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Cyclical Convergence in Europe

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I. Introduction

As of 1999, the newly founded European Central Bank (ECB) conducts a single monetary policy for the eleven EU member states which participate in the European Economic and Monetary Union (EMU).[1] The common monetary policy of the ECB is aimed at achieving price stability in the euro area. In order to ensure a smooth functioning of EMU it is important that the business cycles of individual participating states do not diverge too much. If this condition is not met, it will be hard to adopt a monetary policy stance that suits both the euro area as a whole and individual participating countries. This could lead to a sub-optimal outcome for the common monetary policy through political tensions within EMU and even within the ECB governing council (Von Hagen (1997)). If, however, cyclical divergences are relatively limited, then the loss of independence in monetary policy matters may not constitute a great cost to the participating countries, and tensions will probably remain limited.

The degree of cyclical conformity within EMU is to a large extent an empirical matter. It is the aim of this paper to investigate cyclical convergence in Europe empirically. By doing so, we attempt to shed more light on the question to what extent EMU constitutes an optimum currency area from this perspective. Much of the heated debate on the subject has skipped this prior question of factual cyclical convergence and jumped onto the identification of asymmetric shocks in Europe and the perceived optimal policy responses. For this reason, this contribution attempts to investigate cyclical convergence in the EU not so much among individual countries but with the euro area as a whole as a benchmark[2].

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[1] At the time of writing the entry of Greece in the euro area as of 1 January 2001 was not yet known. Therefore reference is to EMU 11 rather than EMU 12.

The remainder of the paper is organised as follows. The next section briefly reviews the literature on the subject of cyclical convergence in the European Union (EU) and introduces our area-wide approach. Section III. discusses the methods used to identify business cycles. We gauge cyclical movements in GDP and manufacturing production for the 15 EU member states and the euro area aggregate. Section IV. discusses the empirical findings with reference to three core issues: the synchronicity of business cycles, their relative phasing, and the relative amplitude of cyclical fluctuations. In this section we also consider the robustness of our results to the filtering method used. Section V. concludes, and reviews some policy recommendations.

II. Background and Related Literature

A number of recent studies have examined cyclical convergence within the European Union (EU) (Christodoulakis, Dimelis and Kollintzas (CDK) (1995), Artis and Zhang (AZ) (1997 and 1999), Dickerson, Gibson and Tsakalotos (DGT) (1998)). However, the conclusions emerging from these studies on what are in essence the same basic facts are strikingly different. Obviously, the policy conclusions concerning risks attached to EMU differ profoundly.

DGT observe a clear core-periphery distinction in both the timing and magnitude of business cycles over the period 1960–1993 (the a priori defined core countries are Germany, France, the Netherlands, Belgium and Luxembourg, while the periphery consists of the United Kingdom, Italy, Spain, Ireland, Portugal and Greece). Moreover DGT find no evidence that business cycles in the EU have become more synchronised after the formation of the European Exchange Rate Mechanism (ERM) in 1979. Consequently, DGT are sceptical about the prospects for EMU to proceed without internal tensions and stress the need for flexible policy responses to economic shocks. By contrast, both CDK and AZ report a high degree of synchronicity in business cycles among the eleven countries now participating in EMU over the period 1960–1990. CDK find that only variables under control of the government (such as government consumption and money) show strong divergences. Hence they are optimistic about the prospects for EMU and conclude that

[2] *Fatás* (1998) and *OECD* (1999) provide some correlation coefficients for GDP figures using respectively the EU15 and the EMU 11 as a benchmark. However, these studies correlate unadjusted real GDP growth rates, i.e. without identifying the business cycle component.

there should be no major problem as far as business cycle synchronicity is concerned. AZ find that before ERM was formed, most countries' business cycles were linked to the US. After the formation of ERM the business cycle of ERM countries became more closely linked to the German cycle. Moreover, the ERM/German relationship appears to be highly synchronous and the strength of the association particularly high in an international context.

The above mentioned studies use different reference groups to benchmark cyclical coherence. DGT use other OECD countries as well as the average of 12 EU countries as a reference. They argue that all EU countries were to become participants in EMU; hence they consider the EU average as relevant. The conclusions of CDK, however, depend to a large extent on comparing the stylised facts of business cycles between individual countries – although they also show cross correlations between individual countries and the EU-aggregate. By contrast, AZ focus entirely on cross correlations between individual countries.

We consider the euro area aggregate the appropriate frame of reference, because the monetary policy of the ECB is directed at developments in the euro area as a whole. Therefore, the present article examines the degree of cyclical convergence between individual countries on the one hand and the EMU-wide aggregate on the other. We study the cyclical behaviour of manufacturing production and GDP. Our main interest is not to identify or explain so-called "stylised facts" within the context of a theoretical model, as is the case in CDK. Rather, our intention is to seek robust empirical results, which may be used as a prior in discussions on asymmetric shocks. We discuss the degree of business cycle synchronisation within the present euro area and also consider the cyclical behaviour of out-countries compared to the euro area aggregate. In order to benchmark the degree of cyclical coherence found for EU-countries, the American cycle is examined as well.

Our analysis covers a period, which is somewhat different from those in the papers mentioned above: 1973–1996.[3] We consider the 1960s to be economically too different from the present to make inclusion meaningful. These differences include the existence of the Bretton Woods (fixed echange rate) regime and the importance of capital controls. Furthermore, a lack of monthly (manufacturing production) and quarterly (GDP) data for many countries would seriously hamper the extension of our

[3] The analysis of GDP data starts in 1979 due to lack of quarterly data in too many countries for earlier years.

analysis back to the 1960s. Due to the filtering method used (see below), the equivalent of 3 years is lost at the end of the sample, implying that our sample ends in 1996.

We focus in particular on two subperiods. The first is the period starting from April 1979 (the beginning of the ERM-period) to January 1987 (the last realignment within the Dmark-zone). The second subperiod distinguished covers the years 1987–1996. As Basu and Taylor (1999) conclude there is strong evidence that money is not neutral and can thus affect the business cycle. They point in particular at the impact that different exchange rate regimes have on the time-series properties of real variables. Of course, we cannot cover a possible structural break due to EMU as we perforce are limited to studying an earlier period. However, by focusing on the ERM period in which monetary policy in Europe became more synchronised we might gain useful insights for the period after the start of Monetary Union.

III. Identifying Business Cycles

Business cycles may be defined as more or less regular patterns in fluctuations in economic activity (Jacobs (1997)). "The" business cycle is a theoretical concept, which is hard to determine empirically. Following standard practice, time series of aggregate economic fluctuations may be decomposed into four components: a trend, a cycle, seasonal fluctuations, and an irregular error term (Zarnowitz (1992)). The trend and cycle components have to be determined in one common procedure, whereas for seasonal fluctuations separate filters are available and irregular errors can be smoothed out. The method of trend determination is a critical factor in the eventual estimate of the residual "cyclical" component, which remains after filtering the trend out of a de-seasonalised series. Several methods of trend determination may be used to extract this cyclical component.[4]

Here, we define business cycles in terms of production at constant prices in manufacturing industry (called manufacturing production henceforth) and in terms of real GDP. Focusing on manufacturing production has the advantage that in general cycles can be more clearly observed than in GDP data. Furthermore, data on manufacturing production are available on a monthly rather than a quarterly basis. On the other hand, manufacturing accounts for only about a fifth of the econ-

[4] The emphasis is thus on "growth" cycles, i.e. accelerations and retardations relative to an underlying trend, rather than classical business cycles, which are defined in terms of absolute expansions and contractions.

omy in most advanced economies – although it accounts for a larger part of the cyclical fluctuations in economic activity. GDP is the more comprehensive variable and therefore ultimately the more relevant one for analysing economic fluctuations. In practice, however, the contemporaneous correlation coefficients between the cyclical components of manufacturing production and GDP are quite high: 0.94 in the present euro area and 0.92 in the United States over the period 1979–1996.[5] Manufacturing production thus appears to be a good indicator of economy-wide economic fluctuations.[6]

Time series on the volume changes in GDP and manufacturing production were taken from official national accounts publications (published by Eurostat and national statistical agencies). We used 1994 purchasing power parity weights to compute area-wide aggregates for GDP and manufacturing production. Annex 1 discusses the data series and the aggregation method used in more detail.

We used the method proposed by Baxter and King (1995), i.e. a band-pass filter which eliminates very slow moving trend components and very high frequency (irregular and seasonal) components while retaining intermediate (business cycle) components, as our preferred method of trend determination. An ideal band-pass filter passes through only those frequencies which the researcher has defined as belonging to the business cycle domain. This also implies that there is no need to filter out seasonal fluctuations and to smooth the series in separate procedures. The ideal filter requires an infinite time series. Hence, the filter method proposed by Baxter and King is an approximation to an optimal filter. Following Burns and Mitchell (1946), we define business cycles to have a periodicity of at least 6 quarters (18 months) and at most 32 quarters (96 months).

Analyses with a segmented linear trend as used for the Nederlandsche Bank leading indicators for various countries (Berk and Bikker (1995)) and the Hodrick-Prescott (HP) filter (Hodrick and Prescott (1997)) yield results very similar to those presented below.[7] Thus the results prove to be robust to the method of trend determination. Artis and Zhang (1997, 1999) – using a phase-average-trend method, the HP-filter and linear detrending – also concluded that the results are robust with respect to the

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5 Results for the Baxter-King band-pass filter considered below.

6 Of course, cyclical patterns can be observed in many macro-economic variables, e.g. investment, prices, employment and productivity. These would merit closer consideration in future research.

7 The phase average trend method (Boschan and Ebanks (1978)) and the fitting of quadratic trends are alternatives not considered here.

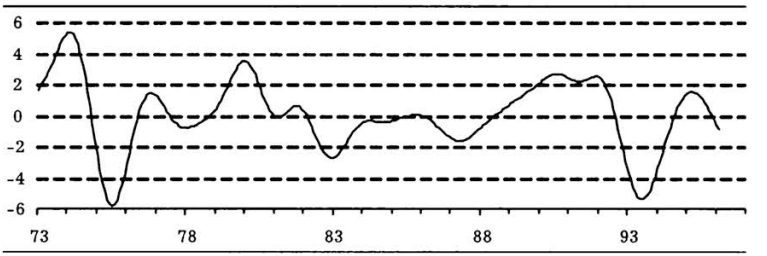
de-trending method chosen. This robustness to the exact choice of filter strengthens our confidence in the reliability of the results obtained. In the present paper, we focus on the results for de-trending with the band-pass filter as this filter is considered to be superior from a theoretical point of view (Stock and Watson (1998)).

A final point to note is that one should endeavour to distinguish differences in absolute growth trends among countries from the degree to which business cycle chronologies coincide. Absolute growth figures can differ among countries due to differences in the rate of trend growth, while there is considerable correspondence of international cyclical movements at the same time. Thus, divergences in absolute growth rates need not imply major differences in growth cycles. In other words, one may find both high conformity of business cycles (as identified by filtering methods) and little vulnerability to asymmetric shocks, while at the same time substantial and persistent differences in growth rates may occur. Recent developments in Germany and the Netherlands may be a case in point. From the middle of the 1990s onwards Germany has had a lower rate of GDP growth than the Netherlands, whereas the degree of cyclical co-movement has remained high. This may have policy implications since international differences in longer term growth rates should be the concern of structural policies.

IV. Results

We follow Artis and Zhang (1997) in examining correlations of business cycles to assess the degree of cyclical convergence in Europe. This may shed some light on the importance of asymmetric shocks. Only in the absence of significant asymmetric shocks would we expect to find a high degree of synchronicity. First, we define contemporaneous synchronicity in terms of the cross correlations of the "reference" cycles of individual countries with the "reference" cycle of the aggregate. Second, we consider the relative phase of the cycles, which obviously is important from a (monetary) policy point of view. The relative phase may be found by leading and lagging the reference cycles. The lead/lag relationship found at the maximum correlation coefficients indicates the relative phase. Third, not only cyclical synchronicity but also the relative magnitude of business cycle fluctuations is of interest. To this end we compare the standard deviation of the reference cycles of the individual countries to that of the euro area.

There exists as yet no accepted chronology of business cycle turning points in the NBER tradition covering a large number of European coun-



Variable: Manufacturing production; Method: Band-pass filter

Figure 1: Business cycle of the euro area

tries. Figure 1 shows the reference cycle we obtained for industrial production in the euro area in the period 1973–1996, using the band-pass filter as our preferred method to identify cyclical fluctuations

Table 1 shows the contemporaneous correlations of the business cycles of individual countries with the reference cycle for the euro area.[8] In the table, the euro area cycle is defined in terms of aggregate manufacturing production of the countries in the euro area, with the individual country examined excluded from the aggregate if it is an EMU-participant. This is done to avoid upward bias in the correlations, which may be important in particular if a country has a large weight in the euro area aggregate. Hence, for EMU-countries the correlation coefficients reported in the table are lower bound estimates. What should be an appropriate benchmark to interpret the figures in table 2 is open to debate. The US is often considered the archetypal case of a well-functioning monetary union and is therefore sometimes used as a benchmark for EMU (Bayoumi and Eichengreen (1993), Bayoumi and Prasad (1997), Chamie, Deserres and Lalonde (1994)). The mean cross correlation of output of 19 individual states in the US amounted to 0.75 over the period 1978–1992 (Hess and Shin (1998)). The mean correlation for income growth rates of individual US states with the aggregate over the period 1969–1990 is of similar magnitude: 0.72 (Fatás (1998)). A second benchmark could be the bilateral correlation between the Netherlands and Germany, who formed a de facto monetary union since 1983. We found the correlation coefficient to be 0.84 for manufacturing production using the band-pass filter over the period 1983–1997.

[8] Denmark and Finland are not included due to lack of data for the 1970s. Data for Belgium start in 1976, for Austria and Ireland in 1978.

Table 1

Contemporaneous correlation coefficients (x 100)
Variable: Manufacturing production, Aggregate: Euro area*

	73.01–96.02	79.04–86.12	87.01–96.02
	Band-pass filter		
Austria	88	90	89
Belgium	75	68	80
France	94	92	93
Germany	74	82	64
Ireland	56	57	59
Italy	78	76	69
Luxemburg	78	64	80
Netherlands	94	89	96
Portugal	58	–14	69
Spain	75	69	85
Greece	66	83	63
Sweden	43	77	48
United Kingdom	60	60	39
United States	57	67	13

* Where appropriate, the individual country examined is excluded from the aggregate.

Set against these benchmarks it can be concluded from table 1 that most participants in EMU had a business cycle, which moved highly synchronous with that of the euro area. It can be observed that Germany shows a lower correlation coefficient over the last subperiod distinguished (1987–1996). The cyclical downturn in the beginning of the 1990s came somewhat later in Germany than in the other countries of the euro area. This might have been a consequence of German re-unification, which induced a demand-led boost to the German economy. The correlation coefficients of Spain and Portugal with the euro area aggregate have increased over time, whereas Italy shows an inverse development. We have no clear-cut answer as to why this is the case. Spain and Portugal may have gained from their accession to the EU in 1986 and ERM in 1989 and 1992 respectively which intensified trade and financial links with the rest of the euro area and geared monetary policy in the direction of the German policy. Moreover, though all three countries frequently devalued against the Deutschmark, only the Italian lira was sus-

pended from ERM following the currency crises of 1992–1993. Ireland shows a somewhat lower synchronicity with the euro-aggregate despite membership of ERM since 1979 – a pattern which is consistent over time. A possible explanation would be the relatively close trade links of Ireland with the UK and the US. Moreover, despite membership of ERM the Irish monetary policy was until fairly recently closely linked to the UK. Finally, the catch-up effect in Irish economic growth in the 1990s may cloud the picture as well. As to the out-countries, only Greece shows a fair degree of synchronicity with the euro area cycle. The correlation coefficients for Sweden and the UK are relatively low. The US and euro area cycles showed a low correlation too during the last subperiod distinguished. This low degree of synchronicity with the US suggests that the consistently close coherence between cycles is a European phenomenon rather than a general characteristic of the business cycle of advanced economies.

Figure 2 shows the average correlation coefficient for the euro area using 9-year rolling correlations.[9] The high degree of correlation during the 1970s can be attributed to the common effect of the oil price shocks, which dominates divergences due to other causes. The growing divergences during the 1980s in the aftermath of the oil shocks is apparent. Between the late 1980s and 1996 cyclical convergence among the countries at present forming the euro area increased again, although German reunification caused a temporary reversal in the early 1990s. It appears from figure 2 that the conclusions drawn from the correlations in table 1 are robust to the precise choice of subperiods.[10]

Table 2 shows the maximum correlation and lead/lag structure of the EU member country and US cycles relative to the euro area reference cycle. The cycles of almost all EU countries are more or less in phase with the euro area when the whole period is taken into account, due to the effects of the oil price shocks which dominate other factors. In the most recent subperiod the lead/lag relationship of the Dmark-block (including Spain and Portugal) underwent a phase shift relative to the US/UK, while maximum correlation coefficients within this zone roughly remained the same. The US cycle clearly leads the European cycle by roughly two years in this period.

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9 The 9-year window is chosen so as to be long enough to cover the maximum duration of cyclical fluctuations identified.

10 Altering the reference cycle by including the UK or excluding the so-called "periphery" countries does – perhaps surprisingly – not alter the results significantly.

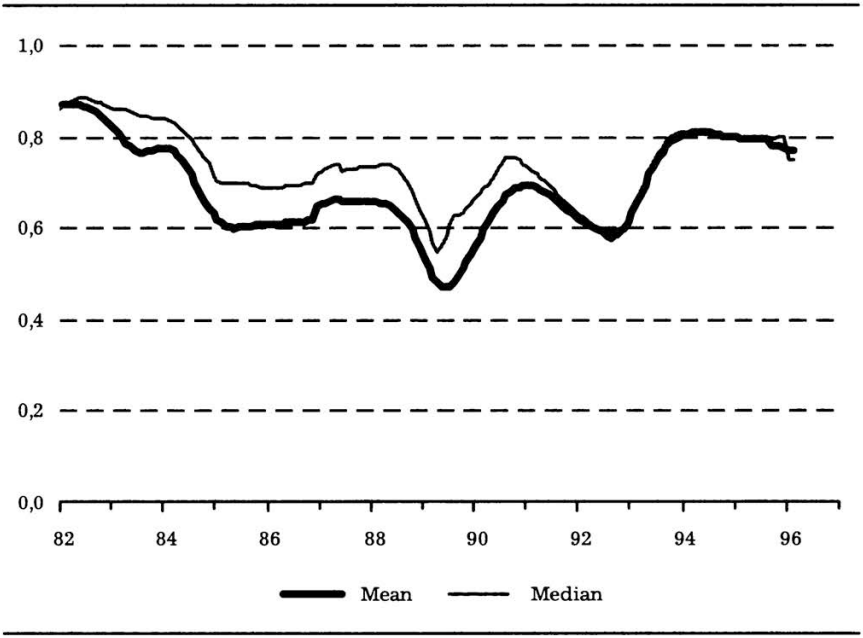

Figure 2: Rolling correlations between the business cycles of individual countries and the euro area

As table 3 shows, the stylised facts of the analyses with cycles defined in terms of manufacturing production and GDP show close resemblance.[11] The analysis of GDP data therefore broadly confirms the conclusions reached on the basis of the manufacturing production series. With respect to Finland and Denmark, which were not included in the analysis of manufacturing production, we find a low degree of business cycle synchronicity. However, Finland is a special case as a consequence of the breakdown of the Soviet-Union. Over the last few years, the Finnish cycle appears to have moved more in line with that of the euro area as a whole, but this period is too short to allow firm conclusions on the basis of the statistical material available.

Not only synchronicity, but also the relative size of economic fluctuations matters. Even in the presence of strong coherence of underlying cyclical movements, substantial differences in the variability of output

[11] Belgium, Luxembourg, Portugal and Sweden are not included due to lack of quarterly GDP data for the 1970s. Data for the Netherlands start in 1977.

Table 2

Maximum correlation coefficients[1] (x 100)
Variable: Manufacturing production, Aggregate: Euro area[2]

	73.01–96.02	79.04–86.12	87.01–96.02
	Band-pass filter		
Austria	89 (–1)	90 (–1)	90 (–1)
Belgium	79 (2)	75 (3)	81 (2)
France	94 (0)	94 (2)	93 (0)
Germany	74 (1)	83 (1)	67 (–3)
Ireland	57 (–2)	75 (6)	67 (–4)
Italy	78 (–1)	90 (–4)	70 (1)
Luxemburg	78 (–1)	64 (1)	81 (1)
Netherlands	94 (0)	90 (1)	96 (0)
Portugal	62 (–4)	55 (22)	79 (–6)
Spain	76 (1)	83 (5)	90 (3)
Greece	76 (4)	83 (0)	64 (1)
Sweden	43 (1)	82 (3)	59 (9)
United Kingdom	61 (2)	74 (5)	77 (17)
United States	62 (3)	81 (5)	84 (23)

[1] Lead (+) or lag (–) in months at which the maximum with respect to the aggregate is attained, is given in parentheses.
[2] Where appropriate, the individual country examined is excluded from the aggregate.

among countries may aggravate imbalances in the short run. Table 4 shows the standardised deviations from trend for GDP and manufacturing production for the euro area aggregate and individual countries relative to the aggregate. The analysis by Fatás (1998) provides a benchmark. He found the standard deviation of state income in 48 US states relative to the aggregate to be on average 1.36 over the period 1969–1990. This is of roughly the same magnitude as the relative standard deviation for GDP in Europe. As expected, the variability of deviations from trend is substantially higher for manufacturing production than for GDP, while it appears that the order of magnitude of cyclical changes in output is roughly comparable for most countries within the euro area.

Table 3

Contemporaneous and maximum correlation coefficients (x 100)
Variable: GDP, aggregate: euro area[1]

	Contemporaneous			Maximum[2]		
	79 II–96 I	79 II–86 IV	87 I–96 I	79 II–96 I	79 II–86 IV	87 I–96 I
	Band-pass filter					
Austria	85	82	89	85 (0)	82 (0)	89 (0)
Belgium	47	20	88	47 (0)	39 (–5)	88 (0)
Finland	28	52	29	72 (5)	71 (–3)	83 (6)
France	72	52	82	72 (0)	78 (–8)	82 (0)
Germany	62	84	52	64 (–1)	84 (1)	59 (–2)
Ireland	56	50	71	56 (0)	70 (–3)	71 (1)
Italy	80	90	75	80 (0)	97 (–1)	75 (1)
Nether-lands	77	77	88	77 (0)	77 (0)	88 (0)
Spain	70	43	86	71 (–1)	56 (7)	87 (1)
Denmark	33	43	27	35 (1)	73 (6)	36 (1)
Greece	67	81	65	68 (–1)	82 (–1)	65 (0)
Sweden	34	6	32	38 (1)	69 (5)	37 (1)
United Kingdom	26	70	2	75 (7)	82 (2)	81 (7)
United States	23	56	–6	52 (8)	63 (2)	95 (8)

[1] Where appropriate, the individual country examined is excluded from the aggregate.
[2] Lead (+) or lag (–) in quarters at which the maximum with respect to the aggregate is attained, is given in parentheses.

V. Conclusions

The likely consequences of EMU have been hotly debated. Much of the discussion on the prospects of EMU has focused on the risks posed to EMU by a possible lack of fiscal discipline, by structural rigidities in European labour and product markets, and by possible asymmetric shocks within a monetary union (e.g. Bayoumi and Eichengreen (1993 and 1996), Feldstein (1997), Kenen (1995), Obstfeld and Peri (1998), Von Hagen and Eichengreen (1996)). Obstfeld (1997) even characterised the EMU-project as "Europe's gamble". With respect to business cycle

Table 4

Standard deviations of business cycle
euro area: absolute figures; others: relative to euro area

	Manufacturing production			GDP		
	79.04–96.02	79.04–86.12	86.12–96.02	79II–96I	79II–86IV	87I–96I
Euro area	*2,25*	*1,52*	*2,25*	*0,79*	*0,70*	*0,86*
Austria	1,03	1,23	1,23	0,94	0,95	0,95
Belgium	0,75	1,10	0,83	–	–	–
Finland	–	–	–	2,77	0,97	3,49
France	0,98	0,85	0,87	0,97	0,88	1,01
Germany	1,14	1,25	1,33	1,35	1,29	1,41
Ireland	1,00	0,98	1,20	1,55	0,79	1,84
Italy	1,30	1,58	1,11	1,20	1,40	1,08
Luxembourg	1,73	2,42	1,26	–	–	–
Netherlands	0,77	0,96	0,75	1,09	1,39	0,89
Portugal	1,38	1,12	1,80	–	–	–
Spain	1,13	0,66	1,45	1,21	0,71	1,32
Mean euro area countries[1]	1,12	1,21	1,18	1,38	1,05	1,50
Denmark	–	–	–	1,46	1,81	1,20
Greece	0,98	1,20	0,81	1,24	1,36	1,18
Sweden	1,49	1,56	1,81	–	–	–
United Kingdom	1,18	1,60	1,04	1,61	1,41	1,69
United States	1,09	1,59	0,76	1,46	1,86	1,17

[1] Unweighted.

behaviour we conclude that the gamble may not be as big as Obstfeld suggests. The degree of cyclical convergence among the 11 participating states appears to be considerable. We find this conclusion to be highly robust to the method of de-trending chosen. For countries of the Dmarkzone this finding is robust to the exact choice of periodisation, though Germany has a lower correlation coefficient in the last subperiod

distinguished. Countries, which became members of EU and ERM later on, show a clear convergence pattern in the run up to EMU, with the exception of Finland. This is not the case for the out-countries.

Some qualifications are in order. As Bayoumi and Eichengreen (1996) point out, with the approach chosen here it cannot be distinguished whether observed output movements reflect disturbances or responses. Attempts to distinguish between demand and supply shocks using VAR-models indicate that there is evidence of a core and periphery distinction within the euro area (e.g. Bayoumi and Eichengreen (1993)). However, studies which specify various types of shocks (such as monetary and non-monetary shocks on the demand side) find a less clear-cut core-periphery distinction, although the symmetry of shocks among EMU countries does not appear to be particularly high (e.g. Bhattacharya and Binner (1998), Chamie et al. (1994)). Given the inherent problems of robustness with VAR models and the different results presented in the studies mentioned above, it remains an open question whether or not differences in the nature of (asymmetric) shocks play an important role in EMU. However, our approach might – a fortiori – provide evidence on the relative importance of asymmetric shocks – as only in the absence of significant asymmetric shocks would we expect to find a high degree of synchronicity. Hence, studying the actual cyclical behaviour of EU economies and the euro area aggregate is a prior to an identification of (a)symmetric supply and demand shocks and the discussion on optimal policy responses.

The most important asymmetric shock of the past decades – German re-unification – certainly had an impact on European economies and it has arguably been a cause for the ERM crises in the early 1990s. However, our analysis shows that it did not have a major impact on the process of cyclical convergence in Europe – the only exception being Germany itself. Thus, even though cyclical divergences among participating states can and no doubt will occur in the foreseeable future, EMU does not appear to be in immediate danger of breaking down due to major divergences in growth path.

The UK has a clearly different cyclical pattern compared to the euro area aggregate. If this would still be the case upon the UK entering EMU, its participation in Monetary Union would complicate the conduct of monetary policy by the ECB. To the extent that monetary policy influences the business cycle, a more synchronous British business cycle could be achieved in case the UK joins ERM-2, reducing the costs for

entering EMU.[12] Moreover as Frankel and Rose (1997) argue, by boosting trade integration, entrance to EMU may lead to increased cyclical synchronisation. Countries, which join EMU, may therefore satisfy optimum currency area criteria ex post better than ex ante.

Annex 1: Data Sources and Aggregation Methods

The time series on GDP and the production volume of manufacturing industry were taken from official sources (national statistical agencies and Eurostat). For most countries in our sample these series cover the whole 1973–1996 period examined, but in some cases we had to omit countries from our calculations, due to a lack of long-running data. We used non-seasonally adjusted data according to ESA79 definitions. At the time of writing national accounts data were being revised in the run-up to the introduction of the new European System of Accounts (ESA95) in all EU Member States as of 1999. However, the ESA95 data currently available tend to have only a short history, which makes them unsuitable for our purposes.

We used purchasing power parity weights to compute aggregates for country groups, in accordance with standard practice for cross-country comparisons of economic growth and fluctuations (Van Ark (1996)). This choice is motivated by the need for a conversion factor, which takes cross-country differences in price levels into account. The alternative approach of conversion at current exchange rates does not allow for differences in price levels among countries. Furthermore, current exchange rates are volatile and affected by a number of factors, such as capital movements, trade flows and the sentiment on financial markets, which makes them unsuitable to compare fluctuations in real economic activity among countries. Finally, conversion at current exchange rates would lead to a conflation of price and volume movements, which should be avoided in international comparisons of business cycle fluctuations, which are defined in real terms. We used fixed 1994 EKS purchasing power parity weights as calculated by Eurostat. The use of yearly shifting weights, which is preferable in theory, is likely to lead to distortions due to the statistical inconstistencies among the succesive rounds of purchasing power parity calculations (Van Ark (1996)). Because of the slow

12 The analysis of Holland and Scott (1998) suggests that monetary policy has influenced the business cycle pattern in the UK by inducing preference shocks on the economy.

changes in country weights over time, the bias which stems from the use of fixed weights likely is quite modest.

To allow for sectoral differences in the production structure among countries, we calculated different weights for GDP and manufacturing production to compute euro area aggregates. Annex table A1 presents the weights used. Historical "euro area aggregates" were computed using the weights for the eleven countries which entered the third phase of EMU as of the beginning of 1999.

Table A1

Country weights

	GDP	Manufacturing production
Austria	3,1	3,0
Belgium	3,9	3,4
Finland	1,6	1,6
France	21,2	19,2
Germany	30,6	34,9
Ireland	1,1	1,5
Italy	20,3	19,3
Luxemburg	0,2	0,2
Netherlands	5,5	4,6
Portugal	2,3	2,6
Spain	10,2	9,7
Euro area	100,0	100,0
Euro area	78,8	81,7
Denmark	1,6	1,3
Greece	1,8	1,1
Sweden	2,3	2,2
United Kingdom	15,5	13,7
EU	100,0	100,0

Note: Based on Eurostat purchasing-power-parity calculations (1994).

Source: Eurostat.

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Summary

Cyclical Convergence in Europe

In order to ensure a smooth functioning of EMU it is important that business cycles of individual participating states do not diverge too much. The present study compares the business cycles of individual EU member states to the cycle of the euro area aggregate – which is considered the relevant reference cycle – over the period 1973–1996. The degree of cyclical convergence among the 11 states participating in EMU is found to be high. This result proves to be robust to the particular de-trending method used. In addition, we find that the impact of German re-unification on cyclical convergence is relatively limited. The UK, however, shows a clearly different cyclical pattern compared to the present euro area. This may complicate the conduct of the single monetary policy if the UK were to enter EMU. (JEL E30, E50)

Zusammenfassung

Zyklische Konvergenz in Europa

Um ein reibungsloses Funktionieren der EWU zu garantieren, kommt es darauf an, daß die Konjunkturzyklen der einzelnen Teilnehmerländer nicht zu stark voneinander abweichen. Diese Studie vergleicht die Konjunkturzyklen der einzelnen EU-Mitgliedstaaten mit dem als einschlägiger Bezugszyklus geltenden Konjunkturzyklus für das aggregierte Eurogebiet im Zeitraum 1973 bis 1996. Der für die elf EWU-Teilnehmerländer ermittelte zyklische Konvergenzgrad gilt als hoch. Dieses Resultat erweist sich gegenüber der angewendeten Detrending-Methode als robust. Darüber hinaus kommen wir zu der Erkenntnis, daß die Auswirkung der deutschen Wiedervereinigung auf die zyklische Konvergenz relativ begrenzt ist. Das Vereinigte Königreich weist jedoch im Vergleich zu dem derzeitigen Eurogebiet ein klar abweichendes Konjunkturmuster auf. Sollte das Vereinigte Königreich der EWU beitreten, könnte dies die Gestaltung einer einheitlichen Währungspolitik verkomplizieren.

Résumé

Convergence cyclique en Europe

Pour assurer le bon fonctionnement de l'UEM, il est important que les cycles économiques des chaque Etat-membre ne divergent pas trop. Cette analyse compare les cycles économiques des Etat-membres individuels de l'UE au cycle de la zone euro – considéré comme le cycle de référence – pour la période s'étendant de 1973 à 1996. Le degré de convergence cyclique entre les 11 Etats participant à l'UEM est considéré comme élevé. Ce résultat se montre résistant à la méthode particulière utilisée d'élimination de la tendance. De plus, l'impact de la réunification allemande sur la convergence cyclique s'est révélé assez limité. Le Royaume Uni, par contre, indique un modèle cyclique clairement différent en comparaison à la zone euro considérée. Ceci peut compliquer la conduite d'une politique monétaire unique si le Royaume Uni entrait dans l'UEM.