EUROPEAN ECONOMY

ECONOMIC PAPERS

Number 287 – September 2007

A fresh look at business cycle synchronisation in the euro area

by Christian Gayer
Directorate-General for Economic and Financial Affairs

Economic and Financial Affairs
DIRECTORATE-GENERAL

EUROPEAN COMMISSION

Economic Papers are written by the Staff of the Directorate-General for Economic and Financial Affairs, or by experts working in association with them. The "Papers" are intended to increase awareness of the technical work being done by the staff and to seek comments and suggestions for further analyses. Views expressed represent exclusively the positions of the author and do not necessarily correspond to those of the European Commission. Comments and enquiries should be addressed to the:

European Commission
Directorate-General for Economic and Financial Affairs
Publications
BU-1
B - 1049 Brussels, Belgium

ISSN 1725-3187 (online)

A fresh look at business cycle synchronisation in the euro area

Christian Gayer[*]

Abstract

This paper revisits the issue of business cycle synchronisation in the euro area looking back on more than eight years of EMU experience. The dispersion of output gaps across Member States has reached historically low levels since around 2002. Yet, this observation seems to reflect a general decrease in the amplitude of cyclical fluctuations rather than a continued increase in business cycle synchronisation. Using cross-country correlations, the mean level of synchronisation of national cycles within the currency union since 1999 is found to be overall high, though not higher than in the first half of the nineties. Around 2003, the level of cross-country synchronisation experienced a quite abrupt decrease. This picture is shared between several measures of the business cycle. A rebound and partial recovery of cross-country synchronisation is indicated from around 2004 onwards. The observed dip in synchronisation thus appears to be a transitory phenomenon, partly rooted in a recurrent pattern of falling business cycle synchronisation in early recovery phases.

Looking at GDP expenditure components, synchronisation of private consumption and investment largely reflects aggregate GDP developments. Net exports show an overall low level of cross-country synchronisation, falling further already since 2000/01. Public consumption turns out entirely unrelated across countries throughout the sample. On the country level, the analysis points to a rather widespread de-synchronisation of Member States around 2003, reflecting differences in adjustment speed in the early recovery phase of the business cycle. This recurrent but transitory de-synchronisation appears to be compounded by specific factors in some countries at the periphery. Cross-checking the results against developments outside the currency union, the recent temporary de-synchronisation turns out much more pronounced between the euro area and outside countries than within the monetary union. This may be interpreted as a relative gain in business cycle affiliation within the currency zone compared to affiliation with outside countries. Altogether, the results show a distinct euro-area business cycle, though evidence for a further increase in synchronisation since the introduction of the euro is sparse. Further structural reforms enhancing the capacity of euro-area economies to adjust to shocks should help to narrow the distribution of adjustment speed across countries in phases of economic uncertainty in the future.

JEL Classifications: C40, E32, E39

Key Words: Business cycles, synchronisation, convergence, EMU

* Correspondence: christian.gayer@ec.europa.eu; European Commission, Directorate-General for Economic and Financial Affairs.

The views expressed in this paper exclusively represent the position of the author and do not necessarily correspond to those of the European Commission. The author would like to thank A. Jonsson, N. Darnaut and P. van den Noord for valuable comments and suggestions.

1. Introduction

A high degree of business cycle synchronisation between Member States is crucial for a smooth functioning of EMU as it facilitates the coordination of economic policies and, in particular, the conduct of a common monetary policy. In turn, monetary union by itself and the economic and financial integration it entails could spur the emergence of a common area-wide business cycle. At the same time, monetary union could lead to greater cross-country specialisation and therefore less synchronisation. Others have argued that constraints on monetary and fiscal policy in a monetary union could reduce the risk of asymmetric shocks that are policy-driven.[1]

The empirical evidence for the euro area so far has not been very conclusive. While Artis and Zhang (1997, 1999) find that membership of EMU, or the ERM before it, has promoted convergence between participating countries' business cycles, Inklaar and de Haan (2001) challenge this finding. Using the same data set, Massmann and Mitchell (2004) find that the euro area has alternated between convergence and divergence in the last 40 years but since the early 1990s has been converging. Several authors find the effect of currency unions on business cycle synchronisation to be positive (following Rose and Engel, 2002), although this is challenged by Baxter and Kouparitsas (2005). Camacho et al. (2006) and Artis (2003, 2005) conclude that European business cycles show signs of failing to hold together.

It should be noted that the cited studies cover only few years of EMU, with the data samples typically ending in 2003 or earlier. With the euro now in place for almost ten years, this note revisits the issue of euro-area business cycle synchronisation on the basis of an extended data set and using various measures and breakdowns of synchronisation.

Section 2 outlines the methodology and data used. Section 3 presents recent developments in the dispersion of output gaps across euro-area Member States, being a very relevant measure of convergence in a short-term macroeconomic policy perspective. However, the dispersion measure is sensitive to the scale of the output gaps, such that a trend of cyclical de-synchronisation might be masked by a falling amplitude of cyclical fluctuations over time.

Therefore, Section 4 turns to measures based on cross-country correlations, which are better suited to reflect the genuine synchronisation aspect of cyclical convergence. Given that the industry sector accounts for the bulk of cyclical variation of the euro-area economy, most studies are based on industrial production data, filtered by some trend adjustment method. Gayer and Weiss (2006) showed that there is a marked correspondence between results derived from filtered industrial production data and those from the European Commission's survey-based Industrial Confidence Indicators (ICI). Since they avoid a number of shortcomings of hard data at the crucial end of the data sample (in terms of timeliness, revisions and end-point problem of filtering), survey-based indicators are thus a useful complementary tool to analyse synchronisation processes in real time, up to and including the most recent observations.

Artis (2003, 2005) and Baxter and Kouparitsas (2005) are examples of studies using the broader, services-dominated GDP aggregate as a measure of economic activity. The greater exposure to external shocks of the trade-intensive manufacturing sector could be a source of bias towards de-synchronisation relative to measures of convergence based on broader activity series. Furthermore, due to the higher (monthly) observation frequency, the manufacturing data might possibly indicate some short-lived periods of divergence not

[1] See Darvas, Rose and Szapáry (2005). For a comprehensive discussion of how EMU is affecting business cycle synchronisation in the euro area, see Mongelli and Vega (2006) and the literature references therein.

present in quarterly activity series. Therefore, after looking at manufacturing-related synchronisation measures, the analysis is complemented by equivalent measures derived from GDP series and related survey indicators across euro-area Member States. The use of GDP series also enables a disaggregate analysis of the major expenditure components, possibly pointing to the sources of observed changes in cross-country synchronisation over time.

Having investigated the development of mean intra-euro-area synchronisation from different angles, Section 5 turns to an analysis of country-wise synchronisation developments with respect to the euro-area total, trying to identify the contribution of individual countries to the mean results.

Artis (2005) provides evidence of an emerging "world business cycle", implying that where increased business cycle synchronisation is found, it is not clear whether this is due to a specific euro-area cycle or due to globalisation. Therefore, the results are cross-checked against developments at the level of the world cycle in Section 6.

Section 7 briefly discusses a number of variations of the used methodology so as to verify the robustness of the attained results. Section 8 summarises and concludes.

2. Methodology

Various methods have been proposed in the literature to investigate the issue of business cycle convergence. One possible approach is to look at the evolution of the standard deviation of euro-area countries' business cycles over time. The smaller the standard deviation for a given period, the closer the individual cycles cluster together. It is important to bear in mind that the measure is scale-dependent, i.e. for a given level of cyclical synchronisation, the standard deviation will rise (fall) proportionally with a rise (fall) of the mean amplitude of the individual cycles. Given that the absolute degree of dispersion of euro-area output gaps is of great importance for the conduct of monetary policy in a monetary union, the standard deviation is a very relevant measure to gauge the degree of cyclical convergence in the euro area.

Due to its scale-dependency, however, it is less suited to measure the genuine synchronisation dimension of business cycle convergence, i.e. whether the cycles display a common periodicity and phase, disregarding possible changes in amplitude. The coefficient of correlation between the business cycles of euro-area countries lends itself well to examine this issue. Such correlation coefficients can be computed over a series of rolling windows of a fixed length, providing a continuous track of developments over time. This approach is taken in numerous investigations of the issue of business cycle synchronisation, in the euro area and elsewhere.[2] Belo (2001) demonstrates that the correlation approach provides an accurate assessment of business cycle synchronisation within the euro area. It enables to draw conclusions that are consistent with a turning-point-oriented tool such as the concordance index proposed by Harding and Pagan (2002).[3]

However, the correlation measure also suffers from drawbacks. Indeed, the results can be rather sensitive to the length of the rolling window chosen, see e.g. European Commission (2006a). While longer windows tend to be more reliable since they are based on more data points, there is the danger of smoothing out important medium-term changes in

[2] A similar set-up to investigate the issue of convergence in the euro area is used, *inter alia*, in Döpke (1999), Massmann and Mitchell (2004), Mitchell and Mouratidis (2004) and BNP (2005).

[3] The concordance index measures the fraction of time that the cycles of two countries are in the same business cycle phase.

synchronisation. Correlations based on shorter windows tend to be more sensitive to short- and medium-term deviations and, since they can be computed closer to the end of the data sample, allow for an analysis of very recent developments. However, it can be shown that if the window is shorter than the mean length of the cycle itself, small phase shifts between otherwise identical cycles can lead to systematic, but artificial, drops in the association measure at the turning points of the cycles. Finally, the empirical evidence in European Commission (2006a) suggests that shorter windows may have some leading properties in signalling declines in business cycle synchronisation in the euro area.

We use monthly industrial production (IP) data from 1975m7 to 2007m2 for eleven euro-area countries (excluding Luxembourg and Slovenia). Quarterly GDP data is available from 1980q1 to 2007q1 for eight euro-area countries: Belgium, Germany, Greece, Spain, Finland, France, Italy, and the Netherlands. For Austria, Ireland and Portugal we carry out a partial analysis based on shorter data series. All quarterly GDP series are augmented by seven observations derived from quarterly growth forecasts for 2007 and 2008.[4] A consistent sample of GDP components across countries is available from 1991q1 to 2007q1 only. The survey data, collected in the framework of the Commission's Joint Harmonised EU Programme of Business and Consumer Surveys[5] is available from 1985 onwards. Monthly data for the Industrial Confidence Indicator (ICI) ends in 2007m4 while data for the monthly Economic Sentiment Indicator (ESI) is used in quarterly frequency to match it with the GDP data and ends in 2007q2. To summarise the $n(n\text{-}1)/2$ possible bilateral correlation coefficients between the n euro-area countries, we look at the evolution of both their mean and their variance. Both unweighted and size-weighted averaging of country correlations is examined (country size is approximated by total population).[6]

A rise in mean correlation is considered as evidence of increased synchronisation. However, this is not a sufficient condition as, at the same time, the variance should remain stable or decrease. If only the mean criterion was met, the distribution of correlation coefficients could still have widened, implying lower instead of higher synchronisation of business cycles.[7] Therefore, to properly identify cyclical synchronisation, an increase in the mean should be coupled with a simultaneous decrease in the variance of the correlation coefficients, and vice versa for de-synchronisation.

Reflecting the above discussion of the impact of the window length, the mean and the variance of bivariate correlation coefficients are computed over two alternative window lengths: four and six years.[8] In the case of e.g. the quarterly GDP data, the initial four-year window covers the period 1980:1-1984:1 (1980:1-1986:1 for the six-year window); the last window summarises business cycle association in the period 2004:4-2008:4 (or 2002:4-

[4] The forecasts for GDP growth are taken from the Commission's Spring 2007 forecast.

[5] See European Commission (2006b) for a detailed description of the scope and methodology of the survey data.

[6] Alternatively, GDP weighting may be considered. However, the impact of weighting turns out very small.

[7] The following extreme case may illustrate the point: From a situation where each individual country displays a 50% correlation with all other countries (zero variance), the mean will remain unchanged if suddenly the group is equally divided into two subgroups with perfect intra- but zero inter-correlation. Only the increase in the variance will point to this important change in synchronisation within the group.

[8] Given our interest in growth cycles (deviations from trend) rather than classical cycles (absolute declines of activity), the six-year window corresponds to almost two typical recent cycles, while the shorter four-year window should still be long enough to cover at least one typical recent growth cycle. The six-year window is also used in BNP (2005). Massmann/Mitchell (2004) use one window of three and a half years and a second window of seven years, while Massmann/Mitchell (2002) use a window length of three years.

2008:4 for the six-year window). In order to provide an appropriate, timely impression of synchronisation developments readily attributable to specific events, the correlations are centered on the *midpoints* of these windows in the graphical presentations below. Thus, the last midpoint of the six-year window characterises euro-area synchronisation around the fourth quarter of 2005, while it is 2006q4 in the case of the shorter window.

A non-negligible problem with the hard data series is that they do not provide a measure of "the business cycle" as such, but first have to be decomposed into trend and cycle using statistical techniques. The survey data, on the other hand, contain genuine cyclical information and thus avoid the problem of (arbitrarily) identifying the cycle from the data. For a related discussion and further advantages of survey data in analysing business cycle synchronisation (timeliness, absence of revisions) see Gayer/Weiss (2006). We use a band-pass version of the Hodrick/Prescott filter to extract the business cycle-related fluctuations from the (natural logarithms of the) GDP and IP series.[9]

3. Convergence of output gaps in the euro area

The dispersion (or more technically the standard deviation) of output gaps is probably the most relevant measure of convergence in a short-term macroeconomic policy perspective. At a given point in time, the dispersion will be close to zero if all Member States display a similar output gap (in percent of potential GDP). Hence, the closer to zero the measure is, the higher is the degree of convergence of relative growth performance across countries and the more appropriate common monetary impulses are for each Member State.

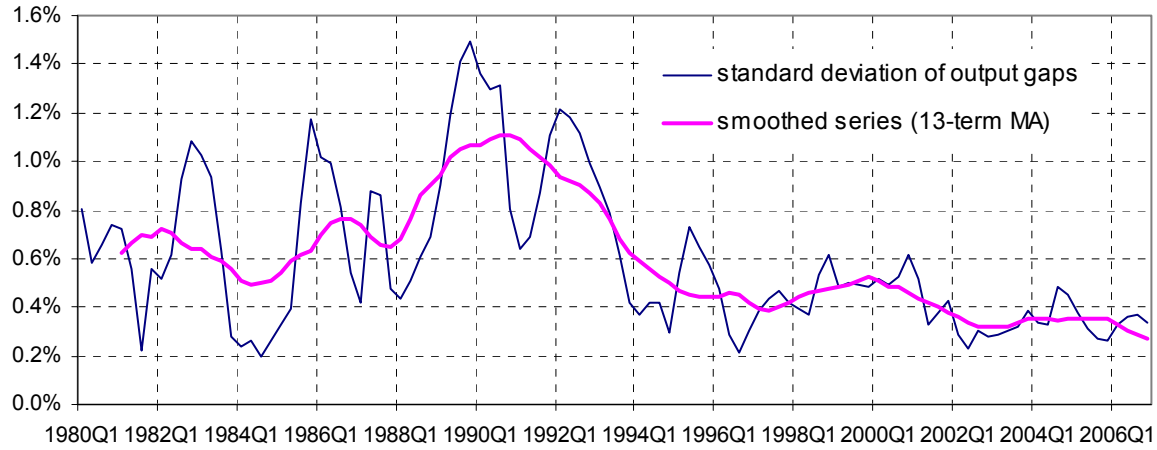
Graph 1 presents the dispersion of output gaps for euro-area countries.[10] It shows that, since the early nineties, dispersion in the euro area as a whole has narrowed considerably. A mild pick-up in the dispersion of output gaps in the late nineties is followed by renewed convergence during the 2001-03 downturn. As pointed out by European Commission (2004), the temporary phase of divergence around the 2000 boom largely reflects the overheating of the Irish and Luxembourg economies.[11] Apart from that, the analysis suggests that differences in the degree of exposure to extra-euro-area trade played a central role. Looking at the most recent period, with the exception of a transitory pick-up in 2004, the dispersion of output gaps in the euro area has been standing at historically low levels since around 2002.

[9] The Hodrick-Prescott (HP) bandpass filter, stemming from the subtraction of two HP low-pass filters, extracts fluctuations with a periodicity between 6 and 32 quarters or 18 and 96 months, respectively, corresponding to the usual band of 1.5 to 8 years associated with business cycle fluctuations. As robustness checks show, our results are not qualitatively changed when the band is extended to include fluctuations of up to 12 years in duration. The HP-based bandpass filter has the advantage over the alternative Baxter-King filter of not losing 12 quarters (36 months) at the start and end of the sample. However, implicitly, it is still subject to the so-called endpoint problem of all such filters, leading to revisions of cycle estimates when new data become available at the end of the sample. For details on the HP bandpass filter, see Artis et al. (2003).

[10] The output gaps were derived by subtracting the logarithm of GDP trend estimates from the logarithm of smoothed GDP series. Using HP filters with parameters set to eliminate fluctuations of less than, respectively, 8 and 1.5 years in duration, these (smoothed) output gaps are thus identical to the GDP-based business cycle estimates used for the calculation of cross-country correlations in later sections.

[11] Luxembourg is not included here due to a lack of quarterly data.

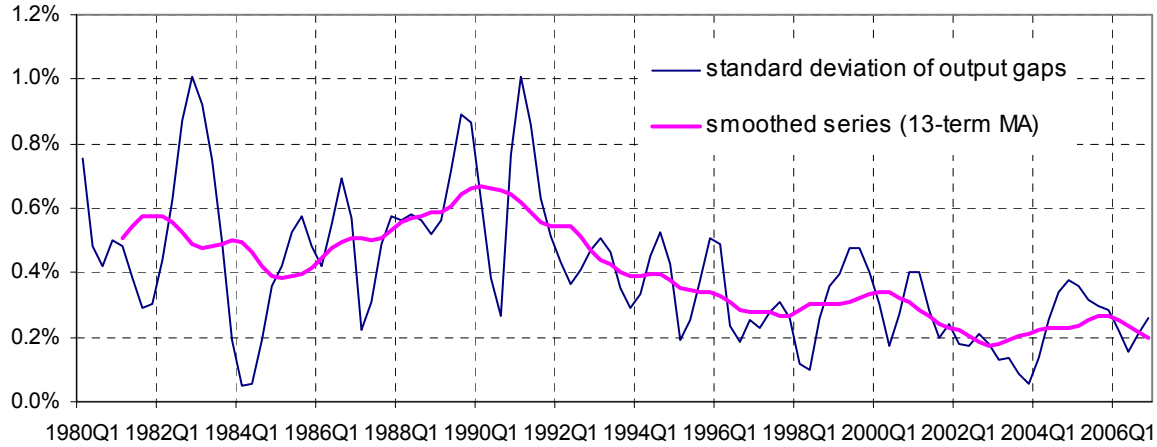
Graph 1: Standard deviation of euro-area output gaps (as % of pot. GDP, 1980-2006)



Source: Commission services

The increase in dispersion of output gaps in 2004 is more marked if the focus is on the four large euro-area Member States only (Germany, France, Italy and Spain), which together account for almost 80% of euro-area GDP. As discernible from Graph 2, the level of output dispersion between the four large Member States is overall markedly lower than that between all euro-area countries. However, after a historically high degree of convergence in late 2003, the dispersion of the four countries' output gaps can be seen to pick up sharply in 2004. McCarthy (2006) attributes these diverging growth performances in the early phase of the current recovery to disparities in the sources of growth across Member States, with Germany relying mainly on exports and seeing domestic demand stagnate, while domestic demand underpinned the robust performance in Spain and was the main factor sustaining growth in France.

Graph 2: Standard deviation of output gaps of big 4 MS (as % of pot. GDP, 1980-2006)



Source: Commission services

Finally, however, with the recovery gaining momentum, the dispersion of output gaps both within the euro area and between the four large Member States can be seen to have decreased again in 2005-2006.

As mentioned previously, the observed long-term downward trend in the dispersion of output gaps since the early nineties is not necessarily due to the fact that Member States' business cycles are increasingly in phase but might rather be explained by a general decrease in the amplitude of cyclical fluctuations. Indeed, the dispersion will remain low even when national

business cycles move apart, as long as output gaps do not stray too far from zero. In that case, a cyclical de-synchronisation trend would be masked by the low amplitude of cyclical fluctuations. While this would not necessarily be a problem for the conduct of monetary policy in the short term, it could herald more difficult times if the forces that have led to a reduction of cyclical fluctuations wane.

Since there has been a well-documented decline in the cyclical volatility of GDP observed in most G7 and OECD countries since the 1990s (see Stock and Watson (2005) for a review of the literature),[12] it cannot be excluded that this trend indeed explains part of the prevailing low level of cyclical dispersion measured in the euro area. It is therefore necessary to complement the analysis by looking at additional indicators of cyclical synchronisation.

4. Synchronisation of business cycles in the euro area

4.1 Correlation results based on industrial production

The industrial sector accounts for less than one-fourth of the euro-area economy but for most of its cyclical variation. The use of industrial production data for business cycle analysis is furthermore justified by the historically strong correlation between IP and GDP data and by the fact that, in contrast to GDP data, monthly observations on IP are available on a consistent basis for the large majority of countries back to the 1960s. Using IP data for eleven euro-area countries, Graph 3 displays the unweighted and weighted mean of the 55 pair-wise country correlations, calculated over moving six-year windows. Clearly, the weighting issue does not qualitatively alter the findings.

Obviously, the picture on the basis of correlations is quite different from that based on the variance of output gaps (Graph 1). Thus, the general moderation of output variance does indeed seem to hide some divergent trends in business cycle synchronisation. In interpreting the graph, it might be useful to relate the developments in average correlation to the exchange rate regime or, more generally, to specific economic events. As noted by Massmann and Mitchell (2004), the period of falling correlation in the early 80s until 1986 can be characterised as a period where the EMS was rather unstable, with a number of exchange rate re-alignments taking place. At the same time, the fall in cross-country correlation could be more directly attributed to the asymmetric effects of the second oil price shock.

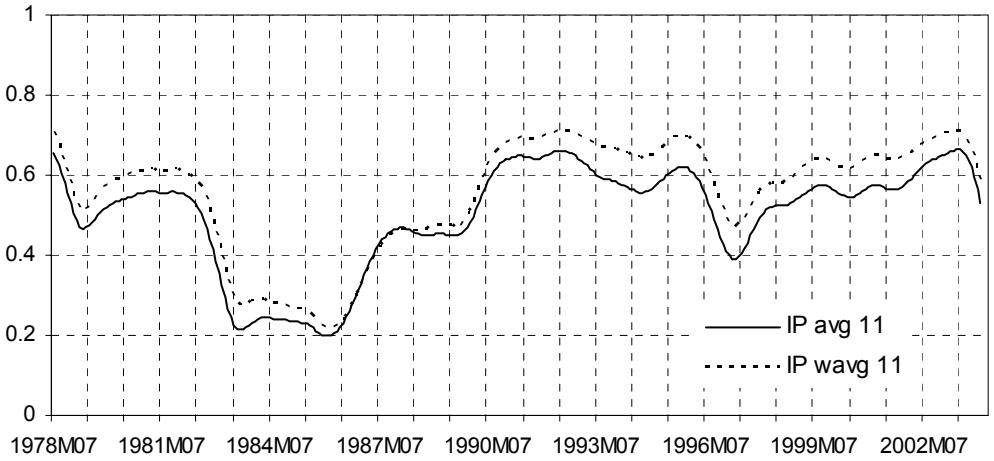
The marked increase in mean correlation in the later eighties occurs in a period when the EMS was relatively stable and credible, with no re-alignments taking place. The next significant decrease in correlation around 1997 coincides with the Asian emerging markets crisis, and reflects the differentiated effects the crisis had on individual euro-area countries.[13] The subsequent Stage 3 of EMU is characterised by a rather steady increase in cyclical synchronisation until mid 2003, when a sudden decline in business-cycle association sets in. While the renewed rise in correlation since the late nineties may be attributable to the effects of enhanced trade and financial integration in the wake of the Internal Market programme and

[12] Three main alternative explanations have been advanced in the literature for this phenomenon labelled "the Great Moderation": structural improvements in the economy, particularly better inventory management, improved macroeconomic policies, and simply "good luck", in the form of fewer and smaller shocks to the economy. Another explanation is that of increased risk sharing, smoothing out GDP variance through capital markets, credit markets and other transfers, see e.g. Giannone and Reichlin (2006). For a recent analysis of the reduced volatility of output growth in the euro area see European Commission (2007).

[13] Furthermore, the decrease reflects the beginning of a phase of severe divergence between Greece and the rest of the euro area; see section 5 for a country-wise analysis of synchronisation developments.

EMU as well as closer macroeconomic policy coordination in the euro area,[14] there is no obvious explanation for the subsequent drop in synchronisation at the end of the sample. The last depicted correlation is based on the sample from 2001m2 to 2007m2 and thus characterises cyclical synchronisation around 2004.

Graph 3: Mean euro-area correlations, IP 6-year window



Source: Commission services

Before we turn to an analysis of the observed drop in correlation, Graph 4 shows the evolution of correlations computed over the shorter four-year window. While clearly more sensitive to short-run deviations (as for example the de-synchronisation following German re-unification in 1990 or the dip around the ERM turmoil in 1992-93), the graph essentially confirms the previous findings. Due to the higher sensitivity of the four-year window, the recent decline in business cycle association is signalled somewhat earlier, around late 2002.[15] The extent of this de-synchronisation, as measured by the low level of mean correlation of 0.2 in late 2003 appears considerable. However, the subsequent four-year correlation windows for 2004 and early 2005 point to a rebound in euro-area synchronisation from early 2004 onwards.

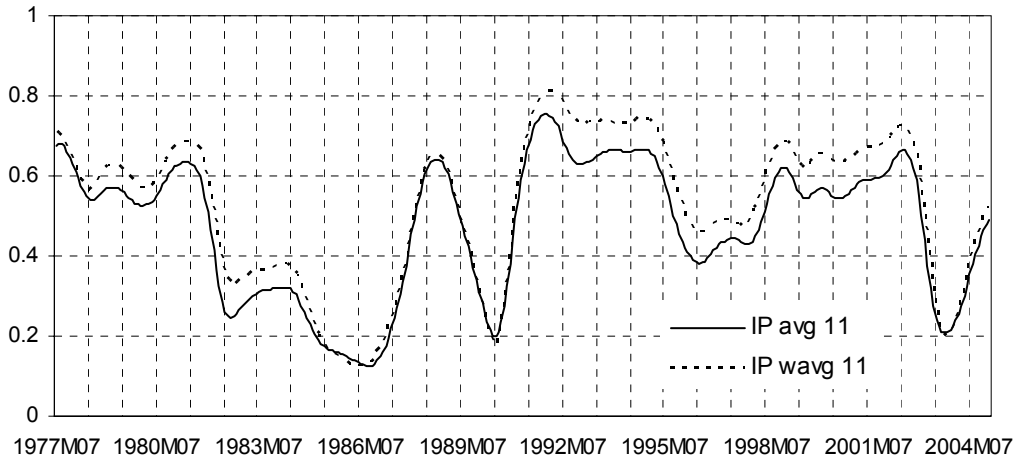
As to the question whether EMU has promoted business cycle synchronisation in the euro area, Graphs 3 and 4 suggest that the degree of cross-country correlation was slightly higher in the first half of the nineties (single market, run-up to EMU) than in the first five or six years following the introduction of the euro in 1999.[16]

[14] See European Commission (2004) for a detailed discussion of these forces of cyclical convergence in EMU.

[15] In line with the outlined characteristics of the different windows lengths, the previous declines in correlation of the early 80s and the mid 90s can also be seen to lead the corresponding declines in the curve based on the longer 6-year window.

[16] Average correlation in the period 1990-1994 is 0.61 (0.58) for the 6-year (4-year) window, while it is 0.58 (0.53) for the period 1999-2003. Clearly, these comparisons are rather sensitive to the selection and length of the benchmark period.

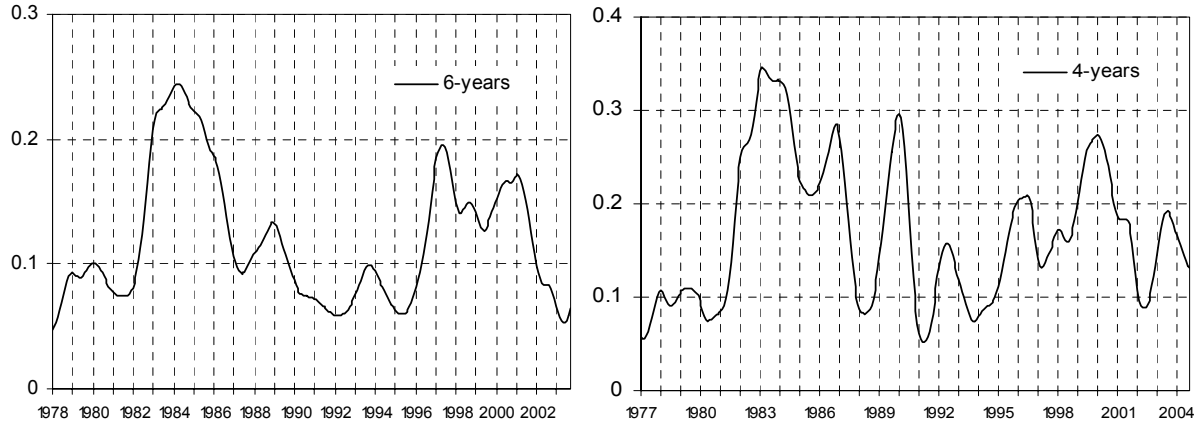
Graph 4: Mean euro-area correlations, IP 4-year window



Source: Commission services

Graph 5 displays the evolution of the (unweighted) variance of the 55 bivariate correlation coefficients over time, using the six- and four-year windows, respectively. Across the sample, the analysis of the variance of cross-country correlations over time mirrors the above findings based on the mean. Confirming the reading of the mean correlations, the distribution of correlation coefficients has apparently narrowed since around 2000, implying higher synchronisation among the eleven euro-area countries considered. However, particularly the 4-year window shows a subsequent widening of the distribution of correlations around 2002/2003. As a mirror image of Graph 4, this signal of de-synchronisation is then reversed at the very end of the sample, where the dispersion of country-correlations falls again.

Graph 5: Dispersion of bivariate correlation coefficients (IP, 6- and 4-year window)

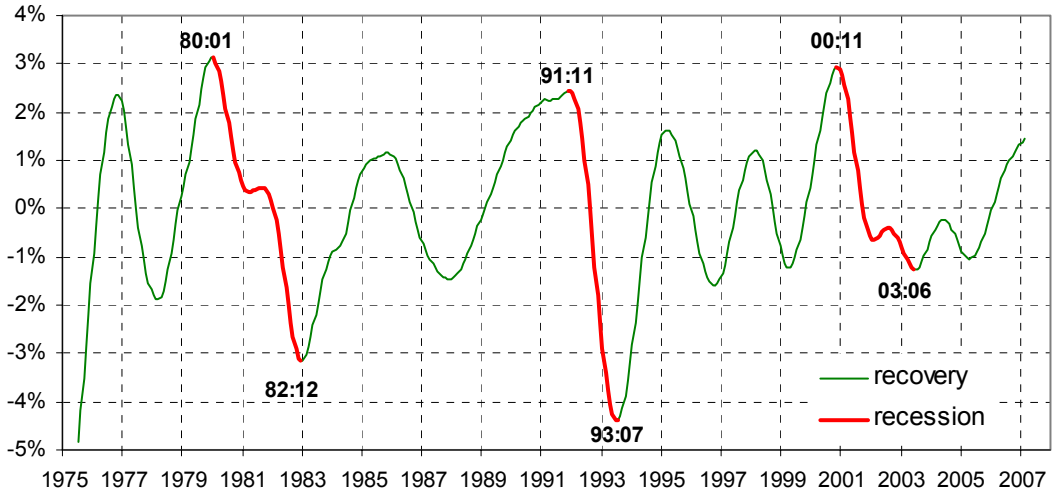


Source: Commission services

Apart from interpreting the evolution of euro-area synchronisation against the background of specific economic events, there is also a "mechanical" approach to the interpretation of phases of falling or rising correlation, based on stylised business cycle facts. To this end, Graph 6 displays the euro-area business cycle phases as identified by applying the previously mentioned bandpass version of the HP filter to monthly industrial production.[17]

[17] The resulting business cycle phases are rather robust to the use of different filtering techniques, such as the Baxter-King bandpass filter. Furthermore, using quarterly GDP instead of monthly IP data results in very similar cyclical turning points, see Section 4.2. For a comparison of different filters for the euro-area business cycle see Artis, Marcellino and Proietti (2003).

Graph 6: Euro-area business cycle phases (IP, 1975m7-2007m2)



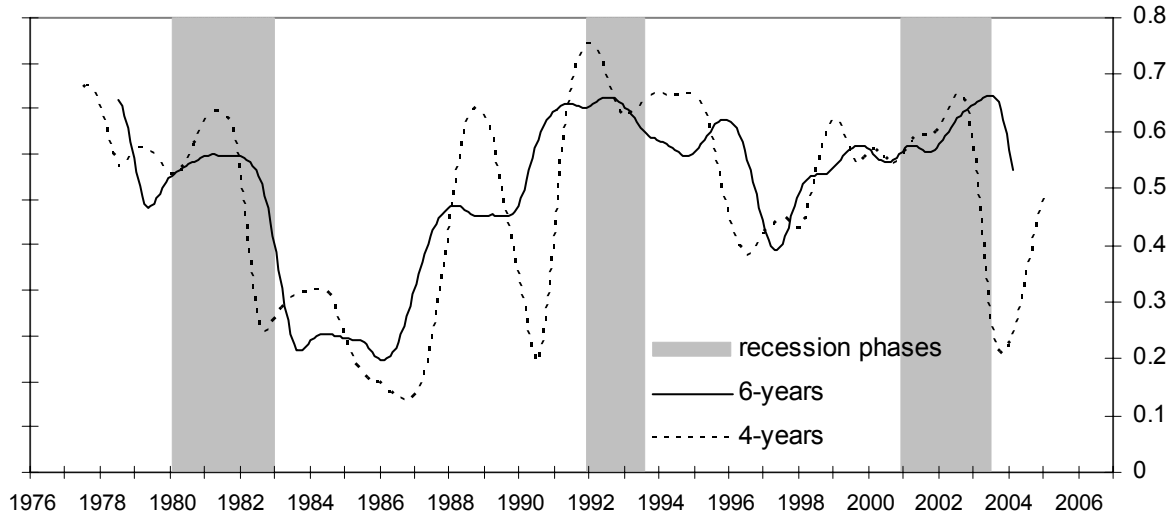
Source: Commission services

It emerges that, while euro-area business cycle recessions are typically short and steep, recovery phases tend to stretch out over a longer period and evolve in (mini-) cycles.[18] Given different adjustment speeds across countries following a recession, it is often argued that there is a general pattern of higher cyclical dispersion across countries during cyclical recoveries. Duval and Elmeskov (2006) e.g. argue that smaller and open economies are more flexible and recover faster from recession through spontaneous accommodation via endogenous changes in competitiveness and external trade. On the other hand, structural rigidities can lower the speed of adjustment to shocks. Furthermore, small countries are on average found to undertake more and faster structural reforms, while slower reforms in larger countries may restrict their adjustment mechanisms, leading to persistent cyclical weakness.

Against this background, Graph 7 reconsiders the moving correlations of Graphs 3 and 4 by cross-plotting them against the recession phases as identified in Graph 6. As can be seen, the three recession phases indeed seem to be characterised by a higher degree of cross-country correlation, and thus higher synchronisation of business cycles. After a recession, cross-country correlations typically decline. Table 1 quantifies the extent of this pattern by showing the mean levels of area-wide correlation during recession and recovery phases for both the six-year and four-year windows. It emerges that mean euro-area correlation is on average 12-13 percentage points lower in recoveries than it is in recessions. In relative terms, this corresponds to a reduction of business cycle synchronisation during recoveries by slightly more than 20% compared to the level during (the previous) recession.

[18] This observation is very much in line with stylised facts of the business cycle in general and with those of the euro-area cycle in particular, see e.g. Agresti and Mojon (2001).

Graph 7: Mean euro-area correlation and recession phases (IP data, 11 euro-area MS)



Source: Commission services

Table 1: Mean euro-area business cycle correlation in recoveries and recessions

	correlation window	
Mean correlation	6-years	4-years
in recovery	0.47	0.44
in recession	0.59	0.57
overall	0.50	0.47

Source: Commission services

There is thus some evidence, although based on three euro-area cycles only, that the observed decline in business cycle synchronisation after the latest turnaround in mid 2003 can be partly ascribed to a recurrent pattern of temporary de-synchronisation during cyclical recoveries, owed to cross-country differences in the speed of adjustment to common shocks. However, given that the causes of transmission asymmetries are manifold and that other sources of cyclical divergence are likely relevant, too, such as idiosyncratic shocks or persistent inflation and real interest rate differentials magnifying divergences,[19] this "mechanic" explanation of recurrent phases of de-synchronisation cannot explain the full extent of the developments in cross-country correlations that we see in the graphs. Furthermore, the degree of the decline in mean correlation according to the four-year window in late 2003 and the very fast recovery thereafter point to some peculiarities compared to the previous two post-recession phases.

In order to avoid the potential analytical problems that arise from the use of hard statistical data at the end of the data sample (due to revisions, largely arbitrary trend-cycle decomposition, end-point problems and publication lags),[20] the following two graphs display the evolution of mean correlations computed from the survey-based ICI series across

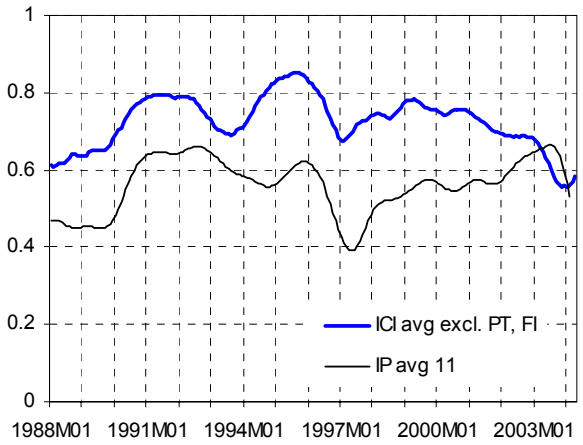
[19] Giannone and Reichlin (2006) find that remaining cyclical heterogeneity in the euro area is mainly due to small but persistent idiosyncratic shocks, whereas propagation mechanisms of common shocks are similar across Member States. For a discussion of the various sources of transmission asymmetries (such as differences in the openness to trade, importance of wealth effects, transmission of monetary impulses, degree of oil dependency) and other main sources of cyclical divergence in the euro area, see European Commission (2004).

[20] See Gayer and Weiss (2006) for a discussion of these problems.

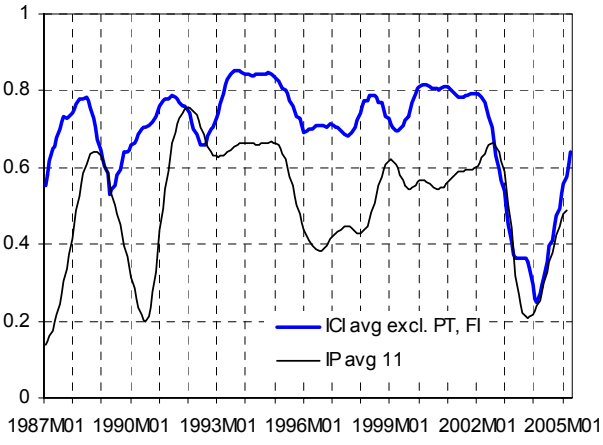
countries.[21] Focusing on the shorter samples available for the surveys, the results are presented along with the corresponding IP-based curves. In line with the results of Gayer/Weiss (2006), a rather close correspondence between the two measures of euro-area synchronisation is evident for both window lengths. While the level of correlation is overall higher using the ICI series, all major ups and downs of the IP-based curves are matched by corresponding movements of the survey-based synchronisation measure, usually with a lead of around six months.[22]

Looking at the longer window first, the evolution of the ICI-based curve, on a slight downward trend since around 2000, suggests a more marked fall in synchronisation in early 2003. Thanks to the lead over the IP series and the additional two observations available at the end of the sample (no publication lag of the survey results), the aforementioned very recent recovery of synchronisation is manifest in the survey-based correlations also using the 6-year window. Turning to the more sensitive 4-year window, it can be seen that, from the high level of synchronisation attained after the emerging markets crisis and the early EMU period, mean correlation started to drop already in early 2002. As can be seen from Graph 9, the extent of this drop in correlation between "confidence cycles" is unprecedented. It can thus not be fully explained by a mere recurrent decline of business cycle synchronisation in phases of economic uncertainty.[23] However, the more recent steep recovery since 2005 clearly points to the transitory character of this apparent de-synchronisation around 2003.

Graph 8: Mean euro-area correlations, ICI vs. IP (6-year window)



Graph 9: Mean euro-area correlations, ICI vs. IP (4-year window)



Source: Commission services

4.2 Correlation results based on GDP and its components

This section complements the so far manufacturing-oriented analysis by a look at cyclical synchronisation at the level of overall economic activity. Graph 10 displays the mean of pair-wise country correlations, calculated over moving windows of quarterly GDP data of both

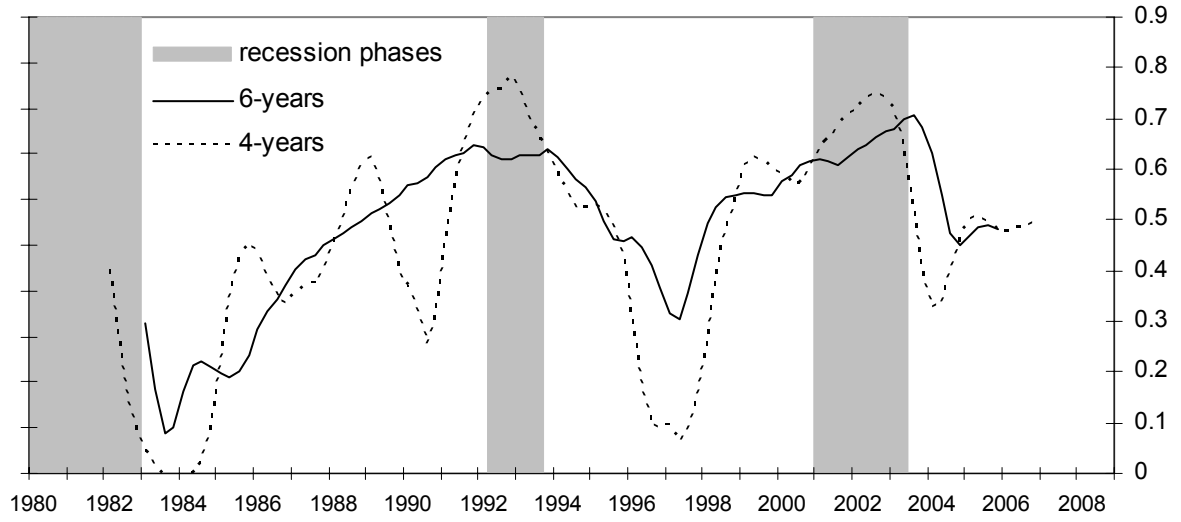
[21] At the euro-area level, the correlation between the ICI and IP growth is above 90%, while it is lower at above 60% on average across euro-area countries.

[22] This is a consequence of the fact that, on average across countries, the ICI shows a corresponding leading behaviour with respect to the cyclical component of IP.

[23] Gayer and Weiss (2006) report that this recurrent pattern of declining correlation in cyclical upswing phases and increasing correlation during downswings is less visible using qualitative ICI data compared to IP data.

six-year and four-year length.[24] Turning to the longer window first, the midpoint of the first six-year window refers to 1983:1. Partly based on the available Commission forecasts for GDP growth, the last window summarises business cycle association in the period 2002:4-2008:4. We can observe a marked increase in mean correlation from the mid-eighties to the early nineties and a stabilisation thereafter. After diminishing around 1997 (emerging markets crisis), synchronisation increases again until 2003. From mid 2003 to late 2004, we see a rather sharp decline in business-cycle association. Since 2005, however, mean correlation has stabilised at a level around 50%.

Graph 10: Mean euro-area correlations and recession phases (GDP, 6-and 4-year window)



Source: Commission services

Turning to the correlations computed over the shorter four-year window, the graph, whilst obviously more responsive to short-run divergence (e.g. German re-unification in 1990), corroborates the previous findings. Due to the higher sensitivity of the four-year window, the recent decline in business cycle association is signalled somewhat earlier, around 2002/2003 and appears slightly more pronounced. The mild recovery and stabilisation of business cycle synchronisation thereafter (2004-2006) is also evident from the graph. However, these latest movements are increasingly based on forecast GDP growth for 2007/2008 and should, therefore, be interpreted with some caution.[25]

As to the crucial comparison of synchronisation before and after the introduction of the euro, average correlation on the basis of GDP data appears somewhat more pronounced under Stage 3 of EMU than in the first half of the nineties,[26] in slight contrast to the earlier IP-based Graphs 3 and 4.

[24] The graph focuses on the unweighted mean. Again, the weighting of countries does not qualitatively alter the findings.

[25] The very last window (2005-2008) is based to almost 50% on forecast data (for 2007q2-2008q4).

[26] Average correlation in the period 1990-1994 is 0.61 (0.58) for the 6-year (4-year) window, while it is 0.62 (0.63) for the period 1999-2003.

Graph 10 also displays the recession phases since 1980, based on the turning points of the cyclical component of euro-area GDP.[27] Here again, the graph suggests a general pattern of decreasing mean euro-area correlation just after the recession phases of the cycle have come to an end, i.e. after the trough has been passed. If this pattern would hold true also for the current business cycle, then an increase in cross-country correlations should be expected in the further course of the recovery, with laggards in cyclical adjustment catching up with faster rebounding countries.

Based on the identified pattern of recurrent ups and downs in synchronisation in the course of the business cycle, one may compare mean correlation in the period 1999–2006 with mean correlation in the corresponding eight-year period of the previous cycle. As discernible from Graph 10, the introduction of the euro in 1999 occurred approximately four and a half years ahead of the latest cyclical trough in 2003q2, when cycles started to diverge. The corresponding benchmark period around the previous trough in mid-1993 thus runs from 1989 to 1996. Mean correlation over that period is 0.58 (based on the six-year window), while it is marginally higher at 0.59 for the corresponding period since the introduction of the euro. On average across the business cycle, synchronisation in the euro area thus appears to have stabilised at a high level.[28]

To investigate the sources of the observed developments in cross-country synchronisation at the end of the data sample, it is useful to look at the expenditure components of GDP. Looking behind the diverging growth performances across Member States since 2003, there have been some well-known disparities in the sources of growth. For example, until very recently in this recovery, Germany has relied mainly on exports, while domestic demand and notably private consumption has stagnated. On the other hand, domestic demand has underpinned the robust economic performance in Spain and has been the main factor sustaining growth in France. Given such differences, a systematically lower cross-country synchronisation is to be expected at the level of GDP components. An open question is how the individual components contribute to the evolution of business cycle association in the euro area in general, and to the recent de-synchronisation of business cycles in particular.

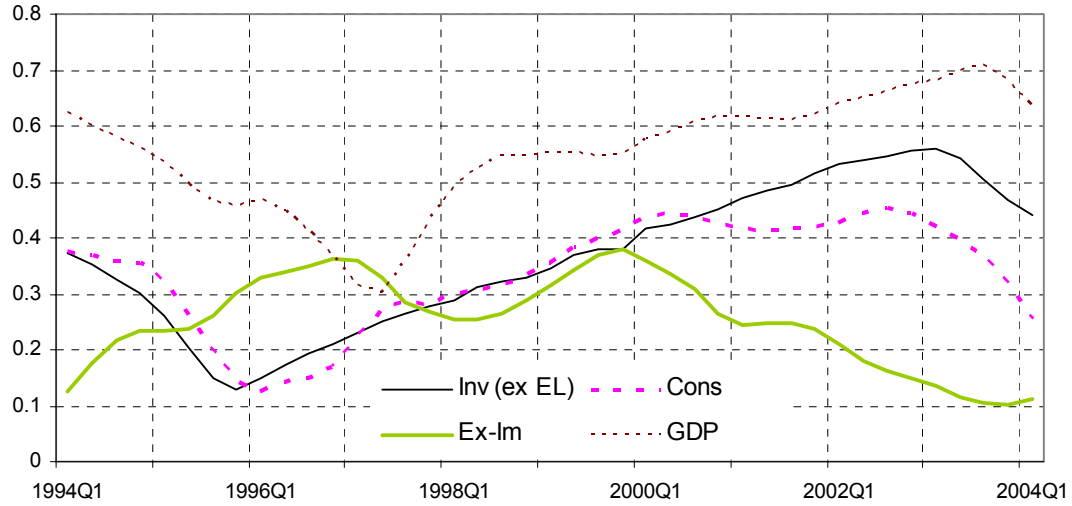
Focusing on the period since 1991,[29] Graphs 11 and 12 display the rolling correlations between countries' main expenditure components, for the six and four-year windows respectively.

[27] Reassuringly, the turning points of the HP-filtered quarterly GDP series (peaks in 80:1, 92:1 and 00:4, troughs in 82:4, 93:3 and 03:2) are fully congruent with those derived from the correspondingly filtered monthly IP series (Graphs 6 and 7).

[28] See Section 6 for a comparison with countries outside the euro-area.

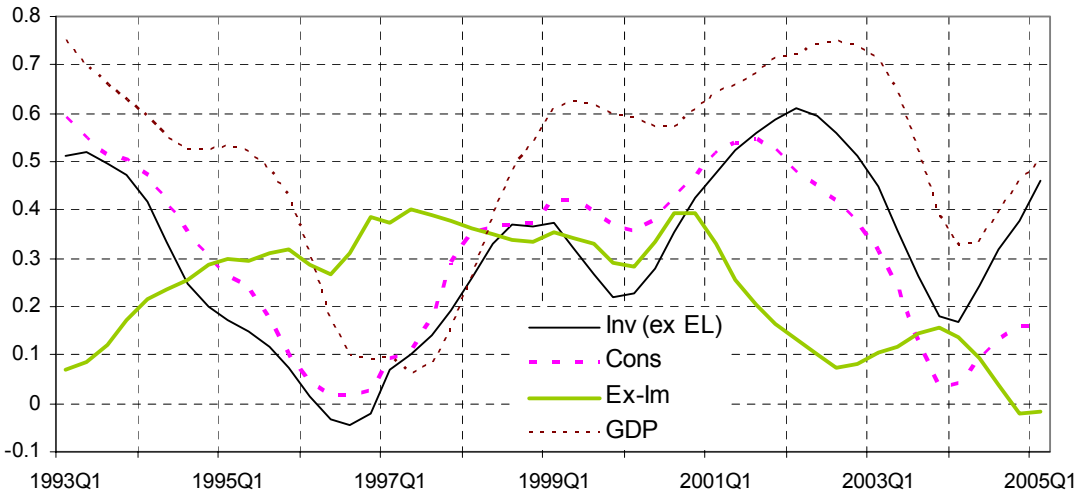
[29] The rather short sample is due to the unavailability of GDP components for Germany before 1991. Since there are no quarterly forecasts available for GDP components, the sample ends in 2007:1.

Graph 11: Mean intra-euro-area correlations (GDP and components, 6-year window)



Source: Commission services

Graph 12: Mean intra-euro-area correlations (GDP and components, 4-year window)



Source: Commission services

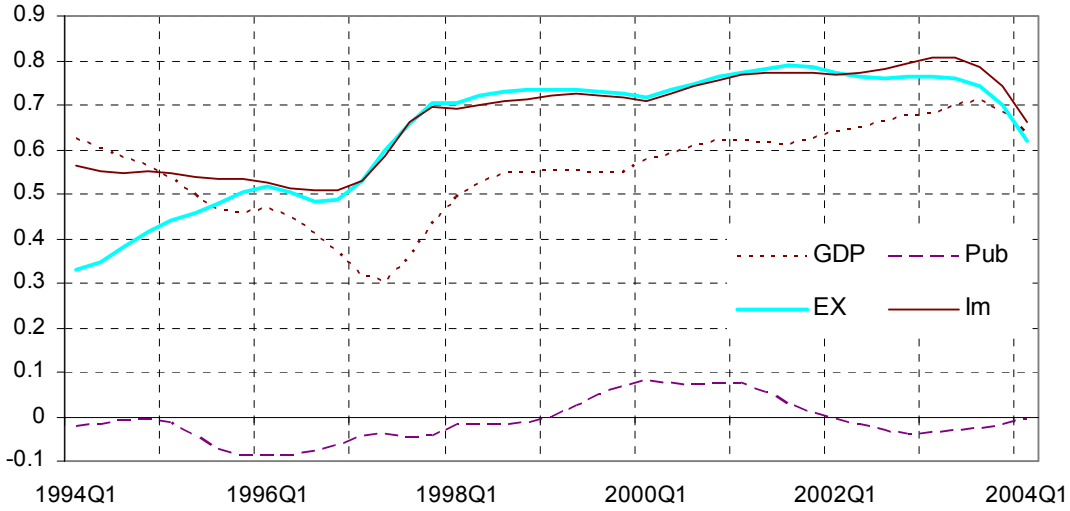
Mean cross-country correlation of private consumption, which represents the largest share of GDP expenditure, can be seen to move rather closely in line with that of total GDP. However, there seems to be a lead of roughly one year at both the upturn in synchronisation in 1996/1997 and the recent downturn around 2002/2003. The behaviour of the curve based on total investment is rather similar, but it shows less of a lead with respect to the GDP-based curve. Based on the shorter correlation window, both curves share the observation of a rebound in cross-country synchronisation in late 2003/early 2004, slightly ahead of the turn in GDP correlations.

Cross-country synchronisation of net exports shows a completely different picture. Coming from a low level in the earlier nineties, synchronisation of net export cycles was relatively high and stable between 1996 and 2000. From 2000/2001 onwards, however, the curves in both graphs can be seen to decline rather steadily to levels of insignificant cross-country correlation until the end of the sample. Given the relatively small impact of net exports on the

level of total GDP, the contribution of that component to overall synchronisation is, of course, equally small.[30]

Looking at exports and imports of goods and services separately, the picture is again different. Graph 13 shows the evolution of mean correlation across countries calculated over moving samples of six years' length. As could be expected from the fact that imports are largely determined by domestic demand, synchronisation of imports across countries is closely related to the pattern of GDP synchronisation. Cross-country-synchronisation of exports is almost identical to that of imports from 1996 until the end of the sample. Both curves show the typical fall from 2003 onwards.[31] Given that exports are a function of foreign demand, the fact that the synchronisation of exports is lower in the earlier part of the sample seems to indicate a lower level of world cycle association until the mid nineties.

Graph 13: Mean intra-euro-area correlations (GDP and components, 6-year window)



Source: Commission services

The graph also shows the cross-country correlation of public consumption over time (Pub). Obviously, the latter is not significantly different from zero across the sample. This suggests that public spending across euro-area countries is largely idiosyncratic, i.e. not related to the (more or less shared) business cycle, which should be expected if the counter-cyclically working automatic stabilisers were let to play.

Summarising the results, the decrease in GDP correlation across countries is led by slightly earlier decreases in cross-country association of private consumption and investment and by a de-coupling of net exports that set in already around 2000/2001. Importantly, for all components including exports and imports (but not net exports) the partial recovery of cyclical synchronisation starting around 2004 can also be found in the respective correlations.

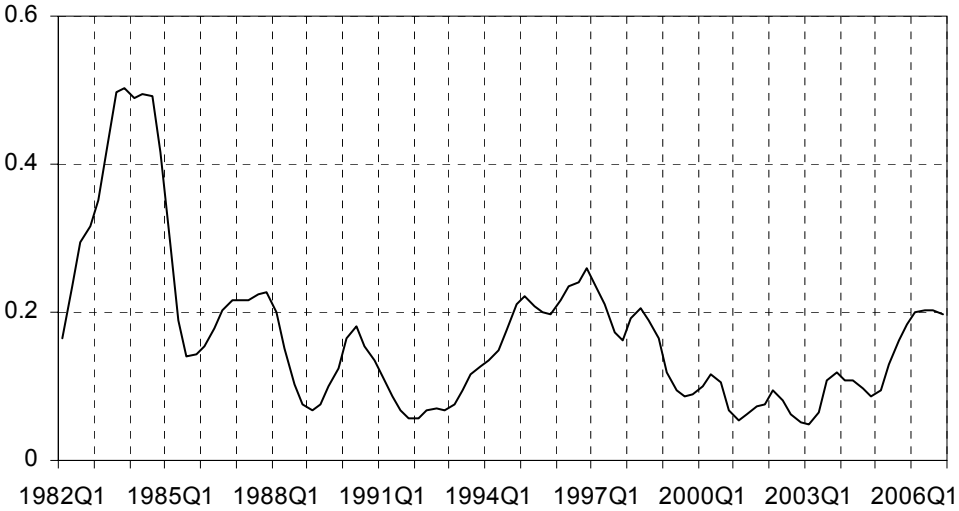
Going back to the GDP aggregates, Graph 14 displays the evolution of the variance of bivariate correlation coefficients over time, using the four-year window. From 1997 to 2002, a decrease in the dispersion of country-to-country correlations can be observed, pointing to overall higher cyclical homogeneity among the group of countries. Since 2003, however, in

[30] Note that our interest is in synchronisation of growth cycles, i.e. deviations from trend. The fact that net exports typically contribute strongly to *changes* in GDP due to their faster (or slower) trend growth is thus not relevant here.

[31] Correlations calculated over four-year windows (not shown here) share the many times observed partial recovery of mean correlation from 2004 onwards.

line with the previous findings, a widening of the dispersion between country correlations is observable. Towards the very end of the sample, there is a stabilisation of the dispersion of cross-country correlations. However, the level of dispersion does not actually decline, as was the case with the IP-based four-year window correlations (Graph 5) and as could have been expected from the pick-up of mean correlation in Graph 10, if empirically a rise in mean correlation was systematically accompanied by a corresponding fall in the dispersion of correlation across countries. Apparently, the latter is not always true, such that a higher mean association can indeed mask that at the same time the differences in association between individual country pairs increase.

Graph 14: Dispersion of bivariate correlation coefficients (GDP, 4-year window)



Source: Commission services

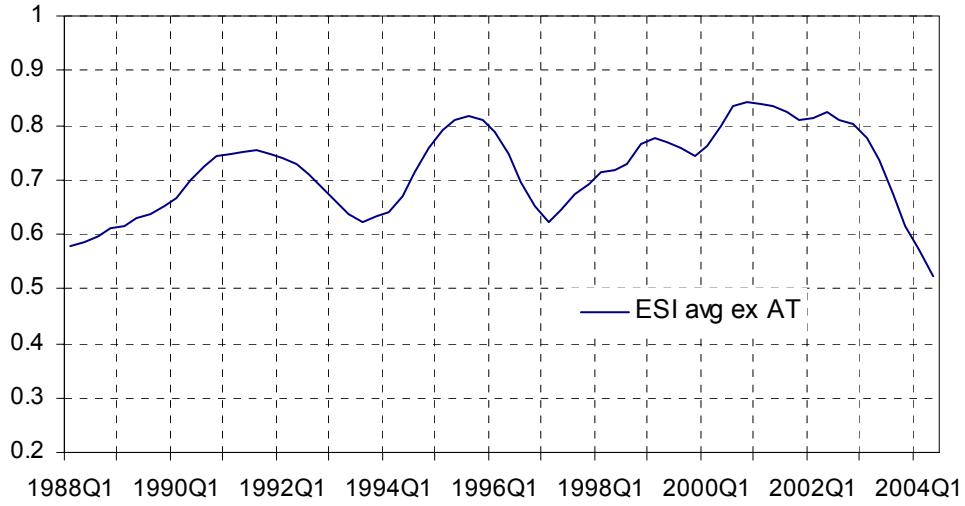
This observation might be explained by the existence of some negative outliers, i.e. country pairs with particularly poor bivariate correlation at the end of the sample, affecting the variance more markedly than the mean of the distribution. More specifically, it could be that while there is a general trend of increasing correlation between countries' business cycles, certain countries' cycles become increasingly more different from all other countries' cycles – against the trend. This calls for a closer, country-wise analysis of correlations to see the contributions of individual countries to mean euro-area developments. While this will be the focus of the next section, the next two graphs complement the analysis of aggregate euro-area GDP correlations by displaying correlation developments based on the closely related Economic Sentiment Indicators (ESI)[32] across countries.

The rolling correlations between the ESI across euro-area countries again broadly confirm the results derived from the hard statistical data. On the basis of survey data up to the second quarter of 2007, the six-year window generates the following picture of synchronisation developments (Graph 15).[33]

[32] At the level of the euro-area aggregate, the correlation between the ESI and GDP growth is above 90%, while it is slightly lower at around 80% on average across euro-area countries.

[33] Austria had to be excluded from the analysis due to too short ESI time series.

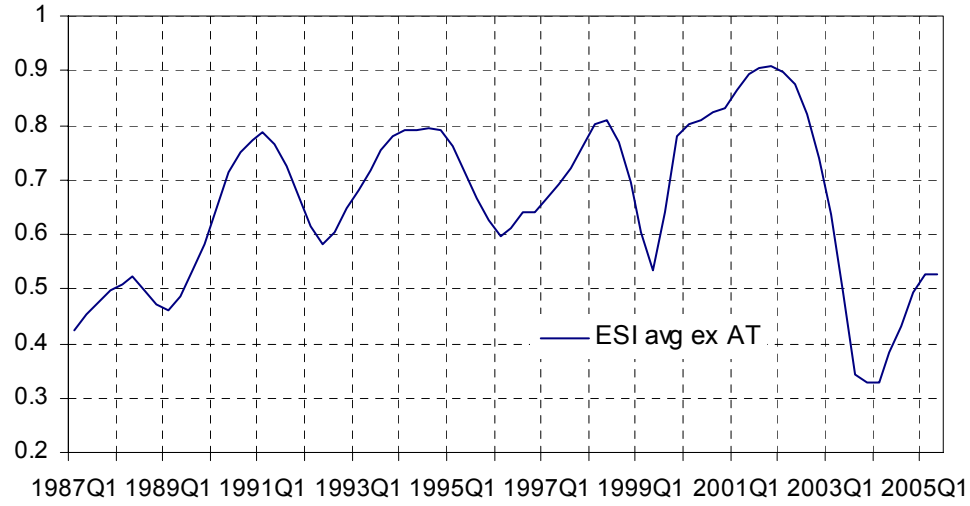
Graph 15: Mean euro-area correlations, ESI 6-year window



Source: Commission services

A decline in correlation is signalled from early 2003 onwards. While the level of mean correlation attained at the end of the observation sample is low in historical terms, Graph 16, using the four-year window, again shows the already several times observed recovery of synchronisation around 2004. Contrary to the corresponding GDP-based Graph 14, the results are entirely based on actual, i.e. observed data. While this removes some of the doubts following from the fact that the GDP results close to the end of the sample are increasingly based on forecasts, it also demonstrates the leading character of the survey data over the hard data. As for the ICI in Graph 9, the degree of the fall in mean correlation is unprecedented. Particularly, no comparable decrease in synchronisation can be spotted in the early period of recovery after the steep recession of 1993.

Graph 16: Mean euro-area correlations, ESI 4-year window



Source: Commission services

To sum up, the analysis of mean synchronisation on the basis of survey data (ESI, and before ICI) helped to remove possible doubts concerning the developments at the very end of the sample, where the analysis based on hard data (GDP, IP) might be less reliable due to the preliminary character of the data (revisions) and end-point problems related to the required

filtering. Due to their timeliness and their leading properties, the survey data could also be used to underpin the results that were partly based on GDP forecasts for 2007 and 2008. Though the extent of the decrease appears larger on the basis of survey data, the coherent picture is that, from a high level attained in the early 2000s, mean euro-area correlation has dropped around 2003 and appears to have rebounded afterwards. While part of this observation is likely attributable to a general pattern of decreasing synchronisation in cyclical upswing phases, the relatively large decreases particularly in the measures based on survey data might point to some peculiar characteristics compared to earlier periods of temporary de-synchronisation. The subsequent section looks at country-wise developments to investigate the possible sources for these aggregate findings.

5. Country contributions

Graph 17 shows the correlations of individual euro-area Member States with the euro area aggregate, using GDP data and based on the six-year window.[34] Averaging across these individual correlations with the euro area produces very similar curves to those presented above (Graph 10). Looking at the individual graphs, several groups of countries can be distinguished. First, there is a group comprising Germany, France, Italy, Spain and the Netherlands that have been displaying consistently high correlation with the euro area since at least 1999. Before that, the Dutch correlation curve showed a marked slump in the mid-nineties, when the country's cycle was temporarily shifted with respect to the aggregate cycle. France and Spain show signs of slightly lower synchronisation since around early 2004, with the French correlation dropping from a level close to 100% to below 80%. However, for both countries, correlations appear to recover again at the very end of the sample.[35] Austria and Portugal displayed slightly lower correlation levels in the first years after the introduction of the euro. Between 2001 and 2003, both countries experienced an increasing association with the euro-area cycle, likely explicable by the very evenly spread cyclical downturn following the burst of the dotcom bubble in 2000. Both countries then experienced a temporary dip in their euro-area correlations around 2004. At the end of the sample, both countries' correlations are back to levels comparable to those recorded around 1999.

An interesting case is Greece. It shows insignificant or even negative correlation with the euro-area cycle since the mid nineties. Continuously falling since 2004, recent developments in correlation point towards counter-cyclical behaviour. As argued in European Commission (2006a), the disconnection from the rest of the euro area can partly be explained by structural features of the Greek economy, particularly its comparatively low integration in intra-area trade. Furthermore, the Greek economy has benefited in recent years from the positive stimuli of a later euro adoption and the Olympic Games in 2004.

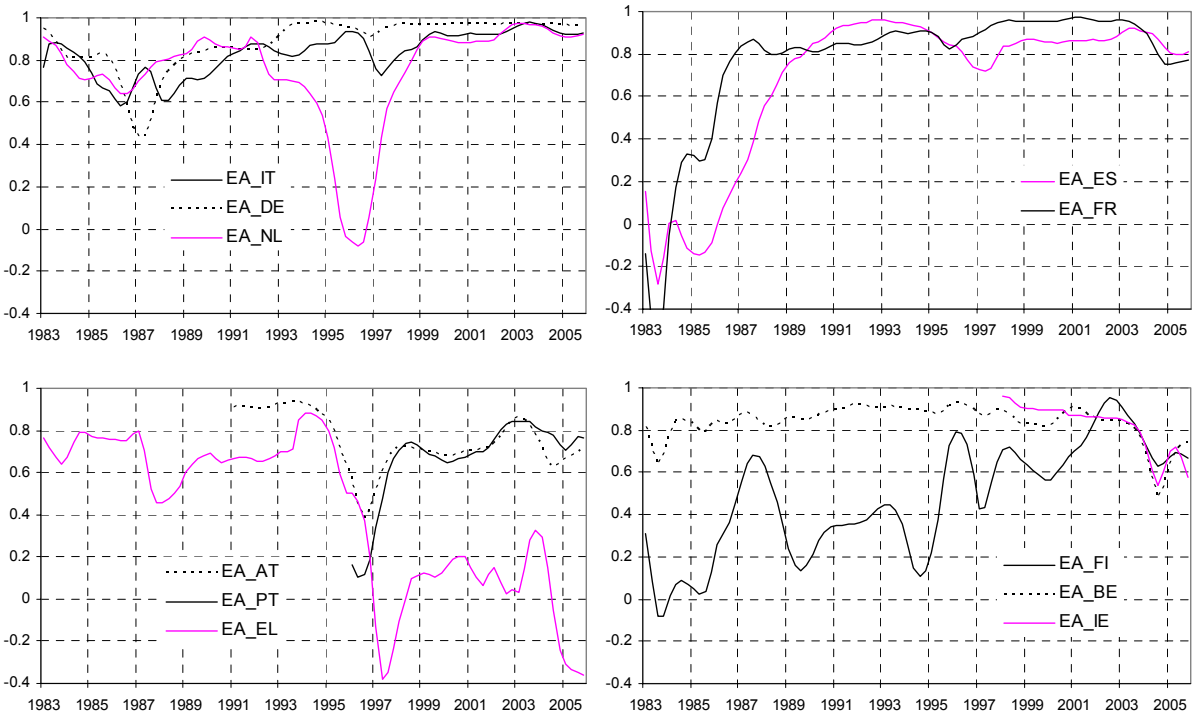
---

[34] This approach generates largely equivalent results to calculating averages of countries' bivariate correlations with all other euro-area countries. Calculating correlations with the euro-area aggregate leads to systematically higher average correlation levels, since any given country contributes to the aggregate cycle itself. Obviously, average pair-wise correlations are particularly lower for the large "core" euro-area countries Germany, France and Italy. Furthermore, contrary to the graphs in the text, a mild fall in mean correlation at the end of the sample can also be observed for Germany and Italy (and the Netherlands), if bivariate correlations are averaged. A bias arises, however, from the fact that in such an unweighted average, a marked de-synchronisation of one (small) country is enough to bring down mean correlations of all other countries. Using the (explicitly weighted) euro-area cycle instead mitigates this problem. Finally, if one believes that there is a genuine "euro-area cycle" driving individual national cycles, then this is the relevant benchmark that the country cycles should be compared to.

[35] This is confirmed by the corresponding calculations based on the four-year window.

Another particular case is Finland, where correlation with the euro area was rather low before 2000, particularly during the period of economic crisis in the early nineties. Having reached a peak level around the recessionary phase of 2002/2003, euro-area association has again fallen since then. Similarly pronounced drops in correlation around 2003/2004 can be seen for Belgium and Ireland. Both countries displayed high levels of euro-area synchronisation from the late nineties (and, in the case of Belgium also before that) to 2003. While the dip seems to be pronounced but temporary in the case of Belgium, the apparent de-synchronisation of the Irish cycle does not (yet) show clear signs of reversal.

Graph 17: Correlation of individual MS with euro-area aggregate (GDP, 6-year window)



Source: Commission services

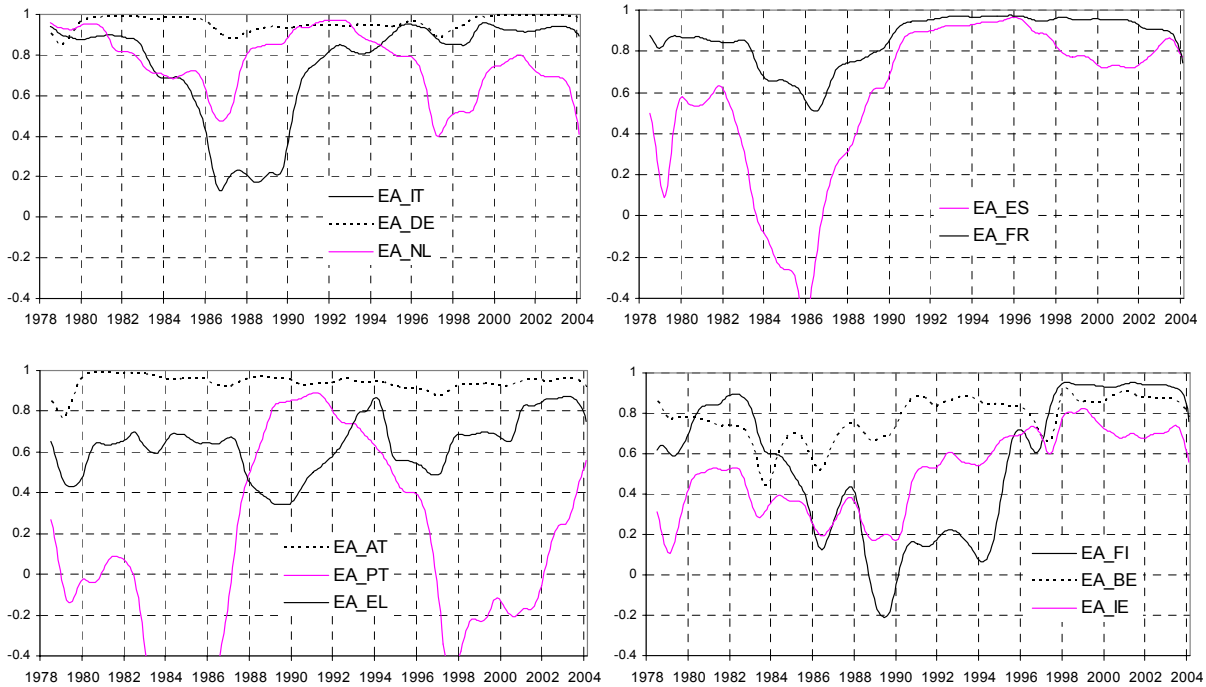
The four-year window results largely corroborate the above findings. The assessment of individual country developments in terms of synchronisation with the euro-area aggregate is partly different when based on IP instead of GDP series (Graph 18). Here, the Netherlands appear to contribute to the overall fall in correlation already since around 2001, which is not visible in Graph 17 above. However, the picture is rather coherent for Germany, Italy, France and Spain, with the latter two countries showing slight signs of decreasing adherence to the euro-area cycle at the end of the sample. For Spain, a somewhat more severe and rather protracted phase of de-synchronisation from the euro-area IP cycle can be seen between 2000 and 2002 already. A look at the underlying cyclical developments shows that Spanish industrial production peaked two quarters before the euro-area aggregate in 2000 and reached the latest trough more than one year in advance in early 2002, when industrial activity in the euro area remained subdued for almost another year (see left panel of Graph 20 below).[36]

[36] For a brief discussion of the impact of the real interest rate channel on de-synchronisation in Spain, see European Commission (2006a).

The curves in Graph 18 for Portugal and Greece differ from those of Graph 17. On the basis of IP cycles, Portugal shows a severe fall in euro-area correlation in the early and mid-nineties, followed by a steep and unbroken recovery from 2001 onwards. The correlation of the Greek cycle with the euro area, on the other hand, appears much closer than on the basis of GDP data. Displaying a step-wise upward trend towards the correlation level of the four large euro-area countries between the mid nineties and 2003, the curve indicates a decline in euro-area synchronisation only very recently. As for Austria, the results are again broadly coherent with those based on GDP for Belgium, Ireland and Finland, with the latter two countries showing more pronounced signs of a recent weakening in euro-area synchronisation.

As to the short-term tendency, reflecting the pick-up in mean euro-area correlation at the very end of the sample in Graph 4, the correlations of IP cycles calculated over four-year windows point to a rebound in synchronisation for the majority of countries where a decrease around 2003 is discernible from the graphs displaying the six-year window results.

Graph 18: Correlations of individual MS with euro-area aggregate (IP, 6-year window)



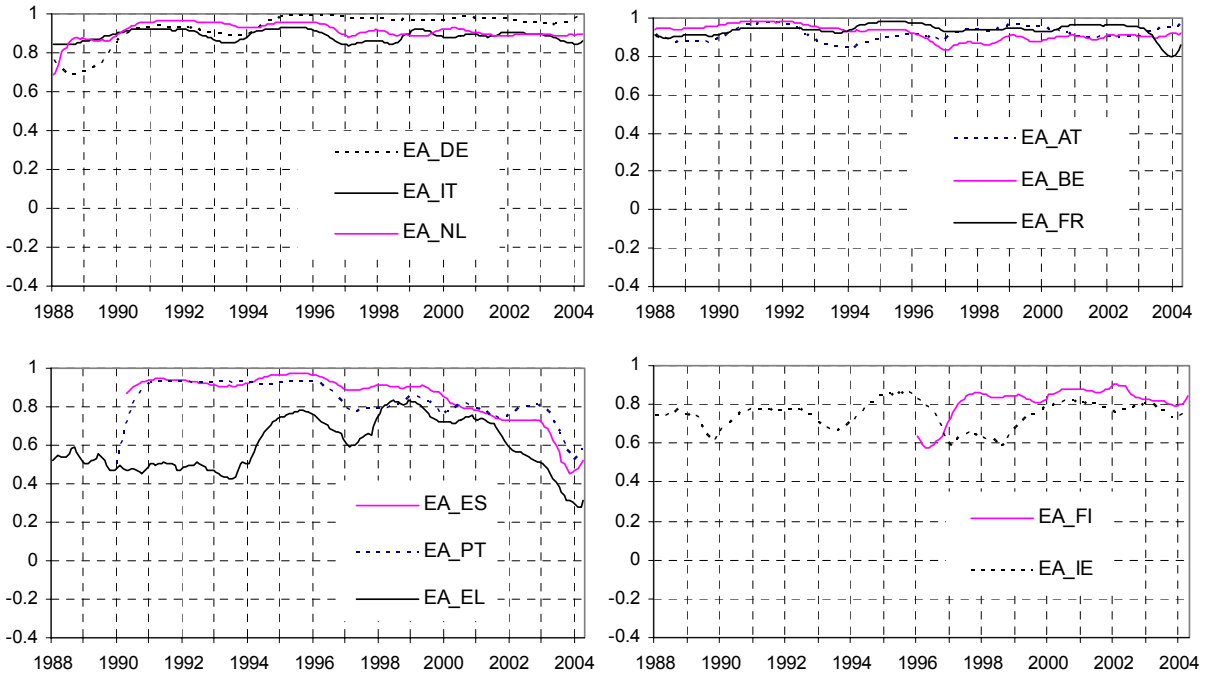
Source: Commission services

All in all, the observed decline in mean correlation in the euro area around 2003 seems to be due to a relatively widespread de-synchronisation at the level of individual countries. Apart from countries such as Greece, Finland and Ireland, there is evidence of rather distinct drops in correlation even for "core" countries such as France and Belgium. Using IP data, also the Dutch cycle shows signs of de-linkage from the euro aggregate. Importantly, however, the drop in synchronisation in 2003 appears to be of a temporary nature overall. Greece, Finland and Ireland are the only countries, for which the GDP-based synchronisation measure does not show a rebound at the end of the sample (Graph 17).

As to the mean level of business cycle correlation since the introduction of the euro in 1999, the GDP data points to a particularly low level of cyclical adherence to the rest of the zone for Greece, while on the basis of IP data the level is particularly low for Portugal. Importantly,

however, in the latter case the data point to a strong upward trend in euro-area synchronisation since 2001.

Graph 19: Correlations of individual MS with euro-area aggregate (ICI, 6-year window)

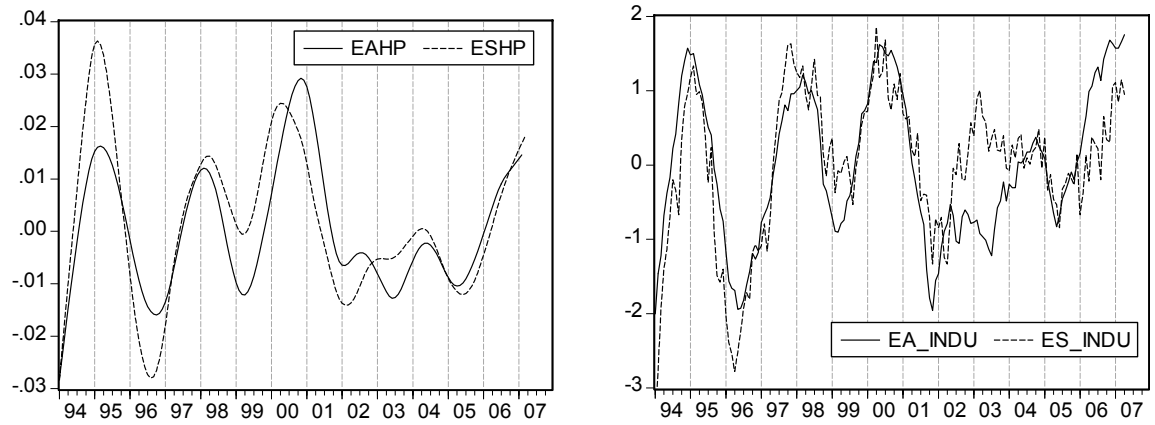


Source: Commission services

Graph 19 takes a final look at individual country developments, now based on survey data, corresponding to the mean results shown in Graph 8. It emerges that, apart from Greece, mainly Spain, Portugal and Ireland[37] are displaying significant drops in correlation with the euro-area confidence indicator (ICI) towards the end of the sample. Among the countries with usually high and stable correlation, presented in the upper panel of the graph, France can be seen to experience a transitory dip in euro-area correlation lately, in line with previous observations. Furthermore, the observation of a slowly descending trend in mean ICI correlation already since 2000 (Graph 8) appears mainly attributable to corresponding developments in Greece and Spain. While the development of the Greek curve is very much in line with the slump in the GDP-based correlations, the contribution of the Spanish ICI to the de-synchronisation of industrialists' confidence in the euro area around 2003 is much more pronounced than suggested by the preceding correlation results using hard data.

[37] The decrease in correlation for Ireland is much more pronounced when the four-year window is used.

Graph 20: IP cycles (left) and confidence cycles (right), EA and ES



Source: Commission services

As discernible from the right panel of Graph 20, the de-linkage between Spanish and euro-area confidence in the early 2000s is markedly more pronounced than suggested by IP data (left panel). Industrialists' confidence in Spain peaked in early 2003, a time when confidence in the euro area experienced a relapse mirroring the trough in industrial production. More recently, the pick-up in confidence since mid-2005 appears somewhat less buoyant compared to the steep rise in the euro-area aggregate, while the rebound in Spanish IP appears at least as pronounced.

The observed differences in amplitude of the declines in mean correlation around 2003 can thus be ascribed to quantitative discrepancies between developments in survey data and hard data, while qualitatively the picture remains unchanged. A general explanation for the apparent stronger de-synchronisation of economic confidence could be related to the high degree of uncertainty surrounding the economic upturn since 2003, in the face of incidents such as terror attacks, the Iraq war, an escalating middle-east conflict, nuclear threats from North Korea and Iran and fears of hard landings in the US and China, to name just a few. It might be argued that these adverse, but largely "intangible" events had more asymmetric effects on economic confidence of survey respondents across euro-area countries than they had on actual production data.

Finally, however, the observation of a rebound in cross-country synchronisation towards the end of the sample is also shared by the analysis of the survey data. As is even more evident in the results based on the shorter estimation window, correlations can be seen to pick up again at the end of the sample for all countries mentioned above, mirroring the recovery of average cross-country correlation observed in Graphs 8 and 9.

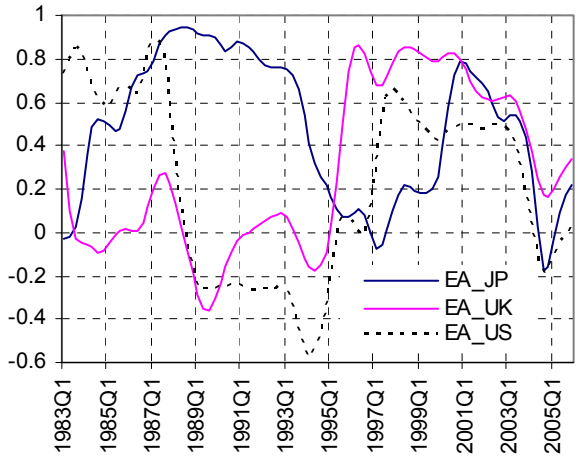
Summarising the analysis of individual country developments, the picture of a relatively widespread but temporary de-synchronisation of cyclical forces across the euro area emerges, spurred by peculiar developments in some countries such as Greece. Despite some signs of transitory de-synchronisation in the case of France and Spain, the larger countries seem to continue to stick reasonably well together. Synchronisation should continue to pick up in the further course of the business cycle.

6. International environment

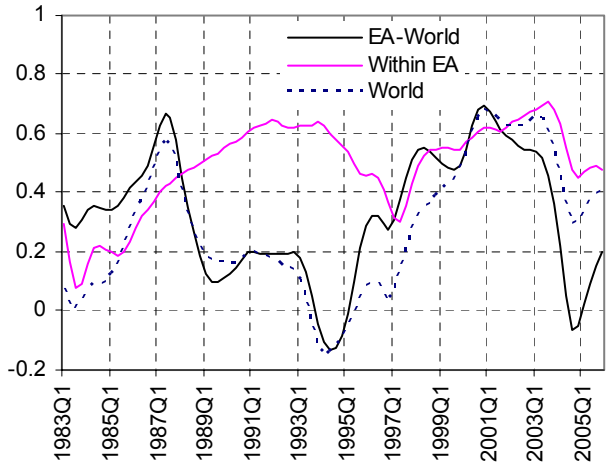
OECD countries have experienced a strong convergence in business cycles over the past few years on the back of rising trade and financial integration as well as forceful common shocks. Correspondingly, Artis (2005) finds evidence of an emerging "world business cycle", implying that where increased business cycle synchronisation in the euro area is found, it is not clear whether this is due to area-specific forces or global trends. Similarly, the finding of a recent dip in business cycle synchronisation within the euro area has to be checked against possible parallel developments at the world level. For this reason, we repeat the analysis for some important non-euro-area countries.

Graph 21 displays the moving correlations of the UK, the US and Japan with the euro-area aggregate. The effects of the emerging markets crisis are clearly visible in the temporary decoupling of the Japanese cycle from that of the euro-area. While high levels of correlation around the early 2000s suggest a period of close euro-area-world synchronisation until very recently, the business cycles of all three external economies appear to simultaneously decouple from the euro-area cycle since early 2003, followed by a rebound in synchronisation in 2004/2005.

Graph 21: Correlations of UK, US and JP with the euro area (6-year window)



Graph 22: Mean correlation: euro-area-world vs. world vs. within-euro-area (6-year window)



Source: Commission services

Graph 22 displays the mean of the six pair-wise correlations between the euro area, the UK, the US and Japan, serving as a measure of worldwide synchronisation of cycles (*World*). It also displays the mean of the three correlation series from Graph 21 as a measure of mean correlation between the euro area on the one hand and important outside countries on the other (*EA-World*). Finally, the graph also recalls the mean of the intra-euro-area correlations (*Within-EA*), known from Graph 10.

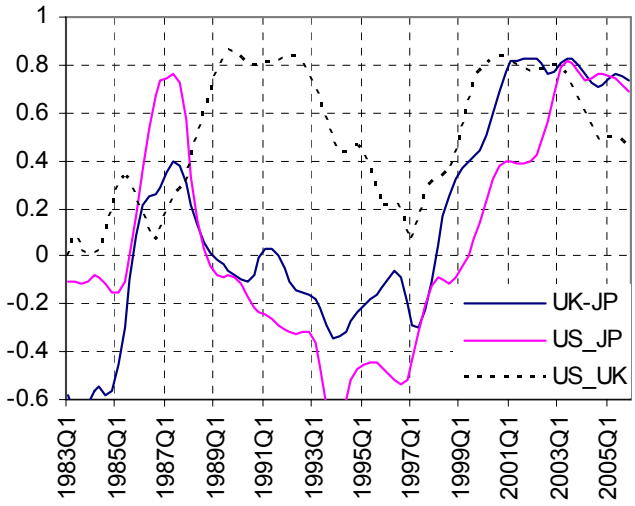
The gap between the *World* and *EA-World* curves on the one hand and the *Within-EA* curve on the other hand over the 10-year period from the late eighties to the late nineties clearly points to a euro-area specific process of cyclical synchronisation during that time. As suggested by Mélitz (2004) and Kalemli-Ozcan et al. (2004) this increase in the symmetry of business cycles in the euro area during the 1990s might reflect the closer economic and financial integration and policy coordination in the run-up to, and early stages of, EMU. This

result would thus support the predictions of the endogenous Optimum Currency Area (OCA) hypothesis due to Rose (2000 and 2004) and Frankel and Rose (1997).

At the same time, the rapid convergence of world cycles since the mid-nineties and the ensuing high level of world-cycle synchronisation attained since 2000 suggest that synchronisation within the euro area might have benefited from synchronisation tendencies at the world level, driven by forceful common shocks such as the universal IT boom of the late nineties and the ensuing dotcom bust and 9/11 terror attacks. Between 1997 and 2002, business cycle association was as high on average between the euro area and the US, UK and Japan as it was within the euro area.

The ensuing parallel decline of both intra-euro-area and euro-area-world correlation since 2003 shows that the temporary de-coupling of business cycles between euro-area Member States is accompanied by a parallel phase of de-coupling of the eurozone aggregate from the rest of the world. However, the latter de-synchronisation appears far more pronounced, with mean euro-area-world correlation temporarily falling to below zero and remaining in insignificant territory until the end of the sample (Graph 22, *EA-World*). At the same time, Graph 23 shows that business cycle synchronisation between the US, the UK and Japan has remained at high levels overall, with the partial exception of the pair US-UK, showing milder downward tendencies since 2003.

Graph 23: Correlations between the UK, the US and JP (6-year window)



Source: Commission services

These latter developments mirror the well-known differences in economic performance between the euro area and its major economic counterparts over the past few years. While the euro area saw actual output growth above potential for the first time in 2006 after a prolonged period of sluggishness in 2003-2005, the US economy experienced three years of rapid expansion and only moved to a growth path below trend in the second quarter of 2006. The UK had reached potential growth already in 2003 and grew clearly above potential in 2004. Japanese growth was also clearly above potential in 2004, and close to potential in 2005.

The dent in the measure of world-cycle synchronisation in Graph 22 (*World*) is thus obviously due to a particular pattern of the euro-area cycle, while the other big economies' cycles appear to remain reasonably closely aligned.

The observation of a transitory but relatively pronounced decline in synchronisation of euro-area Member States' business cycles thus has to be partly qualified by a much more

pronounced decline in synchronisation between the area and the rest of the world. Slightly paradoxically, the implied relative closeness of cycles within the monetary union points to a sustained distinct euro-area business cycle affiliation.

At the same time, the continued high inter-correlation between the US, Japan and the UK at the end of the sample (Graph 23) seems to suggest that a high degree of cyclical synchronisation can be maintained without economic and monetary integration. However, it has to be noted that this high level of synchronisation is a recent and rather exceptional phenomenon. On average across the sample starting in the early eighties, mean correlation between the three non-euro-area countries was below 0.25, while it was 0.50 between euro-area Member States.

Together with the finding that the observed dip in euro-area synchronisation is partly attributable to a recurrent pattern of transitory de-linking in early recovery phases of the cycle, the analysis provides continuous evidence of a distinct euro-area business cycle. The observed temporary divergence within the monetary union around 2003 is much less pronounced than between the union and important outside countries. Coming back to the question of whether increased synchronisation in the euro area might be a mere by-product of globalisation, the empirical evidence does not turn out to be supportive. During the 10-year period from the late eighties to the late nineties, synchronisation within the euro area was clearly ahead of that on the world level. While world-cycle synchronisation rose steeply from the mid-nineties to match euro-area synchronisation around 1999, the recent experience shows that euro-area cycles hold together relatively more closely than cycles on the world level.

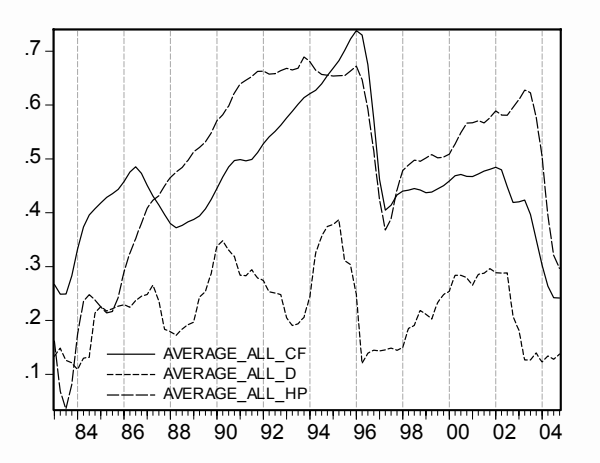
7. Robustness of results

Several variations of the described methodology were used to check the robustness of the results. First, since its is well-known that different trend-cycle decompositions can lead to different properties of the estimated business cycle,[38] two alternatives to the use of HP filters were applied to distil the cyclical fluctuations from the GDP series: a genuine band-pass filter derived by Christiano/Fitzgerald (CF, 1999)[39] and the calculation of growth rates as the differences of the logarithm of GDP. The development of average correlation between the euro-area countries considered is qualitatively unaffected compared to e.g. Graph 10: a peak in mean within-euro-area correlation in the mid-nineties is followed by a temporary trough in 1996/1997 and a subsequent recovery until the early 2000s. However, in case of both the CF-filtered series and the growth rates, the subsequent decline in correlation sets in somewhat earlier, i.e. in mid-2002 (Graph 24).

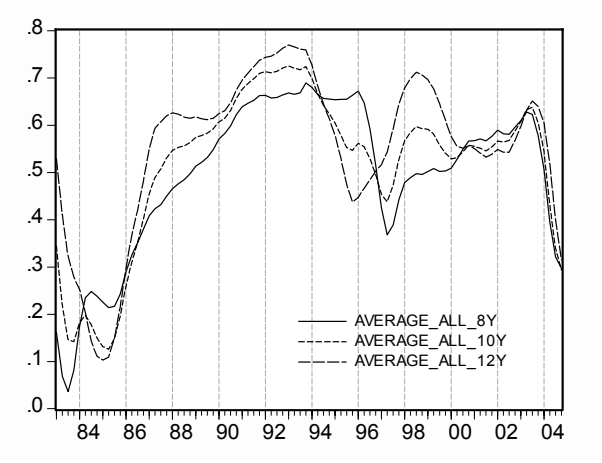
[38] See e.g. Canova (1998).

[39] The CF-filter is an asymmetric variant of the well-known Baxter-King filter, having the advantage that it can be computed up to the ends of the sample, albeit at the risk of introducing a phase shift.

Graph 24: Mean euro-area correlation using different business cycle estimates (GDP, 6-year window)



Graph 25: Mean euro-area correlation using different business cycle lengths (GDP, 6-year window)

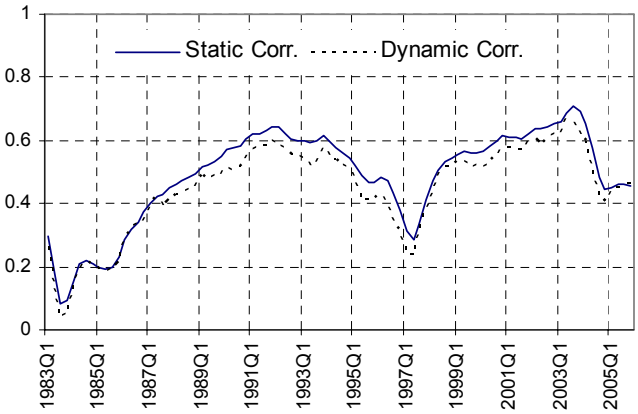


Source: Commission services

Second, the definition of the maximum duration of business cycles was altered from 8 years to 10 and 12 years in the calculation of the band-pass filter. As before, the main message from the moving correlations is not affected by basing the calculations on such longer cycles (Graph 25).

Lastly, an alternative measure of association, based on estimation in the frequency domain, was used instead of the static correlation coefficients. The mean across euro-area countries of these so-called dynamic correlations,[40] computed over rolling windows as before, is depicted in Graph 26. As can be seen, the picture is again unchanged in qualitative terms.

Graph 26: Mean euro-area correlation: static vs. dynamic (GDP, 6-year window)



Source: Commission services

[40] See Croux et al. (2001) for details on the concept of dynamic correlation. The basic idea is to measure the co-movement of two series over a specified frequency band. Since analysis in the frequency domain requires stationarity of the series, the country GDP series were de-trended using a HP filter. The measure is used e.g. in Bulligan (2005) and Camacho et al. (2005) to investigate the issue of convergence in the euro area. We also computed the concordance index proposed by Harding and Pagan (2002), which evaluates the fraction of time that the cycles of two countries spend in the same phase. It gives further support to the robustness of the results.

8. Summary and Conclusions

This paper revisits the issue of euro-area business cycle synchronisation on the basis of a data sample covering more than eight years of EMU experience and using various measures and breakdowns of business cycle synchronisation.

The introductory brief analysis of output gaps across Member States shows that the absolute dispersion of growth in the euro area has narrowed considerably since the early nineties and, with the exception of a transitory pick-up in dispersion mainly between the four large Member States in 2004, has been standing at historically low levels since around 2002.

However, the observed downward trend in the dispersion of output gaps is not necessarily due to the fact that Member States' business cycles are increasingly in phase. It might simply be due to a general decrease in the amplitude of cyclical fluctuations. Therefore, a trend of cyclical de-synchronisation might be masked by the low amplitude of cyclical fluctuations.

The remainder of the analysis uses correlation-based measures of synchronisation, which are unaffected by changes in amplitudes. The level of synchronisation of euro-area business cycles since the introduction of the euro is found to be overall high, though not higher than in the first half of the nineties, i.e. before the worldwide fall in business cycle affiliation in the wake of the 1997 emerging markets crisis.

Around 2003, however, the level of cross-country synchronisation in the euro area experienced a quite abrupt decrease. This picture is shared between several measures of the business cycle (based on IP, GDP and survey data).

Moving correlations computed over windows of four years, though possibly subject to some short-lived changes, indicate a rebound and partial recovery of cross-country association from around 2004 onwards. Again, this picture is shared across several indicators and confirmed for most of them using a smoother six-year correlation window. The observed dip in synchronisation thus appears to be a transitory phenomenon.

Looking at the track history of business cycle synchronisation in the euro area, there is some evidence of a recurrent pattern of falling business cycle synchronisation in the recovery phases of the cycle, which could account for the observed temporary decrease in mean intra-euro-area correlation. The start of the recent decrease in correlation coincides with the latest cyclical trough in mid-2003.

In line mainly with the results based on the shorter correlation window, this pattern would call for a (further) recovery of synchronisation in the further course of the current business cycle.

Looking at GDP expenditure components, synchronisation of private consumption and investment largely reflects aggregate GDP developments, but with a lead, i.e. de-synchronisation set in already somewhat earlier particularly in the case of private consumption. Net exports show an overall low level of cross-country association. From this already low level, cross-country correlations have been falling further already since 2000/01. Public consumption turns out entirely unrelated across countries throughout the sample.

On the country level, the analysis points to a rather widespread de-synchronisation between Member States around 2003, with even core countries showing temporary signs of disassociation. However, this general tendency is aggravated by some particularly poorly synchronised countries like Greece and Finland. The very recent renewed upward trend of business cycle association is confirmed for almost all countries.

The side observation of slightly more severe (temporary) de-synchronisation in survey data might be caused by extremely grim geopolitics and fear of terrorism that weighed on the

current recovery period, possibly impacting on qualitative assessments and expectations more asymmetrically than on hard data.

Cross-checking the results against developments outside the currency union, we find that business cycle synchronisation within the euro area was distinctly higher than world-cycle synchronisation in the ten-year period prior to the introduction of the euro. The finding of a recent (temporary) fall in synchronisation within the euro area is shared by corresponding developments at the level of the world cycle. This observation is, however, mainly due to the contribution of the euro area itself, in that the area's business cycle has become de-linked from that of its trading partners quite abruptly, whereas important outside countries appear to continue to hold together in cyclical terms.

While synchronisation between the euro area and its main economic counterparts was as high as within the area between 1997 and 2002, the recent temporary de-synchronisation is much more pronounced between the area on the one hand and the US, UK and Japan on the other than within the monetary union. This may be interpreted as a relative gain in business cycle affiliation within the currency zone compared to affiliation with outside countries and world-cycle affiliation over the past few years. Together with the finding that the observed dip in euro-area synchronisation is partly attributable to a recurrent pattern of transitory de-linking in early recovery phases, the results are evidence of the continuous existence of a distinct euro-area business cycle. At the same time, evidence for a further increase in synchronisation since the introduction of the euro is sparse.

The presented results are robust to a number of methodological variations in measuring business cycle association across countries.

It has to be stressed that the present analysis focuses on the pure synchronisation aspect of convergence, i.e. on the degree that cycles move in phase. This explains why the observed temporary decline in synchronisation around 2003 does not coincide with a significant increase in the dispersion of output gaps across countries.

Remaining differences in cyclical amplitudes, though found to be small in historical terms, might point to the need for further structural reforms in countries with still subdued response to the improved business cycle conditions. This should also help to narrow the distribution of adjustment speed across countries in phases of economic uncertainty in the future.

References

Agresti, A.M. and B. Mojon (2001): Some stylised facts on the Euro area business cycle, ECB Working Paper No. 95, December 2001.

Artis, M. (2003): Is there a European Business Cycle?, CESifo Working Paper No. 1053, July.

Artis, M. (2005): Business Cycle Affiliations and Their Determinants: Where do We Stand?, Proceedings of the 2004 First Annual DG ECFIN Research Conference on "Business cycles and Growth in Europe", European Economy - Economic Papers, No. 227, June.

Artis, M. J., M. Marcellino and T. Proietti (2003): Dating the Euro Area Business Cycle, CEPR Working Paper No. 3696, January 2003.

Baxter, M. and M.A. Kouparitsas (2005): Determinants of Business Cycle Comovement: a Robustness Analysis, Proceedings of the 2004 First Annual DG ECFIN Research Conference on "Business cycles and Growth in Europe", European Economy - Economic Papers, No. 227, June.

BNP Paribas (2005): Euro Zone: Uncompleted Convergence, Conjoncture No. 7, September 2005.

Bulligan, G. (2005): Synchronisation of Cycles: A Demand Side Perspective, Paper presented at the Research Conference "Growth and cyclical Asymmetries between Germany, France and Italy", organised by the Banque de France, June 2005.

Camacho, M., Pérez-Quirós, G. and Sainz, L. (2005): Are European Business Cycles Close Enough to be just One?, Proceedings of the 2004 First Annual DG ECFIN Research Conference on "Business cycles and Growth in Europe", European Economy - Economic Papers, No. 227, June.

Canova, F. (1998): Detrending and Business Cycle Facts, Journal of Monetary Economics 41:3, 475-512.

Christiano, L.J. and Fitzgerald, T.J. (1999): The Band Pass Filter, NBER Working Paper 7257 (July).

Croux, C., Forni, M. and Reichlin, L. (2001): A Measure of Comovement for Economic Variables: Theory and Empirics, The Review of Economics and Statistics, 83, 232-241.

Darvas, Z., A.K. Rose and G. Szapary (2005): Fiscal Divergence and Business Cycle Synchronization: Irresponsibility is Idiosyncratic (August 2005), CEPR Discussion Paper No. 5188.

Döpke, J. (1999): Stylised Facts of Euroland's Business Cycle, Jahrbücher für Nationalökonomie und Statistik 219, 591-610.

European Commission (2004): Cyclical Convergence in the Euro Area: Recent Developments and Policy Implications, Quarterly Report on the Euro Area, 3 (2), 27-38.

European Commission (2006a): Cyclical Synchronisation within the Euro Area: What Do Recent Data Tell Us?, Quarterly Report on the Euro Area, 5 (2), 19-24.

European Commission (2006b): The Joint Harmonised EU Programme of Business and Consumer Surveys, European Economy, Special Report No 5.

European Commission (2007): The reduced volatility of output growth in the euro area, Quarterly Report on the Euro Area, 6 (1), 37-46.

Frankel, J. and A. Rose (1997): Is EMU more justifiable ex post than ex ante, European Economic Review, 41, 753-760.

Gayer, C. and P. Weiss (2006): Convergence of Business Cycles in the Euro Area: Evidence from Survey Data, Applied Economics Quarterly 52 (3), 193-219.

Giannone, D. and L. Reichlin (2006): Trends and Cycles in the Euro Area: How Much Heterogeneity and Should We Worry About It?, ECB Working Paper Series, No. 595, March.

Harding, D. and A. Pagan (2002), "Synchronization of Cycles", Melbourne Institute of Applied Economic and Social Research, mimeo.

Kalemli-Ozcan, S., Sorensen, B.E. and Yosha, O. (2004): Asymmetric Shocks and Risk Sharing in a Monetary Union: Updated Evidence and Policy Implications for Europe, CEPR Discussion Paper No. 4463.

Massmann, M. and Mitchell, J. (2002): Have UK and Eurozone Business Cycles Become More Correlated?, National Institute Economic Review, No. 182, 58-71.

Massmann, M. and Mitchell, J. (2004): Reconsidering the Evidence: Are Euro Area Business Cycles Converging?, Journal of Business Cycle Measurement and Analysis 1:3, 275-306.

McCarthy, M. (2006): Comments on the paper: Trends and Cycles in the Euro Area: How Much Heterogeneity and Should We Worry About It?, ECB Working Paper Series, No. 595, March.

Mélitz, J. (2004): Risk Sharing and EMU, CEPR Discussion Paper No. 4460.

Mitchell, J. and Mouratidis, K. (2004): Is there a Common Euro-zone Business Cycle?, in: Mazzi, G.L. and Savio, G. (Eds.): Monographs of Official Statistics, Papers and Proceedings of the Third Eurostat Coloquium on Modern Tools for Business Cycle Analysis, Luxembourg, 227-263.

Mongelli, F.P. and J.L. Vega (2006): What Effects is EMU having on the Euro Area and its Member Countries? An Overview, ECB Working Paper Series, No. 599, March.

Rose, A. (2000): One Money, One Market: the Effect of Common Currencies on Trade, Economic Policy, April (2).

Rose, A. (2004): A Meta-Analysis of the Effects of Common Currencies on International Trade, NBER Working Paper No. 10373.

Stock, J. H. and M.W. Watson (2005): Understanding Changes in International Business Cycle Dynamics, Journal of the European Economic Association, 3 (5), 969-1006.