The issue of regional PPS indicators - case study of the Czech Republic

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Abstract

The Purchasing Power Standard (PPS) is widely used for economic analyses, studies and strategic documents in the European Union. Although it is necessary to take the purchasing power i.e. price level into consideration, the PPS indicators are usually not usable at regional level (although widely used). The current PPS is not reflecting regional prices but is based on one country price level. This might lead to serious imperfections and misspecifications especially in relation to regionally oriented policies like the Cohesion Policy. Using PPS for analyzing regional economic processes like regional convergence reveals quite puzzling conclusions (among the countries convergence vs. within the country regional divergence) which are supporting this possible problem of PPS. To get reliable research results, perform good analyses and undertake efficient policies it is probably necessary to adjust the PPS methodology for the case of European regions. In our contribution we show that there is a substantial difference between the currently used PPS and real regional purchasing power, i.e. price levels. We use the case study of the Czech Republic to demonstrate the differences and description of methodology.

Key words: Purchasing power standard, regional price level, regional policy, convergence

JEL: R10, R58, C43

Introduction

Contemporary regional analyses and following policies are often based on indicators that are set in Purchasing Power Parities (PPP) or Purchasing Power Standard (PPS) [1]. It is necessary (without any doubt) to involve purchasing power, i.e. price level, of a region into consideration because neglecting it would lead to serious misleading and misspecifications of related theories and models. It is true that some analyses in history were based on exchange rate conversions and some analysts still use it, however as *Methodological manual on purchasing power parities* (European Communities/OECD, 2006) shows such a method is inappropriate and yields significantly distorted results. The main reason is that pure exchange rate conversion does not include national price levels and therefore virtually increases indicators like GDP in countries with higher price levels and on the other hand decreases these indicators in countries with relatively lower price levels[2]. Therefore EUROSTAT and OECD are now recommending performing all comparative analyses on PPP or PPS bases respectively. The purchasing power parity (or standard) should ensure the comparability of any indicator with respect to individual (national or regional) price levels. Unfortunately now it seems that not even this method yields good results at regional levels as it eventually suppresses regional price levels.

This is quite serious especially in relation to EU Cohesion policy which is based on PPS indicators, mainly the GDP per capita in PPS. Cohesion policy generally supports EU NUTS2 regions in need when the objective 1 - *Convergence* covers 81,5% of all EU cohesion funding. However this most important and financially extensive objective helps only those regions which have the GDP/capita below 75% of EU average. The crucial problem is that regional GDP in PPS estimated and published by Eurostat today does not reflect real regional price levels but is based on some joint national price level[3]. Therefore it is quite possible that EU is systematically supporting regions which are in fact not lagging behind but have relatively lower price levels. Generally using current PPS at regional level can lead to distorted results, policy misspecifications and allocation inefficiency of cohesion funds.

We also believe that reaching proper price levels and accurate PPS indicators could solve many puzzles that are hunting researchers and politicians around Europe. For example there is an ongoing debate concerning the convergence puzzle – EU countries are converging but we face within the countries regional non-convergence or divergence[4]. This could be a typical puzzle caused by inappropriate price measures in regions. For the cohesion policy mentioned above setting proper price levels would ensure that cohesion policy is really helping those regions that are in need and not the regions that are “in need” just because of applied methodology and relatively lower price levels.

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1 PPS is an artificial unit derived from PPP and exchange rate. In practice indicators in PPS are computed as dividing the nominal value in domestic currency by PPP (see European Comparison Programme 2007).

2 It is true that according to the PPP theory the exchange rate should reflect the price levels rates. Nevertheless is is not true as not all goods and services are “trade-able” among the countries.

3 For PPP purposes, most countries in the EU only collect prices in capital cities for cost reasons. In order to arrive at a PPP 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 CPI data.

4 The European Commission report on Cohesion fund (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 or Magrini, 2004).

PPS at EU regional level – methodology and problems

Today there is no complex database with regional price levels of EU member states regions (at NUTS 2 or NUTS 3 level). Usually national statistical offices focus mainly on national price level development using standard methodology and tools (CPI, PPI, GDP deflator) leaving regional price levels behind. However, as in the Czech Republic, this does not mean that there is no data about regional prices at all. National statistical offices often have some regional data but either the data is incomplete (some vital statistics like regional housing prices are missing) or the overall regional price level is not calculated. For international regional comparisons Eurostat offers widely used regional GDP in PPS (as mentioned above); however the parity is derived not from the regional prices but from average national prices. The same methodology is used by Eurostat for all member states. The PPS methodology utilized by Eurostat is based on EKS (Éltetö-Köves-Szulc) method which requires data concerning the volumes of consumer goods and services in particular countries (regions) and concludes in identification of representative groups of goods and services. Calculation of PPP is based on final expenditure on GDP. Each component of expenditure approach is divided into "basic headings" that represent minimum level for which expenditure weights are available. Member countries should select products that are representative for each product heading (at least one product per a basic heading). Moreover countries are supposed to collect also prices of products that are representative for other countries to make a comparison. As mentioned in footnote 3, prices are usually collected in the capital city and adjusted by spatial factors to be representative for entire country.

Before we move to the case study of the Czech Republic a brief overview of EKS method should be introduced. The EKS PPS calculation faces two standard problems in fact[5].
The first one is difference in consumption baskets among the countries and regions. Eurostat methodology uses basic headings here which include various products among which we finally choose representatives with significant share on consumption in respective category (heading). After this identification of basic headings and their representatives we compare the purchasing power i.e. prices. In the first place the Laspeyres index is used

$$L_{B/A} = \left[\prod_{i=1}^{n} \frac{P_{Bi}}{P_{Ai}}\right]^{\frac{1}{i}} \quad , \qquad (1.1)$$

where *P* is price of product *i* of a given base heading. The base country (region) is A which means that if there are more representatives (which is possible) we use the geometric mean of the price indices. However it could happen that the representatives in A and B do not match therefore $L_{A/B} = 1/(L_{B/A})$ does not have to hold. As the second step we use the Paasche index

$$P_{B/A} = \left[\prod_{i=1}^{n} \frac{P_{Ai}}{P_{Bi}}\right]^{\frac{1}{i}} = \frac{1}{L_{A/B}} \quad , \qquad (1.2)$$

when the base country (region) is B. Taking matrices of Paasche and Laspeyres indices we compute the matrix of Fisher indices where those indices are geometric means of Paasche and Laspeyres. Following (1.1) and (1.2) we get

[5] See the Manual for details.

$$F_{B/A} = \sqrt[2]{(L_{B/A})(P_{B/A})} = \sqrt[2]{\frac{(L_{B/A})}{(L_{A/B})}} \qquad (1.3)$$

Although we get reversibility condition, which is necessary for PPS construction, we still lack transitivity of indices. With Fisher indices we have $F_{B/A} = \frac{1}{(F_{A/B})}$. But when including another country (region) there still holds the transitivity problem when $\frac{(F_{B/A})}{(F_{C/A})} \neq F_{B/C}$.
Because the representatives do not have to match for all countries (regions) and their respective consumption baskets, i.e. Paasche or Laspeyres index does not exist. It is necessary to complete the Fisher matrix by adding geometric means of other available indices. Having a complete matrix the next step is to gain transitivity discussed above. To get indices that are transitive we must compute geometric means of Fisher indices for a given combination of countries (regions). Generally

$$EKS_{B/A} = \left[\prod_{i=A}^{n} \frac{F_{B/i}}{F_{A/i}}\right]^{\frac{1}{\sum n}} \qquad (1.4)$$

For example having four countries (regions) – A, B, C, D – we get[6]

$$EKS_{B/A} = \left[\left(\frac{F_{B/A}}{F_{A/A}}\right)\left(\frac{F_{B/B}}{F_{A/B}}\right)\left(\frac{F_{B/C}}{F_{A/C}}\right)\left(\frac{F_{B/D}}{F_{A/D}}\right)\right]^{\frac{1}{4}}$$

The final step is to make the standardization of EKS indices, i.e. provide a joint basis when a price of one basic heading of one region is related to all other regions. Generally

$$EKS_A = \frac{EKS_{A/A}}{[\prod_{i=A}^{n} EKS_{i/A}]^{\frac{1}{\sum i}}} = \frac{EKS_{A/B}}{[\prod_{i=A}^{n} EKS_{i/B}]^{\frac{1}{\sum i}}} = \cdots = \frac{EKS_{A/n}}{[\prod_{i=A}^{n} EKS_{i/n}]^{\frac{1}{\sum i}}} \qquad (1.5)$$

Again taking example of four countries (regions) A, B, C, D we get

$$EKS_A = \frac{EKS_{A/A}}{\left[(EKS_{A/A})(EKS_{B/A})(EKS_{C/A})(EKS_{D/A})\right]^{\frac{1}{4}}} = \frac{EKS_{A/B}}{\left[(EKS_{A/B})(EKS_{B/B})(EKS_{C/B})(EKS_{D/B})\right]^{\frac{1}{4}}}$$

The second problem is the aggregation of all price indices in all representative categories. After getting the matrix of standardized EKS PPP (PPS) we must take the weights of basic headings into our consideration. This is necessary especially for cases when the weights substantially differ among the countries (regions). Using the weights we come to overall aggregated EKS PPP. The method is similar to computation of EKS PPP for one basic heading explained above. First we compute the weighted Laspeyres index as

[6] With respect to reversibility we can adjust the equation as $EKS_{B/A} = \left[(F_{B/A})^2 \left(\frac{F_{B/C}}{F_{A/C}}\right)\left(\frac{F_{B/D}}{F_{A/D}}\right)\right]^{\frac{1}{4}}$

$$\widetilde{L_{B/A}} = \frac{\sum_{k=1}^{z}\left(\frac{EKS_{Bk}}{EKS_{Ai}}\right)(EX_{Ak})}{\sum_{k=1}^{z} EX_{Ak}} \qquad (1.6)$$

when *k* stands for basic heading and *EX* is respective expenditure for basic heading. It is possible to express (1.6) as

$$\widetilde{L_{B/A}} = \sum_{k=1}^{z}\left(\frac{EKS_{Bk}}{EKS_{Ak}}\right) w_{Ak} \qquad (1.7)$$

when w_k is the weight of basic heading in the consumption basket (ratio of expenditure for this heading on total consumption expenditure) . We continue with Paasche index again

$$\widetilde{P_{B/A}} = \frac{\sum_{k=1}^{z}\left(\frac{EKS_{Bi}}{EKS_{Ai}}\right)(EX_{Bi})}{\sum_{k=1}^{z} EX_{Bi}} = \frac{1}{\widetilde{L_{A/B}}} \qquad (1.8)$$

Consequently we compute weighted Fisher index to get reversibility – similarly to (1.3). We continue with weighted Fisher indices to get transitive EKS indices as in (1.4). Finally we get standardized PPS index which shows the ratio of price levels among the base country (region) and other countries (regions) – computed for all goods and services in consumption basket.

Despite the reliability of this method which could easily be used at a national level it is often not possible to use it for price level calculation at regional levels - usually because of lack of data. It is necessary to modify the EKS method for regional price level computation purposes according to data availability in particular member states (there is a problem of regional consumption basket data gathering and scope of regional prices observed). Despite the necessity and urgency of accurate regional price statistics mentioned above, no deeper research has been undertaken in this field yet, as far as we know, either on national or international grounds. Eurostat was considering computation of regional price levels and re-computation of regional GDP in PPS several years ago but they abandoned this cause.

Recalculating regional GDP in PPS – case study of the Czech Republic

The Czech Republic is really not a country with high regional differences, with exception of Prague region. Nevertheless even in relatively homogenous country as the Czech Republic we conduct national regional policy and all regions except Prague are involved in the first Cohesion objective. Therefore even here it is valuable to analyze if there is substantial difference in indicators (mainly GDP) set in standard PPS according to Eurostat and calculated in respect to real regional prices. We analyzed the situation of NUTS 3 regions but the analysis could be extended to NUTS 2 quite easily.

Our methodology is based on the EKS methodology described above. There are several modifications however, which were necessary mainly from the data availability point of view. From the basic heading point of view we assumed that there are the same representatives for all 14 Czech NUTS 3 regions. This allows a simplification of the first level problem explained above. As we do not need any transformations to gain reversibility and transitivity it is possible to use the Laspeyres or Paasche index for a basic heading *j* and *i* regions when

$$EKS_A = \frac{1}{\prod_{i=A}^{n}(L_{i/A})} = \left[\prod_{i=A}^{n}\frac{(P_A)}{(P_i)}\right]^{\frac{1}{\sum i}} \qquad (2.1)$$

The second simplification lies in assumption of identical consumption baskets among the regions. Again this assumption is taken because of lack of regional expenditure data. This assumption might lead to some imperfections in our estimates, especially for highly different regions like Prague[7]. The aggregation is then made simply with average national weights as

$$PPS_A = \frac{\sum_{j=1}^{n}\left(\left[\prod_{i=A}^{n}\frac{(P_A)}{(P_i)}\right]^{\frac{1}{\sum i}}\right)w_j}{\sum_{j=1}^{n} w_j} \qquad (2.2)$$

where w_j stands for the share of *j* basic heading on total (national average) consumption expenditure.

Taking the data from the Czech statistical office with additional data about real estate's from Institute of Regional Information we estimated the EKS PPS for NUTS 3 regions in the Czech Republic for years 2007-2009. Only results from 2007 are presented here. We focus on GDP per capita which is one of the most observed and utilized indicators. Table 1 exhibits the results.

[7] We should assume substantially higher expenditure for housing in Prague for example.

Table 1: PPS Estimates

Region	NUTS	PPS	GDP/capita EUR	% of country average	GDP/capita EUR (PPS)	% of country average (PPS)
Hlavní město Praha	1100	113.00	26 400	214.63%	23363	189.94%
Středočeský kraj	2100	102.90	11 500	93.50%	11176	90.86%
Jihočeský kraj	3100	98.60	10 700	86.99%	10852	88.23%
Plzeňský kraj	3200	99.20	11 400	92.68%	11492	93.43%
Karlovarský kraj	4100	99.40	9 100	73.98%	9155	74.43%
Ústecký kraj	4200	93.10	9 900	80.49%	10634	86.45%
Liberecký kraj	5100	101.90	9 500	77.24%	9323	75.80%
Královéhradecký kraj	5200	96.80	10 500	85.37%	10847	88.19%
Pardubický kraj	5300	97.80	10 300	83.74%	10532	85.62%
Vysočina	6100 (6300)	97.20	10 400	84.55%	10700	86.99%
Jihomoravský kraj	6200 (6400)	104.20	11 300	91.87%	10845	88.17%
Olomoucký kraj	7100	97.40	9 100	73.98%	9343	75.96%
Zlínský kraj	7200	101.70	10 000	81.30%	9833	79.94%
Moravskoslezský kraj	8100	98.20	10 300	83.74%	10489	85.27%
Czech Rep		100.00	12 300	100.00%	12300	100.00%

It is quite clear that there are differences in GDP when using regionally specific price levels. The most substantial change occurred in Prague as expected (almost 25 p.p. drop down showing overvaluation of Prague) but there are other interesting results as well. For instance Ústecký kraj jumped up by 6 p.p. while this region is normally considered as one of the poorer regions and therefore supported by national regional policy. Although the differences in other regions might not be that big; we have to take into account relative homogeneity of Czech regions – Czech Republic is a relatively small country with historically very high regional homogeneity. If we apply regional PPS on countries like Spain, France of Italy it is very likely that we get quite high differences in comparison to currently used indicators. Concerning the convergence problem mentioned above we can calculate the variation coefficient for both cases – with and without regional price levels. The result is 0,37 for the sample without regional PPS and 0,3 when adding the PPS. We can see that taking regional price levels into consideration yields lower interregional differences. We may suppose that adding the regional PPS could be one of the crucial moments for convergence puzzle explanation.

Conclusion, implications and further research

There is no doubt about using PPS for international and interregional comparisons and analyses. Although the current Eurostat methodology (EKS) is suitable for both levels there are no true regional price levels present in the calculation of regional PPS indicators. The joint national price level is used instead. This is resulting in imperfections and may even lead to misleading results and inefficient regional policies. Also the Cohesion policy and its correct focus is at stake as some regions might be artificially underdeveloped (and supported) only because the incorrect price level. As we have shown in the case of the Czech Republic the differences might be substantial especially for agglomerations. Although the overall deviation does not seem to be high in the Czech Republic, we must take historically very high homogeneity of Czech regions. We believe that applying regional prices, i.e. computing regional PPS could bring quite different results from the current state mainly in countries like Spain, Italy, France and others where higher regional differences might be expected. Computing regional price levels could help the countries and EU to conduct more efficient policies. It could also help to solve some analytical puzzles and improve the regional analysis as a whole. Further research in this area is quite straightforward – it is necessary to calculate regional price levels in other countries to prove the basic hypothesis of substantial difference between current PPS and PPS calculated with regional prices. If this hypothesis is proved all regional PPS should be revised even under more than minor simplifications.

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