DOI: 10.18267/j.pep.438

ARTICLES

A COMPARISON OF THE RATES OF GROWTH OF POST-TRANSFORMATION ECONOMIES: WHAT CAN(NOT) BE EXPECTED FROM GDP?

Miroslav Singer*

Abstract:

This paper suggests that real GDP is not an appropriate indicator for long-term comparisons of the performance of transformation and post-transformation economies either with developed economies, or one with another, or across different phases of development of a single economy. We analyse the possible reasons why real GDP diverges from the theoretical concept of the objective level of value added adjusted for inflation. These reasons concern real exchange rate appreciation and overestimation of inflation due to quality changes in output after the collapse of central planning. To overcome the shortcomings of real GDP in explaining the true "transformation story" we develop the concept of "comparable" real GDP. This concept is calculated from nominal GDP, the exchange rate against the euro, and inflation in the euro area. While the differences between "standard" real GDP and "comparable" real GDP are modest and temporary in advanced economies, they are quantitatively and qualitatively significant and persistent in transformation and post-transformation economies. On the basis of the relevant literature we introduce two modifications of "comparable" real GDP. They account for likely differences in productivity patterns between tradables and non-tradables and between the performance of the export and non-export segments of the economy respectively. We conclude that true convergence is proceeding at a significantly higher pace than real GDP implies and that the Czech economy is converging to the euro area somewhat faster than the Polish economy and much faster than the Hungarian economy.

Keywords: real GDP, economic growth, real convergence, GDP- and inflation mis-measurements, transition economies

JEL Classification: N10, O11, O47, O52, O57, P52

* Czech National Bank, Na Příkopě 28, CZ – 115 03 Praha 1 (miroslav.singer@cnb.cz). The author wishes to thank (in alphabetical order) Vít Bárta, Vlado Benáček, Jan Hanousek, Karel Kříž, Lubomír Lízal, Petr Mach, Kateřina Šmídková, Jan Švejnar and two anonymous PEP referees for their valuable comments on earlier versions of this paper and for suggestions, assistance and guidance as well. The author appreciates the data support provided by Jan Kučera and Robert Murárik. The author is responsible for all errors and omissions. The views expressed are those of the author and do not necessarily reflect the official views of the Czech National Bank.

DOI: 10.18267/j.pep.438

1. Introduction

Despite its various shortcomings (and different attempts to overcome them), real GDP remains at the centre of most empirical work dealing with growth and comparing the success of various economic strategies and policies.[1] The reason is that the concept of GDP consists in measuring the "value added" created by the economy. Real GDP growth then adjusts the growth in this value added for inflation. This is consistent not only with theoretical concepts, but also with how the educated public intuitively understands economic performance.

This paper shows that real GDP is not an appropriate indicator for longer-term comparisons of the performance of transformation and post-transformation economies[2] either with developed economies, or one with another, or across different longer-term phases of development of a single economy. While real GDP is basically consistent with the above concept for developed economies such as the USA, Japan or Switzerland, the same cannot be said for former transition economies. We analyse the possible causes of this situation and compare the "transformation story" that is derived from uncritical comparison of the real GDP data for 1993–2011 with the analogous "transformation story" that can be derived from data consistent with the above concept of real GDP. We use this comparison to show that the generally accepted "transformation story" leads to underestimation of the general rate of convergence of Central European transition economies towards their developed neighbours, and to incorrect conclusions on the relative positions of the Czech Republic, Hungary and Poland (the "Central European three") during such convergence.

In Section 2 we provide a review of the literature that examines the possible reasons for the underestimation of economic growth based on the GDP concept, paying particular regard to the Czech economy. This creates a methodological framework for defining alternative indicators that we consider more appropriate for assessing the long-run growth of transition economies. In Section 3 we introduce the term "comparable" real GDP and demonstrate its advantages over "standard" real GDP for describing economic transformation. We compute "comparable" real GDP for three advanced countries and six transition economies and compare its performance with "standard" real GDP. In Section 4 we explain why the use of "standard" real GDP is unsuitable for illustrating the economic convergence of transition economies towards the advanced economies. We analyse the main reasons for the divergence of "comparable" real GDP and "standard" real GDP in transition countries and illustrate the implications of the inappropriate use of "standard" real GDP to describe the speed of economic transformation and the pace of

1 There is an extensive literature on the search for alternative indicators to capture the wider socio-economic aspects of the life and long-term development of a society better than GDP does, for example with regard to sustainability or quality of life. This paper does not belong to this stream of literature, as it deals with how to refine GDP in order to better assess the economic growth of transition economies.

2 The economies which, following the collapse of the Communist system, were transforming, or have transformed, into market economies.

DOI: 10.18267/j.pep.438

real convergence of transformation economies towards advanced countries. In Section 5 we introduce two refinements of the concept of "comparable" real GDP derived from the suggestions in the existing literature, mention the data constraints of modified GDP indicators, and perform a quantitative comparison of all the methods used. We conclude by summarising the main points contained in the preceding text.

2. A Review of Relevant Literature

Doubts about whether real GDP (or the way some national statistical offices were calculating it) reliably illustrates the speed of convergence of transition economies towards advanced market economies started to appear in the literature based on the Czech experience ten years after the transition began. Filer and Hanousek (2000) questioned the correctness of the calculation of inflation by the Czech Statistical Office (CZSO) and identified four factors that might have biased the calculation of the true inflation level upwards and hence the true rate of economic growth downwards. They termed these factors "consumer substitution bias", "outlet substitution bias", "quality improvement bias" and "new goods bias". By their estimation inflation should have been only 5.3%, not 8.8%, in 1996 and only 5.5%, not 8.5%, in 1995. In their view, the rate of economic growth in 1996 should thus have been 8.3% rather than the 4.8% calculated by the CZSO, and in 1997 the economy should have recorded growth of 1.8% instead of a decline of 1%.[3] The approach of Filer and Hanousek, and in particular their estimate of the inflation bias for the Czech economy, was disputed by Brada, King and Kutan (2000a, 2000b). These authors constructed a price model that enabled them to identify systemic and random productivity shocks to producer and consumer price indices in the Czech Republic. They deduced from the magnitude of the productivity shocks that price index biases may have been relatively modest in the first ten years of the transition and were considerably smaller than argued by Filer and Hanousek. According to them, the CZSO appeared to have overcome some daunting methodological problems and provided relatively accurate measures of the CPI and PPI. Therefore, the historical record of macroeconomic performance in the Czech Republic was generally correct and official measures of real macroeconomic aggregates and of the rate of inflation had adequately represented the true economic situation.

Hanousek and Filer (2002) studied possible biases in price indexes in the Czech economy during 1991–1999 and found that the fixed-weight Laspeyres index on average overstated cost of living increases by approximately 5% a year, with a superlative index in the Czech Republic, thus corresponding to patterns found in more stable economies. Their finding suggested that, at least in part, substitution effects were offset by effects due to supply-side phenomena. Hanousek and Filer (2004a) focused on inflation bias due to quality improvements in the Czech economy. When examining 63 products from

3 Filer and Hanousek questioned the conventional wisdom of the transition decline said to have occurred in all economies at the start of their transition, and argued that even a relatively conservative estimate of the inflation bias (which was not correctly taken into account) would turn the decline into economic growth.

DOI: 10.18267/j.pep.438

a variety of sectors and assessing consumers' preferences they found that the CZSO had captured only a fraction of the quality change. They concluded that average quality-adjusted consumption growth rates in the Czech Republic during the 1990s may have been considerably greater than suggested by the official figures. When revisiting the sources of inflation bias in the Czech economy over a longer period, Filer and Hanousek (2004b) found that the true bias may have been even greater than was suggested in their earlier work. According to them, the official CPI increases may have overstated the true cost of living increases during the first decade of transition by at least a third, and by well over 40% once the initial years of price decontrol are excluded from the analysis. They concluded that real growth rates in the transition Czech Republic (and by analogy other transition countries) were much greater than commonly believed. More specifically, instead of a compound decline of 0.7% a year during 1990 and 1999 (as reported by the CZSO), the adoption of the authors' lower-bound estimate of a 36% bias in inflation would imply average economic growth of 3.6% a year during the same period.

Lommatzsch (2004) also noted that the Czech economy had been lagging behind the other New EU Member States in terms of real GDP. She argued that the CZSO had not sufficiently incorporated the increase in production quality into inflation and that this had led to systematic underestimation of the true real GDP growth. She drew particular attention to the hard-to-explain difference in the contribution of net exports to GDP growth at current prices (around zero) compared to the contribution at constant prices (significantly negative). According to her, real GDP growth in the Czech Republic had been underestimated by 1–1.5 percentage points in previous years. Benáček (2004) also argued that the CZSO had not sufficiently accounted for the increase in quality in export production and had incorrectly interpreted the rapid growth in Czech exports. He saw rising product quality as the main cause of the fast growth in exports to the EU and emphasised that Czech exports should not have significantly different inflation expressed in euros than products in the EU. On the basis of conversion of Czech exports into euros and retrospective deflation he concluded that the average rate of growth of the Czech Republic for 1999–2003 had been 4.9% and not 1.8% as implied by the CZSO figures. Kubíček and Tomšík (2004b) accepted the basic logic of converting Czech exports into euros, but regarded it as problematic to use the GDP deflator, which Benáček had used to deflate the entire GDP, for the "non-export" component. According to them, one possibility was to express the entire nominal GDP in euros and to deflate the values obtained in that way by inflation in the euro area. However, they themselves argued that this approach strongly overestimates growth,[4] since it assumes that all goods produced in the economy are exposed to foreign competition, which according to them is not a realistic assumption. To reflect the fact that quality growth in the nontradables sector was not comparable with that in the tradables sector, they refined the calculation method so that instead of converting the entire GDP into euros they only converted the production of the tradables sector (agriculture and industry) and deflated the latter by German tradable production inflation. They then added the result

4 On the basis of this method, Kubíček and Tomšík calculated the rate of growth of the Czech economy at 6% in 1997–2003 and at 7.2% in 1994–2003.

DOI: 10.18267/j.pep.438

to the "nontradable" remainder of real GDP. After converting the output of tradable sectors into real euros, they calculated the average real GDP growth of the Czech Republic in 1994–2003 at 3.6%, whereas according to the CZSO real GDP growth had been 2.2%, *i.e*. 1.2 percentage points lower, in the same period. In their view, a disadvantage of this approach was its high sensitivity to exchange rate movements, so they recommended using it over longer time scales, when such movements are subdued.

Lommatzsch (2004) and Kubíček and Tomšík (2004a) also noted that growth in the terms of trade in the Czech economy was another possible reason why real GDP growth might lead to systematic underestimation of actual economic growth or wealth. The terms of trade were examined in more detail by Vintrová (2005) and Spěváček (2005) at a time when the terms of trade in the Czech economy were growing much faster than in Hungary and particularly in Poland and Slovakia. The aim of both authors was not to reveal flaws in the statistical office's GDP calculations, but to draw attention to the limited information value of GDP, which by definition cannot describe a country's trade success or illustrate the redistribution processes between the domestic economy and the rest of the world, which are essential if one wants to assess wealth. Both authors derived an indicator of real gross domestic income from GDP and terms of trade data (by calculating the gains/losses from changes in the terms of trade). They concluded that real gross domestic income in the Czech Republic had grown 0.9 percentage point faster than GDP on average in 1996–2004, and 1.2 percentage points faster in 2001–2004. In some years, changes in the terms of trade had had a greater effect on real income than GDP growth at constant prices.[5] These figures also changed the picture of the Czech economy's international standing for the better. Since in other Central European economies the effect of the terms of trade on real income had been negative, GDP growth had been higher than real domestic income growth in their case, hence the opposite situation than in the Czech economic had occurred.[6]

This literature review points the way for our subsequent exposition. We should point out that in the following text we work with some of the methods indicated by the above authors rather than with the theory of purchasing power parity. The latter is not free of serious conceptual problems in the long run, which is what we are primarily interested in.

5 In 1998, for example, GDP in the Czech Republic had declined by 1.1%, but this decline had been more than offset by a gain in the terms of trade equal to 3.5% of GDP (see Vintrová, 2005).

6 Alternative economic growth indicators were intensively researched in the past decade for example in Switzerland, which for years recorded systematically lower GDP growth rates than most other advanced economies despite showing no evidence of lagging behind in terms of wealth (see for example Kohli, 2003b or Sfreddo, 2004). Research into real gross domestic income in the Czech economy was justified by the fact that the effect of the terms of trade on economic growth in the Czech Republic in the mid-2000s was greater than in Switzerland. Similar impacts of the terms of trade were also investigated in New Zealand (Kohli, 2003a) and Hong Kong (Kohli, 2006)

DOI: 10.18267/j.pep.438

3. The Concept of GDP and the Requirements It Should Satisfy

The concept of real GDP measures "value added", *i.e.* wages and profits, or surplus product in a form adjusted for inflation. Its values, or rather its expected values, should therefore express *inter alia* the relative attractiveness of one economy or another to investors and the financial markets. One of the basic requirements for the GDP concept to be usable for comparison is that real GDP should not be dependent on the method of adjustment of nominal GDP (GDP at current prices) for inflation.

However, the exchange rate can also be used to partially adjust GDP for inflation. For an exchange rate in an efficient market it should hold true that the rate inherently reflects *inter alia* the inflation and inflation expectations in a particular economy. The output of the investigated economy can therefore be compared with that of the other economy using the exchange rate. But for any economy whose exchange rate is determined by an efficient market, it should then hold true, *ceteris paribus*,[7] that:

real GDP growth of investigated economy = GDP growth at current prices and at current market exchange rate of economy used for comparison – inflation in economy used for comparison

The right-hand side of this expression expresses the growth in the portion of the real output of the compared economy which can be bought at the exchange rate determined in free currency markets in return for the growth in the output of the investigated economy at current prices. This expression expresses the requirement that the growth in real GDP in one economy should match the growth in that part of the real output of the compared (base) economy which can be bought in return for the output of the investigated economy at the exchange rate determined on free markets. Were this not the case, it would hold that the real GDPs of the investigated and base economies capture a different "real" reality. If, for example, the right-hand side of the equation was larger than the left in the long term, it would mean that:

- either the currency markets regard the growth in the real output of the investigated economy as "higher quality" than the growth in the output of the compared economy and are willing to value it at a higher exchange rate,
- or the left-hand side of the equation underestimates the reality.

Such an imbalance, however, would deny the intuitively expected comparability of the real output growth rates of different countries in the same periods. Should the growth in the real GDP of one economy be quantitatively different (perhaps because the market assesses its quality differently) from the growth in the real GDP of the other economy, or should the statistical series underestimate or overestimate them for particular economies, there is no point in comparing them.

7 excluding changes in all other variables

DOI: 10.18267/j.pep.438

The above relationship also states that the exchange rate against the currency of the other economy should, in an efficient market, reflect the expected accumulated inflation differential of the two economies, so that to adjust the GDP growth at current prices expressed in the exchange rate of the foreign currency determined in an efficient market it is sufficient to adjust it for inflation in the base economy. On the right-hand side of the equation, then, GDP at current prices is adjusted for inflation in two steps: 1) the exchange rate adjusts GDP at current prices for the inflation differential between the given and base economies, and (2) the "remainder" of the inflation now consists solely of the base economy's inflation and the result of step (1) is now adjusted for that directly. We shall hereinafter refer to the indicator on the left-hand side of the equation as "standard" real GDP and the indicator expressed using the exchange rate and inflation in the euro area[8] as "comparable"[9] real GDP.

The above relationship expressing real GDP by means of a calculation in the two aforementioned steps (based on the exchange rate against the currency of the other economy and the inflation of that economy) only applies in approximate stochastic terms. In the short run, the swings typical of an exchange rate are due, for example, to investor sentiment, changes in trade and investment flows and suchlike. However, most fluctuations on the financial markets are determined in the long run by movements in asset prices and hence also GDP, and the exchange rate should thus reflect different movements in inflation.[10] If that is not the case, the real GDP concept loses the meaning that even the educated layman intuitively attaches to it. That this relationship holds empirically is also evidenced by Figures 1, 2 and 3, depicting the relationship between the accumulated growth of real GDP ("standard" real GDP) and that of nominal GDP at current prices expressed in euros and adjusted for inflation in the euro area ("comparable" real GDP) for the USA, Japan and Switzerland in 1993–2011.

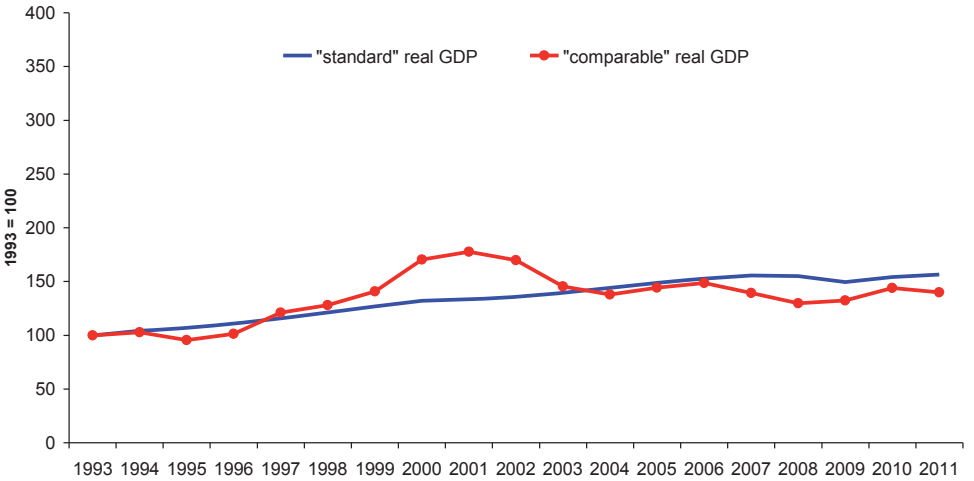
8 The euro area is the natural choice for comparison as the largest trading partner of the investigated economies; the exchange rate of the euro against the currencies of the compared countries is moreover determined in liquid and open markets.

9 The adjective "comparable" expresses comparability with the real GDP of the other economy.

10 As we will see below, exchange rate volatility can cause the two indicators to diverge over a period of several years. Exchange rate oscillation, however, is a qualitatively different process than trend appreciation/depreciation of the exchange rate, which can occur over several decades and is captured by the concept of "comparable" real GDP.

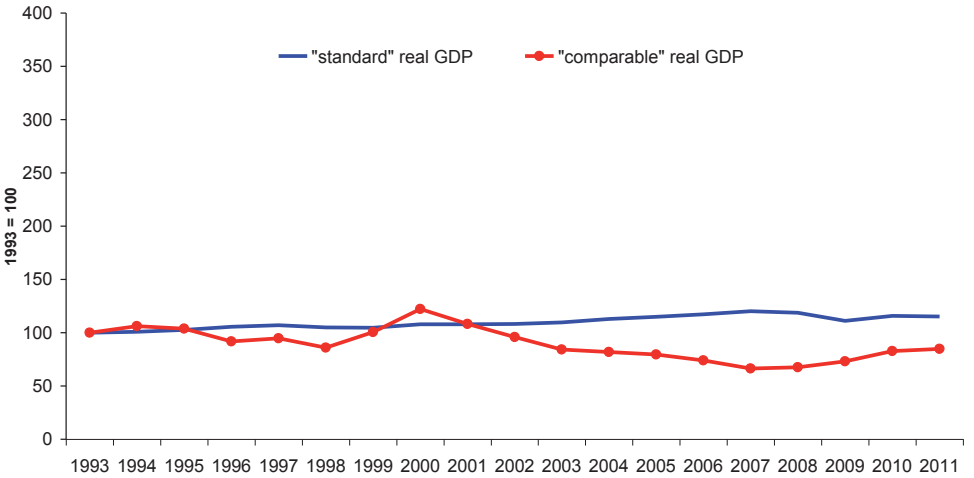
DOI: 10.18267/j.pep.438

Figure 1
The Two Real GDPs of the USA



Source: ECB, author's calculations

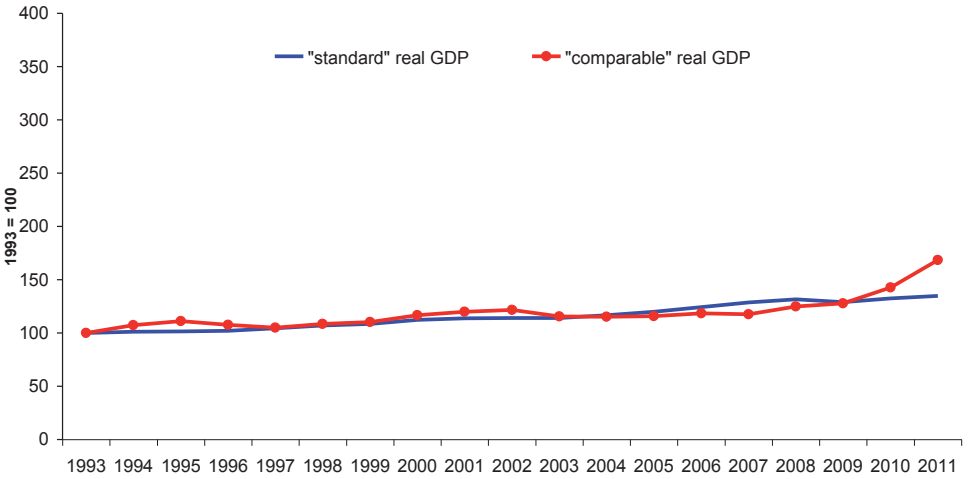
Figure 2
The Two Real GDPs of Japan



Source: ECB, author's calculations

DOI: 10.18267/j.pep.438

Figure 3
The Two Real GDPs of Switzerland



Source: ECB, author's calculations

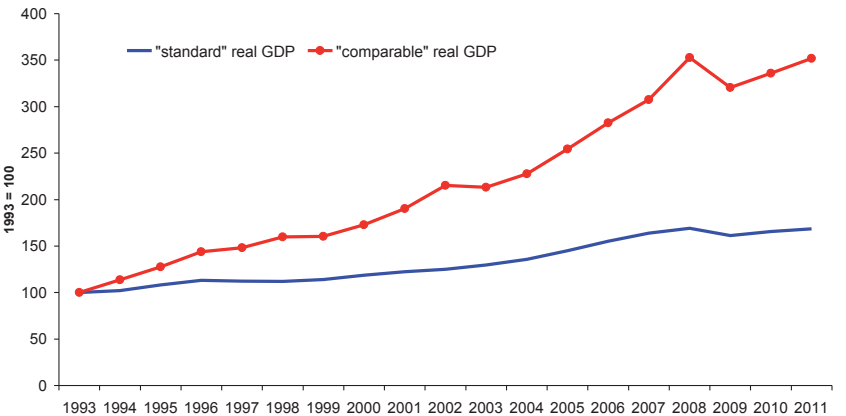
Figure 1 shows that except at the turn of the 2000s, when – probably as a result of the bubble of overconfidence in the strength of the US economy – the dollar fluctuated above its fundamentals (the difference between the two indicators peaking in 2001 at 44 percentage points), the relationship between the two real GDP indicators was quite close. However, this bubble burst following a correction in the currency markets, and the two curves crossed again between 2003 and 2004. Figure 2 depicts the relationship between "standard" real GDP and "comparable" real GDP for Japan, which is particularly relevant to transition economies. As recently as the 1980s Japan was still in many respects a very closed economy, whose institutions, moreover, differed fundamentally from the European or North American market economy model. Only in the 1990s did Japan start opening up its economy and introducing partial structural reforms. This process in some respects resembled the transformation in the countries of Central and Eastern Europe. In Figure 2, we can see that the two curves intersected several times in the 1990s. Negative financial market sentiment over the state of the Japanese economy is the likely cause of the larger deviation in the second half of the monitored period. Figure 3 shows the two GDP indicators for Switzerland. As all three charts have identical scales on the vertical and horizontal axes, so they are directly comparable, it is clear at first glance that the correlation between the two indicators is the closest for Switzerland. This is due *inter alia* to the fact that the Swiss franc in most of the period was nowhere near as volatile as the US dollar and that Switzerland was not exposed to the kind of protracted structural difficulties experienced by Japan. The only exception was 2011, when the Swiss franc was exposed to strong appreciation pressures as a result of the debt crisis and so "comparable" real GDP rose faster than "standard" real GDP to an extent not recorded since 1993.

DOI: 10.18267/j.pep.438

One can sum up, then, that in the case of the USA, Japan and Switzerland a fairly close relationship between "standard" real GDP and "comparable" real GDP applies in the longer run.

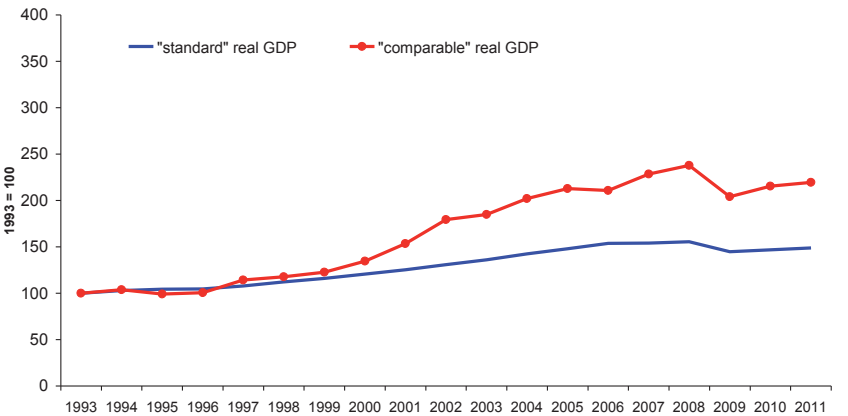
But as soon as we start to investigate the same relationship in the case of the Czech, Hungarian and Polish economies, we arrive at different conclusions. The charts in Figures 4, 5 and 6 depict the relationship between "standard" real GDP growth and "comparable" real GDP growth for the "Central European three" for 1993–2011.[11]

Figure 4
The Two Real GDPs of the Czech Republic



Source: ECB, author's calculations

Figure 5
The Two Real GDPs of Hungary

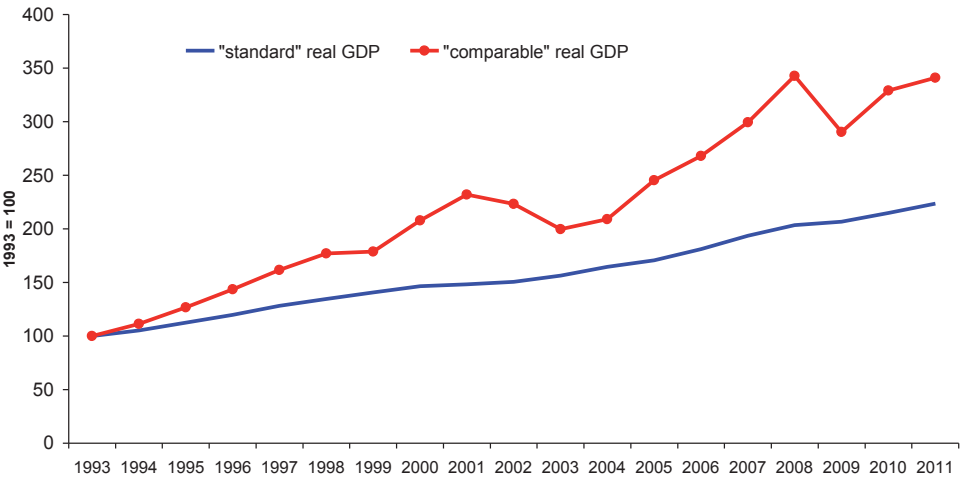


Source: ECB, author's calculations

11 Reliable GDP data for this period are available for all these countries, and their exchange rates are formed on sufficiently free markets.

DOI: 10.18267/j.pep.438

Figure 6
The Two Real GDPs of Poland



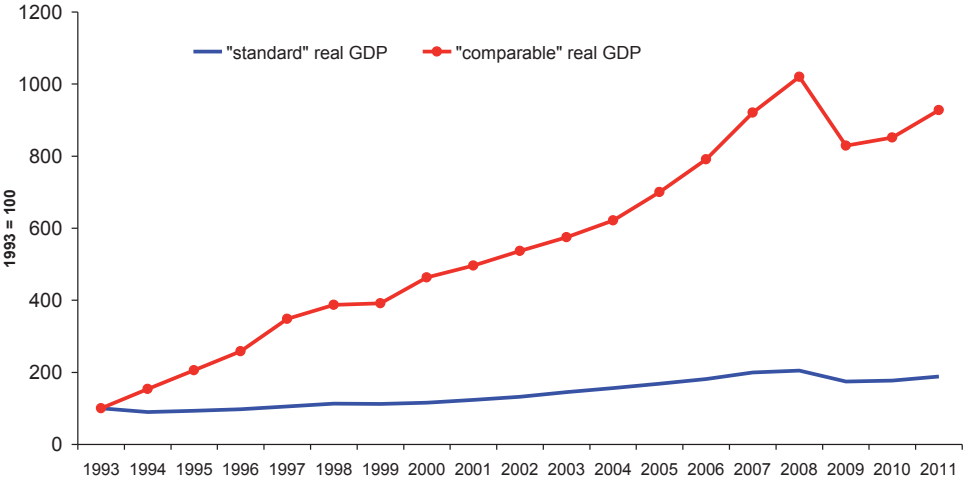
Source: EC*B*, author's calculations

These charts have the same axis scales as those for the USA, Japan and Switzerland. The clearest divergence between the two types of real GDP data can be seen in Figure 4, which depicts the figures for the Czech economy. The gap between "standard" real GDP and "comparable" real GDP widens distinctly throughout the period, except in 1999, 2003 and 2009, reaching 183 percentage points in 2011. In the case of Hungary (Figure 5) one can speak of a linkage between the two GDP indicators during 1993–1999. But then the "comparable" real GDP curve breaks away from the "standard" real GDP curve, the difference between them reaching more than 70 percentage points in 2011. In the case of Poland (Figure 6), the difference between the two figures peaked at more than 139 percentage points in 2008. The two curves converged in 2009 (as in numerous other countries), but the difference was more than 117 percentage points in 2011, *i.e.* roughly two and a half times greater than the largest difference observed in the case of the USA. It is therefore plain to see that the relationship between "standard" real GDP and "comparable" real GDP (calculated from GDP at current prices, the exchange rate against the euro and inflation in the euro area) applies to none of these transformation and post-transformation economies in the longer run.

An even more pronounced difference between "standard" real GDP and "comparable" real GDP is visible for the three Baltic countries. Figures 7, 8 and 9 depict the evolution of the two indicators in Lithuania, Latvia and Estonia for 1993–2011.

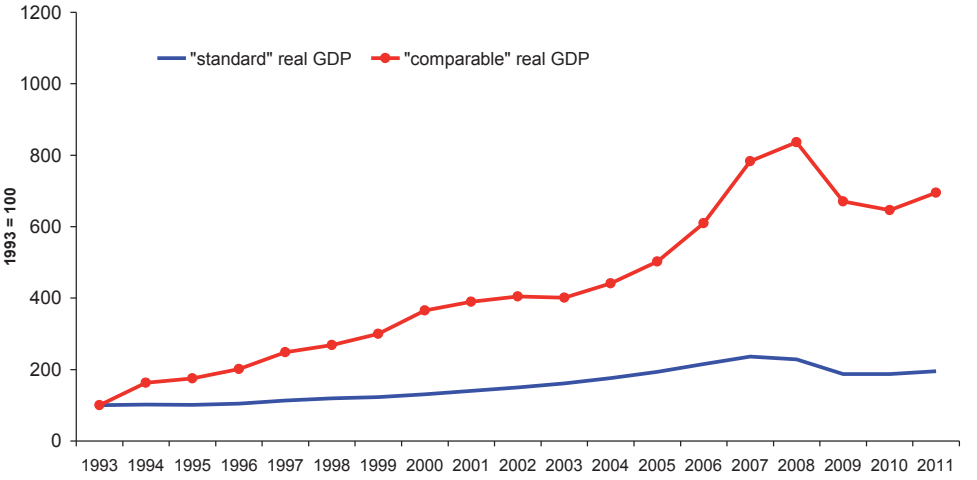
DOI: 10.18267/j.pep.438

Figure 7
The Two Real GDPs of Lithuania



Source: ECB, author's calculations

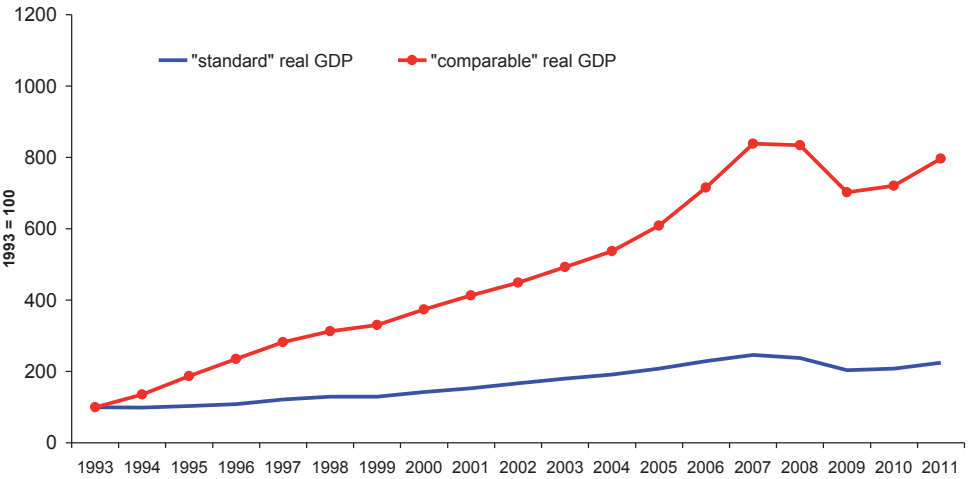
Figure 8
The Two Real GDPs of Latvia



Source: ECB, author's calculations

DOI: 10.18267/j.pep.438

Figure 9
The Two Real GDPs of Estonia



Source: ECB, author's calculations

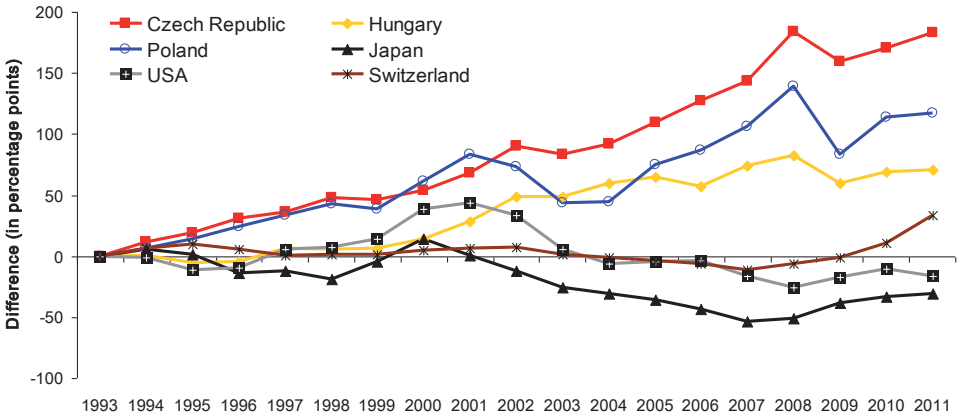
It should be emphasised that in the figures for the three Baltic States the scale on the vertical axis is three times larger than in the previous six figures, so the two groups of charts are not mechanically comparable. The biggest difference between "comparable" real GDP and "standard" real GDP was recorded in 2011 by Lithuania (739 p.p.), followed a relatively long way behind by Estonia (572 p.p.) and Latvia (500 p.p.). The comparison with the "Central European three" indicates that the transformation changes were incomparably deeper in the Baltic countries and that their catching-up with the advanced economies was much more robust. If it holds true that the GDP growth distortions provided using "standard" real GDP are significant in the case of the Central European three, the same is even more true for the Baltic countries.[12]

Let us sum up. In the case of the developed US, Japanese and Swiss economies a parallel trend can be seen in the longer run between "standard" real GDP growth and "comparable" real GDP growth (calculated using GDP at current prices, the exchange rate of the domestic currency against the euro and inflation in the euro area). But in the case of the selected Central European economies such a relationship does not apply and the two indicators diverge in the long run. This is shown in Figure 10, which summarises the differences between the two GDP indicators for three advanced economies and the "Central European three" discussed above.

12 Although the numerical growth rates of "comparable" real GDP for the Baltic economies may not be intuitively in line with those implied by mainstream growth theory, they capture pretty consistently the fact that the Baltic economies form a special group of countries that differ substantially from the Central European countries or other catching-up post-transition economies.

DOI: 10.18267/j.pep.438

Figure 10
Differences between the Two Real GDPs for Six Selected Countries



Source: ECB, author's calculations

In the case of the "Central European three", the growth in "comparable" real GDP visibly exceeds the growth in "standard" real GDP. In the case of the Czech Republic it does so by 4.4 percentage points a year on average and in the cases of Poland and Hungary it does so by 2.9 percentage points and 2.4 percentage points respectively. A much greater difference between the two indicators is evident in the three Baltic economies: 10.4 percentage points on average in Lithuania, 8.5 percentage points in Latvia and 8.1 percentage points in Estonia (for more details on 29 countries see Table 1 in the Appendix).[13] Such divergence is manifestly at odds with what the indicator of "standard" real GDP is supposed to express at least in the longer run.

4. Why Do "Standard" Real GDP and "Comparable" Real GDP Differ in Transformation Economies and What Does This Imply?

As we showed in the previous section, the difference between the two indicators of real GDP in transformation economies is numerically too high and persistent over time to be ignored. In this section, we analyse the possible causes of this difference.

As the relationship between these indicators of real GDP holds for developed economies in the longer run, we can abstract from inflation in the euro area. When focusing on the indicators relating to transformation and post-transformation economies only, we are left with just three indicators: (1) the exchange rate of the domestic currency against the

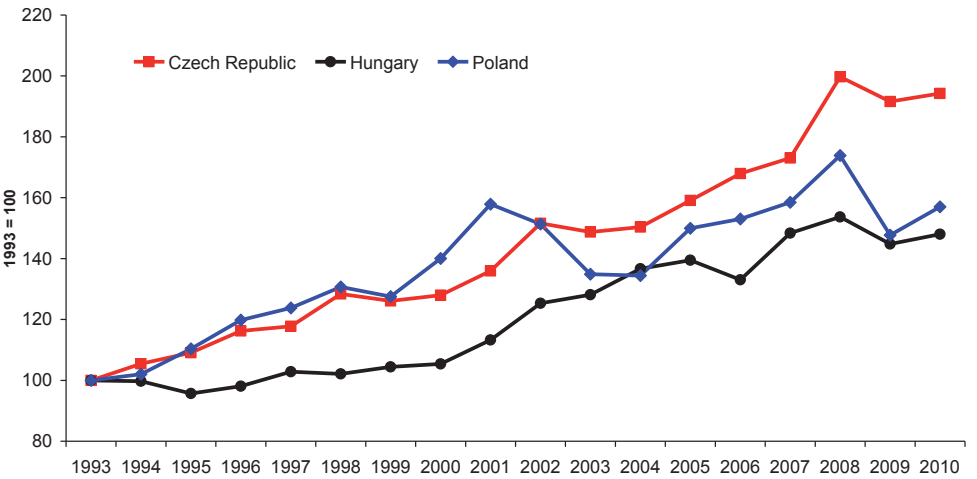
13 Due to its large extent, the Appendix will be published only in an electronic version of the article. The full text of the article (*i.e.*, with its Appendix) can be downloaded from the PEP website www.vse.cz/pep.

DOI: 10.18267/j.pep.438

euro, (2) the directly measurable indicator of GDP at current prices,[14] and (3) inflation in the domestic economy, *i.e.* the deflator which GDP at current prices is adjusted for.

As far as the exchange rate is concerned, the obvious explanation of the divergence of the two indicators is real appreciation of the exchange rate, in other words the situation where the exchange rate does not reflect the inflation differentials.[15] Figure 11 depicts the real appreciation of the "Central European three" economies' exchange rates in 1993–2010.

Figure 11
Real Appreciation of Central European Currencies



Source: IFS, author's calculations

The Polish zloty's real appreciation curve is meanwhile clearly linked to the GDP profile calculated for Poland in 2001–2004 (see Figure 6). The problem is that although real appreciation caused, for example, by investment flows, can satisfactorily explain such deviations in the short run, its ability to explain the divergence of the real GDP indicators in the long run is low. If the indicator of domestic inflation faithfully captures the change in prices of "real" domestic output (and is not distorted as a result, for example, of an inability to capture the rising quality of domestic output), it is difficult to imagine why the exchange rate of the currency of a relatively open economy (determined in the long run by free markets) should diverge significantly and persistently from the equilibrium exchange rate (whatever the definition of equilibrium

14 In practice, measuring GDP at current prices is also a very complicated business. Nevertheless, we consider it to be far simpler, so we will not analyse it any further except in the relevant passage of this section.

15 More generally with respect to foreign trade partners.

DOI: 10.18267/j.pep.438

may be). This would mean that the exchange-rate-determining market for some reason tolerates, for example, a higher level of inflation in the given economy in the long run. As stated above, this can be imagined in the short run, but not in the long run. Were such a phenomenon observable in the longer run, it would mean that there exists a component of the value of the economy that is not reflected in the long run either in inflation or in the real output data. But that would be at odds with the very concept of real GDP as an indicator of the economy's ability to create inflation-adjusted value added. In other words, if we do not want to assume a very long-running and concurrent bubble in the exchange rates of the "Central European three's" currencies,[16] we have to consider whether the inflation rate that is used to calculate the real appreciation of the Central European currencies overestimates the true growth in prices (or underestimates the growth in the quality of the output of these economies). Even the observed real appreciation (which, as we have already stated, does not explain much in the longer run) is not, in the case of the Czech economy, particularly capable of explaining the entire quantitative divergence of the two GDP indicators.

The professional literature, not to mention more popular texts, often overlooks the fact that, as a result of changes in accounting and statistical methods, the indicator of nominal GDP (from which real GDP is derived) is subject to considerable errors at a time of fundamental institutional change. One problem is the valuation and revaluation of capital at the start of the transformation, which had to be reflected negatively in corporate earnings, but also stimulated tax evasion[17] leading to underestimation of GDP. Even the changeover itself from central planning to the market economy led to the underestimation of many output indicators in the statistical reporting. Although phenomena associated with the "initial concentration of privatisation capital" are probably materially significant, it is difficult to obtain data (*e.g.* in the form of imports of services from tax havens in the initial transformation period) that allow us to estimate their contribution to the distortion of the "standard" real GDP figures.

As already indicated in Section 2, a potentially significant source of errors in calculating "standard" real GDP is the deflator, *i.e.* the inflation indicator used to adjust GDP at current prices for inflation. It should be said that inflation is generally regarded as overestimated by around 1 percentage point even in the developed economies, owing to the inability of statistical methods to capture improvements in the quality of products and services. Further distortions can arise from the calculation method,[18] with the errors accumulating on hundreds of items.[19] Understandably, these phenomena

16 The data on the other transformation and post-transformation economies suggest that divergence of the two indicators of real GDP or high real appreciation is a general phenomenon in transition economies.

17 The main tool of tax evasion is fictitious costs, leading to underestimation of earnings (components of GDP).

18 The term "estimation" is often used in preference to "calculation".

19 This is evidenced, *inter alia*, by the fact that the simple price of a Big Mac, which, including the set of services accompanying its sale, is very homogeneous across all the countries compared, is often a better predictor of exchange rate changes than the complex measurement of inflation using seemingly sophisticated, but error-laden cost-of-living indices.

DOI: 10.18267/j.pep.438

leading to possible overestimation of inflation may have been greatly magnified in transformation economies (see for example, Hanousek and Filer (2000, 2002, 2003, 2004a, 2004b), Benáček (2004), Lommatzsch (2004), Kubíček and Tomšík (2004a, 2004b) or Brada, King and Kutan (2000a and 2000b) for opposing views).

In any event, we can sum up that there are numerous theoretical reasons suggesting that "standard" real GDP can diverge from the theoretical concept of the objective level of value added adjusted for inflation. Several papers have suggested (see Section 2) why such divergence should be quantitatively bigger in transformation economies than in developed economies. This interpretation is consistent with the observed data presented in the figures in the preceding section.

Below we show how different are the conclusions that can be reached when one compares the rates of growth of the "Central European three" and the euro area using "standard" real GDP and "comparable" real GDP.

A comparison of real GDP statistics and other inflation-adjusted data formed the basis, *inter alia*, of a paper by Švejnar (2002), who arrived at the following conclusions (on GDP, see Figure 12; Figure 12 is not taken from Švejnar but is based on the latest data):[20]

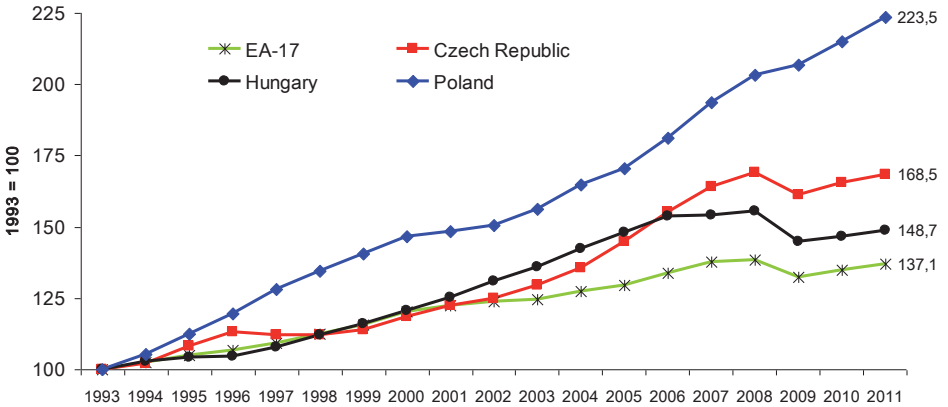
- The pace of equalisation of the economic level between the "Central European three" and the euro area is quite sluggish. Over the period 1993–2001 the Czech economy grew at the same pace as the euro area and Hungary grew by only 3 percentage points more than the euro area. The most successful was Poland, which grew by 26 percentage points more than the euro area over the same period.[21]
- As regards equalisation of the economic level, the developed Central European economies are better off than the other transformation economies, which started their convergence processes from lower levels.
- Despite its advantageous geographical position, the Czech Republic lags behind Hungary and especially Poland in the process of catching up with the developed nations' economic level.
- The initial transformation strategy and the 1997 and 1998 crises had a disastrous effect on the equalisation of the economic levels of the Czech Republic and the developed economies.

20 Data on other transformation and post-transformation economies are not given in Figure 12, but are analysed in Švejnar (2002).

21 In Figure 12 we use data for the euro area with 17 Member States.

DOI: 10.18267/j.pep.438

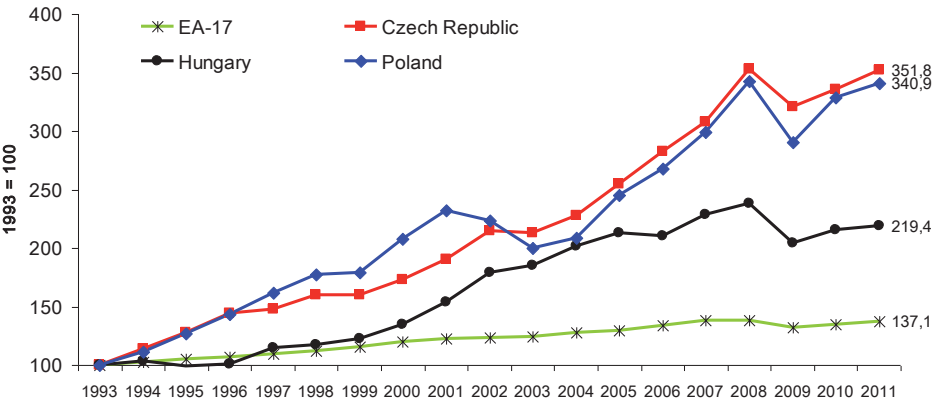
Figure 12
"Standard" Real GDP Growth



Source: ECB, author's calculations

If, however, we begin to analyse the growth in "comparable" real GDP we obtain an entirely different picture of the success of the transformation of the former centrally planned economies. Figure 13 shows the growth in "comparable" real GDP in the euro area and the "Central European three".

Figure 13
"Comparable" Real GDP Growth



Source: ECB, author's calculations

Virtually all of Švejnar's conclusions can be questioned on the strength of Figure 13 and "comparable" real GDP. The convergence is fast, not slow. The Czech and Polish economies grew at a similar rate and considerably faster than Hungary, while even

DOI: 10.18267/j.pep.438

Hungary grew much faster than the euro area economy. Table 1 in the Appendix presents a detailed comparison of the growth rates of "standard" real GDP and "comparable" real GDP for 26 EU countries and the USA, Japan and Switzerland during 1993–2011. The second-to-last column expresses the average rates of growth of the two indicators for this period and the last column gives the difference between the average rates. The table shows on a wide sample of countries that for the advanced economies the difference between the average rates of growth of "standard" real GDP and "comparable" real GDP is either negligible (*e.g.* 0.06 p.p. for Belgium and -0.14 p.p. for France) or small (*e.g.* 0.48 p.p. for Denmark and 0.35 p.p. for the UK), whereas for the New Member States it is large (*e.g.* 4.5 p.p. for Bulgaria and 4.38 p.p. for Slovakia) and for the Baltic countries it is very large (*e.g.* 8.08 p.p. for Estonia and 10.37 p.p. for Lithuania).

It is therefore clear that the use of "comparable" real GDP casts doubt on the results that can be obtained from analysing "standard" real GDP and similar real indicators. These differences are quantitatively and qualitatively significant and persistent over time. Attempts to explain them with transitory exchange rate movements meanwhile inevitably imply the existence of long-running and concurrent bubbles in the exchange rates of the transition economies' currencies.

The above analysis shows that "comparable" real GDP is not only a useful instrument for comparing the long-term relative performance of different economies, but can also be a suitable guide for comparing two different phases of development of a single economy. For example, in the Czech economy one can find some periods that can be described as relatively successful compared to other periods when one uses "standard" real GDP, while the assessment would be the opposite if one uses "comparable" real GDP.[22] This situation confirms that the interpretation of a certain period (or policy adopted) based only on "standard" real GDP may be misleading or confusing, as it does not take into account factors which are important for economic growth in reality.

5. "Comparable" Real GDP: Possible Refinements

A key area of doubt regarding the suitability of "standard" real GDP for measuring the rate of convergence of transition economies towards advanced market economies was the issue of correct incorporation of the unquestionable growth in production quality in transition economies into their national inflation rates. In this section we present two modifications of the calculation of "comparable" real GDP based on the past debate on the measurement of GDP in the Czech economy. As mentioned in Section 2, Benáček (2004) proposed to convert Czech exports at current prices into euros and to

22 The comparison of the period 1993–1998 with the period 1999–2004 can serve as an example. Whereas "standard" real GDP grew at an average pace of 2.0% a year in the first period and 2.8% in the second period (so that growth was 0.8 percentage point faster in the second period), "comparable" real GDP grew at an average pace of 11.4% a year in the first period and 8% in the second period (so that growth was 3.4 percentage point slower). Most of the authors mentioned in Section 2 reached a similar conclusion, albeit using different methodology.

DOI: 10.18267/j.pep.438

adjust the figure obtained in this way for inflation in the euro area, to which products there were exposed.[23] He suggested calculating the remaining approximately one-third of GDP (*i.e.* domestic output for domestic consumption) by deducting exports from GDP at current prices and using standard deflators. Kubíček and Tomšík (2004b) argued against deflating Czech exports expressed in euros by inflation in the euro area, since they regarded it as more appropriate to express Czech tradable production (*i.e.* production in industry and agriculture) in euros and to deflate that by inflation in German industry. They assumed that nontradable production is not exposed to foreign competition and that faster growth in export production prices than in prices on foreign markets (approximated by inflation in the German tradable sector) reflects growth in the quality of export production of catching-up economies.

Our first modification of the calculation of "comparable" real GDP involves separating GDP into tradable and nontradable parts. We express the tradable part of GDP (namely industry and agriculture) at current prices in euros, then deflate it by inflation in these sectors in Germany, and then use the exchange rate between a given national currency and the euro in the base year to calculate output in the tradable sector expressed in constant prices in the national currency. We express production in the remaining sectors, which produce mostly nontradables, in current prices in national currencies and then deflate them by inflation in the relevant sectors of the countries concerned. Finally, we add up the countries' tradable and nontradable productions and express them in the form of basic indexes. We will refer to the indicator obtained as "comparable" real GDP Modified I and we will assume that for advanced economies it should grow at a similar rate as both "standard" real GDP and "comparable" real GDP.[24] In the case of catching-up transition economies we can expect "comparable" real GDP Modified I to grow faster than "standard" real GDP but slower than "comparable" real GDP, because only the tradable part of output is converted into euros.

In the spirit of the analysis of Benáček (2004) and Kubíček and Tomšík (2004b), we made one more modification to "comparable" real GDP. We obtained "comparable" real GDP Modified II by deflating domestic demand in the country of interest expressed in current prices by the domestic demand deflator of that country then adding to it the country's exports expressed in euros deflated by inflation in industry in Germany and by deducting from it the country's imports at current prices deflated by its import deflator. All the results for 23 countries, with base year 2000 = 100, are contained in Table 2 in the Appendix. The second-to-last column shows the average rates of growth of the indicators for 2001–2011 and the last column gives the differences between the average rate of growth of the given indicator and "standard" real GDP.

23 He assumed that rapid export price growth is primarily a consequence of a fast increase in the quality of exported goods, and he calculated that exports expressed in constant euros rose at an average rate of 9% in 1997–2003.

24 As statistical data are not available for many EU countries before 2000 and especially before 1995, the base year for this analysis is 2000. Unfortunately, however, no data are available for Poland even for this base year.

DOI: 10.18267/j.pep.438

For visual clarity, the evolution of all four GDP indicators for 14 countries is presented in graphical form in Figure A1 in the Appendix.[25]

The results are in line with economic intuition and with our expectations. In practically all transition economies and in most of the advanced economies, "standard" real GDP represents the lower limit and "comparable" real GDP the upper limit for movements of the two modified GDP indicators. One exception during the 2009–2010 crisis was Hungary, where "comparable" real GDP Modified I actually fell below "standard" real GDP. Among the advanced economies there are more exceptions. In the UK, "comparable" real GDP diverged significantly from the three other measures as a result of a sharp depreciation of the British pound after the crisis erupted. This not only confirms the significant sensitivity of this measure to exchange rate movements, but also suggests a possible relative lack of trade openness for this economy.[26] The similarly atypical behaviour of "comparable" real GDP in Germany – consisting in stagnation and slower growth than in the case of "standard" real GDP – can probably be attributed to lower inflation in Germany than in the euro area. Owing to the fixing of exchange rates in the euro area, this several-year-long inflation differential could not be reflected in nominal appreciation of the exchange rate, which is what would very probably have happened had Germany had its own currency. In line with the preceding interpretation, the charts illustrate that the faster (slower) "comparable" real GDP grows relative to "standard" real GDP, the faster (slower) is the catch-up process of the given country relative to the advanced economies. Large and growing differences are recorded by Bulgaria, the Czech Republic, Estonia, Hungary, Lithuania, Latvia and especially Slovakia. Catch-up is also apparent to some extent in Spain and Greece even though all the GDP measures in these economies have been falling rapidly during the crisis.

When one compares the results for "comparable" real GDP Modified I with those for "comparable" real GDP Modified II, the differences between the two measures are not clear cut in the sample of countries under review. If we convert the two measures to mean rates of growth over the period 2001–2011 (see Table 2 in the Appendix), the biggest differences are recorded for Hungary: -2.6 p.p. (3.8% Mod I *vs*. 1.2% Mod II), Slovakia: 1.9 p.p. (5.8% Mod I *vs.* 7.7% Mod II), Lithuania: 1.4 p.p. (5.9% Mod I *vs*. 7.3% Mod II), and Estonia: 1 p.p. (5.7% Mod I *vs*. 6.7% Mod II). For Belgium, France, Italy and Finland, by contrast, the differences are negligible (*i.e*. one tenth of a p.p. or less). In most cases, however, as mentioned earlier, both modifications somewhat "depress" the results provided by "comparable" real GDP and generate intuitively more acceptable numerical values. In the case of the Czech Republic, the average rate of growth of "comparable" real GDP for 2001–2011 is 6.9%, while the two modifications generate figures of 4.3% and 4.6% respectively. The differences are even

25 To avoid misinterpretation of the data in the charts, we should point out that the y-axis has a maximum value of 150 for Austria, Belgium, Germany, Spain, the UK, Greece and Slovenia, 240 for Bulgaria, the Czech Republic, Estonia, Hungary, Lithuania and Latvia, and 280 for Slovakia.

26 The negative growth of "comparable" real GDP *versus* "standard" real GDP since the outbreak of the crisis in fact implies an absolute contraction of the UK economy.

DOI: 10.18267/j.pep.438

more apparent in the case of Slovakia: average "comparable" real GDP growth for the said period is 9.3%, while the two modifications are 5.8% and 7.7% respectively. The question therefore arises whether the two modifications of "comparable" real GDP are realistic alternatives to actual "comparable" real GDP.

We do not regard it as useful to assess how convincing the individual measures are solely on the basis of numerical values. It is more appropriate to return to the economic content of each measure and to judge accordingly the degree to which each approach is justified. The two modifications of "comparable" real GDP are based on the assumption that growth in the quality of production in transition economies occurred primarily in the tradable sector, so that the rising quality of production was reliably tested by tough international competition. This led to proposals to modify factors linked closely with foreign trade, either by dividing production into tradable and nontradable items or by deflating exports and imports. We do not share the view of Benáček (2004) and Kubíček and Tomšík (2004b) that the growth in production quality during the transformation period occurred primarily in the tradable sector. It is true that nontradable production is not exposed to foreign competition, but it cannot be denied that the quality of nontradable production has also been going up sharply.[27] Many examples can be found. In construction over the last 15 years there has been an unprecedented rise in the technology used, the range of building materials available has increased, and construction itself has accelerated enormously. In the telecoms sector, the quality, breadth and speed of the services offered has also increased at an unprecedented rate. In the period of central planning it used to take several years to get a telephone line installed. In the transition period the waiting time was cut to just a few days. Financial service provision has seen a similar boom. At the start of the transition it took several weeks to transfer money from one account to another within a single institution. Now transfers must be performed by the next day. Health care provision has also seen major progress. Diagnostic and therapeutic procedures are of incomparably higher quality than they were in the past and medical care is much more patient friendly. Many procedures which used to involve spending several days in hospital are now done on an outpatient basis, generating huge time savings. The list of examples of quality improvements in other nontradable sectors is much longer.

This leads us to conclude that growth in "comparable" real GDP Modified I *underestimates* true economic growth in the extent to which growth in the quality of production is realised in the nontradable area, while growth in "comparable" real GDP may *overestimate* true economic growth in the extent to which growth in the quality of production is not realised in the nontradable area. Given our belief that the nontradable area also saw very rapid growth in production quality (and therefore possible distortion of the relevant price deflators), we regard the "comparable" real GDP approach as the best alternative to "standard" real GDP.

27 It can therefore be regarded as no accident that various studies have been unable to identify any major Balassa-Samuelson effect (see, for example, Flek, Marková and Podpiera, 2002).

DOI: 10.18267/j.pep.438

6. Conclusion

In this paper we have tried to demonstrate that the real GDP of post-transformation economies as reported by statistical institutions is a long way off the ideal concept which it ought to match up to. This concept, however, is satisfied in the longer run by "standard" real GDP in the case of the developed economies (the USA, Japan and Switzerland).

In the case of the figures for the "Central European three", the divergence from the indicator computed from GDP at current prices and defined using the market-determined exchange rate against the euro and the more reliable indicator of the inflation of a developed economy is systematically and quantitatively significant. The "comparable" real GDP growth (calculated from GDP at current prices, the exchange rate against the euro and inflation in the euro area) exceeds the real GDP growth ("standard" real GDP) reported by statistical authorities by 4.4 percentage points a year on average in the case of the Czech Republic, by 2.9 percentage points in the case of Poland and by 2.4 percentage points in the case of Hungary in 1994–2011. The difference between the two indicators for the three Baltic countries is much higher still. Such divergence is manifestly at odds with the concept of factors which, according to the economic theory, real GDP and the exchange rate determined in approximately efficient markets (such as the Central European currency markets) should satisfy in the longer run, which the period 1993–2011 unquestionably is.

In our paper we mention factors – and a number of studies discuss them thoroughly – which can lead to distortion of the official GDP figures relative to the theoretical concept of GDP. Such distortion has its origins both in factors peculiar to each economy and in factors that are common to transformation generally. In each case we find theoretical reasons which imply that the divergence of the official real GDP figures will be considerable in transformation and post-transformation economies. And therein lies the explanation for the persistent divergence of "standard" real GDP growth and "comparable" real GDP growth calculated from current GDP, the exchange rate against the euro and inflation in the euro area.

Using the examples of the Czech Republic, Hungary and Poland we show how misleading an assessment of the economic transformation (namely regarding the speed of convergence to the euro area economic level and the relative success of individual transformation strategies) can be arrived at using the official real GDP figures. The difference in the "transformation story" told by the official figures and the figures based on market exchange rates and the more reliable data on inflation in the euro area should lead authors in this area to be cautious. We conclude that true convergence is proceeding at a significantly higher pace and that the Czech economy is converging to the euro area somewhat faster than the Polish economy and much faster than the Hungarian economy. Using the example of a comparison of two periods in the Czech Republic, we show that the official real GDP figures may also distort the picture of the success of the individual periods of one and the same economy. The hypothesis about

DOI: 10.18267/j.pep.438

the greater success of the post-transformation period derived from the "standard" real GDP data becomes difficult to defend once one compares those figures with "comparable" real GDP.

On the basis of relevant literature dealing primarily with the Czech economy, we generated two modifications of "comparable" real GDP. These modifications are based on the assumption that real GDP growth is not able to capture rapid growth in the quality of tradable goods sufficiently accurately. This leads to overestimation of foreign trade deflators and underestimation of the contribution of foreign trade to GDP growth. We therefore applied a similar approach to that used to calculate "comparable" real GDP (*i.e.* first converting nominal variables into euros and then deflating by the foreign inflation deflator) to the tradable output sector and to net exports. As expected, we found that the values of the two measures in the sample of countries under review were mostly higher than the values of "standard" real GDP but lower than those of "comparable" real GDP. Given our belief that the nontradable area also saw rapid growth in production quality during the transformation period, we view these results as complementary or illustrative and we continue to regard "comparable" real GDP as the best alternative for analysing the long-term catch-up of transformation and post-transformation economies towards the advanced economies.

One final question remains: What sort of comparisons can the official real GDP figures actually be used for in transformation and post-transformation economies? The answer is very pragmatic. Given the degree of variability of exchange rates in the short run (months, quarters or 1–2 years) we do not have a better indicator available for comparing the output of the economy over such periods. We have tried to show, however, that for comparing different economies and their outputs in the longer run the figures on the real GDP of transformation and post-transformation economies are very misleading and often entirely inappropriate, owing to their divergence from the concept of value added adjusted for inflation. Anyone attempting to make such comparisons should therefore always interpret them with maximum caution and compare the message they give with those obtained from alternative approaches. Regrettably, however, that rarely happens.

References

Benáček, V. (2004), "Král není nahý", *Ekonom*, No. 31, 29 July 2004, pp. 32–34.

Benáček, V. (2005), "Konkurenční schopnost české ekonomiky: současný stav a možnosti jejího posilování", CESES Working Paper, FSV, Univ. Karlova, 2005.

Brada, C. J., King, E. A., Kutan, M. A. (2000a), "Inflation Bias and Productivity Shocks in Transition Economies: The Case of the Czech Republic", *Economic Systems*, Vol. 24, No. 2, pp. 119–138.

Brada, C. J., King, E. A., Kutan, M. A. (2000b), "More on Inflation, Productivity and Output in Transition", *Economic Systems*, Vol. 24, No. 3 (September 2000), pp. 295–300.

ČNB (2004), "Reálný HDP a vliv změny směnných relací", mimeo.

Filer, K. R., Hanousek, J. (2000), "Output Changes and Inflationary Bias in Transition", *Economic Systems*, Vol. 24, No. 3 (September 2000).

DOI: 10.18267/j.pep.438

Filer, K. R., Hanousek, J. (2003), "Inflationary Bias in Mid to Late Transition Czech Republic", *Economic Systems*, 27, pp. 367–376.

Flek, V., Marková, L., Podpiera, J. (2002), "Sectoral Productivity and Real Exchange Rate Appreciation: Much Ado about Nothing?", CNB Working Paper 4.

Hanousek, J., Filer, K. R. (2002), "Evaluating Imperfection and Biases in Price Indexes during Transition", CERGE-EI, mimeo.

Hanousek, J., Filer, K. R. (2004a), "Consumers' Opinion of Inflation Bias due to Quality Improvements in Transition in the Czech Republic", *Economic Development and Cultural Change*, Vol. 53, No. 1, pp. 235–254.

Hanousek, J., Filer, K. R. (2004b), "Substitution Biases in Price Indexes During Transition", *Statistical Journal*, Vol. 21, No. 2, pp. 153–163.

Kohli, U. (2003a), "Terms of Trade, Real GDP, and Real Value Added: A New Look at New Zealand's Growth Performance", Swiss National Bank, May 2003, mimeo.

Kohli, U. (2003b), "Real GDP, Real Domestic Income, and Terms-of-Trade Changes", *Journal of International Economics*, Vol. 62 (2004), pp. 83–106.

Kohli, U. (2006), "Terms-of-Trade Changes, Real GDP, and Real Value Added in the Open Economy: Reassessing Hong Kong's Growth Performance", Swiss National Bank, March 2006, mimeo.

Kubíček, J., Tomšík, V. (2004a), "Kouzlo směnných relací aneb jak přepočítat HDP", *Ekonom*, No. 34, 19 August 2004, pp. 44–45.

Kubíček, J., Tomšík, V. (2004b), "Král není nahý, ale ani bohatý", *Ekonom*, No. 34, 19 August 2004, pp. 46–47.

Lommatzsch, K. (2004), "Jak přepočítat HDP", *Ekonom*, No. 31, 29 July 2004, pp. 30–32

Sfreddo, C. (2004), "Growth in Switzerland: Is the Picture Really that Gloomy?", Institut CREA de macroéconomie appliqué, October 2004, mimeo.

Spěváček, V. (2005), "Ekonomický růst České republiky ve světle ukazatelů reálného důchodu", Working Paper CES VŠEM No 2/2005, Centrum ekonomických studií VŠEM.

Švejnar, J. (2002), "Transition Economies: Performance and Challenges", *Journal of Economic Perspectives*, Vol. 16, No. 1, pp. 3–28.

Vintrová, R. (2005), "Co neodhaluje HDP při analýze ekonomického růstu a reálné konvergence", Working Paper CES VŠEM No 1/2005, Centrum ekonomických studií VŠEM.

DOI: 10.18267/j.pep.438

Appendix

(available in an electronic PDF version only – for details see the note 13 in the article)

Table 1
"Standard" Real GDP and "Comparable" Real GDP in 26 EU Countries and the USA, Japan and Switzerland during 1993–2011

	1993 = 100	1993	1995	2000	2005	2006	2007	2008	2009	2010	2011	Average in % 1994-2011	Difference in p.p.
Austria	"Standard" real GDP	100,0	105,1	122,7	133,4	138,3	143,4	145,4	139,8	143,1	147,2	2,2	
	"Comparable" real GDP	100,0	108,8	116,6	123,0	127,6	131,8	133,4	128,5	132,9	138,0	1,8	-0,36
Belgium	"Standard" real GDP	100,0	105,7	121,7	131,7	135,2	139,1	140,5	136,5	139,6	142,6	2,0	
	"Comparable" real GDP	100,0	109,9	119,6	128,9	133,0	136,8	138,3	134,8	139,4	143,9	2,1	0,06
Bulgaria	"Standard" real GDP	100,0	104,7	102,9	134,3	143,1	152,3	161,7	152,9	153,1	156,5	2,6	
	"Comparable" real GDP	100,0	103,8	136,3	202,6	226,5	257,2	290,3	283,7	290,6	310,6	7,1	4,50
Cyprus	"Standard" real GDP	100,0	116,4	140,1	164,2	171,0	179,7	186,1	182,7	184,8	185,3	3,5	
	"Comparable" real GDP	100,0	115,1	153,2	187,9	199,0	210,7	222,9	217,0	221,7	226,5	4,7	1,17
Czech Republic	"Standard" real GDP	100,0	108,3	118,6	144,9	155,1	164,0	169,1	161,2	165,6	168,5	3,0	
	"Comparable" real GDP	100,0	127,7	172,8	254,4	282,4	307,6	352,7	320,6	336,0	351,8	7,4	4,43
Germany	"Standard" real GDP	100,0	104,2	114,3	117,7	122,1	126,0	127,4	120,9	125,3	128,9	1,4	
	"Comparable" real GDP	100,0	107,9	107,4	104,6	106,9	109,6	109,4	104,1	107,8	110,4	0,6	-0,87
Denmark	"Standard" real GDP	100,0	108,8	125,2	133,3	137,8	140,0	138,4	131,2	133,5	135,1	1,7	
	"Comparable" real GDP	100,0	111,0	129,9	139,2	144,2	146,5	147,4	139,2	145,4	147,0	2,2	0,48
Spain	"Standard" real GDP	100,0	105,2	128,7	151,0	157,2	162,7	164,1	158,0	157,9	159,0	2,6	
	"Comparable" real GDP	100,0	100,5	130,2	168,6	179,4	187,3	189,7	181,1	180,4	182,2	3,4	0,80
Estonia	"Standard" real GDP	100,0	102,8	142,1	208,1	229,1	246,3	237,2	203,4	208,0	224,7	4,8	
	"Comparable" real GDP	100,0	186,8	373,7	608,6	715,6	838,8	834,5	702,1	720,6	796,6	12,9	8,08
Finland	"Standard" real GDP	100,0	107,8	136,2	155,1	162,0	170,6	172,3	158,1	163,9	168,9	3,0	
	"Comparable" real GDP	100,0	128,7	159,5	170,4	176,1	186,6	188,9	174,8	180,5	188,2	3,7	0,69
France	"Standard" real GDP	100,0	104,3	119,3	129,2	132,4	135,4	135,3	131,6	133,5	135,7	1,7	
	"Comparable" real GDP	100,0	104,1	116,8	125,1	128,6	131,8	132,4	128,2	130,3	132,3	1,6	-0,14
United Kingdom	"Standard" real GDP	100,0	107,5	128,4	148,0	151,8	157,1	155,4	148,6	151,2	152,2	2,4	
	"Comparable" real GDP	100,0	101,1	171,7	176,3	184,0	189,4	162,8	140,2	151,3	152,4	2,7	0,35
Greece	"Standard" real GDP	100,0	104,1	123,4	150,4	158,7	163,5	163,2	157,9	152,4	144,0	2,1	
	"Comparable" real GDP	100,0	108,0	138,7	175,7	186,7	194,5	199,4	196,5	191,5	181,3	3,4	1,33
Hungary	"Standard" real GDP	100,0	104,4	120,8	148,1	153,9	154,0	155,4	144,9	146,7	148,7	2,3	
	"Comparable" real GDP	100,0	99,1	134,5	212,7	210,8	228,5	237,9	204,2	215,4	219,4	4,7	2,44
Ireland	"Standard" real GDP	100,0	116,1	185,6	236,1	248,6	261,5	253,7	236,0	235,0	237,5	5,0	
	"Comparable" real GDP	100,0	114,2	221,0	306,2	327,9	341,2	317,1	280,4	270,5	267,3	5,9	0,88
Italy	"Standard" real GDP	100,0	105,0	115,4	121,2	123,9	125,9	124,5	118,2	120,0	120,7	1,1	
	"Comparable" real GDP	100,0	94,6	123,4	132,7	135,5	137,7	136,9	131,5	133,1	134,0	1,7	0,64
Lithuania	"Standard" real GDP	100,0	93,2	115,8	168,5	181,7	199,5	205,3	174,8	177,3	188,1	3,8	
	"Comparable" real GDP	100,0	205,5	463,7	700,6	790,8	920,8	1019,9	829,0	851,5	927,5	14,2	10,37
Latvia	"Standard" real GDP	100,0	101,3	130,6	193,9	215,5	236,2	228,4	187,9	187,3	195,7	4,0	
	"Comparable" real GDP	100,0	175,1	365,2	502,3	609,7	783,5	836,3	670,7	646,3	695,3	12,5	8,46
Malta	"Standard" real GDP	100,0	112,3	140,2	146,6	149,9	156,3	163,1	158,8	163,1	166,5	2,9	
	"Comparable" real GDP	100,0	113,1	165,3	166,3	172,2	180,8	189,8	187,8	197,2	203,8	4,1	1,22
Netherlands	"Standard" real GDP	100,0	106,2	129,5	138,2	142,9	148,5	151,2	145,9	148,3	151,0	2,3	
	"Comparable" real GDP	100,0	109,8	134,3	148,0	152,9	158,1	161,2	153,5	157,0	160,1	2,7	0,35
Poland	"Standard" real GDP	100,0	112,6	146,6	170,6	181,2	193,5	203,5	206,7	214,9	223,5	4,6	
	"Comparable" real GDP	100,0	126,8	207,7	245,3	268,1	299,3	342,7	290,3	329,1	340,9	7,5	2,87
Portugal	"Standard" real GDP	100,0	103,8	127,7	132,9	134,8	138,0	138,0	134,6	136,4	133,9	1,7	
	"Comparable" real GDP	100,0	107,9	143,2	155,5	159,2	164,3	163,6	159,0	161,8	158,9	2,6	0,99

DOI: 10.18267/j.pep.438

	1993 = 100	1993	1995	2000	2005	2006	2007	2008	2009	2010	2011	Average in % 1994-2011	Difference in p.p.
Romania	"Standard" real GDP	100,0	111,4	109,2	144,2	155,6	165,4	177,5	165,9	162,7	165,5	2,9	
	"Comparable" real GDP	100,0	114,8	152,3	268,3	322,7	402,1	441,8	370,4	379,4	397,6	8,5	5,61
Slovakia	"Standard" real GDP	100,0	112,4	132,9	168,8	182,9	202,1	214,0	203,5	212,1	218,2	4,5	
	"Comparable" real GDP	100,0	124,5	171,9	269,2	305,7	367,7	424,3	410,1	426,6	447,3	8,9	4,38
Slovenia	"Standard" real GDP	100,0	109,7	135,6	162,0	171,5	183,2	189,8	174,6	177,0	178,9	3,3	
	"Comparable" real GDP	100,0	135,5	170,8	204,4	216,9	235,9	249,4	234,2	233,2	232,9	5,0	1,63
Sweden	"Standard" real GDP	100,0	108,1	128,5	146,8	153,1	158,2	157,2	149,1	157,5	163,7	2,8	
	"Comparable" real GDP	100,0	107,8	139,8	139,5	146,1	151,6	146,6	127,0	150,1	165,1	3,0	0,24
Switzerland	"Standard" real GDP	100,0	101,5	112,3	119,9	124,2	128,8	131,5	129,0	132,5	134,7	1,7	
	"Comparable" real GDP	100,0	111,1	116,8	115,9	118,4	117,7	124,9	127,9	142,8	168,5	3,1	1,39
Japan	"Standard" real GDP	100,0	102,8	107,8	115,0	117,3	120,1	118,7	111,2	115,7	115,2	0,8	
	"Comparable" real GDP	100,0	103,8	122,3	79,5	74,0	66,5	67,5	73,1	82,8	84,8	-0,4	-1,23
United States	"Standard" real GDP	100,0	106,8	132,1	148,7	152,7	155,6	155,0	149,6	154,1	156,6	2,5	
	"Comparable" real GDP	100,0	95,4	170,5	144,2	148,6	139,5	129,8	132,2	144,0	140,0	2,3	-0,27

Note 1: Average growth is computed as the arithmetic mean of the annual changes.
Note 2: The difference is computed as “comparable” real GDP *minus* “standard” real GDP; a positive sign means that the latter is higher than the former
Source: Eurostat, author’s calculations

DOI: 10.18267/j.pep.438

Table 2

"Standard" Real GDP and "Comparable" Real GDP plus Two Modifications of "Comparable" Real GDP in 23 EU Countries during 2000–2011

	2000 = 100	1995	2000	2005	2010	2011	Average in % 1996-2011	Differ. in p.p.	Average in % 2001-2011	Differ. in p.p.
Austria	Real HDP	85,6	100,0	108,7	116,6	120,0	2,15		1,69	
	Comparable real GDP	93,3	100,0	105,5	114,0	118,4	1,52	-0,63	1,57	-0,12
	Comparable GDP Mod. I	86,4	100,0	110,3	118,7	121,6	2,18	0,04	1,82	0,13
	Comparable GDP Mod. II	85,5	100,0	109,1	115,2	121,4	2,27	0,12	1,85	0,16
Belgium	Real HDP	86,9	100,0	108,2	114,7	117,2	1,90		1,47	
	Comparable real GDP	91,9	100,0	107,8	116,5	120,3	1,72	-0,18	1,71	0,24
	Comparable GDP Mod. I	88,9	100,0	108,8	114,5	116,6	1,73	-0,18	1,43	-0,04
	Comparable GDP Mod. II	85,2	100,0	110,9	116,4	122,7	2,40	0,50	1,99	0,52
Bulgaria	Real HDP	101,8	100,0	130,6	148,8	152,1	2,66		3,95	
	Comparable real GDP	76,1	100,0	148,6	213,2	227,8	7,61	4,95	7,87	3,92
	Comparable GDP Mod. I	n.a.	100,0	145,1	186,5	196,4	n.a.	n.a.	6,40	2,45
	Comparable GDP Mod. II	91,4	100,0	135,7	181,9	200,0	5,44	2,77	6,81	2,86
Czech Republic	Real HDP	91,3	100,0	122,2	139,6	142,1	2,84		3,29	
	Comparable real GDP	73,9	100,0	147,2	194,5	203,6	6,71	3,87	6,89	3,60
	Comparable GDP Mod. I	90,2	100,0	131,8	154,1	157,4	3,64	0,80	4,34	1,05
	Comparable GDP Mod. II	85,6	100,0	130,9	152,2	159,9	4,15	1,30	4,57	1,28
Denmark	Real HDP	86,9	100,0	106,4	106,6	107,9	1,39		0,72	
	Comparable real GDP	85,4	100,0	107,2	111,9	113,1	1,80	0,41	1,16	0,44
	Comparable GDP Mod. I	84,1	100,0	107,5	110,9	112,2	1,86	0,47	1,10	0,38
	Comparable GDP Mod. II	83,2	100,0	108,3	107,1	108,2	1,75	0,37	0,83	0,11
Germany	Real HDP	91,2	100,0	103,0	109,7	112,9	1,36		1,13	
	Comparable real GDP	100,5	100,0	97,5	100,4	102,8	0,17	-1,20	0,28	-0,86
	Comparable GDP Mod. I	90,5	100,0	104,7	111,1	114,5	1,51	0,15	1,28	0,14
	Comparable GDP Mod. II	91,1	100,0	101,7	104,7	108,2	1,13	-0,23	0,78	-0,35
Estonia	Real HDP	72,4	100,0	146,5	146,4	158,1	5,21		4,51	
	Comparable real GDP	50,0	100,0	162,8	192,8	213,2	9,90	4,68	7,54	3,03
	Comparable GDP Mod. I	67,7	100,0	151,4	164,9	177,3	6,45	1,23	5,66	1,15
	Comparable GDP Mod. II	58,5	100,0	150,5	170,6	196,5	8,21	3,00	6,72	2,22
Ireland	Real HDP	62,6	100,0	127,2	126,6	128,0	4,69		2,35	
	Comparable real GDP	51,7	100,0	138,5	122,4	120,9	5,79	1,10	1,96	-0,39
	Comparable GDP Mod. I	n.a.	100,0	122,7	131,4	126,6	n.a.	n.a.	2,30	-0,05
	Comparable GDP Mod. II	54,0	100,0	125,5	119,8	122,0	5,50	0,81	1,97	-0,38
Greece	Real HDP	84,4	100,0	121,9	123,5	116,7	2,10		1,49	
	Comparable real GDP	77,8	100,0	126,7	138,1	130,7	3,36	1,26	2,53	1,05
	Comparable GDP Mod. I	n.a.	100,0	129,1	135,1	124,4	n.a.	n.a.	2,10	0,62
	Comparable GDP Mod. II	n.a.	100,0	125,4	128,4	121,4	n.a.	n.a.	1,86	0,38
Spain	Real HDP	81,8	100,0	117,4	122,7	123,6	2,64		1,97	
	Comparable real GDP	77,2	100,0	129,5	138,6	139,9	3,83	1,19	3,15	1,18
	Comparable GDP Mod. I	n.a.	100,0	122,5	132,0	133,4	n.a.	n.a.	2,69	0,71
	Comparable GDP Mod. II	79,7	100,0	118,7	123,5	126,3	2,96	0,32	2,19	0,22
France	Real HDP	87,5	100,0	108,3	111,9	113,7	1,67		1,19	
	Comparable real GDP	89,1	100,0	107,1	111,5	113,2	1,52	-0,14	1,15	-0,04
	Comparable GDP Mod. I	88,0	100,0	107,9	111,7	113,0	1,59	-0,08	1,13	-0,06
	Comparable GDP Mod. II	86,6	100,0	106,9	109,0	111,3	1,61	-0,06	1,00	-0,19
Italy	Real HDP	91,0	100,0	105,0	104,0	104,6	0,89		0,43	
	Comparable real GDP	76,6	100,0	107,5	107,8	108,6	2,26	1,37	0,76	0,34
	Comparable GDP Mod. I	86,8	100,0	107,9	107,7	107,3	1,36	0,48	0,67	0,24
	Comparable GDP Mod. II	86,8	100,0	106,3	104,4	106,0	1,29	0,40	0,57	0,15

DOI: 10.18267/j.pep.438

	2000 = 100	1995	2000	2005	2010	2011	Average in % 1996-2011	Differ. in p.p.	Average in % 2001-2011	Differ. in p.p.
Cyprus	Real HDP	83,1	100,0	117,2	131,8	132,2	2,97		2,59	
	Comparable real GDP	75,1	100,0	122,6	144,7	147,8	4,36	1,39	3,65	1,06
	Comparable GDP Mod. I	79,5	100,0	121,2	139,2	139,3	3,58	0,62	3,08	0,49
	Comparable GDP Mod. II	74,1	100,0	119,2	133,0	134,4	3,85	0,88	2,78	0,19
Latvia	Real HDP	77,6	100,0	148,5	143,5	149,9	4,45		4,10	
	Comparable real GDP	47,9	100,0	137,5	177,0	190,4	9,64	5,19	6,75	2,66
	Comparable GDP Mod. I	n.a.	100,0	151,1	172,2	182,3	n.a.	n.a.	5,91	1,82
	Comparable GDP Mod. II	67,4	100,0	154,8	170,6	190,7	7,10	2,65	6,56	2,47
Lithuania	Real HDP	80,5	100,0	145,5	153,1	162,4	4,66		4,74	
	Comparable real GDP	44,3	100,0	151,1	183,6	200,0	10,46	5,80	6,92	2,18
	Comparable GDP Mod. I	n.a.	100,0	154,5	167,8	181,5	n.a.	n.a.	5,93	1,19
	Comparable GDP Mod. II	63,7	100,0	153,8	175,7	203,4	8,06	3,40	7,33	2,59
Hungary	Real HDP	86,5	100,0	122,6	121,5	123,2	2,27		1,96	
	Comparable real GDP	73,7	100,0	158,2	160,2	163,1	5,33	3,06	4,85	2,89
	Comparable GDP Mod. I	84,5	100,0	138,3	140,4	148,9	3,71	1,43	3,82	1,85
	Comparable GDP Mod. II	81,6	100,0	122,7	108,1	111,2	2,17	-0,11	1,24	-0,73
Netherlands	Real HDP	82,0	100,0	106,8	114,6	116,6	2,25		1,43	
	Comparable real GDP	81,8	100,0	110,2	116,9	119,2	2,42	0,17	1,64	0,21
	Comparable GDP Mod. I	82,3	100,0	110,1	120,0	121,7	2,50	0,26	1,83	0,40
	Comparable GDP Mod. II	79,7	100,0	106,8	113,7	118,2	2,60	0,35	1,65	0,22
Portugal	Real HDP	81,3	100,0	104,1	106,9	104,9	1,62		0,44	
	Comparable real GDP	75,3	100,0	108,6	113,0	111,0	2,49	0,87	0,97	0,52
	Comparable GDP Mod. I	81,2	100,0	107,3	113,0	110,5	1,96	0,34	0,92	0,48
	Comparable GDP Mod. II	79,1	100,0	104,2	106,0	106,4	1,91	0,29	0,60	0,15
Slovenia	Real HDP	80,9	100,0	119,5	130,5	131,9	3,16		2,62	
	Comparable real GDP	79,3	100,0	119,7	136,6	136,4	3,51	0,35	2,93	0,31
	Comparable GDP Mod. I	79,5	100,0	124,0	136,6	136,3	3,50	0,34	2,94	0,32
	Comparable GDP Mod. II	77,3	100,0	124,4	136,4	140,3	3,92	0,76	3,29	0,67
Slovakia	Real HDP	84,6	100,0	127,1	159,7	164,3	4,29		4,68	
	Comparable real GDP	72,4	100,0	156,6	248,1	260,2	8,52	4,23	9,26	4,58
	Comparable GDP Mod. I	n.a.	100,0	129,0	177,4	182,5	n.a.	n.a.	5,78	1,10
	Comparable GDP Mod. II	82,3	100,0	139,3	205,1	220,2	6,67	2,38	7,72	3,04
Finland	Real HDP	79,1	100,0	113,9	120,3	124,0	2,90		2,04	
	Comparable real GDP	80,7	100,0	106,8	113,2	118,0	2,47	-0,43	1,58	-0,46
	Comparable GDP Mod. I	80,5	100,0	109,7	115,1	117,4	2,46	-0,44	1,56	-0,47
	Comparable GDP Mod. II	79,6	100,0	109,2	109,0	115,0	2,44	-0,46	1,42	-0,62
Sweden	Real HDP	84,1	100,0	114,2	122,5	127,4	2,66		2,27	
	Comparable real GDP	77,1	100,0	99,8	107,4	118,1	2,95	0,29	1,83	-0,43
	Comparable GDP Mod. I	83,8	100,0	108,9	119,2	125,0	2,59	-0,07	2,13	-0,14
	Comparable GDP Mod. II	82,0	100,0	108,7	115,7	121,9	2,62	-0,04	1,96	-0,30
United Kingdom	Real HDP	83,7	100,0	115,2	117,7	118,5	2,22		1,58	
	Comparable real GDP	58,9	100,0	102,7	88,1	88,8	3,00	0,78	-0,82	-2,40
	Comparable GDP Mod. I	n.a.	100,0	112,9	117,7	118,9	n.a.	n.a.	1,63	0,05
	Comparable GDP Mod. II	78,7	100,0	111,1	110,7	111,5	2,26	0,03	1,04	-0,54

Note 1: Average growth is computed as the arithmetic mean of the annual changes.
Note 2: The difference is computed as "comparable" real GDP and all three modifications of "comparable" real GDP *minus* "standard" real GDP; a positive sign means that the latter is higher than the former

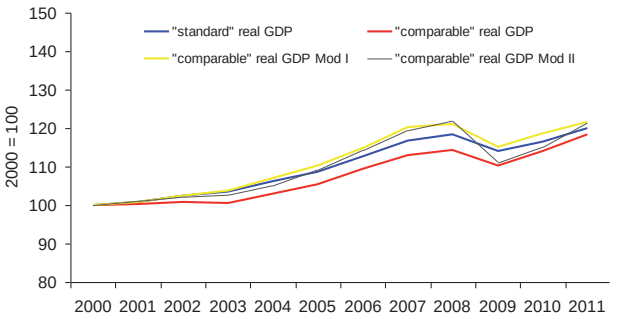
Source: Eurostat, author's calculations

DOI: 10.18267/j.pep.438

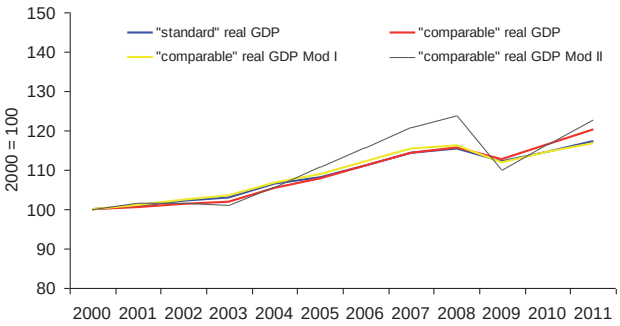
Figure A1

Four Measures of GDP: "Standard" Real GDP, "Comparable" Real GDP, "Comparable" Real GDP Modified I, "Comparable" Real GDP Modified II

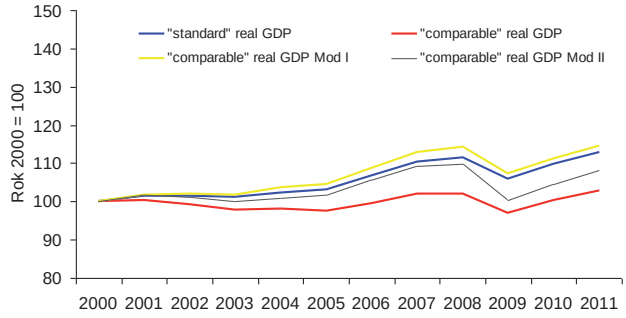
a) Austria



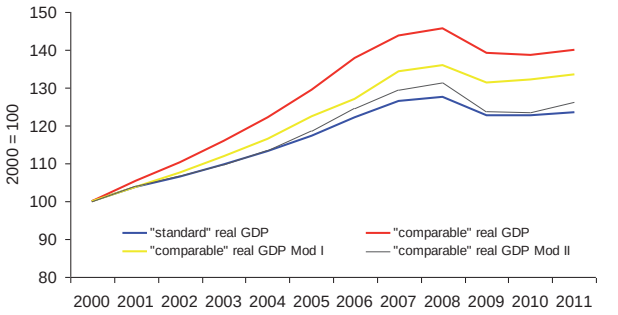
b) Belgium



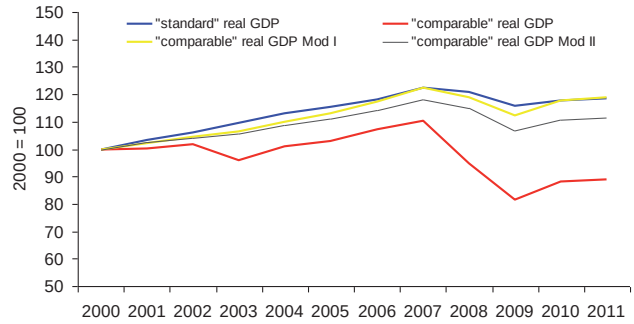
c) Germany



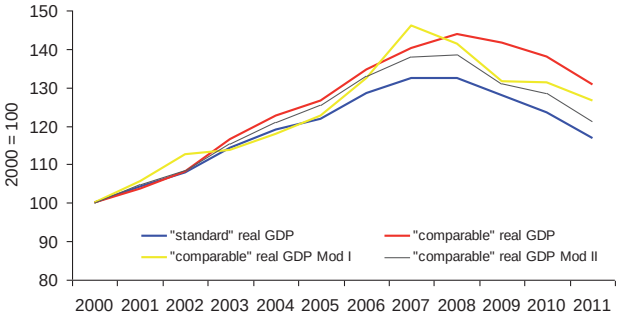
d) Spain



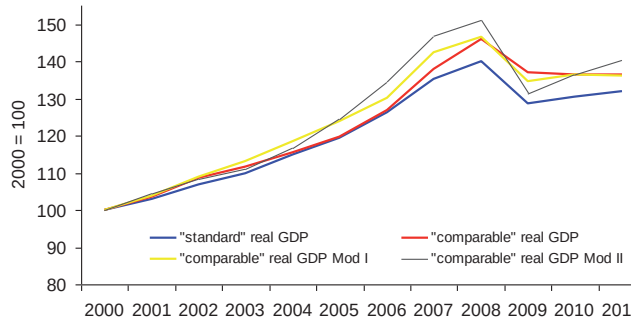
e) United Kingdom



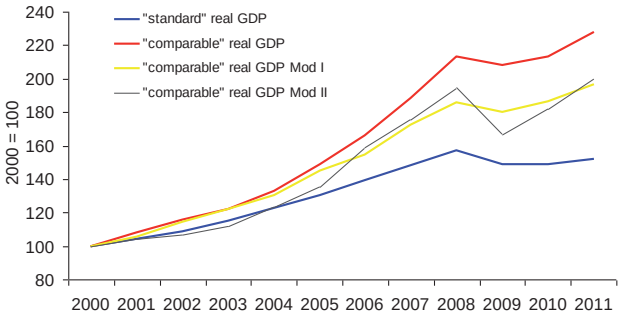
f) Greece



g) Slovenia

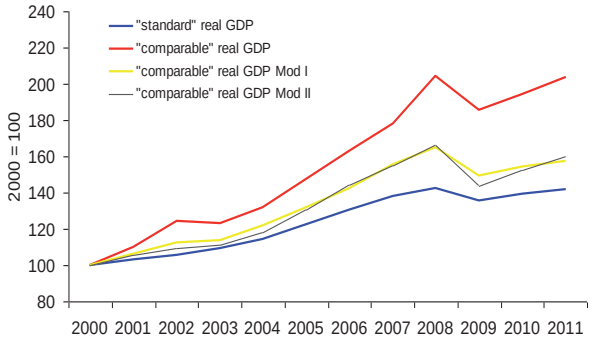


h) Bulgaria

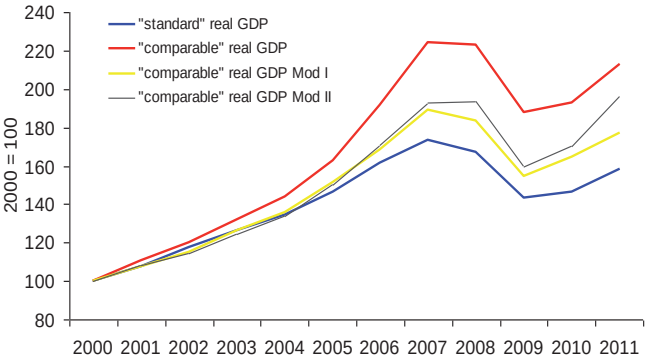


DOI: 10.18267/j.pep.438

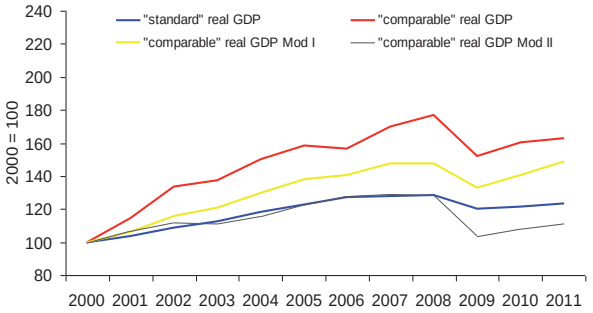
i) Czech Republic



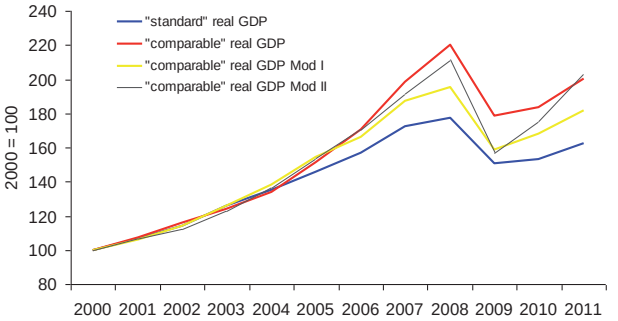
j) Estonia



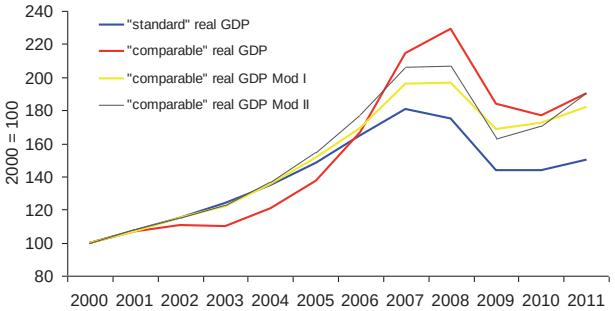
k) Hungary



l) Lithuania



m) Latvia



n) Slovakia