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Business Cycle Convergence or Decoupling?

Economic Adjustment in CESEE during the Crisis[*][†][‡]

Martin Gächter, Aleksandra Riedl and Doris Ritzberger-Grünwald[§]

Abstract

We analyze business cycle convergence in the EU by focusing on the decoupling vs. convergence hypothesis for central, eastern and south eastern Europe (CESEE). In a nutshell, we find that business cycles in CESEE have decoupled considerably from the euro area (EA) during the financial crisis in terms of both cyclical dispersion (i.e. the deviation of output gaps) and cyclical correlation. The results are mainly driven by smaller countries, which can be explained by the fact that small economies seem to have larger cyclical swings as they are more dependent on external demand, which causes a decoupling in terms of higher output gap deviations from the EA cycle in times of economic crises. At the same time, this does not necessarily affect business cycle synchronization as measured by cyclical correlations, where the strength of the linear relationship of two cycles is measured. However, despite the recent declines in the co-movement, we generally observe high correlation levels of CESEE countries with the EA after their EU accession in 2004. Finally, we find a significant decoupling of trend growth rates between EA and CESEE until the onset of the financial crises. Since the beginning of the crisis, trend growth rates have declined both in CESEE and the EA with the trend growth differential decreasing significantly from about three to below two percentage points in 2011.

JEL classification: E32, E52, F15, F33, F44;
Keywords: Business cycles, EMU, CESEE, optimum currency areas;

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1 Introduction

The recent financial crisis has shifted both public and academic interest towards business cycle developments within the troubled euro area (EA), while the previously fast growing literature on business cycle convergence of central, eastern and south eastern European (CESEE) countries has temporarily lost some attention. Despite the current debt crisis within the EA, it also seems interesting which remaining (non EA) EU member states experienced smooth economic adjustment (i.e. synchronous cycles) as opposed to countries which diverged considerably during the crisis. Recently, Kose et al. (2012) stressed that global emerging market economies (EMEs) have decoupled somewhat from industrialized countries in terms of business cycle synchronization during the last two decades, while business cycles within each of these two groups of countries converged over time.[1] From a theoretical perspective, this relationship is ambiguous. On the one hand, rising trade and financial integration might lead to convergence of business cycles, as proposed by Frankel & Rose (1998). But on the other hand, rapidly rising income levels in EMEs are expanding the size of the domestic market, making them less reliant on demand from advanced economies. While the results by Kose et al. (2008, 2012) have recently been put into question by Wälti (2010), they also raise the question about the corresponding relationship at the European level. Since the onset of the European debt crisis, wide-ranging economic coordination measures have been decided and implemented at the EU level. In this respect, the recent strengthening of the Stability and Growth Pact aims at more harmonized and coordinated fiscal policies in the EU, while the Europe 2020 growth strategy targets structural policies across member countries. Furthermore, according to the treaties of accession, membership in the euro area is still the long-run objective of all new member countries in the CESEE region. While CESEE countries are increasingly linked to advanced European economies due to their membership in the EU and enhanced trade interlinkages, the opposing argument of increasing income and domestic market size also applies to EMEs in Europe. Clearly, this relationship might also depend on the size of the economy. As smaller countries are observed to be more open – and hence more reliant on external demand – they might experience a higher co-movement with the EA cycle. On the other hand, a higher fraction of external demand might cause more volatile cycles over time leading to larger deviations from the EA cycle.

Against this background, we want to shed some light on the economic adjustment experiences of European countries in recent years, especially during the financial crisis. A particular focus is put on business cycle heterogeneity as well as correlations between CESEE and EA countries, thereby analyzing whether this convergence process differs with respect to the size of the economies. Finally, we want to examine the development of the trend growth differential between CESEE and the EA. As evidence points towards a decoupling of global EMEs from industrialized countries in terms of trend growth rates (Helbling et al. 2007, Kose et al. 2012), it seems interesting to explore whether this pattern also applies to EMEs in Europe and if the relationship between trend growth rates has changed significantly since the beginning of the financial crisis.

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[1] Similar contributions by (partly) the same authors, albeit with a slightly different focus, were already published earlier, see for instance Kose et al. (2003), Helbling et al. (2007) or Prasad et al. (2008).

The paper is structured as follows. Section 2 gives an overview of the theoretical background as well as the current literature on business cycle synchronization in Europe both in EA and CESEE countries. Section 3 explains the data set and the methodology of our study, while section 4 reports empirical results. Finally, section 5 draws some conclusions.

2 Literature Review

2.1 Theoretical Background

In the empirical literature, two main strands of literature on convergence can be distinguished, namely studies on (i) income convergence, and (ii) business cycle convergence. The former concept is based on neoclassical growth models and focuses on a long-run setting, where recent studies for CEE find a pronounced catching-up process in Eastern Europe before the crisis, starting in the second half of the 1990s (Vojinovic & Próchniak 2009). Income convergence is also confirmed for the EU (27) countries, although new entrants and older members of the EU have been observed to belong to different groups of convergence (Cavenaile & Dubois 2011). Our paper, however, mainly focuses on the second strand of literature, i.e. business cycle convergence in the CESEE region, while certain conclusions can also be drawn for the catching-up process and with regard to how the patterns have changed since the recent crisis. The concept of business cycle synchronization examines short-run fluctuations around long-run trend GDP and is therefore particularly relevant for the establishment of a common currency area. In this context, the theory of optimum currency areas (OCA) put forward by Mundell (1961), McKinnon (1963) and Kenen (1969), has proposed a wide range of criteria for the optimality of a region for establishing a currency union, e.g. wage and labor market flexibility, trade and financial integration, coordination of fiscal policies etc. Generally, the synchronization of business cycles across member states has been proposed to be the most important 'meta-criterion' for the establishment of an OCA. The line of argument is simple: If two countries share the same business cycle, abandoning an independent monetary policy is less costly, as the same monetary policy stance might be optimal for both countries. As highlighted by Fidrmuc & Korhonen (2006), the application of the OCA theory was quite common after the break-down of the Bretton Woods system in order to assess the appropriateness of a possible fixed exchange rate for any given country. Subsequently, OCA theory once again attracted increased interest before the introduction of the euro, where most empirical studies assessed the correlations of business cycles between Germany and other potential member countries (Artis & Zhang 1997, 1999, Inklaar & de Haan 2001). The EU accession by 10 countries in 2004[2], followed by the entry of Romania and Bulgaria in 2007, led to a deeper analysis of the new member states and their business cycles. In particular, the membership of several new member states in the Exchange Rate Mechanism II (ERM II) as a prerequisite for the future introduction of the euro increased public interest in such studies. Fidrmuc & Korhonen (2006) give a comprehensive review of this literature, with most studies finding a considerably increased synchronization of CESEE countries with the euro area in their run-up to EU membership. The accession to EMU

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[2]   Estonia, Latvia, Lithuania, Poland, Czech Republic, Slovakia, Hungary, Slovenia, Cyprus, Malta.

by Slovenia (2007), Malta, Cyprus (2008), Slovakia (2009) and Estonia (2011) might also have implications for business cycle synchronization, as many OCA criteria are potentially endogenous (as shown for trade integration by Frankel & Rose (1998)). Interestingly, the effects of the current economic crisis on business cycle synchronization in Europe (and on CESEE countries in particular) have hardly been examined so far, although the heterogeneity in monetary and fiscal policies in those countries make a corresponding analysis particularly interesting.

2.2 Business Cycle Convergence within the Euro Area

While a broad strand of literature examined business cycle synchronization in the EA before the introduction of the euro in order to assess the euro readiness of various countries, more recent studies mainly focus on the actual impact of the introduction of the euro on business cycle convergence. The results of those studies, however, are quite mixed.[3] Previous studies differ by (i) the country sample, (ii) the covered time period, (iii) the methods for calculating the cyclical components (i.e. the filter method), and finally by (iv) the synchronization measure. From a theoretical perspective, the impact of a common currency is ambiguous. On the one hand, stronger bilateral trade relations might lead to more symmetric shocks across member states. Therefore, the OCA criteria might rather be fulfilled ex post than ex ante, as argued by Frankel & Rose (1998). On the other hand, Krugman (1991) and Imbs (2004) argue that economies of scale might lead to increased specialization across regions, which could even reinforce asymmetric shocks after the establishment of a currency union.[4] Massmann & Mitchell (2004) analyze monthly industrial production data for 40 years to give a comprehensive historical overview of business cycle synchronization in Europe. By applying eight different measures of synchronization, they find both periods of convergence and divergence during the last decades. However, probably due to the convergence criteria established in the Maastricht treaty, business cycle synchronization increases significantly during the 1990s which is also confirmed in several other studies (Altavilla 2004, Darvas & Szapáry 2008). Subsequently, Camacho et al. (2006) find a relatively high level of synchronization among EA countries. However, further increases of synchronization after the introduction of the common currency, as suggested theoretically by Frankel & Rose (1998), cannot be corroborated. Böwer & Guillemineau (2006), on the contrary, analyze the determinants of business cycle synchronization in the EA and find more synchronous cycles after 1999, which they mainly trace back to increased intra-industry trade across countries in the EA. Similarly, Gayer (2007) reports a general decrease in the dispersion of EA output gaps in the currency union. However, the synchronization (as measured by bilateral correlation coefficients), although stabilized at high levels, has not increased further since 1999. According to his reasoning, the decrease in dispersion is mainly due to a general decline of the amplitude of cyclical components, which might lead to lower standard deviations. Although Furceri & Karras (2008) find an increased correlation of national cycles after the introduction of the euro by comparing fixed 5-year windows before and after 1999, most other studies are not able to

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[3] See de Haan et al. (2008) for a comprehensive literature review.
[4] Therefore, the overall effect mainly depends on whether bilateral trade between countries is predominantly inter- or intra-industry trade, respectively.

detect such an 'euro effect'. Recently, Weyerstrass et al. (2011) confirmed the proposition that national cycles have not become more synchronized in the currency union by applying dynamic correlations across member states.

To sum up, while the results generally differ substantially across studies due to different country samples, time periods and measurement techniques, the empirical pattern generally suggests that business cycles in the EA converged during the 1990s in the run-up period to the euro and, since then, correlations have leveled out at a relatively high level. Thus, further convergence after the establishment of the currency union, as suggested by the endogeneity criterion (Frankel & Rose 1998), is found not to have materialized in most empirical studies.

2.3 Business Cycle Correlations between CESEE and the Euro Area

As mentioned above, the convergence of business cycles in CESEE countries attracted increased interest in the literature in the early 2000s, just before the enlargement of the EU. The accession to the EU by 12 countries between 2004 and 2007 implied a path towards full monetary integration for those countries, although the year of the euro introduction differs across countries and is still open for some new member countries (NMC). Fidrmuc & Korhonen (2006) give a comprehensive literature overview on business cycle correlations between Central and Eastern European (CEE) countries and the EA and analyze 35 publications (between 1999 and 2005) by means of a meta-analysis. They find that some NMC already have comparably high correlations with the euro area business cycles, although the results across countries are quite heterogeneous. The highest average business cycle correlation with the EA are reported for Hungary, followed by Slovenia and Poland. The Czech Republic, Estonia and Latvia exhibit significantly lower correlations, but still more synchronization than Bulgaria, Romania and Slovakia. For Lithuania, the meta-analysis suggests even negative correlations with the EA. Although the literature survey documents large differences among various publications, it suggests that the synchronization of business cycles in several CESEE countries matches or even exceeds that of smaller, peripheral monetary union members. The results are basically in line with an earlier study by the same authors (Fidrmuc & Korhonen 2004) where they assess the correlation of supply and demand shocks between the EA and EU accession candidates from 1993 to 2002. Interestingly, however, the economic slowdown between 2000 and 2002 increased the heterogeneity between the two regions. Thus, it seems interesting to examine economic adjustments in the current financial crisis to assess whether similar patterns of divergence are emerging.

Darvas & Szapáry (2008) extend the analysis by including synchronization measures not only for GDP, but also for its components. They confirm the high degree of synchronization for Hungary, Poland and Slovenia (for GDP, industrial production and exports, but less so for consumption and services). The Czech Republic and Slovakia are less synchronized, while the Baltic States are hardly synchronized at all. Furthermore, as suggested by previous papers (see, for instance, Artis et al. (2005)), the three leading NMC indeed exhibit higher synchronization measures than peripheral EMU countries in the time period 1998-2002. This is basically confirmed by Eickmeier & Breitung (2006) who investigate

the issue by calculating dynamic correlation and cohesion measures. However, in addition to the three NMC mentioned above (Hungary, Poland, Slovenia) and contrary to other studies, they find that Estonia is also well prepared for an entry into EMU. While the findings by Artis et al. (2008) are consistent with previous results, their analysis of potential sources of business cycle synchronization suggests that EU integration might have ambiguous effects on the synchronization of business cycles. More precisely, fiscal shocks and labor market rigidities may counteract the positive effects associated with increased trade and financial flows. Benczúr & Rátfai (2010) show that business fluctuations in CESEE countries are generally more pronounced than in developed ones, being similar in size to the fluctuations in other emerging market economies. More recently, Savva et al. (2010), by allowing for the endogenous determination of the timing and the length of structural shifts in the degree of co-movement between the cyclical components of industrial production, find that CESEE countries generally experienced a sizeable increase in their business cycle synchronization with the euro area. Remarkably, all NMC at least doubled their business cycle synchronization or changed from negative to positive correlations since the early 1990s, respectively. However, their results also show a great variety in the timing and speed of correlation shifts across the country sample, although most of the NMC experienced a change around or after the completion of their admission negotiations at the end of 2002. On the other hand, Aslanidis (2010) reports a high synchronization of the Hungarian cycle, but less so for the Czech Republic and particularly for Poland by applying threshold-seemingly-unrelated regressions. Recently, Gomez et al. (2012) offer a novel methodological approach based on networks within a correlation matrix applied to EU and candidate countries. They find that some countries have achieved a significant degree of co-movement (such as the Baltic countries, Hungary or Slovenia), while others have even experienced reduced synchronization (e.g. Romania, Bulgaria or Greece). In general, particularly when examining the business cycle synchronization of NMC, it should be highlighted that any analysis is necessarily backward-looking, which might be particularly relevant for transition economies (Eickmeier & Breitung 2006), as they are undergoing a phase of structural change which could also change business cycle synchronization patterns. Therefore, an analysis of economic adjustment of those countries during the crisis seems particularly relevant for the purpose of examining changing patterns in European business cycle convergence.

3 Data & Methodology

3.1 Dataset

Most of previous studies used either GDP or industrial production to measure business cycle synchronization (de Haan et al. 2008). As GDP is clearly the most comprehensive output variable, we use real GDP data (seasonally adjusted, 2005 price level) from Q1 1999 to Q1 2012. The country sample includes the countries which have been with the EA from the beginning (EA 12), the recently (between 2007 and 2011) joined EA countries ('New' EA 5), and the remaining Non-EA countries in CESEE, including Croatia (CESEE

8).[5] All data are extracted from Eurostat and are therefore comparable both in the cross section and time series dimension.

3.2 Calculation of Business Cycles

The output gap is an important determinant for monetary policy, as it is usually a good indicator of future inflation developments. As the common monetary policy within a currency union is only able to consider aggregated output and price developments in the whole currency union, the synchronization of business cycles (i.e. output gaps) across countries is commonly referred to as the most important criterion of an optimum currency area (OCA). To extract the trend from the cyclical component of the GDP time series, various filter techniques have been proposed in the literature (see Gächter et al. (2012) for a related discussion). In order to increase the comparability with other studies, we apply the widely used Hodrick-Prescott (Hodrick & Prescott 1997) filter to calculate cyclical components[6]. The trend component is estimated by minimizing the deviation of the actual data points from this trend, with the smoothing parameter being determined ex ante. While the trend can be interpreted as potential output, the cyclical component corresponds to the output gap (i.e. fluctuation around the long-run trend).

3.3 Synchronization Measures

Subsequently, the cyclical components are used to calculate various measures of business cycle synchronization. Synchronous cycles imply that cyclical components of two countries (country aggregates) are moving up/down simultaneously and/or that the output gaps show similar values at a given point in time. Asymmetric shocks, on the contrary, point to situations where business cycles diverge across countries. The reason for such divergence can either be an asymmetric shock (i.e. concerning only one country, e.g. natural disasters, national economic policy) or a common shock (e.g. an increase of oil prices) which, however, affects countries in different ways. For a comprehensive analysis, we therefore need more than one synchronization measure (Gächter et al. 2012). More precisely, we calculate both the (i) dispersion (standard deviation) of cyclical components across countries at a given point in time, and (ii) the correlation between cyclical components in two-year moving windows in various country samples, as described below.

- **Dispersion:** Following Crespo-Cuaresma & Fernández-Amador (2010), the dispersion of the output gap at each point in time is measured by the standard deviation of cyclical components across the examined country sample. Thus, the dispersion can be used to assess whether business cycles are converging or diverging within a region. The main disadvantage of this measure is, however, that business cycles

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[5] Our study focuses on developments within the EA and the CESEE region; UK, Sweden and Denmark are not included in the following analysis.

[6] Note that this estimation method might be subject to parameter instability at the end of the sample period. As shown by Gächter et al. (2012) for the EA, parameter instability is most pronounced in the last four quarters and mainly affects the dispersion measure. Hence, results concerning the dispersion in 2011 exhibit considerable uncertainty.

could exhibit similar output gaps (and therefore, low dispersion rates) even if they develop in different directions (i.e. one output gap is still increasing, while the other one is already decreasing).

- **Correlation:** This drawback is offset by the second measure for synchronization, namely the correlation of two cycles. The correlation coefficient measures the strength of the linear relationship between two time series (i.e. cyclical components). Therefore, the absolute value of the output gap is not captured by a correlation analysis. Furthermore, the correlation cannot be measured in each point in time, but only for two time series (e.g. in rolling windows of two years). This synchronization measure is calculated either by (i) the average bilateral cyclical correlations across a given country sample (e.g. EA, CESEE etc.), or by (ii) the correlation coefficient between the corresponding country and the relevant country aggregate (e.g. EA).

4 Empirical Results

4.1 Business Cycle Synchronization in Europe

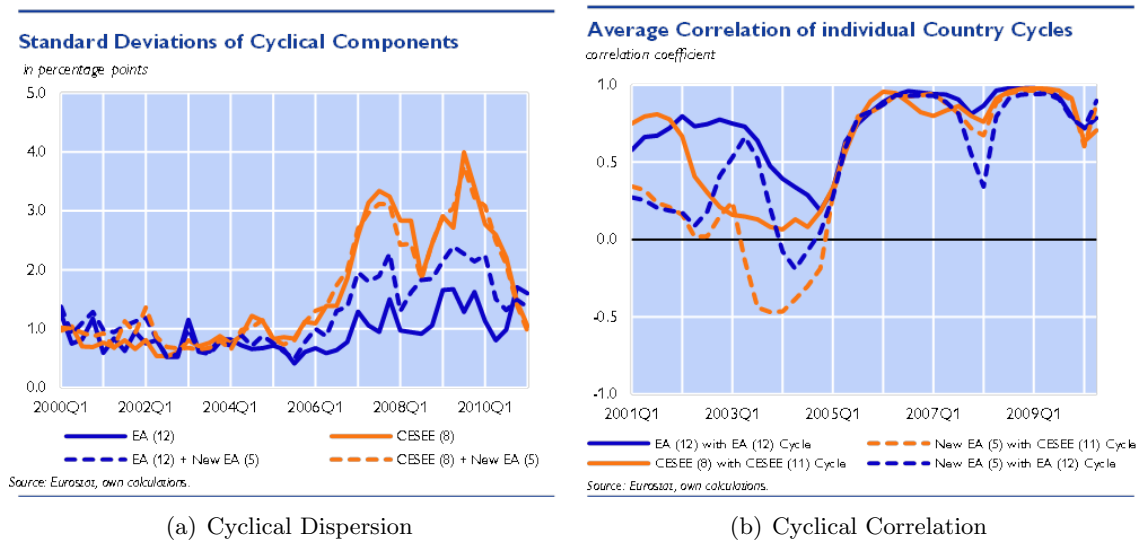(a) Cyclical Dispersion (b) Cyclical Correlation

Figure 1: Cyclical Heterogeneity in CESEE and the EA

First of all, we examine the development of business cycle synchronization in CESEE and the EA, respectively.[7] Panel (a) in Figure 1 shows the standard deviations of cyclical com-

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[7] The sample include the starting EA (12) countries, the 5 recently joined ('New') EA countries (Slovakia, Malta, Cyprus, Slovenia, Estonia) and the 8 remaining CESEE EU member states (Latvia, Lithuania, Poland, Czech Republic, Hungary, Romania, Bulgaria and Croatia). Croatia is included as it will join the EU in 2013. On the contrary, UK, Denmark and Sweden are excluded as the issue of business cycle synchronization outside the currency union seems less important, and further, the focus of this study is on EU member states in CESEE.

ponents for various country groups. At the beginning of EMU, business cycle heterogeneity was no major issue, as cyclical deviations were relatively small and the correlations comparably high, even outside the EA. The increase in the dispersion of cyclical components across all country aggregates since the end of 2006 clearly stands out.[8] Interestingly, this divergence became an issue approximately two years before the crisis in the corresponding boom period, while it somehow declines slightly at the beginning of the crisis (when the cycles seem to move downward simultaneously). At the beginning of the recovery phase in end-2009, the standard deviations peak the second time, before they start to decline again in the light of the current sovereign debt crisis, where economic activity weakens all over Europe. While this pattern is also observable for the EA (12) countries, it is much more pronounced for the CESEE (8) countries. Obviously, the development across CESEE economies during the crisis was much more heterogeneous than across the EA.

For the group of countries which recently joined the EMU ('New' EA), it is theoretically ambiguous in which country aggregate they actually fit best. On the one hand, these countries belong to the group of new member countries which joined the EU in 2004, and therefore, should be classified as EMEs belonging to the CESEE aggregate. On the other hand, they fulfilled the convergence criteria very quickly and joined the currency union in recent years. A simple visual inspection of the data might help to assess whether the patterns point to an inclusion in the EA or CESEE subsample, respectively. The two dashed lines in panel (a) of Figure 1 show the dispersion of cycles in the EA and CESEE countries, in each case including the New EA (5) economies. While the standard deviation of the enlarged CESEE sample (13) hardly deviates from its original values for CESEE (8), the dispersion of the EA sample significantly increases when including the 'New' EA (5), at least for the period from 2006 to 2010. Thus, we conclude that the new EMU countries rather tend to follow the patterns of other (non-EMU) CESEE countries than the EA (12) countries. Similar (albeit less clear) conclusions can be drawn from panel (b) in Figure 1, where we report average correlations of the cyclical components with the EA (12) cycle and the CESEE (11) cycle in two-year rolling windows. Interestingly, when analyzing an earlier interesting point of time, the (comparatively small) recession in 2003/2004 and the following policy reactions led to a significant decrease in cyclical correlations. At that time, the synchronization appears generally lower in CESEE than in the EA. At the beginning of the recovery, starting in Q1 2005, we observe a distinctive increase in cyclical correlations for all countries, i.e. including the EA. At the cyclical peak in Q1 2008, there is a decline in synchronicity for a short period of time for all country groups, but to a much higher extent in CESEE economies than in EA countries. Particularly the 'New' EA (5) countries seem to deviate substantially from each other, which is likely caused by differing cyclical peaks (i.e. their cycles peak at different points in time). A similar pattern can be observed at the beginning of 2010, where the most recent decrease in synchronization occurs. However, contrary to 2008, the 'New' EA (5) countries follow the behavior of the other EA countries more closely, while CESEE (8) record a slightly stronger decline in cyclical synchronization. To put it short, two main insights stand out, namely (i) that the 'New' EA (5) show a similar pattern as the CESEE (8) region, although they seem to converge towards EA (12) at the end of the sample period, and (ii) while the dispersion of output gaps starts to diverge significantly in 2006, the pattern for cyclical correlations

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[8] For the EA countries, this has been already discussed by Gächter et al. (2012).

generally shows an increased synchronicity after the recession in 2004, with the exceptions at the end of the boom (Q1 2008) and the current crisis (since Q4 2009), particularly in the CESEE (8) countries. Overall, we observe a higher heterogeneity among CESEE countries than within the EA with respect to both dispersion and correlation of business cycles, although the homogeneity seems to increase substantially towards the end of the sample period.
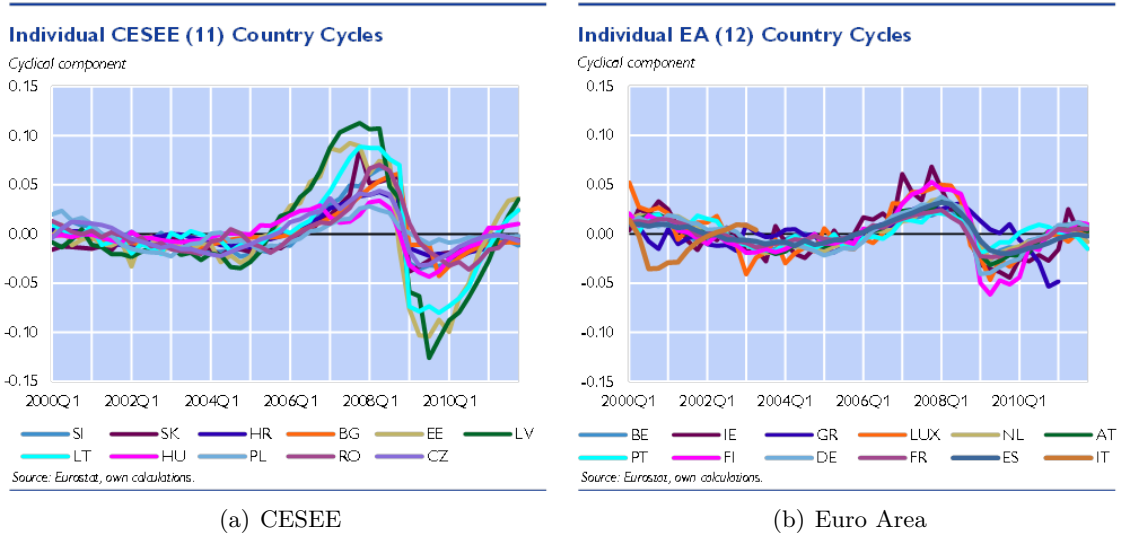

(a) CESEE   (b) Euro Area

Figure 2: Cyclical Swings and Volatility

Figure 2 compares individual country cycles in CESEE and the EA, giving some first insights on the economic adjustment in small and large economies. While the cyclical deviations are generally larger in CESEE as compared to the EA (as indicated by the larger cyclical swings), the cyclical components are also smaller in larger countries across-the-board, both in the EA and CESEE. The largest cyclical swings (i.e. output gaps) during the crisis are reported for small open economies in CESEE, such as the Baltic countries, where the output gaps exceed 10% of potential GDP in certain time periods. Poland, on the other hand, seems to have the most stable cycle, and thus, the lowest average output gap during the crisis in CESEE. Similarly, the remaining three large economies (CZ, RO, HU) also exhibit substantially lower cyclical swings than their smaller counterparts.

4.2 A simple Decomposition of Heterogeneity: Size and Openness

The larger swings of smaller countries support the hypothesis that larger economies are less reliant on external markets, and thus, achieve more stable cycles. One obvious explanation is the relationship between the size and openness of an economy, as shown in Figure 3.[9]

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[9] Luxembourg is omitted in Figure 3 for scaling reasons, as it is by far the smallest and most open economy in the EA. To increase the comparability of the two graphs, we scaled the trade axis similarly, and therefore, had to exclude Luxembourg from this figure.

Total trade, i.e. the sum of exports (of goods and services) relative to GDP, tends to be lower in larger economies, which might imply smaller (more stable) cyclical swings and/or less dependence on external developments. However, while large economies are generally less open due to their large domestic markets, the relationship is less clear for small economies, where the degree of openness, ceteris paribus, spreads considerably.
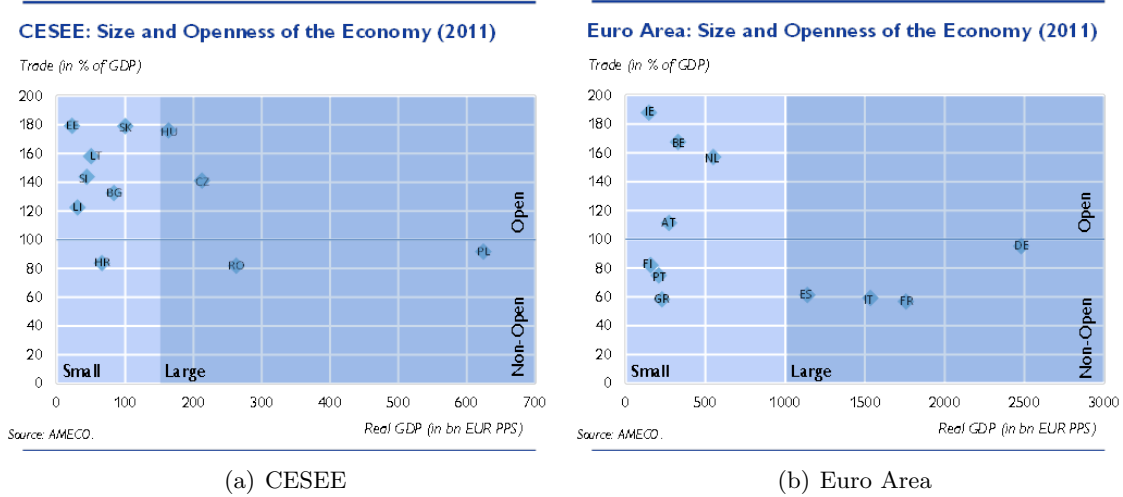

(a) CESEE

(b) Euro Area

Figure 3: Openness und Size of the Economies

In the EA, for instance, Greece, Portugal and Finland are small, but relatively closed economies (where the trade to GDP ratio in 2011 was smaller than 100%), the same applies to Croatia in the CESEE country sample. On the other hand, two of the larger economies in CESEE, HU and CZ, are quite open economies, exceeding our threshold trade/GDP ratio of 100% by far. Hence, for the following analysis, we divide the sample of CESEE and EA countries both according to their size (large/small) and openness (open/non-open) to analyze cyclical deviations separately for those groups.

Due to the different stage of economic development, the threshold between small and large economies differs between CESEE and the EA. In the EA, we classify DE, FR, IT and ES as 'large' (as their real GDP exceeds 1000 billion EUR PPS), while the remaining eight economies are classified as 'small' (LU, FI, IE, PT, GR, AT, BE, NL). For CESEE countries, we also classify four economies as 'large' (HU, CZ, RO, PL), while the remaining seven countries are assigned to the 'small' economies sample (EE, LI, SI, LT, HR, BG, SK). While the threshold between small and large economies in CESEE was somehow arbitrarily set (at 150 billion EUR PPS), the four larger countries also differ significantly in their economic policy. While the small economies either have already adopted the euro or exhibit a fixed exchange rate (and therefore, no independent interest rate policy), the four large countries in our sample still feature floating exchange rates, which might influence economic adjustment during the crisis significantly.

While the distinction between small/large and open/non-open economies mostly overlaps, there are also some exceptions. As mentioned above, while Finland, Portugal and Greece

are classified as small economies, they are nevertheless comparatively closed, and therefore, are added to the four large economies in the EA in the 'non-open' sample. The same applies to Croatia in the CESEE sample, while two countries, Hungary and Czech Republic, are classified as 'large', but 'open' economies. Figure 3 gives an overview on the country samples in CESEE and the EA, respectively.
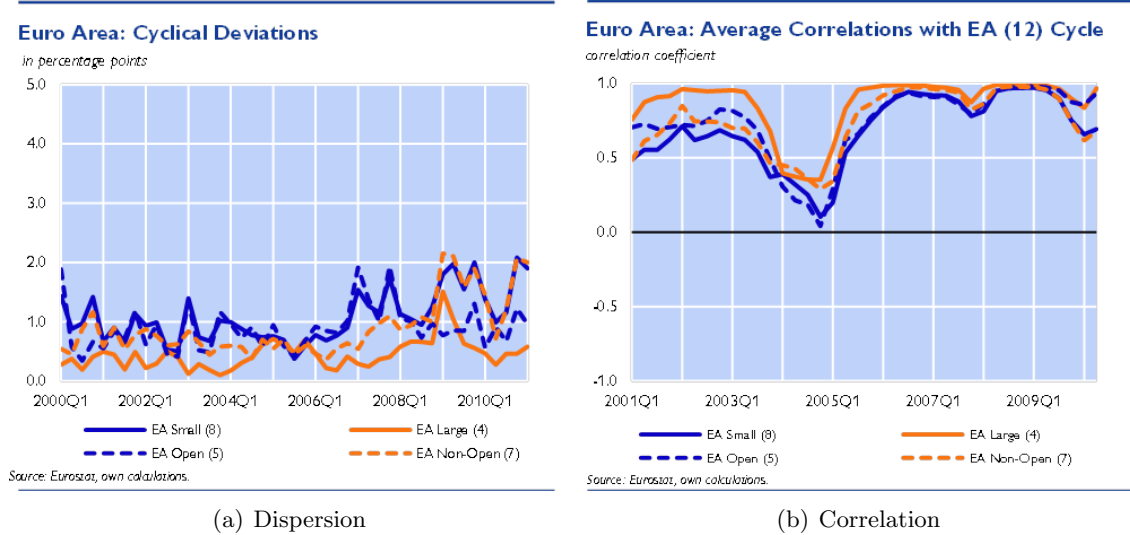

(a) Dispersion (b) Correlation

Figure 4: Small/Large and Open/Non-open Economies in the EA

Figures 4 and 5 show the results for the EA and CESEE, where panel (a) indicates cyclical deviations (standard deviations) and panel (b) cyclical correlations in the corresponding sub-samples, respectively. In the EA, small and open economies show higher dispersions of cyclical deviations than their large counterparts, at least until the start of the crisis in 2008. This is not surprising, as they are more reliant on external demand, which makes their cycles more volatile over time, leading to higher output gap amplitudes. Furthermore, small and open economies tend to have more specialized industries, likewise resulting in larger cyclical swings. Remarkably, non-open economies show considerably higher dispersion than large economies. As the definitions / samples between the two categories are somewhat overlapping, the higher standard deviation of non-open economies (as compared to large economies) can be traced back to the inclusion of small, non-open economies, which are consistently peripheral countries (Greece, Portugal and Finland) of the EA. Particularly at the end of the sample during the sovereign debt crisis, non-open economies with low trade volumes seem to have difficulties to adjust smoothly to economic shocks, as shown by the high dispersion of non-open economies in recent quarters. Hence, the comparably higher dispersion of small economies is clearly driven by the three non-open small economies, as explained above. Less clear conclusions can be drawn from panel (b) in Figure 4. Although the cyclical correlation of small and open economies tend to be slightly lower in the EA, the correlations of individual country cycles is likely to depend on the trade intensity with other EA countries. A more detailed analysis, however, would go beyond the scope of this paper.
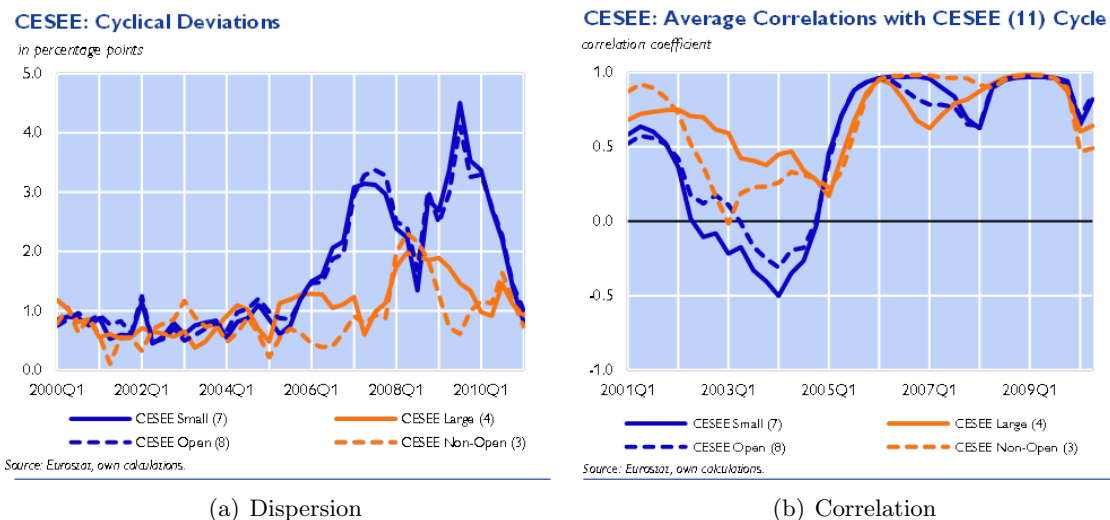
(a) Dispersion	(b) Correlation

Figure 5: Small/Large and Open/Non-open Economies in CESEE

Figure 5 shows the same analysis for the CESEE sample. While the cyclical dispersions are generally higher in CESEE, as already explained in the last section, the differences across small/large and open/non-open economies are also much more pronounced in CESEE than in the EA. While there are hardly any systematic differences across sub-samples until 2006, cyclical dispersions are much higher in small and open economies both in the pre-crisis boom period and the following bust period. In CESEE, the results for small and open economies are almost identical (although CZ and HU are included in the 'open', but not in the 'small' sample). With respect to cyclical correlations, small and open economies show signficantly lower correlations with the CESEE (11) cycle than their large counterparts. This is not surprising, given that open economies are more dependent on external demand, where non-CESEE trade partners (such as EA countries) play a major role for external demand in these countries.[10] Once again, in the run-up period to EU accession, all country samples show a remarkable convergence process in terms of cyclical correlations. During the boom phase before 2007, large countries seem to have slightly lower business cycle synchronization than small economies. While the correlation coefficients converge towards one during the crisis period when almost all economies record an economic downturn, large CESEE economies become less synchronized again after 2010 with the start of the European debt crisis. Thus, while small economies tend to have larger cyclical swings, and therefore, also exhibit larger cyclical dispersions, they seem able to adjust more smoothly during the crisis period in terms of cyclical correlations due to their trade openness.

The following section focuses on a comparison of the EA and the CESEE region and raises the question whether the CESEE region has decoupled from or rather converged to the EA cycle in recent years. As we have observed similar patterns for small and open vs. large

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[10] Note also that small countries can be less correlated with the CESEE cycle since the latter is a GDP-weighted measure.

and non-open economies, we will subsequently focus on the distinction between small and large countries in the CESEE region.

4.3   Decoupling or Convergence?

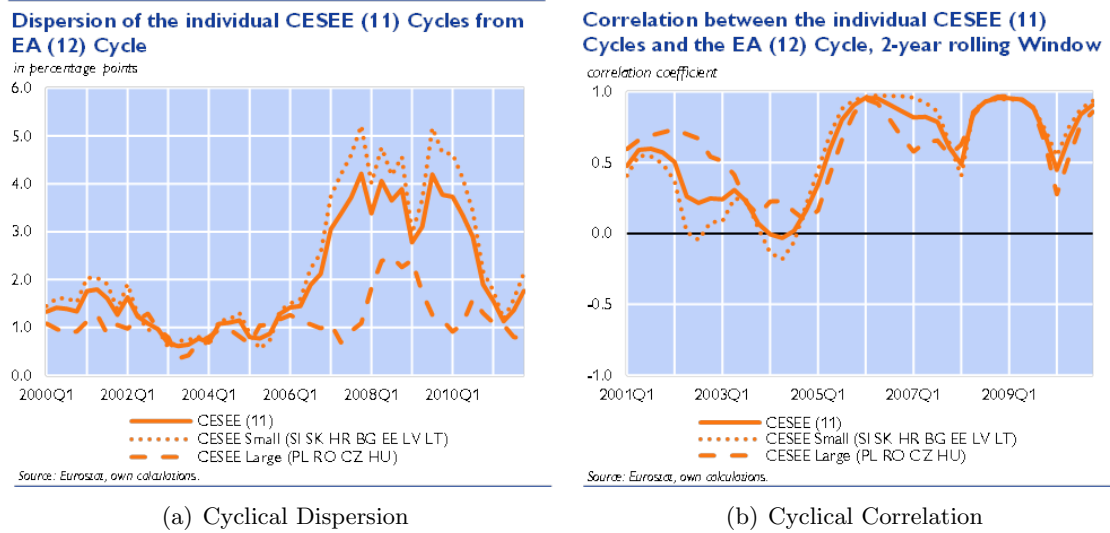(a) Cyclical Dispersion   (b) Cyclical Correlation

Figure 6: Decoupling of CESEE from the EA?

Panel (a) of Figure 6 shows the dispersion of cyclical deviations from the EA (12) cycle in the CESEE (11) region[11] as well as the results for two sub-samples, namely small and large economies. As mentioned above, we include four CESEE countries in the large sample (Poland, Romania, Czech Republic and Hungary), while the remaining seven CESEE countries are classified as small economies.

Once again, we observe a pronounced increase of cyclical deviations during the years 2006 and 2007, i.e. in the boom phase before the financial crisis. More importantly, however, we can interpret this figure as a substantial decoupling of the CESEE region from the EA in terms of cyclical deviations. The decoupling starts at the beginning of 2006 and peaks twice in Q4 2007 and Q2 2009, before moving downwards again towards the end of the sample. While we also observe slightly elevated dispersions in CESEE at the start of the sample, i.e. from 2000 to 2002, when the economies were moving towards the EU, the decoupling during the recent financial and economic crisis is considerably larger. Interestingly, this decoupling trend is mainly driven by small CESEE countries, whereas the large economies show only some marginal deviation from the EA cycle. This confirms

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[11] Contrary to Figure 1 where we calculated standard deviations of cyclical components within the corresponding group of countries, panel (a) in Figure 6 shows the average dispersion of the individual CESEE cycles from the EA (12) cycle. More precisely, we apply a slightly adapted standard deviation (i.e. deviation from the EA cycle) across the corresponding groups, where we use the sum of squared deviations from the aggregated EA (12) cycle (instead of the sum of squared deviations from the sample mean) to compute the corresponding measure.

that large (more closed) economies, where the size of the domestic market is high, are less reliant on demand from advanced economies.

Panel (b) in Figure 6 shows average correlations between individual CESEE (11) cycles and the EA (12) cycle, once again divided into small and large economies. It mainly reflects the pattern observed for the dispersion measure. The correlation with the EA (12) cycle increases considerably after the small recession in 2004 - simultaneously with the increase of correlations within the EA - but decreases remarkably during the boom and bust period around the onset of the financial crises. The correlation coefficient decreases twice from around 0.95 to 0.5 in Q1 2008 and Q1 2010. Although a correlation coefficient of 0.5 is quite high compared to the period before 2005, the graph clearly shows a decoupling of CESEE countries from the EA during this boom-bust period. Contrary to the dispersion of cyclical deviations explained above, the two declines in synchronization as measured by rolling-window correlations in 2008 and 2010 seem slightly more pronounced in larger economies. However, as the difference between small and large economies is quite small, the size of the economy does not seem to influence the co-movement of the cyclical component significantly. Finally, it should be stressed again that the mean correlation coefficient after 2005 is much higher than in the period before. An analysis of two year-rolling window correlations of individual CESEE countries with the EA (12) cycle shows a pronounced increase in the synchronization of CESEE cycles after their EU accession in 2004. Besides the already discussed declines in Q1 2008 and Q1 2010, only Hungary seems to have decoupled significantly from the EA in 2006/2007, while the remaining CESEE economies exhibit high co-movement with the EA cycle.

4.4 The Long-Run Perspective: Growth Differentials and Economic Adjustment
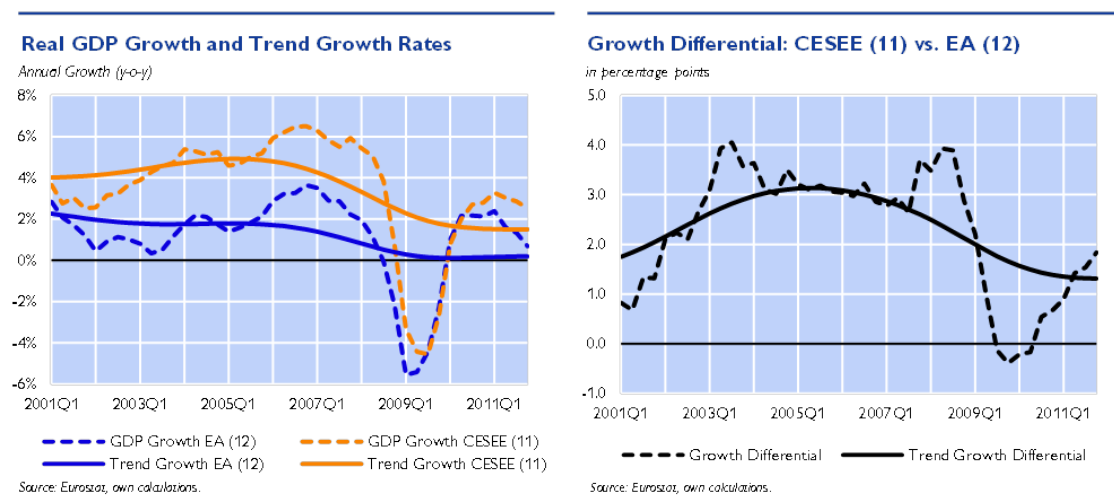
(a) (Trend) Growth Rates in CESEE and the EA   (b) (Trend) Growth Differential

Figure 7: The Long-Run Perspective

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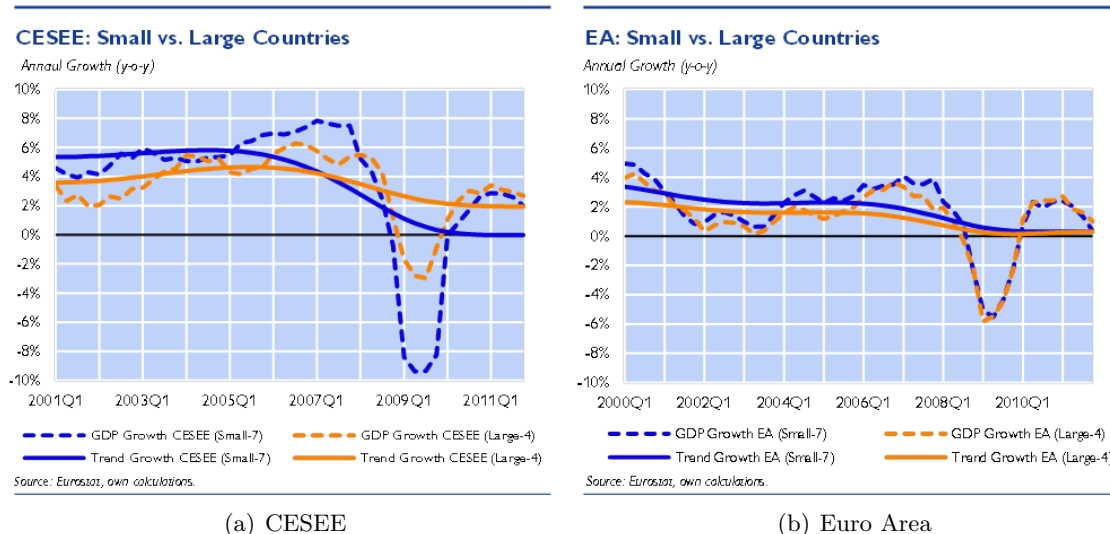(a) CESEE   (b) Euro Area

Figure 8: The Long-Run Perspective: Small and Large Economies

While the previous two sections focused on business cycle synchronization from two different perspectives, i.e. dispersion and correlations of cyclical components, the following section examines economic adjustment not only in the short-run, i.e. by investigating business cycles, but also in the long-run, i.e. by examining the development of trend growth rates in CESEE vs. EA countries. Figure 7 shows annual real GDP growth rates (on the same quarter of the previous year) for the EA (12) and the CESEE (11) aggregates as well as trend growth rates.[12] The figure on the right hand side, on the other hand, shows the growth differences (both for actual and trend growth) between the two regions. Several stylized facts stand out.

First, the growth differential between the EA and CESEE increased in the run-up period to EU entry (until mid-2003) and stayed rather constant around 3-4% until mid-2008. Subsequently, the growth differential even turned slightly negative during the Great Recession, but recovered towards 2% again at the end of the sample. Second, trend growth rates have declined during the crisis both in CESEE and the EA. Third, the trend growth differential of the EA and CESEE increased by more than one percentage point from 2001 to 2005/2006, and dropped from about three to below two percentage points by end-2011, with trend growth in the EA being estimated only slightly above zero.

Yet, what does that imply for the catching up process? As shown in Figure 7, the catching up process in CESEE even accelerated during the boom phase (as the growth differential increased), but slowed down significantly in the aftermath of the crisis. Hence, while the catching up process is continuing, it is considerably slower than before the crisis.

Figure 8 shows differences between small and large countries in terms of real GPD growth

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[12] The trend growth rate is calculated as the annual growth rate (on the same quarter of the previous year) of the trend variable, as calculated by a standard Hodrick & Prescott (1997) filter. For simplicity reasons, we calculate log-differences to compute the corresponding growth rates.

and trend growth in both regions. Remarkably, the experiences of economic adjustment differ strongly between the two regions, as shown by the considerable differences between large and small economies in CESEE. While the growth rates of small and large economies appear very similar in the EA, the pattern is very different for CESEE. Small economies exhibit (slightly) higher growth rates until 2008, but they are also much more affected by the crisis. By mid-2009, annual growth rates in small CESEE economies bottom out at record values of almost -10%. Since 2010, the growth differential between large and small economies within CESEE has shrank considerably, although large countries still feature slightly higher growth rates at the end of the sample.

This empirical pattern also impinges on the trend growth rate: While small and large economies converge in terms of their trend growth rate in the EA, this is not the case in CESEE. On the contrary, large economies exhibit significantly higher trend growth rates than small economies at the end of the sample (with the difference amounting to almost two percentage points), while small economies outperformed their larger counterparts in terms of trend growth rates until the start of 2007 when the crisis triggered a much stronger recession in small CESEE countries. This pattern confirms the hypothesis that larger economies are less reliant on external demand, and therefore, were less affected by the recent crisis due to the size of their domestic markets. However, looking at the individual country level, it becomes apparent that the relatively high trend growth rate of large countries is mainly driven by Poland, the largest economy in CESEE. In 2011, trend growth rates amounted to 4% in Poland, to 1% in the Czech Republic and Hungary and 0% in Romania.

To sum up, we gained three important empirical patterns in this section. First, we observe a pronounced decoupling of trend growth rates between EA and CESEE until the onset of the financial crisis, which is in line with the evidence that global EMEs decoupled from industrialized economies. Second, trend growth rates have started to decline during the crisis both in CESEE and the EA and converged ever since. Third, the observed growth differential of two percentage points in 2011 between EA and CESEE implies a decelerated catching up process in CESEE, while the current growth differential is mainly driven by large CESEE economies, with Poland's trend growth rate of 4% being primarily responsible for this positive growth differential.

5 Summary

In this paper we analyzed the empirical pattern of business cycle convergence/divergence in the EU, especially with regard to cyclical co-movements between CESEE and the EA. In particular, we tested the decoupling vs. convergence hypothesis for the CESEE region, as the impact of the catching-up process on business cycle synchronization is theoretically ambiguous. Moreover, in light of recent evidence showing a decoupling of global EMEs from industrialized economies, we explored the development of trend growth differentials between CESEE and the EA. The most important findings of our study can be summarized as follows.

First, CESEE economies are still much more heterogeneous than the countries in the EA,

both with respect to cyclical dispersion as well as correlations. Moreover, we observe a pronounced business cycle decoupling of CESEE countries from the EA starting with the onset of the financial crisis, once again confirmed for both the dispersion of output gaps and cyclical co-movement. The results concerning the dispersion measure are mainly driven by smaller countries. This can be explained by the fact that small economies seem to have larger cyclical swings as they are more dependent on external demand, which causes a decoupling in terms of higher output gap deviations from the EA cycle in times of economic crises. At the same time, this does not necessarily affect business cycle synchronization as measured by cyclical correlations, where the strength of the linear relationship of two cycles is measured. In fact, there is some evidence for a more pronounced decline in the co-movement of larger economies from the EA cycle. Despite the observed declines of correlation coefficients during two particular time spans after 2007, the average cyclical correlation of the CESEE economies with the EA has risen significantly after their EU accession in 2004. Furthermore, at the end of the sample, a 'recoupling' of the CESEE countries to the EA economy can be observed. Overall, the already high correlations of cyclical components with the EA cycle imply quite favorable conditions for a common monetary policy in CESEE, if the new member states in CESEE decide to join the EA.

Second, we find a significant decoupling of trend growth rates between the EA and CESEE until the onset of the financial crisis, which is in line with recent observations concerning the decoupling of global EMEs from industrialized economies. Moreover, trend growth rates have declined during the crisis both in CESEE and the EA, which resulted in a considerable reduction of the trend growth differential between the two regions from around three to below two percentage points. Interestingly, the currently observed growth differential between EA and CESEE is mainly driven by large CESEE economies, with Poland's trend growth rate being the major driver of this gap. On the one hand, from a long-run perspective, we therefore conclude that the catching-up process of CESEE continues, but has slowed down considerably during the crisis. On the other hand, the lower growth differential might also be a rebalancing towards a more sustained and balanced growth in the region, hopefully leading to a more stable process of income convergence.

References

Altavilla, C. (2004), 'Do EMU members share the same business cycle?', *JCMS: Journal of Common Market Studies* **42**(5), 869–896.
  URL: *http://dx.doi.org/10.1111/j.0021-9886.2004.00533.x*

Artis, M. J., Fidrmuc, J. & Scharler, J. (2008), 'The transmission of business cycles. implications for EMU enlargement', *Economics of Transition* **16**(3), 559–582.
  URL: *http://dx.doi.org/10.1111/j.1468-0351.2008.00325.x*

Artis, M. J. & Zhang, W. (1997), 'International business cycles and the ERM: Is there a European business cycle?', *International Journal of Finance & Economics* **2**(1), 1–16.
  URL: *http://ideas.repec.org/a/ijf/ijfiec/v2y1997i1p1-16.html*

Artis, M., Marcellino, M. & Proietti, T. (2005), 'Business cycles in the new EU member countries and their conformity with the euro area', *Journal of Business Cycle Measurement and Analysis* **2**(1), 7–32.

Artis, M. & Zhang, W. (1999), 'Further evidence on the international business cycle and the ERM: Is there a European business cycle?', *Oxford Economic Papers* **51**(1), 120–132.
  URL: *http://oep.oxfordjournals.org/content/51/1/120.abstract*

Aslanidis, N. (2010), 'Business cycle synchronization between the CEEC and the Euro-Area: Evidence from threshold seemingly unrelated regressions', *The Manchester School* **78**(6), 538–555.
  URL: *http://dx.doi.org/10.1111/j.1467-9957.2009.02149.x*

Benczúr, P. & Rátfai, A. (2010), 'Economic fluctuations in Central and Eastern Europe: the facts', *Applied Economics* **42**(25), 3279–3292.
  URL: *http://www.tandfonline.com/doi/abs/10.1080/00036840802112380*

Böwer, U. & Guillemineau, C. (2006), Determinants of business cycle synchronisation across euro area countries, Working Paper Series 587, European Central Bank.
  URL: *http://ideas.repec.org/p/ecb/ecbwps/20060587.html*

Camacho, M., Perez-Quiros, G. & Saiz, L. (2006), 'Are European business cycles close enough to be just one?', *Journal of Economic Dynamics and Control* **30**(9-10), 1687–1706.
  URL: *http://ideas.repec.org/a/eee/dyncon/v30y2006i9-10p1687-1706.html*

Cavenaile, L. & Dubois, D. (2011), 'An empirical analysis of income convergence in the European Union', *Applied Economics Letters* **18**(17), 1705–1708.
  URL: *http://www.tandfonline.com/doi/abs/10.1080/13504851.2011.560104*

Crespo-Cuaresma, J. & Fernández-Amador, O. (2010), Business cycle convergence in EMU: A first look at the second moment, Working Papers 2010-22, Faculty of Economics and Statistics, University of Innsbruck.
  URL: *http://ideas.repec.org/p/inn/wpaper/2010-22.html*

Darvas, Z. & Szapáry, G. (2008), 'Business cycle synchronization in the enlarged EU', *Open Economies Review* **19**, 1–19. 10.1007/s11079-007-9027-7.
  URL: *http://dx.doi.org/10.1007/s11079-007-9027-7*

de Haan, J., Inklaar, R. & Jong-A-Pin, R. (2008), 'Will business cycles in the euro area converge? A critical survey of empirical research', *Journal of Economic Surveys* **22**(2), 234–273.
  URL: *http://ideas.repec.org/a/bla/jecsur/v22y2008i2p234-273.html*

Eickmeier, S. & Breitung, J. (2006), 'How synchronized are new EU member states with the euro area? evidence from a structural factor model', *Journal of Comparative Economics* **34**(3), 538 – 563.
  URL: *http://www.sciencedirect.com/science/article/pii/S0147596706000382*

Fidrmuc, J. & Korhonen, I. (2004), 'The euro goes east: Implications of the 2000-2002 economic slowdown for synchronisation of business cycles between the euro area and CEECs', *Comparative Economic Studies* **46**(1), 45–62.

Fidrmuc, J. & Korhonen, I. (2006), 'Meta-analysis of the business cycle correlation between the euro area and the CEECs', *Journal of Comparative Economics* **34**(3), 518 – 537.
  URL: *http://www.sciencedirect.com/science/article/pii/S0147596706000400*

Frankel, J. A. & Rose, A. K. (1998), 'The endogeneity of the optimum currency area criteria', *Economic Journal* **108**(449), 1009–25.
  URL: *http://ideas.repec.org/a/ecj/econjl/v108y1998i449p1009-25.html*

Furceri, D. & Karras, G. (2008), 'Business-cycle synchronization in the EMU', *Applied Economics* **40**(12), 1491–1501.
  URL: *http://ideas.repec.org/a/taf/applec/v40y2008i12p1491-1501.html*

Gayer, C. (2007), 'A fresh look at business cycle synchronization in the euro area', *European Economy, Economic Papers* (287).

Gächter, M., Riedl, A. & Ritzberger-Grünwald, D. (2012), 'Business cycle synchronization in the euro area and the impact of the financial crisis', *Monetary Policy & the Economy* (2), 33–60.

Gomez, D. M., Ortega, G. J. & Torgler, B. (2012), Synchronization and diversity in business cycles: A network approach applied to the European Union, CREMA Working Paper Series 2012-01, Center for Research in Economics, Management and the Arts (CREMA).
  URL: *http://ideas.repec.org/p/cra/wpaper/2012-01.html*

Helbling, T., Berezin, P., Kose, A., Kumhof, M., Laxton, D. & Spatafora, N. (2007), Decoupling the train? Spillovers and cycles in the global economy, *in* 'World Economic Outlook', International Monetary Fund, April 2007, pp. 121–160.

Hodrick, R. J. & Prescott, E. C. (1997), 'Postwar U.S. business cycles: An empirical investigation', *Journal of Money, Credit and Banking* **29**(1), 1–16.
  URL: *http://ideas.repec.org/a/mcb/jmoncb/v29y1997i1p1-16.html*

Imbs, J. (2004), 'Trade, finance, specialization, and synchronization', *The Review of Economics and Statistics* **86**(3), 723–734.
  URL: *http://ideas.repec.org/a/tpr/restat/v86y2004i3p723-734.html*

Inklaar, R. & de Haan, J. (2001), 'Is there really a European business cycle? A comment', *Oxford Economic Papers* **53**(2), 215–20.
  URL: *http://EconPapers.repec.org/RePEc:oup:oxecpp:v:53:y:2001:i:2:p:215-20*

Kenen, P. (1969), The optimum currency area: An eclectic view, *in* R. Mundell & A. Sowboda, eds, 'Monetary Problems of the International Economy', Chicaco: University of Chicago Press.

Kose, M. A., Otrok, C. & Prasad, E. (2008), Global business cycles: Convergence or decoupling?, IZA Discussion Papers 3442, Institute for the Study of Labor (IZA).
  URL: *http://ideas.repec.org/p/iza/izadps/dp3442.html*

Kose, M. A., Otrok, C. & Prasad, E. (2012), 'Global business cycles: Convergence or decoupling?', *International Economic Review* **53**(2), 511–538.
  URL: *http://dx.doi.org/10.1111/j.1468-2354.2012.00690.x*

Kose, M. A., Prasad, E. S. & Terrones, M. E. (2003), 'How does globalization affect the synchronization of business cycles?', *The American Economic Review* **93**(2), pp. 57–62.
  URL: *http://www.jstor.org/stable/3132200*

Krugman, P. (1991), *Geography and Trade*, MIT Press.

Massmann, M. & Mitchell, J. (2004), 'Reconsidering the evidence: Are euro area business cycles converging?', *Journal of Business Cycle Measurement and Analysis* **2004**(3), 16.
   URL: *http://ideas.repec.org/a/oec/stdkaa/5lgv2584100r.html*

McKinnon, R. I. (1963), 'Optimum currency areas', *The American Economic Review* **53**(4), pp. 717–725.
   URL: *http://www.jstor.org/stable/1811021*

Mundell, R. A. (1961), 'A theory of optimum currency areas', *The American Economic Review* **51**(4), pp. 657–665.
   URL: *http://www.jstor.org/stable/1812792*

Prasad, E., Otrok, C. & Kose, M. A. (2008), 'Dissecting the decoupling debate'.
   URL: *http://www.voxeu.org/article/dissecting-decoupling-debate*

Savva, C. S., Neanidis, K. C. & Osborn, D. R. (2010), 'Business cycle synchronization of the euro area with the new and negotiating member countries', *International Journal of Finance & Economics* **15**(3), 288–306.
   URL: *http://dx.doi.org/10.1002/ijfe.396*

Vojinovic, B. & Próchniak, M. (2009), 'Divergence period in the European convergence process', *Transition Studies Review* **15**, 685–700.
   URL: *http://dx.doi.org/10.1007/s11300-008-0037-y*

Weyerstrass, K., van Aarle, B., Kappler, M. & Seymen, A. (2011), 'Business cycle synchronisation with(in) the Euro Area: in search of a 'euro effect'', *Open Economies Review* **22**, 427–446. 10.1007/s11079-009-9131-y.
   URL: *http://dx.doi.org/10.1007/s11079-009-9131-y*

Wälti, S. (2010), No decoupling, more interdependence: Business cycle comovements between advanced and emerging economies, MPRA Paper 20869, University Library of Munich, Germany.
   URL: *http://ideas.repec.org/p/pra/mprapa/20869.html*

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