department of Regional Studies, W. Churchill sq. 4, Prague 3, 13067, Czech Republic, tel.: +420 724835335, e-mail: j_cadil@yahoo.com

Petr Mazouch, Assistant professor, Department of Economic Statistics, W. Churchill sq. 4, Prague 3, 13067, Czech Republic, tel.: +420 602838898, email: mazouchp@vse.cz

(corresponding author)

Petr Musil, Ph.D. candidate, Department of Economic Statistics, W. Churchill sq. 4, Prague 3, 13067, Czech Republic, tel.: +420 723975533, email: petr.musil@vse.cz

Jana Kramulova, Ph.D. candidate, Department of Regional Studies, W. Churchill sq. 4, Prague 3, 13067, Czech Republic, tel.: +420 224095623, e-mail: jana.kramulova@vse.cz

True Regional Purchasing Power: Evidence from the Czech Republic

It is probably without question that regional price levels must be taken into account when any regional analysis is done and that price levels should be reflected in regional policies as well. The current approach of most researchers and policy makers is to use regional indicators converted, for the case of EU regions, in Purchasing Power Standard (PPS). Although the PPS indicators work well for countries they probably fail for regions. The main reason is that regional purchasing power standards do not reflect the actual regional price levels - there is only a national parity (price level) which is equally applied on all the regions within a country. This fact downgrades the reliability of regional PPS indicators and brings serious analytical and political issues. The key problem is that most of regional socio-economic indicators can significantly change when regional price levels are taken into account.

The aim of this paper is to present results of research focused on regional price levels estimation in the Czech Republic. The results clearly show that there are substantial differences between newly computed real regional indicators and currently used PPS indicators. The impact of these findings on regional convergence, household's real income and cohesion policy efficiency are considered. This topic is worldwide broadly discussed, although in the Czech Republic just first attempts can be seen. Nevertheless, its importance will probably rise especially in relation to persisting system of European financial aid being distributed according to e.g. regional Gross Domestic Product (GDP) per capita in PPS.

Keywords: regional price level; regional purchasing power parity; purchasing power standard; regional GDP; regional household's income; regional convergence; cohesion policy

Subject classification codes: JEL E31, O18, R11

Introduction

When any regional research concerning economic indicators and inter-regional comparisons is done, it always faces the problem of regional price levels. Geographical difference in price levels and their incorporation into further analyses is truly necessary because neglecting them would lead to serious misleading and misspecifications of any regional analyses and related political implications. Contemporary practice and common data availability often leads

researchers to the utilization of Purchasing Power Parities (PPP) or, namely in the EU, Purchasing Power Standard (PPS) indicators.

Formerly Gross Domestic Product (GDP) and other indicators were converted by the exchange rate to widespread currencies (e.g. US dollar). The first problem of such approach is that exchange rate does not reflect all prices and is mainly influenced by currency's supply and demand, intervention by central banks, speculation etc. Another disadvantage of this approach is a narrow coverage because not all products are negotiable, e.g. government consumption cannot be traded internationally (see Methodological manual on purchasing power parities, European Commission 2006). These are the main reasons why EUROSTAT and OECD jointly recommend using common artificial currencies such as PPS for EU countries or OECD dollars for OECD countries. These artificial currencies have the same purchasing power in all member states (EU countries or OECD countries) and in comparison to exchange rates truly respect price level differences among countries (and theoretically regions). Basically the PPS can be obtained by dividing the nominal value of an indicator in domestic currency by respective purchasing power parity (PPP) – the PPP acts as an exchange rate of the PPS against euro (see European Comparison Programme, National Statistical Institute Bulgaria, 2009). In other words the PPS is derived from PPP for particular indicators like GDP. However, the condition of PPP stability must hold, otherwise this approach is meaningless (Telatar and Hasanov, 2009).

Although the PPS is working sufficiently well on the country level it has to be said that it is failing on the regional level. The reason is quite simple – there are no true PPS indicators for regions in fact because no true regional price levels are reported. Instead a sort of national “average” price level is used – the same for all the regions within a country. For PPS calculation purposes, most countries in the EU only collect prices in capital cities for cost reasons. In order to arrive at a PPP (as a starting point to calculate the PPS) covering the

national price level, countries are asked to provide a "Spatial Adjustment Factor" (SAF) for each product group, which is used to adjust (usually downwards) the capital city price level to the national price level. The method applied to calculating the SAF may differ from country to country, and from product to product. It is often based on Consumer Price Index (CPI) data.

There is evidence from several studies that there is probably a substantial difference between national PPP and regional PPPs (Engel and Rogers 2001 or Aten et al. 2012). Also studies concluding in the quite surprising fact, that regional price differences are persistent over time and they are not a result of a temporary shock can be found (see Tabuchi, 2001 or Slesnick, 2002 for example). In spite of these important findings there have been surprisingly very few attempts to estimate true regional price levels and to reach the real regional PPPs and subsequently PPS. More often some proxy variables for regional price levels differences are used like population density or wages or some econometric models for price estimations have been developed (see DuMond et al., 1999 or Kosfeld et al., 2007 or Aten and Heston, 2005 for example). However, it is questionable whether using these proxy variables or estimations is good enough, i.e. if they reflect the regional price differences well enough. Probably the most complex analysis of regional price levels so far was made by Roos (see Roos, 2003 or Roos, 2006) who estimated regional price levels for German regions (districts). He based his estimates on price levels of 50 German cities using the original database of Ströhl (Ströhl, 1994). Besides the price levels estimation itself Roos has found a tight connection of regional prices to wages and population, which is usually assumed (see above). However, the database he used did not include housing prices, which could make the major difference in regional price levels and did not reflect the differences in consumption baskets among the regions (Roos himself advocated adding these variables in further research, which was unfortunately never done). Therefore his model could have brought distorted results as

well. However, this topic remains very important, as many attempts to provide interregional comparisons or regional price level estimations occur. Researchers from different countries focus on this issue, such as Spain (Alberola and Marques, 2001), Great Britain (Hayes, 2005), USA (Aten et al., 2012, Aten and D'Souza, 2008), China (Brandt and Holz, 2006) or very often in Germany (Blien et al., 2009; Dreger and Kosfeld, 2010; Roos, 2006). The first attempts have recently been done in the Czech Republic (Musil et al., 2012a, 2012b or Chlad and Kahoun, 2011).

It is without a question that calculation of proper regional price levels could be of great help to all regional researchers and possibly even help the regional policies (and EU cohesion policy as well) to be more efficient. However, to get proper price levels is not an easy task to perform, especially on a European scale. There are some methodological but mainly regional data availability problems. Nevertheless, as shown in the article, regional price levels can be estimated quite well (after some acceptable simplifications) at the country level in the case of the Czech Republic. Doing so it gets quite interesting results when applied recalculated price levels on basic indicators of economic performance like regional GDP or wages. Results can be used as a first step towards regional PPS discussion in Europe.

Performing analyses with proper regional price levels could also give answers to contemporary regional riddles. One of them is the convergence puzzle when convergence among EU countries but divergence (or non-convergence) among regions is witnessed in these countries (the European Commission report on Cohesion fund, see European Commission 1999, shows that between 1986 and 1996 regional disparities decreased only in the UK and Portugal. Also various subsequent studies confirm such trend, for example see Overman and Puga, 2002, Magrini, 2004, Čadil and Mazouch, 2011, or for case of regional per capita income Geppert and Stephan, 2008). By the way this problem is quite tightly related to cohesion policy efficiency (e.g. Fischer and Fischer, 2005). NUTS 2 regions whose

GDP in PPS per capita is lower than 75% of EU average are eligible to be supported from EU funds (the Structural Funds and the Cohesion Fund), when the basic goal is to speed up the convergence process. However, it is possible that cohesion policy, as well as national regional policies, is oriented on regions that are only artificially undervalued (Jüssen 2005 addresses this problem as well). By supporting the wrong regions the cohesion policy may eventually promote real divergence and not convergence. Therefore it is necessary to continue in the regional price levels research further and eventually get a sufficiently long time series of regional price levels.

Regional price levels, regional PPPs and PPS calculation – current approach and modifications

The current official methodology of regional price levels comparison is in the Czech Republic, as in other European countries, inspired by PPP Programme that is carried out by OECD and EUROSTAT and described in the Methodological Manual on Purchasing Power Parities (European Commission 2006). Its main objective is to allow the comparison of macroeconomic indicators among the regions. A typical example is regional GDP¹, however, PPP methodology can be applied on other socio-economic indicators as well. It is not our intention to fully describe the methodology itself, because it is well known, but we just highlight the problems it brings and necessary modifications which were done to approach regional price levels in the Czech Republic.

Current EUROSTAT PPPs calculation is based on expenditure oriented Éltető-Köves-Szulc method (EKS). EKS is an index method², based on Laspeyres, Paasche and Fisher indices when after several transformations to deal with reversibility, transitivity and aggregation issues we get PPP index which shows the ratio of price levels among the base country (region) and other countries (regions), calculated for all goods and services in

consumption basket. The particular PPS indicator is then technically obtained by dividing the respective indicator nominal value in domestic currency by respective PPP³.

At the very beginning EKS identifies so called “basic headings” and their “representatives” (expenditure items) in consumption basket. There are 226 basic headings defined (for the list of them see box II.1 in Annex II, European Commission 2006, p. 163). Usually the prices are collected in the capital city and adjusted by spatial factors (SAF) to be representative for the entire country. This brings the main problem of the methodology – the whole subsequent calculation of regional PPS relies only on one set of prices – the prices of the capital city. Other problems also occur, mainly relating to comparability of the consumption baskets, but are not that severe for the case of regional PPPs calculation.

Table 1 illustrates the problem of no true regional PPPs for the case of the Czech Republic – the table refers to PPS indicator GDP per inhabitant. Note that there are regional PPPs related to EU, calculated as GDP per inhabitant in national currency (CZK) divided by GDP per inhabitant in PPS (times 100 to get the percentage) and then regional PPPs related to Czech Republic itself. The level yields 100% for all the regions. This is because the regional PPPs compared to EU do not actually differ among the Czech regions as the result of application of joint price level for all the regions mentioned above.

Put Table 1 here

Our estimate of regional price levels is in contrast to official methodology described above being based only on the data of final household consumption. Other components of GDP, such as government consumption, NPISH expenditures⁴ or gross fixed capital formation, are not included in the calculations. The reason for this is that data sources for other components are scarce, this holds especially for external trade (problems of its estimation can be found e.g. in Bracalente and Perugini, 2010 or Harris and Liu, 1998). On one hand it represents a sort of simplification, on the other hand final household consumption

expenditure generally form the main component of expenditure approach (in the Czech Republic approximately 50% of GDP and in other countries the share is usually even higher). In addition, the main differences between final household consumption and total expenditures are supposed to be exactly in the prices of rents and services for households.

In our approach (see Musil *et al.* 2012a and 2012b for details) there are some other differences. Firstly, the calculation is done instead of the level of basic headings at the level of representatives for which expenditure weights are available. In other words each basic heading has only one (and the same) representative among all regions. That means that our estimates are based on a much more detailed level than in the official methodology. Instead of 148 basic headings for final household consumption expenditure the paper works with approximately 700 representatives.

All representatives are supposed to be representative in all regions. The size of the Czech Republic allows accepting this assumption, because there are not significant differences in product supply among Czech regions. Consumption manners are similar in all regions and chain stores offer almost the same products in all regions. For the computations it means that Laspeyres, Paasche and Fisher type of PPPs for each representative are the same. Moreover, there is no need to use the EKS method, because all indices are transitive (in fact the EKS simplifies to basic indices).

Second step to arrive to final PPPs and subsequently PPS is to aggregate all the particular price indices. In our approach two sets of regional purchasing power parities were estimated. The first one does not take into account differences in the structure of consumption expenditures. Weights are based on the structure of final household consumption expenditures (FHCE) in national concept. As the FHCE data are available just for groups of COICOP classification, weights of representatives within the group are derived by linear interpolation using CPI data. Utilisation of weights of representatives in CPI data directly is not possible

due to several methodological distinctions⁵. Because of identical weights in all regions there is no need to use EKS method for aggregation as all indices are transitive. We get the regional PPPs simply as a sum of weighted averages of particular, one representative, PPPs calculated in previous step. Formally

$$PPP_A = \frac{\sum_{i=1}^n \left(\left[\prod_{j=A}^n \frac{(P_A)}{(P_j)} \right]^{\frac{1}{\sum j}} \right) w_i}{\sum_{j=1}^n w_i}, \quad (1)$$

where P stands for a price of representative i in region A and w_i stands for the share of expenditure on representative i on total regional (national average) consumption expenditure.

The second set is based on regionally different structures of consumption expenditures.

Firstly, regional final household expenditures had to be estimated using data from household budget survey (HBS), transportation, health, education and other statistics. Regional structure of FHCE was calculated and incorporated in the calculation. The EKS method must be applied in this case as Fisher indices are not transitive because of different regional weights.

Regarding the possibility of missing values our methodology simplified the situation again. As all products (items) are considered to be representatives, which means that all products are representative in all regions, the missing values occur only because some items are simply not sold in a region. For example in Pardubicky region there is no price available for 5-star hotels, because no 5-star hotels are located there. Such missing prices were estimated as an arithmetic average of prices in other regions.

To distinguish between current regional PPPs and PPS indicators reported by EUROSTAT and our findings we label new regional purchasing power parities as RPPPs and derived purchasing power standard indicators as RPPS indicators.

Data sources

Data on prices and expenditure weights for PPP programme are generally provided by

National Statistical Institutes (NSI). Countries can choose if prices of all goods are collected within single year or over three years. In the second case products in consumer basket are divided into six groups and every half a year prices of one sixth of products are surveyed. In order to estimate all prices of products every year temporal adjustment factors must be provided for products for which prices are not collected in the selected year. Prices should be representative for the whole country, therefore either the data are collected in the capital city and adjusted by spatial factors or another approach is used in the form that data collection is not limited to the capital city. Selection of stores should respect shopping manners in each country. In order to ensure comparability between countries a description of representatives is more detailed than it is for representatives in the sample for consumer price index.

Several data sources are used in the calculation. Data from a monthly consumer price survey published by the Czech Statistical Office (CZSO) are included instead of PPP survey due to the following reasons. Firstly, in PPP survey one third of prices are collected during one year while the rest of prices are estimated using temporal adjustment factors. The consumer price survey provides data each month. Therefore it was decided to use the monthly data from Czech CPI. Secondly, the minimum level of aggregation in PPP calculation is the basic heading, and as it was already stated, final household consumption expenditure is divided into 148 basic headings. About 700 representatives are observed in consumer price survey and more detailed weights are available. Using 148 basic headings would lead to senseless loss of information.

It was necessary to use also other data sources in order to improve our estimates and make them more accurate in cases where the CPI does not provide complete information. Data on rents were provided by the Institute for Regional Information (hereinafter IRI) that collects data on paid rents at a very detailed regional stratification (263 territorial units within the Czech Republic). A so-called standard flat is defined (same flat dimensions, age, location

etc.) and the prices for this standard flat are collected in all regions. Therefore the differences in the regional structure of housing fund are not taken into account. Especially in the first steps of our research web data sources and experts' estimates were also used. These were later on step by step being substituted by better input data.

The year chosen for our analysis is 2007. Our research lasts already several years due to quite complicated data gathering procedure. The year 2007 was at the time of project beginning the most suitable for computation, among others, according to availability of final data from national accounts and data for paid and imputed rents. Since the year 2008 CPI data collection system has been changed and less regional data is available now. Including older data would be useless. The change in methodology and mainly the limitation of range of data surveyed restricted us from our initial effort to construct time series of regional price levels. Although the year 2007 may seem to be far behind, we see the first attempt in the Czech Republic to construct the regional price levels as very useful, especially as an example that can be further extended and improved. In the next section the main results will be presented and discussed.

Results

The RPPPs have been computed for 14 Czech NUTS 3 regions in the year 2007. As mentioned above two different approaches were conducted. In the first case one common consumption basket for all 14 regions is applied (all regions have the same weights), in the second case regions have consumption baskets with regionally adjusted weights. **Table 2** shows the results.

Put Table 2 here

It is obvious that the results do not differ much with the different weights, so the specific regional weights do not actually bite. In both approaches the highest RPPP is in

Hlavní město Praha (hereafter Prague). This region includes the capital city, but not the surrounding (agglomeration). That is one of the reasons why the value is so high. Other regions above 100 are suburban region of Prague (Středočeský region) and the region with the second biggest city in the Czech Republic (Jihomoravský region). Also the three smallest regions (according to area) have RPPPs above 100 – Karlovarský, Liberecký and Zlínský regions. On the other hand the lowest RPPPs values are in Ústecký region (structurally affected region with high unemployment rate over a long period) and Vysočina region (the most recently established NUTS 3 region in the Czech Republic). **Figure 1** shows the geographical distribution of regional price levels. **Annex 1** shows the map of Czech NUTS 3 regions.

Put Figure 1 here

When applying the computed RPPPs (both approaches) on different regional indicators it is possible to compare the results with the official OECD/EUROSTAT methodology, based on one average national price (current PPS indicators). We presented the official EUROSTAT GDP per inhabitant in PPS above as one of the most important indicators⁶ to illustrate the equality of regional PPPs for all the regions in the Czech Republic. Now, if we use the RPPPs instead the official PPS, we get quite different results, as shows **Table 3**.

Put Table 3 here

Of course this can be done for various indicators as price levels affect all economic agents. Taking true regional price levels into account has then serious consequences - both on analyses and policies. Here we pick only a few of them that seem important to us but the applications are virtually unlimited.

Analytical and policy consequences: Regional price levels

Firstly we take a look at the RPPPs themselves. As already mentioned in the introduction one might suppose, according to studies that are using proxy for the regional price levels or make econometric estimates of price levels, that there should be strong relation between population density (population density or city size are usually present as one of the variables in econometric models), degree of urbanization or wages and price levels, i.e. RPPPs. Table 4 shows data of RPPPs and population density, index of urbanization (urbanization index is a share of population living in cities to total population in region) and average wage for Czech NUTS 3 regions.

Put Table 4 here

After the outlier (Prague) was cut out, the correlation coefficients between RPPPs and population density, urbanization index and average wage were calculated. The results are really not in favour of using these variables as proxies for regional price levels. The correlation coefficients are 0.06 for population density; -0.16 for urbanization index and 0.27 for wages. Although wages are the best out of these three considered (and used) variables the correlation is not high enough to be regarded as reliable proxy. It should be stressed here that to strictly deny the utilization of proxies listed above more observations are probably needed. Having only 14 observations with one outlier cannot be regarded as sufficient number of observations from the pure statistical point of view. On the other hand these preliminary results give us at least a feeding ground for revision of current regional price levels calculations based on econometric models. Also searching for some better proxy for RPPPs (if any exists) could be one of the future aims of research in this area.

GDP per capita, convergence and cohesion policy

As **Table 3** revealed the calculated regional GDP in RPPS differs quite substantially from the values officially presented (in PPS). Moreover, it is quite important to notice that differences in GDP per capita tend to shrink when we use regional price levels instead of official national average. Variation coefficient of GDP per capita drops down from 0.34 to 0.25. These are important findings especially from the convergence issue point of view and related policies mentioned in the introduction.

Calculating the proper RPPPs could be one of the crucial moments for the convergence puzzle explanation. It is possible that the real convergence process among the regions is taking place but we do not actually see it as we use joint national price level. The most substantial change occurred in Prague as expected (almost 35 p.p. drop showing an overvaluation of Prague) but there are other interesting results as well. For instance Ustecký kraj jumped by 5 p.p. while this region is normally considered as one of the poorest regions and therefore supported by national regional policy. Although the differences in other regions might not appear to be that big, it does not mean that RPPPs calculation is not important. Czech Republic is a relatively small country with historically very high regional homogeneity which is naturally reflected even in price levels. If regional RPPPs are applied on more heterogeneous countries like Spain, France or Italy it is very likely that it yields higher differences. This could possibly affect whole cohesion policy as some regions could be just artificially undervalued while having low GDP per capita in PPS but also relatively lower price level like in Ustecký kraj mentioned above.

Regional income disparities, wages and pensions

From previous findings it is quite clear that RPPPs somehow adjust and settle regional disparities. For deeper analysis of the situation of regional households, their standard of

living, the GDP per capita is probably not a suitable indicator.

Table 5 shows data on Net Disposable Income (NDI) per capita – both in PPS and RPPS. Clearly the advantage of Prague decreases sharply from 132.3 % in PPS to 109.5 % in RPPS, though Prague still remains the richest region of the Czech Republic. However, final household consumption expenditures represent the main use of NDI and households in Prague have to face higher cost of living which greatly downgrades their higher incomes⁷.

The similar situation happens to wages. When the official PPS indicator is used we see that all the Czech regions are below the average with Prague as the only exception quite high above this average. This is, however, a bit unlikely to be the truth and using RPPPs yields more realistic results – Prague is still the richest region but the distance among the regions diminishes. Variation coefficient drops down from 0.12 to 0.065. The Prague's leading position can be explained plainly by its economic and education structure having higher ratio of workers with tertiary education whose wages are also higher (Fischer and Mazouch, 2010).

Put Table 5 here

As a possible research which could be done further in this matter is the distribution of wages within the regions. So far it is known that generally 65% of population of the Czech Republic does not reach the average wage (Čadil et al., 2011), however, it is a question how the wages are distributed within the regions in real terms. Especially the rich regions like Prague might have more than 50% of population poorer than national average due to higher prices and more unequal distribution. Also compensation of employees is paid in the region where the place of work is located, but it represents a resource of the household in the region, where the household lives. Such research would be very interesting especially from the social point of view but also from the regional policy point of view again. It is because we simply cannot claim rich regions to have equally rich population especially when we account for the price level.

The other possible application concerning household's income is to focus on tabulated salaries, which are very common in the Czech Republic for public sector (teachers, medicals, officers, police officers). These salaries are strictly regulated by law (Government regulation) which is applied to all employees in public sector with no difference among regions (Czech Republic, 2006). Results are in Table 6 where wages for teachers and physicians (medical doctor) are described. By Government regulation those are equal for all regions but in RPPS there are big differences and it can cause some professions unfavourable in some regions.

Put Table 6 here

The situation with pensions as shown in Table 7 is a bit similar as pensions also do not account for a spatial factor. They are very loosely derived from the average salary during active age but do not differ much in population in nominal values. The pension system in the Czech Republic gives almost strict equality of pensions and it causes that pensions' variability among regions is very small. Pension determination depends of course on previous wages (or salaries) but there are some reductions and above some level there is not significant influence to pension. That means that employees with very high wages have very similar pensions as other employees with lower wages (Czech Republic, 1995). This situation shows that differences between region with higher wages (for example Prague) and region with lower wages (some other region in Czech Republic) are not reflected in differences of pensions. Applying RPPPs estimate of real average pensions in regions can be done. Increase of variation is the same as decline of variation of wages – 50 % (from 0.024 to 0.037). These results show that pensions in Prague are the highest (due to high wages) but the levelling of nominal pensions and high differences in prices cause that real pensions in Prague are the smallest of all regions in Czech Republic.

Put Table 7 here

Conclusion and Discussion

It is probably without a question that regional price levels must be reflected in analyses and policies as well. However, as the example of the Czech Republic has shown researchers should not rely on current regional PPS indicators as they do not actually reflect regional prices and the differences can be substantial. Even in a quite regionally homogenous country as the post-communist Czech Republic is, a substantial gap between actual regional PPS indicators provided by Eurostat and recalculated RPPS indicators remains.

The calculation of “true” regional PPPs in case of the Czech Republic is based on standard EKS methodology with necessary, but not principal, simplifications. On the other hand the data set consists of more than 700 representatives, which is much more than the standard Eurostat PPPs calculation holds. The results then can be recognized as reliable and consistent.

Generally it can be said that rich regions (according to current RPPPs) become less rich when the real regional price levels are taken into account and vice versa – the poor region’s economic performance improves. The GDP per capita in Prague, which is the richest Czech NUTS 3 region, dropped down by 35 p.p. Moreover, the variation coefficient among the Czech NUTS 3 regions decreased by almost 40 %. Similar situation occurs when RPPPs are applied on wages and disposable income. It is important to emphasize that the influence of regional price levels on households’ standard of living varies according to social groups.

This raises a very important question regarding regional convergence. Is the regional convergence or divergence, which researchers and policy makers deal with now, real or is it just a dance in quicksand? Is the regional and cohesion policy efficient or inefficient? Are the regions which are in need of support those actually being supported or are only artificially undervalued regions supported? To answer these questions it is inevitable to recalculate PPPs for regional levels in the whole EU which is not an easy task to perform but the outcome

could be fruitful. This paper showed possible way to perform these computations on the case study of the Czech Republic.

Acknowledgement

Earlier versions of this paper were presented at the “Networked Regions and Cities in Time of Fragmentation: Developing Smart, Sustainable and Inclusive Places“ workshop held at Delft University of Technology (13-16 May 2012); and in “Regionální studia” journal at University of Economics, Prague (Čadil et al., 2012) and “Statistika, Economy and Statistics Journal” (Musil et al., 2012a).

The authors gratefully acknowledge funding from the University of Economics in Prague under project No. IGA MF/12/2011 “Estimation of regional price levels”. The authors would like to thank anonymous referees for their extremely valuable and extended suggestions on how to improve the paper. All errors and omissions remain the authors’ own.

Notes

1. GDP per capita is often applied for comparisons of states or regions (Novotný, 2010, Gardiner et al., 2004) and serves very good especially for comparison of regional or state economic performance. Giovannini (2008, p. 162) sees GDP even as “*the most prominent of all the variables in the national accounts*”. Moreover, regional GDP is classified among the most important regional indicators also in European System of Accounts (Eurostat, 1996) standard ESA 1995 (Hronová et al., 2009, p. 268).
2. For more detailed information about EKS method see Jílek and Moravová (2007, p. 227-229), European Commission (2006) or Slavík (2007).
3. For detailed calculation see Musil et al., 2012a.
4. NPISH stands for Non-profit institutions serving households.
5. CPI represents a Laspeyres type of price index, i.e. the weights are derived from the base year. On the contrary the weights in European Comparison Programme come from current year. Consumption basket of CPI is based on monetary expenditures while FHCE contain also consumption in kind (e.g. self-supply). Consumption of prostitution, drugs, FISIM (Financial Intermediation Services Indirectly Measured) are included in FHCE as well.
6. There are several issues concerning especially the validity of GDP (see Stiglitz et al., 2009), however, it is not the intention of this article to deal with GDP and other indicators calculation methodology.
7. Especially housing is relatively very expensive in Prague in comparison to other regions.

References

- Alberola, E. and Marques, J. M., 2001. On the Evolution of Relative Prices and Its Nature at the Regional Level: The Case of Spain. *Journal of Regional Science*, 41 (3), 451-74.
- Aten, B.H. and Heston, A., 2005. Regional Output Differences in International Perspective. In Kanbur, R. and Venables, A.J., eds. *Spatial Inequality and Development*, UNU-Wider Studies in Development Economics. Oxford University Press, New York, 15-36.
- Aten, B.H., and D'Souza, R.J., 2008. Research Spotlight: Regional Price Parities Comparing Price Level Differences across Geographic Areas. *Survey of Current Business*, 88 (11), 64-74.
- Aten, B.H., Figueroa, E.B. and Martin, T.M., 2012. Regional Price Parities for States and Metropolitan Areas, 2006-2010. *Survey of Current Business*, 92 (8), 229-242.
- Blien, U., Gartner, H., Stuber, H. and Wolf, K., 2009. Regional Price Levels and the Agglomeration Wage Differential in Western Germany. *Annals of Regional Science*, 43 (1), 71-88.
- Bracalente, B. and Perugini, C., 2010. The components of regional disparities in Europe. *Annals of Regional Science*, 44 (3), 621-645.
- Brandt, L. and Holz, C.A., 2006. Spatial Price Differences in China: Estimates and Implications. *Economic Development and Cultural Change*, 55 (1), 43-86.
- Chlad, M. and Kahoun, J., 2011. Factors Influencing the Rating of Regional Economic Performance or Reasons why Prague has Become the 6th Best Economically Performing Region of the EU. *Statistika, Economy and Statistics Journal*, 48 (2), 4-23.
- Czech Republic, 1995. *Zákon č. 155/1995 Sb., o důchodovém pojištění*. Legal regulation.
- Czech Republic, 2006. *Nariadení vlády č. 564/2006 Sb. o platových poměrech zaměstnanců veřejných službách a správě*. Legal regulation.
- Čadil, J., Pavelka, T., Kaňková, E. and Vorlíček, J., 2011. Odhad nákladů nezaměstnanosti z pohledu veřejných rozpočtů [Unemployment cost estimate from public budgets perspective]. *Politická Ekonomie*, 59 (5), 618-637.
- Čadil, J. and Mazouch, P., 2011. PPS and EU Regional Price Level Problem. *The Open Political Science Journal*, 4, 1-5.
- Čadil, J., Mazouch, P., Musil, P. and Kramulová, J., 2012. Regional price levels in the Czech Republic – preliminary results and application. *Regionální studia*, 6 (2), 52-57.

- Dreger, Ch. and Kosfeld, R., 2010. Do Regional Price Levels Converge? *Jahrbucher für Nationalökonomie und Statistik*, 230 (3), 274-286.
- DuMond, J.M., Hirsch, B.T. and Macpherson, D.A., 1999. Wage Differentials Across Labor Markets and Workers: Does Cost of Living Matter? *Economic Inquiry*, 37 (4), 577-598.
- Engel, C. and Rogers, J.H., 2001. Deviations from Purchasing Power Parity: Causes and Welfare Costs. *Journal of International Economics*, 55 (1), 29-57.
- European Commission, 1999. *The cohesion fund in 1999*. Technical report.
- European Commission, 2006. *Eurostat-OECD Methodological Manual on Purchasing Power Parities*. Paris: Office for Official Publications of the European Communities.
- Eurostat, 1996. *European System of Accounts – ESA 1995*. Luxembourg: Office for Official Publications of the European Communities.
- Gardiner, B., Martin, R. and Tyler, P., 2004. Competitiveness, Productivity and Economic Growth across the European Regions. *Regional Studies*. Special Issue, 38 (9), 1045-1067.
- Giovannini, E., 2008. *Understanding economic statistics: an OECD perspective*. Paris: Organisation for Economic Co-operation and Development,
- Fischer, J. and Fischer, J., 2005. Měříme správně hrubý domácí produkt? [Do we measure Gross Domestic Product properly?] *Statistika*, 42 (3), 177–187.
- Fischer, J. and Mazouch, P., 2010. What means competitiveness of tertiary sector in regions? *In: IDIMT-2010 Information Technology – Human Values, Innovation and Economy*, 8-10 September 2010 Jindřichův Hradec. Linz: Trauner Verlag universität, 237–242.
- Geppert, K. and Stephan, A., 2008. Regional disparities in the European Union: Convergence and agglomeration. *Papers in Regional Science*, 87 (2), 193-217.
- Harris, R.I.D., Liu, A., 1998. Input-output modelling of the urban and regional economy: The importance of external trade. *Regional Studies*, 32 (9), 851-862.
- Hayes, P., 2005. Estimating UK Regional Price Indices, 1974-96. *Regional Studies*, 39 (3), 333-344.
- Hronová, S., Fischer, J., Hindls, R. and Sixta, J., 2009. *Národní účetnictví: nástroj popisu globální ekonomiky [National Accounting: Tool for Description of Global Economics]*. Praha: C. H. Beck.
- Jílek, J. and Moravová, J., 2007. *Ekonomické a sociální indikátory: od statistiky k poznatkům [Economic and Social Indicators: from Statistics to Knowledge]*. Praha: Futura.

- Jüssen, F., 2005. *A distribution dynamics approach to regional income convergence in reunified Germany*. ERSa 2005 conference paper, European Regional Science Association.
- Kosfeld, R., Eckey, H.-F. and Lauridsen, J., 2007. *Disparities in Prices and Income Across German NUTS 3 Regions*. Economic Discussion Papers 93/07, University of Kassel.
- Magrini, S., 2004. Regional (di)convergence. In: Henderson, J. and Thisse, J.-F., eds. *Handbook of Regional and Urban Economics*, Elsevier North Holland, 2741–2796.
- Ministry of Transport, 2005. Transport Yearbook Czech Republic 2004. Praha: Ministry of Transport.
- Musil, P., Kramulová, J., Čadil, J. and Mazouch, P., 2012a. Application of Regional Price Levels on Estimation of Regional Macro-Aggregates Per Capita in PPS. *Statistika, Economy and Statistics Journal*, 49 (4), 4-13.
- Musil, P., Kramulová, J. and Sixta, J., 2012b. Regional price differences and their impact on regional macro-aggregates. In: *International Input-Output Analysis 2012*, 25-29 June 2012 Bratislava. [online] Bratislava : Ekonomická univerzita, 1–6. URL: <http://www.iioa.org/files/conference-3/681.pdf>
- National Statistical Institute Bulgaria, 2009. European Comparison Programme, Methodological notes 2009.
- Novotný, J., 2010, Regionální ekonomická konvergence, divergence a další aspekty distribuční dynamiky evropských regionů v období 1992-2006 [Regional Convergence, Divergence and Other Aspects of Distributional Dynamics of European Regions in the Period 1992-2006]. *Politická ekonomie*, 58 (2), 166-185.
- Overman, H.G. and Puga, D., 2002. Unemployment clusters across Europe's regions and countries. *Economic Policy: A European Forum*, 34, 115–143.
- Roos, M., 2003. *Regional price levels in Germany*. ERSa conference papers, European Regional Science Association.
- Roos, M.W.M., 2006. Regional Price Levels in Germany. *Applied Economics*, 38 (13). 1553-1566.
- Slavík, C., 2007. Reálná konvergence České republiky k Evropské unii v porovnání s ostatními novými členskými zeměmi [Real convergence of the Czech republic to the EU in comparison with the other new member countries]. *Politická Ekonomie*, 55 (1), 23-40.
- Slesnick, D.T., 2002. Prices and Regional Variation in Welfare. *Journal of Urban Economics*, 51 (3), 446-468.

- Stiglitz, J.E., Sen, A., Fitoussi, J.-P. *et al.*, 2009. *Report by the Commission on the Measurement of Economic Performance and Social Progress*. [online]. Commission on the Measurement of Economic Performance and Social Progress, 2009. [last accessed 2012-10-01], <http://www.stiglitz-sen-fitoussi.fr/en/index.htm>
- Ströhl, G., 1994. Zwischenörtlicher Vergleich des Verbraucherpreis-niveaus in 50 Städten. *Wirtschaft und Statistik*, 6/1994, 415-434.
- Tabuchi, T., 2001. On Interregional Price Differentials. *Japanese Economic Review*, 52 (1), 104-115.
- Telatar, E. and Hasanov, M., 2009. Purchasing Power Parity in transition economies: evidence from the Commonwealth of Independent States. *Post-Communist Economies*, 21 (2), 157-173.

Table 1. No true regional PPPs for the case of the Czech Republic

Region	GDP/inhabitant (PPS)	GDP/inhabitant (CZK)	RPPP in % (compared to EU)	RPPP in % (compared to CR)
Hlavní město Praha	42 983	736 228	1712.8	100
Středočeský kraj	18 778	321 631	1712.8	100
Jihoceský kraj	17 168	294 058	1712.8	100
Plzeňský kraj	18 380	314 809	1712.8	100
Karlovarský kraj	14 259	244 233	1712.8	100
Ústecký kraj	15 858	271 616	1712.8	100
Liberecký kraj	15 415	264 031	1712.8	100
Královéhradecký kraj	16 994	291 076	1712.8	100
Pardubický kraj	16 709	286 196	1712.8	100
Vysočina kraj	16 853	288 667	1712.8	100
Jihomoravský kraj	18 378	314 774	1712.8	100
Olomoucký kraj	14 787	253 277	1712.8	100
Zlínský kraj	16 350	280 042	1712.8	100
Moravskoslezský kraj	16 825	288 186	1712.8	100
Czech Republic	19 996	342 494	1712.8	100

Table 2. Results of RPPPs computations when applying one common consumption basket and different regional consumption baskets (2007)

Region	RPPP in % (one basket)	RPPP in % (regional baskets)
Hlavní město Praha	119.7	120.8
Středočeský kraj	101.9	102.6
Jihočeský kraj	97.9	97.5
Plzeňský kraj	97.1	97.1
Karlovarský kraj	101.4	101.3
Ústecký kraj	94.9	94.1
Liberecký kraj	101.4	100.2
Královéhradecký kraj	96.4	96.2
Pardubický kraj	98.2	98.9
Kraj Vysočina	95.6	95.1
Jihomoravský kraj	103.4	104.6
Olomoucký kraj	96.9	96.6
Zlínský kraj	100.8	100.8
Moravskoslezský kraj	96.7	96.9
Czech Republic	100.0	100.0

Source: authors' computations

Table 3. Estimates of GDP in RPPS (2007)

Region	GDP per capita in PPS	GDP per capita in PPS in %	RPPP	GDP per capita in RPPS	GDP per capita in RPPS %
Hlavní město Praha	44 200	213.5	120.8	36 589	176.8
Středočeský kraj	19 300	93.2	102.6	18 811	90.9
Jihocheský kraj	17 900	86.5	97.5	18 359	88.7
Plzeňský kraj	19 100	92.3	97.1	19 670	95.0
Karlovarský kraj	15 300	73.9	101.3	15 104	73.0
Ústecký kraj	16 600	80.2	94.1	17 641	85.2
Liberecký kraj	16 000	77.3	100.2	15 968	77.1
Královéhradecký kraj	17 600	85.0	96.2	18 295	88.4
Pardubický kraj	17 300	83.6	98.9	17 492	84.5
Kraj Vysočina	17 300	83.6	95.1	18 191	87.9
Jihomoravský kraj	18 900	91.3	104.6	18 069	87.3
Olomoucký kraj	15 300	73.9	96.6	15 839	76.5
Zlínský kraj	16 800	81.2	100.8	16 667	80.5
Moravskoslezský kraj	17 300	83.6	96.9	17 853	86.2
Czech Republic	20 700	100.0	100.0	20 700	100.0

Source: Czech Statistical Office, IRI, Own Calculation

Table 4. Population density (inhabitants per sq. km). Degree of urbanization (ratio of inhabitants living in town) and Average wage (2007)

Region	RPPP in % (regional baskets)	Population density	Index of urbanization	Average wage
Hlavní město Praha	120.8	2 444	100.0	27 803
Středočeský kraj	102.6	109	54.7	22 316
Jihocesky kraj	97.5	63	65.0	19 733
Plzeňský kraj	97.1	74	67.9	20 629
Karlovarský kraj	101.3	93	83.4	18 692
Ústecký kraj	94.1	156	80.3	20 031
Liberecký kraj	100.2	137	78.6	20 054
Královéhradecký kraj	96.2	116	83.4	19 235
Pardubický kraj	98.9	113	62.0	19 180
Kraj Vysočina	95.1	76	58.5	19 421
Jihomoravský kraj	104.6	159	62.7	20 589
Olomoucký kraj	96.6	122	57.6	19 101
Zlínský kraj	100.8	149	60.8	19 261
Moravskoslezský kraj	96.9	230	76.2	20 560
Czech Republic	100.0	132	71.3	22 382

Source: Czech Statistical Office. IRI. Own Calculation

Table 5. Estimates of NDI in RPPS (2007)

Region	NDI per capita in PPS	NDI per capita in PPS %	NDI per capita in RPPS	NDI per capita in RPPS %
Hlavní město Praha	13 402	132.2	11 094	109.5
Středočeský kraj	10 878	107.3	10 602	104.6
Jihomoravský kraj	9 770	96.4	10 021	98.9
Plzeňský kraj	10 047	99.1	10 347	102.1
Karlovarský kraj	9 070	89.5	8 954	88.4
Ústecký kraj	8 890	87.7	9 447	93.2
Liberecký kraj	9 474	93.5	9 455	93.3
Královéhradecký kraj	9 818	96.9	10 206	100.7
Pardubický kraj	9 609	94.8	9 716	95.9
Kraj Vysočina	9 628	95.0	10 124	99.9
Jihomoravský kraj	9 949	98.2	9 511	93.9
Olomoucký kraj	9 336	92.1	9 665	95.4
Zlínský kraj	9 795	96.7	9 717	95.9
Moravskoslezský kraj	9 131	90.1	9 423	93.0
Czech Republic	10 134	100.0	10 134	100.0

Source: Czech Statistical Office, IRI, Own Calculation

Table 6. Estimates of wages of teachers and physicians in PPS (2007)

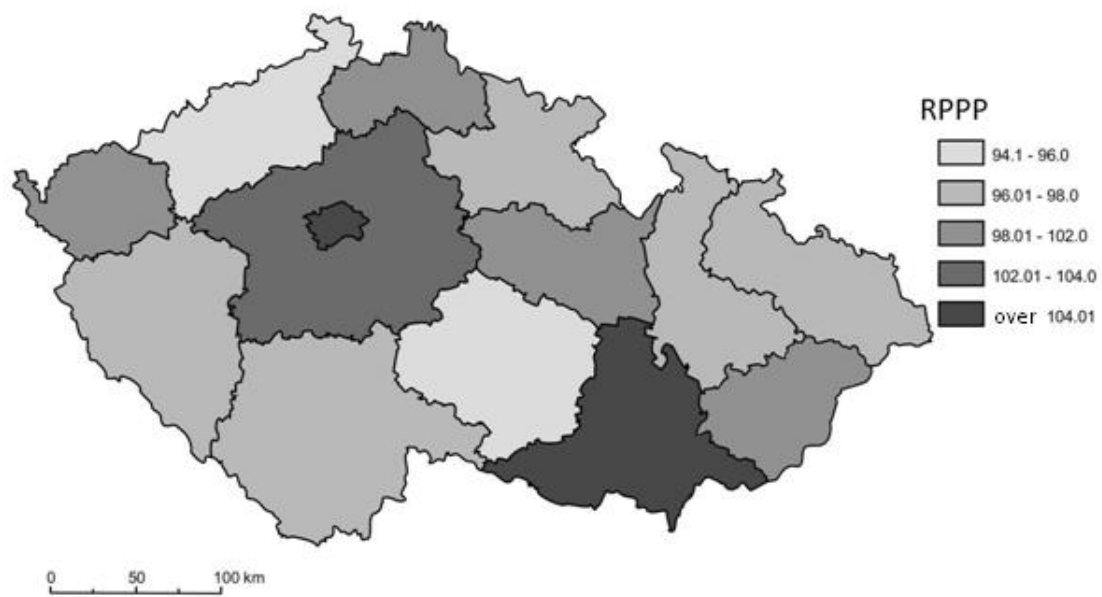
Region	Average wage of teachers in PPS	% of average country	Average wage of teachers in RPPS	% of average country	Average wage of physicians in PPS	% of average country	Average wage of physicians in RPPS	% of average country
Hlavní mesto Praha	788	100.0	652	82.7	926	100.0	767	82.8
Středočeský kraj	788	100.0	768	97.5	926	100.0	903	97.5
Jihočeský kraj	788	100.0	808	102.5	926	100.0	950	102.6
Plzeňský kraj	788	100.0	812	103.0	926	100.0	954	103.0
Karlovarský kraj	788	100.0	778	98.7	926	100.0	914	98.7
Ústecký kraj	788	100.0	837	106.2	926	100.0	984	106.3
Liberecký kraj	788	100.0	786	99.7	926	100.0	924	99.8
Královéhradecký kraj	788	100.0	819	103.9	926	100.0	963	104.0
Pardubický kraj	788	100.0	797	101.1	926	100.0	936	101.1
Kraj Vysočina	788	100.0	829	105.2	926	100.0	974	105.2
Jihomoravský kraj	788	100.0	753	95.6	926	100.0	885	95.6
Olomoucký kraj	788	100.0	816	103.6	926	100.0	959	103.6
Zlínský kraj	788	100.0	782	99.2	926	100.0	919	99.2
Moravskoslezský kraj	788	100.0	813	103.2	926	100.0	956	103.2
Czech Republic	788	100.0	788	100.0	926	100.0	926	100.0

Table 7. Estimates of wage and pension in PPS (2007)

Region	Average wage in PPS	% of average country	Average wage in RPPS	% of average country	Average pension in PPS	% of average country	Average pension in RPPS	% of average country
Hlavní město Praha	1 616	124.2	1 338	102.8	545	107.3	451	88.8
Středočeský kraj	1 297	99.7	1 264	97.2	510	100.4	497	97.8
Jihočeský kraj	1 147	88.2	1 176	90.4	502	98.8	515	101.4
Plzeňský kraj	1 199	92.2	1 235	94.9	506	99.6	521	102.6
Karlovarský kraj	1 086	83.5	1 072	82.4	500	98.4	494	97.2
Ústecký kraj	1 164	89.5	1 237	95.1	505	99.4	537	105.7
Liberecký kraj	1 166	89.6	1 164	89.5	504	99.2	503	99.0
Královéhradecký kraj	1 118	85.9	1 162	89.3	501	98.6	521	102.6
Pardubický kraj	1 115	85.7	1 127	86.6	497	97.8	503	99.0
Kraj Vysočina	1 129	86.8	1 187	91.2	493	97.0	518	102.0
Jihomoravský kraj	1 197	92.0	1 144	87.9	503	99.0	481	94.7
Olomoucký kraj	1 110	85.3	1 149	88.3	494	97.2	511	100.6
Zlínský kraj	1 119	86.0	1 110	85.3	496	97.6	492	96.9
Moravskoslezský kraj	1 195	91.9	1 233	94.8	513	101.0	529	104.1
Czech Republic	1 301	100.0	1 301	100.0	508	100.0	508	100.0

Source: Czech Statistical Office. IRI. Own Calculation

Figure 1. RPPPs in the Czech NUTS 3 regions in % (2007)



Source: authors' computations

Annex

Annex 1. NUTS 3 regions in the Czech Republic



Source: Ministry of Transport, 2005, authors' adaption