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THE CAUSES OF POST-2009 DIFFERENCES IN THE ECONOMIC PERFORMANCE OF EU COUNTRIES*

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This study examines the causes of the rather dissimilar development of individual EU economies after the 2008/09 crisis. The initial elemental analysis of contributions to GDP growth is followed by a growth accounting exercise, with decomposition into the effects of movements in total factor productivity, capital stock, and several labour market indicators. The subsequent section then seeks to clarify to what extent this development was driven by changes in cyclical conditions and the potential product.

Keywords: growth accounting, potential output, production function, HP filter, band-pass filter

JEL classification indices: E22, E24, E32

1. INTRODUCTION AND STYLISED FACTS

The economic development after the 2008/09 crisis has been much diversified in the EU countries. Those struck by the sovereign debt crisis entered a prolonged recession; many Member States experienced a "double-dip", while some witnessed a buoyant recovery. The causes of these varied outcomes have been

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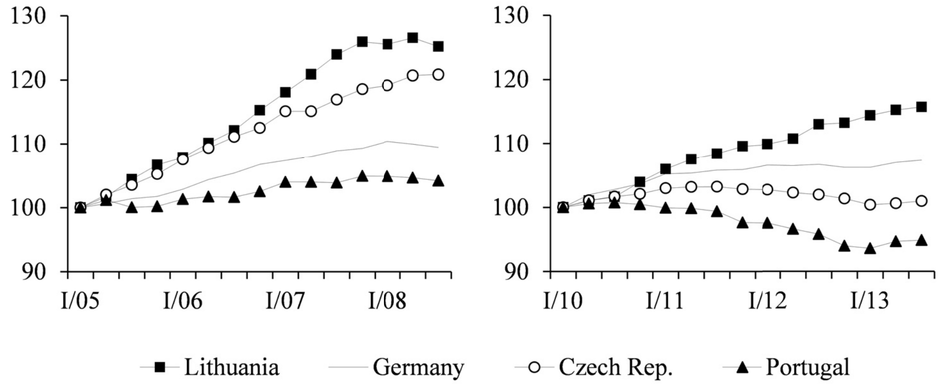

Figure 1. Real GDP (seasonally adjusted) in selected EU countries Q1/2005 = 100 (lhs), Q1/2010 = 100 (rhs)

Source: Eurostat.

widely researched, largely focusing on the impacts of government policies and also on the individual sectors of the respective economies.

This paper seeks to shed a different light on the post-2009 crisis situation, focusing principally on two growth decompositions, by means of *growth accounting* and *business cycle* analysis. These techniques should identify weak spots in each country's recent economic development. Where applicable, clusters of countries with similar growth patterns are identified. In this study, we focus on the time span between the first quarters of 2010 and 2013, marking the general exit from the global recession of 2008/09, and the hint of widespread change in economic conditions during the year 2013.[1]

Among the most recent papers, Husabø (2013) used growth accounting techniques on the basis of a production function to discern differences in the growth patterns of euro area countries before the Great Crisis (1996–2007) and in the midst of the crisis (2008–2012). Slower growth in the latter case was on the back of lower labour utilisation and total factor productivity (TFP) growth. The author then forecast post-crisis growth potential output (2013–2020) and showed that

[1] From the growth accounting perspective, it is convenient to analyse development between the same quarters: any possible distortions stemming from seasonal adjustment techniques would then be avoided. Furthermore, the business cycle analysis is particularly vulnerable to changes at the end of the time series, thus the three additional observations available at the time of creating this study (Q2–Q4/2013) could allow for more accurate conclusions.

under the most plausible scenario, potential growth would reach approximately half of the value before the crisis. Van Ark et al. (2013) enhanced the growth accounting exercise by explicitly distinguishing between information and telecommunications capital and other capital. Marked differences among individual European countries were found. One of the main conclusions is that the recent slow productivity growth has broadened from the services sector to the goods sector in most European economies.

The European Commission utilises an extended production function as a means to forecast the budgetary costs of ageing (European Commission 2012). Growth accounting techniques on the basis of identities (for further discussion see Section 2) were used, e.g., by Crafts (2013), who showed underlying factors behind the growth differential between the EU-15 countries and the US in various time periods from 1950 to 2007.

Table 1 presents a first overview of the causes of growth differentials among EU countries by means of contributions to real GDP growth using national accounts aggregates.[2] Gross fixed capital formation (INV) is further decomposed into that of government sector and other sectors, and residuals encompass both changes in inventories and valuables, together with statistical discrepancies.[3] Despite the marked differences in economic performance, there has been a general pattern of positive contribution of net exports, also on the back of a weak domestic demand. Other national aggregates cannot be interpreted in such a straightforward way. For countries struck by the sovereign debt crisis (Greece, Portugal, Spain, Italy, Ireland), all components of the domestic demand were falling: household consumption, government consumption, and both private and public investments, largely due to the well-researched effects of fiscal contraction. This is in contrast with the three Baltic States, where all these components contributed positively to GDP growth, also due to the rebound effect after the particularly large slump during the year 2009. For the remaining countries, no such generalisation can be made.

As such, results reported in *Table 1* indicate the first glimpses of drags on growth by means of standard growth accounting techniques. First, the falling investment activity should have had negative repercussions towards capital accumulation. Next, the subdued growth patterns spurred adverse developments in labour markets, generally indicating lower labour utilisation, and even likely transmitting such issues to the lower growth of potential output by means of hysteresis effects.

[2] Ordering of countries in *Tables 1* and *3* follows the EU standard based on the original written form of the short name of each country. Countries in *Table 2* are divided into several groups, as will be indicated further on.

[3] The source of all primary data in this study is Eurostat.

Table 1. Real GDP growth from Q1/2010 to Q1/2013 (%) and contributions, national accounts perspective

	GDP	HH cons.	GVT cons.	INV	Priv. INV	GVT INV	NX	Resid.
BEL	2.6	0.4	0.7	0.3	0.2	0.1	1.1	0.1
BGR	3.9	0.4	1.2	–1.3	–1.0	–0.3	3.7	–0.1
CZE	0.3	–1.2	–0.5	–1.4	–0.2	–1.3	3.5	0.0
DNK	2.0	0.1	–0.7	1.2	1.3	–0.1	–1.0	2.3
DEU	5.9	2.3	0.4	1.0	1.1	0.0	2.0	0.1
EST	18.9	7.6	0.5	7.1	6.3	0.8	–0.6	4.3
IRL	–0.1	–2.0	–1.0	–2.1	–2.1	0.1	3.6	1.4
GRC	–20.6	–22.6	–3.3	–9.3	–8.2	–1.1	9.7	5.0
ESP	–3.3	–4.3	–1.1	–3.9	–0.6	–3.3	5.5	0.4
FRA	3.3	0.8	2.1	0.7	0.5	0.2	0.5	–0.8
HRV	–4.2	–2.3	–0.9	–1.8	—	—	–1.0	1.8
ITA	–2.7	–3.4	–1.0	–2.4	–1.9	–0.6	4.6	–0.4
CYP	–5.2	–0.5	–0.9	–6.7	–4.7	–2.0	2.5	0.5
LVA	14.2	11.4	0.6	6.9	5.7	1.2	–5.4	0.7
LTU	13.6	9.3	0.6	7.9	9.0	–1.0	6.4	–10.6
LUX	2.8	2.2	1.6	3.2	2.9	0.3	–3.1	–1.1
HUN	1.1	–1.3	0.4	–2.0	–2.0	0.0	4.5	–0.6
MLT	4.4	3.5	2.9	–3.4	–3.8	0.4	1.1	0.3
NLD	–0.5	–1.5	0.1	–1.2	–1.0	–0.3	2.6	–0.5
AUT	6.6	0.9	0.8	1.7	1.8	–0.1	3.3	–0.1
POL	8.4	3.5	–0.4	0.9	0.7	0.1	2.9	1.6
PRT	–5.2	–6.8	–1.6	–6.2	–5.4	–0.9	9.2	0.1
ROU	4.0	1.7	–0.2	0.1	1.7	–1.6	3.6	–1.2
SVN	–2.2	–2.8	–0.6	–2.7	–1.8	–1.0	5.8	–1.8
SVK	6.2	–0.9	–0.4	–3.9	–2.9	–1.1	11.5	–0.1
FIN	3.5	3.2	0.2	1.2	0.6	0.6	2.9	–4.0
SWE	8.1	3.2	0.8	2.5	2.1	0.4	1.4	0.1
GBR	3.6	2.4	0.3	0.2	0.8	–0.7	1.0	–0.3
EU	2.0	–0.2	0.0	–0.5	–	–	2.6	0.1

Note: HH: household final consumption expenditure; GVT: final consumption expenditure of general government; INV: gross fixed capital formation; NX: net exports.

Source: Own calculations, based on Eurostat purchasing power parity GDP data.

2. GROWTH ACCOUNTING: METHODOLOGY

There are many feasible ways to decompose both real GDP growth and GDP per capita levels (Mourré 2009). We will focus on two widely used methods, i.e. the identity-based approach, using hours worked, and the production function with further decomposition of hours worked into four subgroups.

2.1 Identity-based approach

This method is the simplest possible decomposition of GDP growth, utilising either headcount or hourly labour productivity. We will use the following macroeconomic identity utilising number of hours worked (HW), see equation (1). The real GDP level at a time t is equal to hours worked multiplied by hourly productivity of labour (GDP per hour worked):

$$GDP_t = HW_t \frac{GDP_t}{HW_t}. \tag{1}$$

As we are interested to see the differences between time t and a selected time τ in the past, we divide each component of (1) by its respective figure at time τ. Then, taking natural logarithms, we get the final decomposition

$$\log GDP_t - \log GDP_\tau = \left(\log HW_t - \log HW_\tau\right) + \left(\log \frac{GDP_t}{HW_t} - \log \frac{GDP_\tau}{HW_\tau}\right). \tag{2}$$

However, hours worked are not readily available for all EU countries at quarterly frequencies. Therefore, we approximate them using the Labour Force Survey. HW is equal to weekly actual hours worked in the main job times total employment, adjusted for actual weekly hours worked in the second job times employed who have a second job[4]:

$$HW_t = HW_t^{1st} \cdot E_t + HW_t^{2nd} \cdot E_t^{2nd}. \tag{3}$$

4 Average weekly hours worked are a standard component of the Labour Force Survey; there are two definitions included in the questionnaire: number of hours per week *usually* worked and number of hours *actually* worked during the reference week (European Commission 2013). For the purposes of this paper, the second option is used, as it encompasses more information: e.g. more hours worked due to overtime, or less hours worked due to illness, training. Furthermore, there is no indicator for *usual* hours worked in the second job, which may cause some inconsistencies in the aggregate hours worked indicator as presented in equation (3).

2.2 Production function-based approach

A mainstream approach is to further disentangle real GDP growth by means of a production function, which was outlined in the seminal paper of Solow (1957) and elaborated upon by numerous authors, notably, e.g., by Barro (1998), who presented several caveats related to this topic and a novel discussion of the interpretation of TFP. By this, we are able to see how selected factors of production (most commonly labour and capital) contributed to GDP growth. In this paper, a commonly used Cobb-Douglas production function is used. First, we will consider constant returns to scale, in line with the overwhelming array of the empirical literature. As argued, e.g., by d'Auria et al. (2009: 9), there is little empirical evidence for increasing or decreasing returns to scale. Burnside et al. (1995) found that there are no important deviations from constant returns to scale in the US manufacturing industry. Another argument, as discussed by Willman (2002), is that it is very difficult to disentangle the increasing return to scale from the effects of technological progress.

Next, we would implicitly treat technological change as Hicks-neutral (Romer 1996: 7). Also, we will decompose the labour input (total hours worked) into two main parts: employment and hours worked per person employed. The basic setup can be then written as follows:

$$GDP_t = A_t K_t^{\alpha} \left(E_t \frac{HW_t}{E_t} \right)^{1-\alpha} . \tag{4}$$

Here, A_t denotes the Solow residual (TFP), K_t the capital stock, E_t employment, and HW_t total hours worked as defined in equation (3). The parameter α is then a country-specific (adjusted) capital to output ratio, as will be explained further on. We will then use the conventional identity for splitting total employment (for this and every other labour market variable using the 15–64 age cohort) into working age population (15–64), participation rate (the ratio of workforce, i.e. employed E_t and unemployed U_t to population 15–64) and unemployment rate (the ratio of unemployed to workforce):

$$E_t = pop_t \cdot part_t \cdot (1 - un_t) = pop_t \cdot \frac{E_t + U_t}{pop_t} \cdot \left(1 - \frac{U_t}{E_t + U_t} \right). \tag{5}$$

Again, dividing each component of equation (4) by its respective value at time τ and taking natural logarithms, we get

$$\log GDP_t - \log GDP_\tau = \left(\log A_t - \log A_\tau\right) + \alpha\left(\log K_t - \log K_\tau\right) + \\ + \left(1-\alpha\right)\left[E_t + \left(\log\frac{HW_t}{E_t} - \log\frac{HW_\tau}{E_\tau}\right)\right] \tag{6}$$

where

$$E_t = \left(\log pop_t - \log pop_\tau\right) + \left(\log part_t - \log part_\tau\right) + \left[\log\left(1-un_t\right) - \log\left(1-un_\tau\right)\right]. \tag{7}$$

The K_t may be calculated principally using two main methods (OECD 2001). First, capital stock data can be collected by direct measurement, i.e. using surveys. However, the reliability of such figures could be quite dubious in many countries; furthermore, such data are not commonly available at quarterly frequencies. Capital stock can be alternatively computed by the Perpetual Inventory Method. It states that the current capital stock is equal to capital stock in the past period, adjusted for depreciation, plus current gross fixed capital formation. However, this approach necessitates setting two additional parameters: the depreciation rate and the "initial capital stock".

The depreciation rate is often stipulated to be fixed and common for all countries, where applicable. In line with Mourré (2009), we set the annual depreciation rate at 5%. The initial capital stock is then defined as the first link in the chain of the time series of capital stocks, which needs to be calculated ad hoc. We then use a similar approach as d'Auria et al. (2010), stating that in the first quarter of 1997, capital stock equalled three times the real (annual) GDP, for all countries.

The next crucial step is to estimate the capital/output ratio, i.e. parameter α, as its magnitude may have a particularly large impact on the factors of production's contributions to GDP growth. Specifically, as an example, contributions of the capital component to GDP growth, given the capital/output ratio set at a given value α_1, are defined as follows – see also equation (6):

$$K_1' = \alpha_1\left(\log K_t - \log K_\tau\right). \tag{8}$$

After trivial arithmetic calculations, it can be seen that the ratio of capital component contributions (with a different alpha parameter used as a basis) is equal to the respective α parameters.

$$\frac{K_1'}{K_2'} = \frac{\alpha_1}{\alpha_2} \tag{9}$$

A similar pattern emerges in terms of the total hours worked component:

$$\frac{HW_1'}{HW_2'} = \frac{1-\alpha_1}{1-\alpha_2}. \tag{10}$$

As discussed earlier, we opted for constant returns to scale, we can therefore estimate the α parameter indirectly, by means of the share of labour income in output: 1 – α. The easiest possible method is via the (unadjusted) wage share, i.e. the ratio of compensation of employees to (nominal) GDP. However, labour income of self-employed would be then omitted. In national accounts, this is accounted for in the balancing item "mixed income" (ESA 95 entry B.3); which, however, contains both remuneration of work and entrepreneurial profits, which cannot be distinguished from each other (Council Regulation No 2223/96).

The most widely used technique to allow for the wages of self-employed to enter the labour/output ratio is to adjust compensation of employees by the number of self-employed (Freeman 2011). We then have to assume that the "average wage" of self-employed is the same as that of employees. Arpaia et al. (2009), however, argue that this assumption may distort the measure of labour share as self-employed tend to be high-skilled professionals and therefore above-average earners. An alternative to this approach, used also by Freeman (2011), would be to estimate the adjusted labour share on the basis of individual sectors, and express the national labour share as a weighted average across sectorally adjusted labour shares. Nevertheless, this approach still suffers from the same inherent assumption of the same "average wage". Furthermore, it would be very data-demanding due to the number of countries we examine and a country-specific knowledge may be needed to allow for the possible caveats related to this method. We will therefore utilise the former methodology using the aggregate adjustment for self-employed. The adjusted compensation of employees by the approach can be written as follows:

$$COE_t^{adj} = COE_t \cdot \frac{employees_t + self_t}{employees_t}. \tag{11}$$

The adjusted capital share is then shown as equation (12), where Y_t denotes the nominal GDP at time *t*. As we need to keep the returns to scale constant, we calculate the adjusted capital share as an average for the period Q1/2010 to Q1/2013:

$$\alpha = 1 - \frac{COE_t}{Y_t} \cdot \frac{employees_t + self_t}{employees_t}. \tag{12}$$

Finally, in the case of the Czech Republic, Latvia, Lithuania, Poland and Slovakia, it was necessary to adjust a part of the time series of Labour Force Survey data (i.e. population of working age, employed and unemployed) due to population censuses in order to remove breaks in these time series.[5]

3. GROWTH ACCOUNTING: RESULTS

Table 2 summarises the results obtained for all EU countries and the EU as a whole (these estimates were calculated by means of the aggregation of all underlying primary data).[6] Two general observations can be made. (i) There was a widespread decline in hours worked per person employed, which may point to labour hoarding during the period with still uncertain prospects for employers. (ii) Quite surprisingly, contribution of capital stock to growth was still positive in all countries with the exception of Ireland and Greece, suggesting that even depressed fixed investments were still sufficient to offset the depreciation of the capital stock. With some exceptions, the contribution of total labour supply in terms of participation rate was also positive.

The three Baltic States experienced the most buoyant recovery, with GDP rising by 13.4% (Lithuania) to 17.7% (Estonia). The growth pattern seems to have been quite balanced, as all main items contributed positively: capital, labour, and TFP. A remarkable feature is that headcount employment was on a rise even despite the quite substantial decline in the working age population. The main contributor to such a benign outcome was the sharp decline in unemployment rates.

The EU "periphery" countries (Ireland, Greece, Spain, Italy, Cyprus, and Portugal) had a particularly negative development of their labour markets, which substantially contributed to their poor economic performance. The increase in the unemployment rate of Greece accounted for the decline of its real GDP by 10 pps. On top of that, participation rates were not able to offset these adverse tendencies, or were only slightly decreasing in some countries. Patterns of TFP were also quite diverse. For example, Greece experienced a particularly sharp drop, possibly related to the strong reaction of the domestic economy on the fiscal retrenchment.

5 Specifically, levels of population at working age were shifted after the respective breaks to allow for smooth courses of population time series. This level coefficient was then applied to both employment and unemployment figures.

6 In order to achieve a mutual comparability of results with *Table 3,* seasonally-adjusted GDP data are utilised in *Table 2*. In any case, such outcomes are not entirely comparable to *Table 1,* as it consists of additive decomposition, as opposed to multiplicative decomposition in *Tables 2* and *3*.

Table 2. Real GDP growth from Q1/2010 to Q1/2013 (%) and contributions, growth accounting perspective

	GDP	HW	GDP/HW	TFP	K	HW/E	E	Pop	Part	Un
EST	17.7	6.5	11.2	10.6	3.7	–1.9	5.3	–1.5	0.7	6.0
LTU	13.4	2.9	10.5	8.5	3.6	–0.3	1.6	–2.9	1.8	2.7
LVA	13.9	6.5	7.5	8.6	2.3	0.4	2.6	–2.8	0.8	4.6
CYP	–5.3	–1.6	–3.6	–6.4	1.9	0.2	–1.1	3.9	0.1	–5.1
ESP	–2.6	–11.2	8.5	2.4	1.3	–1.1	–5.2	–0.8	0.9	–5.3
GRC	–21.7	–19.4	–2.3	–11.1	–0.7	0.4	–10.3	–0.1	–0.3	–10.0
IRL	0.5	–3.5	4.0	3.1	–0.8	–0.4	–1.4	–1.0	–0.1	–0.4
ITA	–2.7	–5.3	2.6	–0.3	0.5	–1.9	–1.0	0.1	1.2	–2.3
PRT	–6.6	–13.1	6.5	1.1	0.0	–0.9	–6.9	–1.1	–0.6	–5.1
AUT	5.0	1.3	3.7	2.4	1.9	–0.5	1.2	0.8	0.8	–0.4
DEU	6.1	3.1	3.0	3.1	1.2	–0.2	2.0	0.1	0.6	1.3
FIN	3.4	–0.7	4.1	1.9	1.9	–0.6	0.2	–0.7	0.5	0.3
SWE	7.9	3.4	4.5	3.4	2.5	–0.3	2.2	0.2	1.6	0.5
BGR	4.5	–5.6	10.1	2.3	4.6	–0.5	–2.0	–1.2	1.0	–1.8
MLT	4.5	3.3	1.2	2.7	0.1	–1.7	3.4	–0.3	3.1	0.6
POL	8.6	–0.5	9.1	3.0	5.8	–0.5	0.2	–0.4	1.0	–0.4
ROU	4.1	–0.3	4.5	–2.1	6.4	–0.7	0.5	–0.3	0.5	0.3
SVK	6.2	2.6	3.7	0.7	4.4	–0.2	1.4	0.0	1.1	0.3
BEL	2.5	–1.6	4.1	1.8	1.7	–1.2	0.2	0.8	–0.7	0.1
CZE	0.4	–2.7	3.1	–1.8	3.6	–2.3	0.9	–1.2	1.8	0.3
DNK	2.1	–2.3	4.5	2.8	0.7	–0.6	–0.9	–0.1	–0.9	0.1
FRA	3.2	–2.1	5.3	2.8	1.7	–1.3	0.1	0.1	0.5	–0.5
GBR	2.8	2.1	0.7	1.0	0.5	–0.2	1.5	0.4	1.0	0.1
HRV	–3.5	–13.6	10.0	2.7	1.8	0.3	–8.4	0.2	–3.8	–4.8
HUN	0.6	–0.9	1.5	–0.1	1.1	–1.8	1.4	–0.5	1.9	0.0
LUX	3.3	7.4	–4.0	–4.3	3.8	–0.7	4.5	4.1	0.7	–0.3
NLD	–0.8	–1.8	1.1	–0.6	1.0	–1.1	0.0	0.0	1.1	–1.0
SVN	–1.8	–7.0	5.2	1.6	0.8	0.4	–4.6	–0.9	–1.1	–2.6
EU	1.9	–2.0	3.9	1.9	1.2	–0.9	–0.2	–0.2	0.8	–0.9

Note: HW: hours worked; TFP: total factor productivity; K: capital stock; E: employment; Pop: working age population; Part: participation rate; Un: unemployment rate.

Source: Own calculations, based on Eurostat purchasing power parity GDP data after seasonal adjustment.

The recovery in the EU "core" countries (Germany, Austria, Finland, and Sweden) was in the growth accounting perspective driven by relatively well-functioning labour markets, with unemployment rate levels falling (an exception was Austria), topped up by increasing participation rates. Also, a positive contribution of capital stock to GDP growth – on the back of the positive growth of fixed investments – coincided with a supporting role of development in total factor productivity.

Catching-up economies (Bulgaria, Poland, Romania, Slovakia, and Malta) managed to emerge from the 2009 crisis with renewed and quite strong growth dynamics. However, their growth pattern showed several weaknesses. Despite the fact that capital accumulation was still positive and contributed in an extensive way to GDP development, fixed investments were actually falling in Bulgaria, Slovakia and Malta, and experienced only moderate growth in the remaining two countries. The employment (headcount) figures were encumbered by the decline in the working age population. The still slightly positive employment contribution (with the exception of Bulgaria) was then largely driven by increases in the participation rate, whereas unemployment dynamics proved to be somewhat faltering.

The remaining countries, the "mediocre performers", form a heterogeneous group, where economic growth was either only weak or completely stalled. The causes of such development can be quite varied; the Czech Republic, Luxembourg, and the Netherlands experienced a negative TFP contribution; Belgium, France, and Hungary a particularly large slump in hours worked per person employed; Denmark, Slovenia, and Croatia one of the largest declines in participation rates among the EU countries.

For the EU as a whole, rising unemployment rates, declining hours worked per person employed, and a somewhat lower population at working age provided for drags on growth, other items contributing positively to growth.

Possible explanations

As discussed in the Introduction of this paper, a vast array of literature has been accumulated to explain such developments presented above. In particular, the existence of a link between discretionary fiscal policy-making and real output has been confirmed in a number of empirical studies: in many cases, authors apply structural vector autoregression (SVAR) and DSGE models to investigate deeper the aspects of fiscal policy impacts. Given the large-scale fiscal contraction during this time span in many EU countries, this channel could have been particularly prominent.

To name examples of such studies, Bachmann – Sims (2012) emphasise the importance of confidence effects as an important transmission channel of fiscal policy to economic fundamentals. Using the SVAR technique, they show that confidence is a very important channel of government shocks in economic downturns, but virtually irrelevant in normal times. Coenen et al. (2012) used 7 existing DSGE models to find common points in the responses of an economy to fiscal shocks. Generally, there was a robust finding across all models that fiscal policy can have sizable output multipliers, in particular when it consists of spending and (targeted) transfers measures.

There has also been a discussion regarding growth spillovers among individual countries with respect to the 2009- and the subsequent sovereign debt crisis. Notably, Poirson – Weber (2011) found, on the basis of the vector autoregression framework, that the US and Japan seem to have been driving the post-2009 recovery, whereas negative spillovers from the European crisis countries appeared to have been limited, consistent with their modest size.

Many studies have also investigated the particularly adverse developments on labour markets and their underlying causes. Bonthuis et al. (2013) examined divergent labour market outcomes with a focus on structural shifts of the Beveridge curves in selected EU countries. Overall, they found a significant shift in the euro area Beveridge curve since the onset of the crisis, but considerable heterogeneity at the country level; only Germany has exhibited a clearly favourable shift in this structural relationship. They found evidence that such different outcomes can be the combination of many factors, namely the composition of the labour force (especially the intensity of the response of young persons' unemployment rate to economic activity), the severity of sectoral problems (notably in the construction sector), and institutional factors such as employment protection, use of temporary contracts, and trade union density. Moreover, sectoral issues can negatively affect labour markets outcomes via different channels: Farber (2012) found that in the case of the US, the housing market crisis prevented the unemployed from selling their homes and moving to take new jobs. This may have played some role, especially in countries facing severe contractions in this sector, Ireland and Spain being particularly prominent examples.

As discussed by the ECB (2012), heterogeneity in labour market outcomes was further accentuated by the presence of imbalances such as previous booms in the construction sector or accumulated competitiveness losses. Furthermore, the 2008/09 crisis has likely triggered an increase in structural employment, with repercussions to potential product growth, which will be discussed in the following section. Labour market outcomes were researched by different techniques e.g. by Neri – Ropele (2013), who used the Factor Augmented Vector Autoregression model. They argue that diverging trends in economic activity and employment among EU countries were caused by heterogeneous credit conditions and by significant fiscal consolidations in some countries. Additionally, they state that sovereign debt tensions exerted significant effects on interest rates on loans to households in peripheral countries, together with a decline in lending to non-financial corporations. These factors could then, in turn, have contributed to the rather weak private investment in many countries, as already discussed in the Introduction.

4. BUSINESS CYCLE PERSPECTIVE

In this framework, when an economy rests above its potential, the output gap at time *t* (GAP_t) is defined as positive, when the economy is below its potential, the output gap is situated in the negative territory. Typically, the output gap is defined as a ratio of real and potential product; for technical details, see, e.g., Fedelino – Ivanova (2009).

$$GAP_t = \frac{GDP_t}{POT_t} \tag{13}$$

We are then interested to see the contributions of the output gap and potential product to the growth of real product for each country. The same technique of taking natural logarithms can be applied, as explained in the previous section:

$$\log GDP_t - \log GDP_\tau = \left(\log POT_t - \log POT_\tau\right) + \left(\log GAP_t - \log GAP_\tau\right). \tag{14}$$

In order not to rely on a single approach, we will apply three methods: two univariate ones, which take into account only the development of real GDP – the Hodrick-Prescott filter and the band-pass filter – and a multivariate method based on the production function that takes on board a larger number of explanatory variables.

Each country's potential outputs are estimated on the time span of Q1/2000–Q4/2013. This should, *inter alia,* reduce the end-point biases of the HP filter applied at some stages of the methodology, as will be discussed below. *Figure 2* presents an example of final output gap estimates for the British economy using all three above-mentioned methodologies, on the basis of equation (13). The general pattern of most EU economies is that the production function yields a more negative output gap during the year 2009 crisis, especially due to the increase in cyclical unemployment and the cyclical TFP decrease.

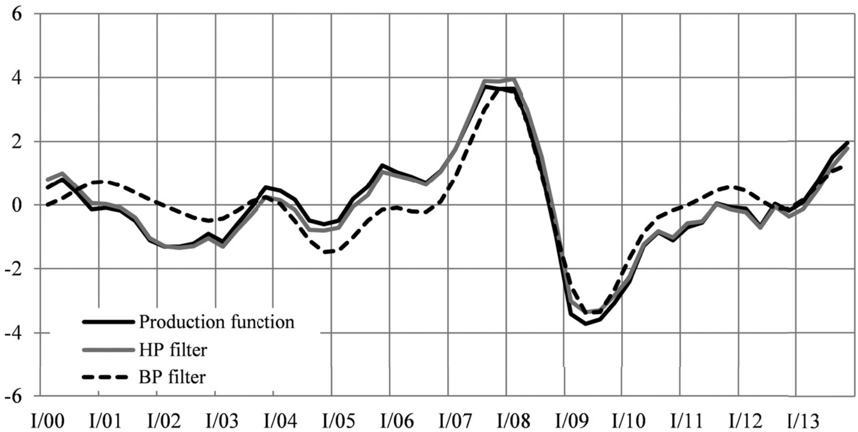

Figure 2. Output gaps using three different methodologies in GB (% of potential output)

Source: Eurostat, own calculations.

4.1 Hodrick-Prescott filter

This method is often regarded as a first-choice detrending technique in macroeconomics. In its original form, it seeks to minimise differences between a time series and its trend part, subject to the only parameter to be set ad hoc, which establishes the smoothness of the trend part (Hodrick – Prescott 1997). Its drawbacks are very well researched, and include in particular the end-point bias problem: the filter is more sensitive to changes at the ends of the time series, possibly leading to large revisions of the trend component as soon as new data are available. There are several methodologies to help avoiding this, such as forecasting the time series and applying the HP filter on the whole resulting time series (Maravall – del Río 2001: 9). Nevertheless, we are using three additional observations (Q2 to Q4/2013), which could yet allow for a more accurate analysis of the potential product in the first quarter of 2013.

The next inherent drawback is the necessity for the rather ad-hoc choice of the smoothing parameter. For the purposes of the paper, we will choose the value recommended in the original paper for quarterly figures: 1,600. There is an array of follow-up literature regarding the choice of this parameter; authors generally tend to use the traditional value if they cannot find a clear counterfactual. To quote an example, French (2001: 6) argues that on the basis of variance decomposition of cyclical and trend TFP shocks in the US economy over 1960–1990, the smoothing (lambda) parameter should be larger than 1,600; nevertheless, due to the lack of a substantive counterfactual, he uses the originally proposed value.

4.2 Band-pass filter

This group of filters allows for detrending using assumptions in the frequency domain, and only business cycle frequencies within a set time margin can feed through to the potential. A frequently used tool is the Baxter–King method (1995); however, due to its construction, a certain number of values at the ends of the time series cannot be calculated, and it is therefore not applicable for this study, where we need to examine the end of the time series. Another approach is to use the HP filter several times with different values of the smoothing parameter in order to obtain the desired frequency composition (Nilsson – Gyomai 2011). In this study, we rather use the "single-step" Christiano–Fitzgerald filter (1999) that enables us to calculate underlying trend developments during the whole time series. In line with this paper and the common practice, we define business-cycle frequencies at between 1½ to 8 years.

4.3 Production function

The methodology for defining the potential product on the basis of the production function is the same as described in the first part of this paper. Instead of decomposing the real GDP into its "actual" components, we now have to construct the potential output from its potential components, i.e. the potential unemployment rate, potential participation rate, potential hours worked per person employed, and potential TFP.

The potential unemployment rate is typically referred to as the NAIRU (non-accelerating inflation rate of unemployment) or, alternatively, the NAWRU (non-accelerating wage rate of unemployment), which states a level of unemployment that does not cause inflationary (or wage) pressures. It can be calculated with a large array of methods, notably by a linear model (Elmeskov 1993), Kalman filtering (d'Auria et al. 2009), and is not restricted to the aggregate level only. Kadeřábková – Jašová (2011) present a methodology for determining the NAIRU at individual sectors of an economy. Nevertheless, for the sake of simplicity, constituents of the potential output would be calculated on the basis of the HP filter – including the NAIRU, as elaborated upon, e.g., by Ball – Mankiw (2002). Furthermore, we will then use this technique to calculate the potential (or rather "trend") participation rate, trend hours worked per person employed, and trend TFP. This would still allow us to see cyclical variations in each of them. Finally, we will set equal the potential and actual capital stock, as discussed in greater detail, e.g., in CBO (2001: 18).

Having defined the individual potential components, the calculation of the potential output is straightforward, on the basis of equations (4) and (5); instead of actual figures, their potential levels are imputed to these equations, which yields the final potential output estimates on the basis of the production function. Again, as an example, the time series underlying calculations for Great Britain are displayed in *Figures 3* and *4*. As already discussed, there has been a particular increase in cyclical unemployment in most EU countries during the year 2009, which was complemented by a cyclical decline in TFP. The post-2009 crisis potential TFP growth has been much more subdued in most examined countries, even falling in some, which is also the case in Great Britain.

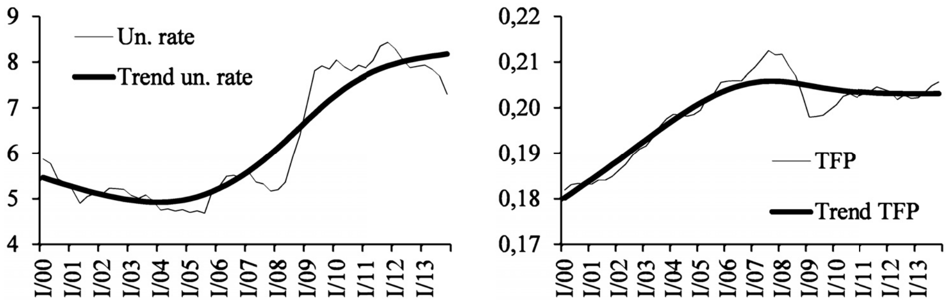

Figure 3. Unemployment rate (lhs, % of labour force, seasonal adjustment), TFP (rhs, implicitly seasonal adjustment) and their trend components in GB

Source: Eurostat, own calculations.

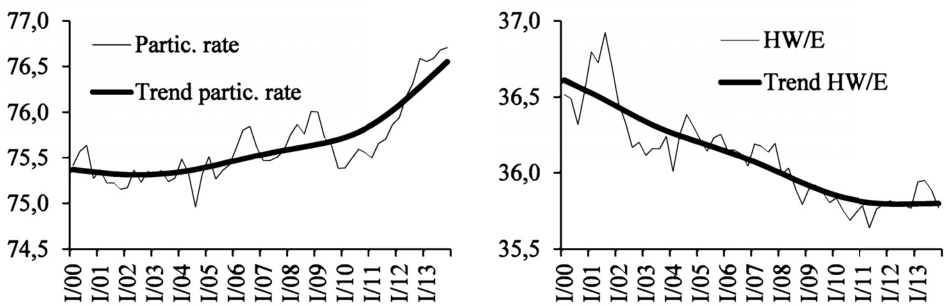

Figure 4. Participation rate (lhs, % of population 15–64, seasonally adjusted), average hours worked per person employed (rhs, seasonal adjustment) and their trend components in GB

Source: Eurostat, own calculations.

4.4 Business cycle perspective: the results

When looking at the results presented in *Table 3,* we see that there have been quite substantial differences in the business cycle conditions among EU countries.[7] For a number of them, potential product seems to have actually fallen over the researched time span. On the other hand, cyclical factors may have played a positive role after the deep 2008/09 crisis for most countries, with the notable exceptions of Greece and Portugal. For the EU aggregate, all methods show a very slow growth of potential output, suggesting that the modest recovery has been largely cyclical.

When comparing the three used methods, the production function generally hints at a lower potential product than the other two univariate methods. This result is not surprising, given the further decomposition of potential output growth in *Table 3,* showing contributions of four of its sub-components. Contributions of capital stock are by definition identical to those in *Table 2,* as discussed in the methodological section. The decline in trend hours worked per person employed, together with adverse developments in structural headcount labour market outcomes (denoted as *E* in *Table 3*) were the predominant sources of sluggish potential growth on the basis of the production function. Of this, the elevated trend unemployment rate played a particularly unfavourable role.

Furthermore, some differences between HP and band-pass filters can be also tracked down; for example, the difference for the Czech Republic was caused by the particularly large GDP slump in the first quarter of 2013, which directly impacted the potential product in the band-pass filtering method.

Turning to individual countries, the Baltic States generally enjoyed a marked improvement in cyclical conditions, given the particularly deep crisis in the preceding year. In contrast, all periphery countries experienced a slump in potential product, Greece a staggering 18.5% according to the production function method. The improvement in EU "core" countries was based on both improvement in cyclical conditions and a solid growth of potential product, with the exception of Finland, where all three methods point to a decline in potential product close to 1%.

[7] The calculations in *Table 3* are based on seasonally-adjusted primary data (using Tramo/Seats), which is necessary from the business cycle perspective, as opposed to those in *Table 1.*

Table 3. Real GDP growth from Q1/2010 to Q1/2013 (%) and contributions, business cycle perspective

	GDP	HP POT	BP POT	PF POT	TFP	K	HW/E	E	HP GAP	BP GAP	PF GAP
BEL	2.5	1.7	1.5	1.4	–1.0	1.7	–0.1	0.7	0.8	1.1	1.1
BGR	4.5	1.3	0.4	–0.8	–2.1	4.6	–0.6	–2.7	3.2	4.1	5.3
CZE	0.4	0.3	–1.2	–0.4	–2.5	3.6	–1.3	–0.2	0.1	1.6	0.9
DNK	2.1	–0.8	–1.1	–1.2	0.3	0.7	–0.1	–2.1	3.0	3.3	3.4
DEU	6.1	3.9	3.3	4.0	1.2	1.2	–0.4	1.9	2.2	2.7	2.1
EST	17.7	4.7	3.5	3.6	0.6	3.7	–0.3	–0.4	13.0	14.3	14.1
IRL	0.5	–2.2	–4.2	–4.1	1.2	–0.8	–0.7	–3.7	2.7	4.7	4.6
GRC	–21.7	–17.1	–17.9	–18.5	–9.9	–0.7	–0.3	–7.6	–4.6	–3.8	–3.2
ESP	–2.6	–3.2	–3.9	–4.4	1.4	1.3	–1.0	–6.1	0.6	1.3	1.8
FRA	3.2	1.9	1.3	1.7	0.7	1.7	–0.6	0.0	1.3	1.9	1.5
HRV	–3.5	–5.8	–6.6	–6.7	–2.3	1.8	–0.8	–5.4	2.3	3.1	3.1
ITA	–2.7	–3.6	–4.0	–4.0	–1.7	0.5	–1.3	–1.4	0.9	1.3	1.3
CYP	–5.3	–3.5	–6.3	–4.3	–5.4	1.9	–0.7	–0.2	–1.8	1.0	–0.9
LVA	13.9	0.6	–0.9	–0.6	0.5	2.3	–0.9	–2.6	13.3	14.8	14.6
LTU	13.4	3.9	3.0	2.5	1.6	3.6	–0.5	–2.2	9.4	10.4	10.9
LUX	3.3	2.0	1.0	1.9	–7.0	3.8	0.3	4.8	1.3	2.3	1.4
HUN	0.6	–1.7	–1.1	–2.4	–3.1	1.1	–1.1	0.7	2.3	1.7	3.0
MLT	4.5	5.0	3.3	4.6	2.8	0.1	–1.2	2.9	–0.6	1.2	–0.1
NLD	–0.8	–0.7	–1.7	–1.0	–0.9	1.0	–0.2	–0.9	–0.1	1.0	0.2
AUT	5.0	2.7	1.8	2.8	0.9	1.9	–1.3	1.3	2.3	3.2	2.2
POL	8.6	8.9	7.6	8.8	3.0	5.8	–0.5	0.4	–0.3	1.0	–0.2
PRT	–6.6	–3.6	–3.6	–4.2	0.9	0.0	–0.2	–4.9	–3.0	–3.0	–2.4
ROU	4.1	1.7	1.8	0.2	–5.9	6.4	–0.5	0.2	2.4	2.3	4.0
SVN	–1.8	–3.3	–4.0	–5.0	–1.5	0.8	–0.7	–3.6	1.5	2.2	3.2
SVK	6.2	5.5	3.5	5.2	1.3	4.4	–0.2	–0.3	0.7	2.7	1.0
FIN	3.4	–0.6	–0.7	–1.1	–1.4	1.9	–0.7	–0.9	4.0	4.1	4.5
SWE	7.9	5.2	5.1	5.0	1.5	2.5	0.1	0.8	2.7	2.7	2.9
GBR	2.8	0.6	0.9	0.3	–0.5	0.5	–0.1	0.4	2.2	1.9	2.5
EU	1.9	0.5	0.1	0.2	0.3	1.2	–0.7	–0.7	1.4	1.9	1.8

Note: HP: Hodrick–Prescott filter; BP: band–pass filter; PF: production function; POT: potential product; GAP: output gap.

Source: Own calculations, based on Eurostat purchasing power parity GDP data after seasonal adjustment.

5. CONCLUSION

This paper presented an overview of the drivers of the marked differences in economic performance among EU countries between the first quarter of 2010 and the first quarter of 2013. From the perspective of national accounts, it was demonstrated that the majority of countries enjoyed a positive contribution of net exports. In countries struck by the sovereign debt crisis, all components of domestic demand were falling, on the back of the extensive fiscal retrenchment. On the other hand, all components of the domestic demand contributed positively for rapidly growing economies.

The growth accounting exercise then allowed for a deeper insight into real GDP development. Although fixed investments fell quite substantially in many countries, the contributions of capital stock to GDP growth were still generally positive, suggesting that new investments still managed to surpass the depreciation of capital stock. Labour market outcomes have been much diversified, and only one general observation can be made: the widespread reduction in hours worked per person employed. This might suggest that labour hoarding tendencies were present in most EU countries, reflecting the still uncertain future prospects for employers in this region as a whole. Several countries experienced large increases in unemployment rates, which contributed markedly to the poor economic performance; notably, the higher unemployment rate in Greece impacted the GDP growth by 10 percentage points.

From the perspective of the business cycle, the GDP growth in most EU countries has been supported by a cyclical upturn, with the exception of EU periphery countries. In these states, the economic slump was also largely caused by the decline of the potential product. Of the three methodologies used for calculating the potential product, the production function generally suggests a more subdued potential output growth, which was dragged down especially due to the worsened labour market situation.

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