Jürgen Kröger, Nikolaos Sdrakas, Cedric Viguie*

CYCLICAL CONVERGENCE IN THE EURO AREA: EVIDENCE FROM THE ECONOMIC SENTIMENT INDICATOR

1. Background and aim

According to conventional economic reasoning, economic integration leads to nominal convergence, i.e. the equalisation of price levels. This follows from the law of one price which in an integrated economic area tends to be imposed by market forces. Economic integration is furthermore supposed to lead to a process of real convergence, whereby income differences between the participating countries diminish, with poorer countries "catching up" to richer countries in terms of per capita income. Under the assumptions..., an integrated economic area will be characterised, over time, by greater homogeneity of incomes and prices than would have been observed without integration.

While this would be observed in the longer term it is not obvious, however, that the same also holds during the period of adjustment towards the new "steady state." Indeed, the adjustment period could be characterised by a temporary increase in economic divergence. For instance, as income levels converge in the catching-up countries, price levels converge as well. This will generate higher inflation rates in the catching-up countries in comparison with the richer countries (Balassa-Samuelson effect), with a protracted dispersion in inflation rates across countries as a result. Liberalised capital markets may accentuate such a process via high capital imports (FDI), threatening an overheating as observed many times when exchange rates are (quasi) fixed.

As long as such a temporary divergence is caused by an adjustment towards a new equilibrium position there is generally no need for policy intervention. However, it is intrinsically difficult to distinguish between these adjustments and other developments, which are not due to "equilibrium" adjustments and which could necessitate a policy response. For instance, the introduction of a single currency implies the equalisation of nominal short-term interest rates. However, in practice a downward convergence of interest rates in previously high-interest countries could lead to a pronounced demand boom in these countries. Obviously, it is essential for economic policy to distinguish between a temporary increase in growth based on an upward adjustment of the productive potential and a purely demand-driven expansion which could push the economy towards an unsustainable disequilibrium position.

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* The authors are employees of Directorate-General Economics and Finance at the European Commission. The findings and conclusions expressed in this paper are those of the authors and do not necessary represent the views of the European Commission. This paper was originally presented at the RWI Seminar in Essen, in June 2003.

In the latter situation, monetary policy, directed as it is towards the needs of the area as a whole, would not be able to address the problem. Therefore, in order to avoid sustained differences in the development of euro area member economies, other policy instruments, in particular fiscal and incomes policy, would need to step in. A re-balancing of the macro-economic policy mix via these instruments could then counteract unwanted divergence in economic developments. Whether this will actually happen depends on political circumstances and opportunities. However, given the customary recognition and implementation lags there is a risk that the policy response comes late, thereby lowering its effectiveness.

In this paper we address the issue of convergence of business cycles by looking at the evidence provided by business and consumer opinions in the euro area member countries. The use of business and consumer survey data for measuring cyclical phenomena offers the advantage that the derived indicators do not, in general, exhibit a trend. Therefore, the analysis is not complicated by the difficult question of how to extract a trend from time series (see Zarnowitz and Ozyildirim, 2002; Canova, 1998).

Moreover, information on cyclical developments from business and consumer surveys is typically available several months ahead of real economic data. If real and nominal convergence/divergence phenomena are reflected in the perceptions of producers and consumers, survey indicators can provide important information about the development of real variables. Clearly, as mentioned before, early recognition of a divergence in economic developments is an essential element in an effective policy co-ordination in a monetary union like EMU.

The aim of this paper is to assess the size, speed and importance of cyclical convergence/divergence in the euro area in the light of the information provided by business and consumer surveys (BCS), and, more particularly, by the main indicator derived from it, the Economic Sentiment Indicator (ESI). To this effect, Section 2 presents a brief survey of the recent literature on cyclical convergence in the euro area. Section 3 explores the properties of the BCS indicators by analysing their correlation with quarterly GDP and by assessing their potential as leading indicators for the determination of turning points of GDP. Section 4 analyses the correlation and compares turning points between the ESIs of the euro area countries over time. A distinction is made between a core group of countries where the correlation is high and other countries, mostly peripheral, for which convergence is less obvious. Clearly, such a lack of convergence has to be assessed in the light of data sources. More specifically, an attempt is made to identify a link between differences in BCS indicators and real economic differences, using the euro area core as a reference. Section 5 summarises and suggests future work.

2. Research on business cycle convergence in the euro area

In the years preceding the introduction of the single currency, research efforts concentrated mainly on the question of whether a common cycle for the whole region exists. This was part of a broader research agenda dominated by the Maastricht process. Thus the issue under study was mainly the existence or not of an optimal

currency area and research efforts focused on the convergence or synchronisation of cyclical fluctuations in the future euro area countries (e.g. Bayoumi and Eichengreen, 1993; Christodoulakis et al., 1995; Artis and Zhang, 1995; Lumsdaine and Prasad, 1997; Forni and Reichlin; 1997)

The introduction of a single currency by eleven (or, since 2001, twelve) EU countries changed the focus of the analysis. The common monetary policy, by definition, refers to the whole euro area and addresses the aggregate business cycle. Research focus, therefore, shifted more on the characteristics of the aggregate of the euro area business cycle itself (e.g., Döpke, 1998; Altissimo et al., 2001; Agresti and Mojon, 2001). Partly encouraged by the results of the previous group of studies most of this research took it for granted that a common cycle exists – or at least that the common monetary policy will automatically facilitate further convergence. The studies following this approach tried to establish a number of stylised facts regarding the relationship between various economic variables and the business cycle.

More recently, the issue of convergence has again come to the fore. This may have been caused by fears that the convergence process has slowed down or even reversed and is related also to the discussion about whether the single monetary policy could have asymmetric real effects on individual euro area countries (e.g., Huchet, 2003). In view of its paramount importance for economic policy, the degree of the business cycle convergence within a monetary union remains, therefore, a key issue.

Studies of cyclical convergence have been carried out basically with "hard" economic data. Most of this research provides evidence to support the view that there has been increased synchronisation in time between the business cycles of the European Union/euro area countries. For instance, Artis and Zhang (1995) studied the cyclical movements in industrial production and focused on the role of the Exchange Rate Mechanism (ERM) in inducing common business cycles among the participating countries. They found that, over time, the business cycle affiliation of most countries had shifted from the United States to Germany.

Angeloni and Dedola (1999) studied a larger set of variables and concluded that the cyclical correlation of output, prices and stock indexes between euro countries has increased. Belo (2001) provided an analysis of the cyclical evolution of the European Union countries between 1960 and 1999. The results obtained are in line with those from previous studies and suggest that Italy, Spain, Austria, the Netherlands, Portugal and Greece have cyclically converged to the euro area business cycle.

More recently, Valle e Azevelo (2002) conducted a frequency domain analysis of annual real GDP to investigate the cyclical co-movements inside (and outside) the European Union during the period 1960-1999. Comparing the business cycles of the various countries with the euro area business cycle, he concluded that most countries exhibit a high degree of correlation with the euro area business cycle.

Luginbuhl and Koopman (2002) used a multivariate unobserved components model to analyse whether quarterly GDP of euro area countries converged. Their approach distinguishes between level convergence and cyclical convergence. Regarding the latter, their results point to an increased synchronisation of national cycles, especially

since the beginning of the 1980s. The authors surmise that this has to do primarily with the introduction of the ERM in 1979.

Convergence of euro area cycles is also the conclusion of a study by Carvalho and Harvey (2002), who used a multivariate unobserved components model to study convergence of income per capita in the euro area. They conclude that cyclical components of the euro area countries have become much more co-ordinated over time and that the cycles of the five core countries – Germany, France, Italy, Belgium and the Netherlands – became almost perfectly correlated by the end of the 1990s.

Mitchell and Mouratidis (2002) used a variety of methods to extract the cyclical component of the industrial production indices for the euro area countries. They show that, in line with previous research, empirical evidence about euro area business cycles is sensitive to the measure of the cyclical component considered. However, regardless of the approach taken, cyclical synchronisation between euro area countries seems to have risen since the mid-1980s.

3. Business and consumer survey data: how well do they reflect developments in the euro area?

Much comfort has been taken from the results of the above mentioned studies regarding the long term convergence of the business cycles of euro area countries. However, it should be kept in mind that the reference period underlying these studies is between three to five decades, depending on the data source. Clearly, with ongoing integration and globalisation, an increase in cyclical synchronisation is to be expected over such a time span. From a policy point of view, the question is rather whether such synchronisation is also typical for the short and medium term, the time horizon over which macro-economic policy aims to act. Here the situation is less clear and looking at the results of some of the studies mentioned before, one can have doubts as to whether the period since the start of the 1990s has been a period of continued cyclical convergence. In addition, the end-point problem,[1] which impacts on the results in a majority of these studies, makes judgements for the very recent past, and hence the future, particularly unreliable.

For this reason, we propose here the use of business consumer survey (BCS) data for the study of cyclical convergence/divergence in the euro area. The BCS data are qualitative economic data, intended for short-term economic analysis. While conventional econometric models of the economy perform reasonably well when the economy is on a stable growth trend, their performance is mixed at best when it comes to signalling changes of direction. There is accordingly an increasing interest in the use

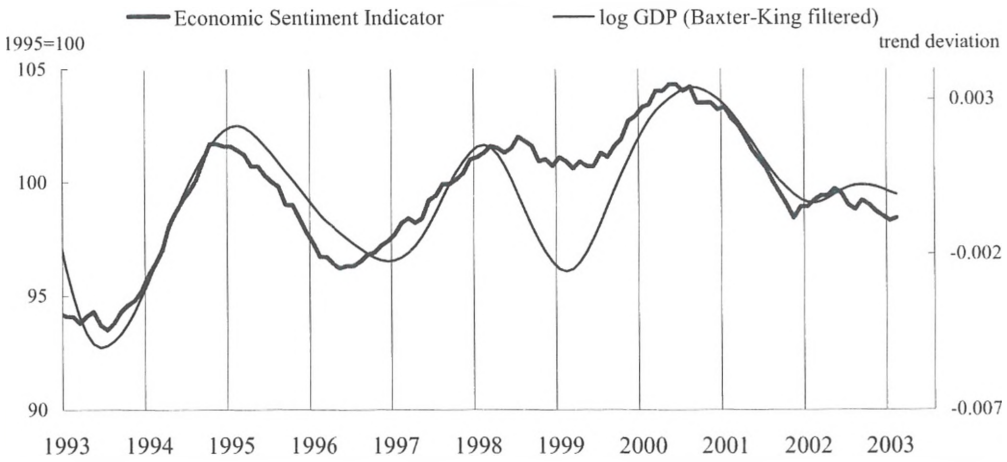
[1] The end-point problem refers to the fact that most business cycle extraction methods are based on symmetric filters and, therefore, need to make forecasts over a period of two or more years beyond the end the sample period. As these forecasts are subject to the usual forecast error, the extracted cyclical component is less reliable at end-points than at centre points of the sample period

of economic surveys for predicting turning points in the economic cycle. In this context, BCSs can provide a useful complement to quantitative statistical surveys.
The BCS series are designed to facilitate the forecasting of the evolution of the main official indicators such as GDP, industrial production, final consumption of private households, etc. The BCS series have two main advantages for forecasting:

1. Early availability: BCS information is available at least 1-2 months before the first estimates of the most common quantitative indicators such as industrial production or GDP.
2. Leading indicator quality: by construction, BCS information should have a certain lead in terms of the cyclical components of quantitative indicators.

In this section we try to ascertain the latter proposition for the ESI with reference to the cyclical evolution of GDP. The ESI is a composite indicator derived from the EU harmonised programme of BCS, which combines judgements and attitudes of producers and consumers. It has a monthly frequency and summarises the information included in the surveys on industry, consumers, construction and retail trade.

Figure 1. ESI and (Baxter-King filtered) GDP for the euro area



For the BCS indicators to provide relevant information on the reference statistics it is necessary that the two series are strongly correlated. This appears to be the case with the euro area ESI, which shows a cyclical pattern very similar to that of the GDP series. This is demonstrated by Figure 1 which shows the level of the ESI and the Baxter-King filtered log of GDP for the euro area.[2] The figure also illustrates that turning points in the GDP series are well captured by the development of the ESI. Except for the period 1998-99 (Asian crisis) the ESI seems to lead the GDP generally by a short time interval of one or two months.

[2] The results are essentially the same when instead of the Baxter-King filter the PAT procedure is used to eliminate the trend component from the GDP series.

More formally, Table 1 shows the contemporaneous correlation between GDP and the ESI for the euro area aggregate and for individual euro area countries (column *r0*).[3] The correlation is highest for the euro area and lies between 0.6 and 0.8 for all countries but Greece. The second column of the table shows the maximum correlation at all leads and lags of the ESI (*rmax*) and the third column the associated lead/lag (*tmax*). For the euro area the maximum correlation is reached at a lead of one month (leads indicated by the '–' sign, lags by a '+'). For the individual countries, leads and lags vary between -4 (Greece) and +1 (Germany). However, in the case of Greece, given the low overall correlation, the lead of four months of the ESI should not be overstated.

Table 1. Correlation and turning point analysis between ESI and GDP

	Cross-Correlation			*Average Lag*			*Median Lag*		
	r0	*rmax*	*tmax*	*Peak*	*Trough*	*All*	*Peak*	*Trough*	*All*
EA	0.8	0.81	-1	-0.25	-1	-0.63	-1	-1	-1
BE	0.75	0.75	0	1.33	1.2	1.27	1.5	1	1
DE	0.67	0.68	1	2.67	0	1.14	1.5	1	1
GR	0.19	0.27	-4	-4.6	-3	-3.73	-8.5	-3.5	-5.5
ES	0.59	0.62	-2	1.2	1.5	1.33	1	1	1
FR	0.74	0.77	-2	-0.5	-1.17	-0.83	-0.5	-0.5	-0.5
IT	0.79	0.8	-1	1.5	1.33	1.42	0.5	1	1
NL	0.67	0.67	0	-0.33	-3.5	-1.92	0	-4.5	-2
FI	0.68	0.74	-2	-1.8	-1.8	-1.8	-2.5	-2.5	-1.5

Note: The (-) or (+) sign refers to a lead (lag) of the ESI with respect to GDP.

The remaining columns of Table 1 show the leading power of the ESI at turning points. Turning points were determined by means of the Bry-Boschan algorithm. It can be seen that, for the euro area, the ESI leads GDP by about half a month at turning points (average lag). The lead is more pronounced in the case of troughs. As for the individual countries, results are quite different across countries. While, on average, turning points of the ESI lead the GDP series for France, the Netherlands, Finland and Greece, a lag at turning points results for Belgium, Germany, Spain and Italy, with the maximum average lag remaining, however, below 1½ months. Overall, therefore, the ESI appears to trace quite closely the cyclical component of GDP for both the euro area countries and the euro area as a whole.

4. Convergence in the EMU: evidence from the early years

The previous section has shown that the ESI appears to be a fairly good indicator for cyclical developments in the euro area. In this section we present a more detailed analysis of the cyclical evolution of the euro area economies in the period between 1988Q1 and 2003Q1 by means of the ESI. We first analyse the development the ESI in the economies of the euro area and identify a group of core countries. On the basis of a

[3] Due to missing data, the table does not include Ireland, Luxembourg, Austria and Portugal.

correlation analysis we examine the issue of whether and to what extent the business cycles of these countries have become more aligned. We furthermore determine the turning points of the country ESIs and compare them with the turning points of the aggregate euro area core. We then look more closely at the developments in the peripheral countries in relation to the euro area core. In the last sub-section, we consider the developments of the components of the ESI in more detail.

The core euro area countries

In this sub-section we examine cyclical developments in the euro area by looking at the development of the ESI for various sub-periods between 1988:1–2003:1. Four periods of roughly equal length are considered. They correspond, broadly speaking, to the pre-Maastricht era, the initial period of EMS turbulence following the entry into force of the Maastricht Treaty; the stabilisation period in the run-up to the introduction of the euro; and the early years of the euro.

Table 2 contains the correlation coefficients between the euro area ESI and the ESI of each country for the four sub-periods[4]. Country-by-country correlation coefficients for the same sub-periods are presented in Appendix 1. As can be seen from the table and the appendix, the business cycles of Germany, France, Italy, the Netherlands and Belgium seem to be highly correlated for most sub-periods.

Table 2. Correlation of national ESIs with the euro area ESI

	88:1 - 91:4	92:1 - 95:2	95:3 - 98:4	99:1 - 03:1
Belgium	0.95	0.94	0.86	0.94
Germany	0.61	0.96	0.97	0.98
Greece	0.63	0.12	0.80	0.81
Spain	0.68	0.96	0.92	0.86
France	0.88	0.99	0.99	0.96
Ireland	0.82	0.87	0.56	0.86
Italy	0.74	0.97	0.74	0.79
Luxembourg	0.73	0.92	0.90	0.90
Netherlands	0.96	0.97	0.90	0.90
Portugal	0.19	0.81	0.80	0.81
Finland	0.74	0.86	0.74	0.83

In line with these results and following the approach by Carvalho and Harvey (2002), we define the euro area "core" as composed of Germany, France, Italy, the Netherlands and Belgium. Our intention is to evaluate the degree of association between the business cycles of these countries against the aggregate. Since we are interested not only in the degree of cyclical association but also in its evolution, the sample was again divided in four (overlapping) sub-periods in accordance with the

[4] Austria and Luxembourg are not included because of missing data.

identified cyclical troughs and peaks of the euro area core as identified by the Bry-Boschan algorithm.

Table 3 presents the results of the correlation analysis. The most interesting feature is the high degree of contemporaneous correlation for almost all sub-periods and for a majority of the countries with respect to the euro area core. The results suggest that, in terms of cyclical convergence, it is possible to distinguish two groups of countries. A first group includes Germany, France and Italy, where a high degree of association with the euro area core cycle exists over the whole period. A second group includes Belgium and the Netherlands, where we observe a decrease in the degree of association with the euro area core during the period 1993-1998/99. In the case of the Netherlands this is particularly evident for the period 1994-98. However, the results point to an increase in cyclical convergence in the latest period of the sample.

Table 3. Correlation in the euro area 'core'

		Business cycles							
Countries	Full sample	* to T	T to T	T to T	T to T	P to P	P to P	P to P	P to *
	1988Q1-2003Q1	88Q1-93Q2	93Q2-96Q2	96Q2-99Q2	99Q2-01Q4	90Q2-94Q4	94Q4-98Q1	98Q1-00Q3	00Q3-03Q1
Belgium	0.86	0.97	0.86	0.88	0.95	0.94	0.71	0.94	0.94
Germany	0.96	0.95	0.98	0.99	0.99	0.98	0.98	0.95	0.99
France	0.96	0.92	0.99	0.98	0.98	0.94	0.99	0.96	0.99
Italy	0.91	0.91	0.92	0.84	0.88	0.92	0.88	0.9	0.95
Netherlands	0.87	0.96	0.81	0.91	0.89	0.96	0.22	0.92	0.96

* No Peak or trough

Note: T (P) denotes a trough (peak).

Table 4. Maximum correlation with the euro area 'core'

Countries	Full sample	I
	1988Q1-2003Q1	
Belgium	0.94	-1
Germany	0.96	0
France	0.96	0
Italy	0.91	0
Netherlands	0.87	0

Note: The sign (-) refers to a lead.

In order to determine the existence of cyclical convergence with respect to the euro area core, it is not only necessary to analyse the evolution of the degree of association between each country and the euro area core business cycle but also the degree of synchronisation. The degree of synchronisation will be measured by the number of leads or lags at which the maximum correlation is obtained. According to the results

presented in Tables 4 and 5, we can say that for the whole sample period the euro area core countries are highly synchronised with the euro area core cycle.

Table 5. Turning point analysis

Countries	*toT	TtoT	TtoT	TtoT	PtoP	PtoP	PtoP	Pto*
	88Q1-93Q2	93Q2-96Q2	96Q2-99Q2	99Q2-01Q4	90Q2-94Q4	94Q4-98Q1	98Q1-00Q3	00Q3-03Q1
Belgium	0	0	-1	-1	0	0	-1	-1
Germany	0	0	0	0	1	1	0	0
France	0	0	0	0	-1	0	0	0
Italy	0	1	0	0	0	0	1	0
Netherlands	0	0	0	-1	-1	0	-1	-1

* No Peak or trough

Note: The table indicates the displacement where the correlation coefficient reaches its maximum. A positive (negative) value means that the country has a lag (lead) cycle with respect to the euro area core cycle.

This synchronisation is illustrated in Figures 2a and 2b, where in the last sub-period of the sample no country seems to exhibit a significant lead or lag cycle. Considering the whole sample period, the euro area core countries are in general well synchronised with the euro area core cycle. However, there is some evidence of a small lead by Belgium and the Netherlands, especially during the latter part of the period. By contrast, Germany, France and Italy have become more synchronised with the euro area core cycle.

Figure 2a. Business cycles in the euro area core

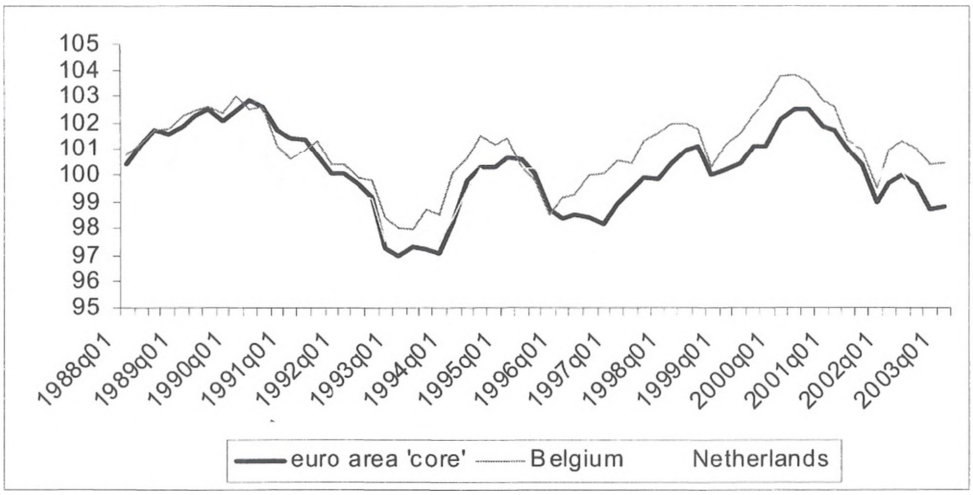
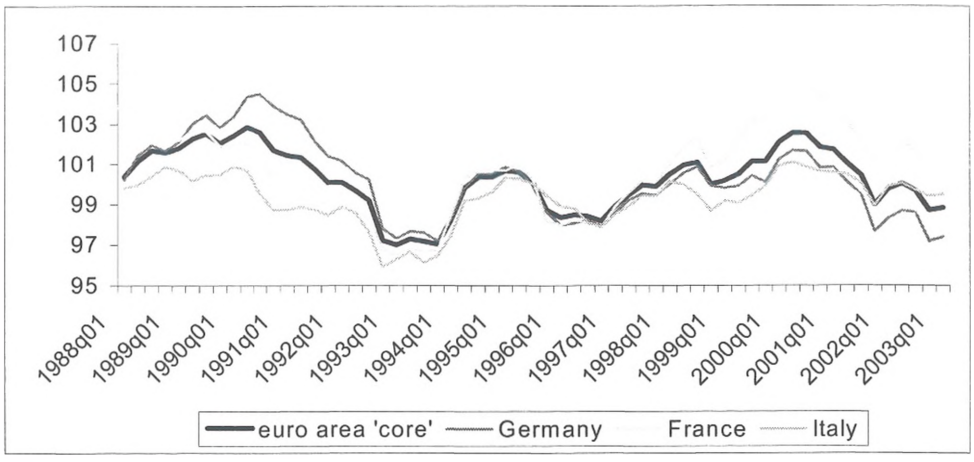


Figure 2b. Business cycles in the euro area core



The peripheral countries

Over the past decades, Europe has seen a considerable increase in economic integration. At the same time, the initially poorer countries (Greece, Spain, Ireland and Portugal) have seen their average living standards rise towards the EU average. (...)

In this sub-section we analyse the degree of convergence of these countries with the euro area core. The issue we are particularly interested in is whether individual country responses to changes in the monetary regime related to the introduction of the euro differed from those of the euro area core countries. In case of the existence of such differences the question is, furthermore, whether they could be used as an early indication to the fact that the economy moves out of line in relation with the euro area core. With this in mind, we examine to what extent differences in the development of BCS data can be taken as a proxy for differences in real economic developments.

The graphs in Appendix 2 show the development of the ESI for the euro area core and the peripheral countries as well as the respective difference in GDP growth. Looking at the results country by country, an interesting picture emerges. In the case of Greece, there was a widening of the gap in the ESI, with economic developments in Greece being assessed clearly more optimistically. At the same time, this is reflected by a positive growth difference. In the case of Spain, the ESI remains relatively stable in comparison with the euro area core. Nevertheless, there is also growing optimism relative to euro area core in the most recent period and this is again reflected by a rising growth gap. In Ireland and Portugal economic sentiment has deteriorated steeply from 2000 onwards. In the case of Portugal, the difference *vis-à-vis* the euro core has even changed from a significant positive gap to a significant negative gap (although the relative levels are difficult to interpret). In both countries, output growth differentials have also diminished, in the case of Portugal even changing its sign.

These results can be interpreted in the following way. The monetary shock induced by the introduction of the euro had quite asymmetric effects in the euro area. While it

tended to increase cyclical convergence in the core countries, in the peripheral countries convergence came to a temporarily halt. These developments are by and large reflected in the (relative) evolution of the ESI. Thus looking at such developments might provide some useful additional information in judging where the economy stands relative to euro area core.

In order to get a clearer picture on the sources of the divergence found in the ESI we assessed growth differences by looking also at differences in the components of the ESI. This could help to distinguish between situations where such differences are desired – e.g. by reflecting a catching up by induced investment – or harmful if they are purely consumption led. (...)

Although the evidence is less clear-cut, the following scenario emerges. In Greece, there seems to be a slight correlation between the narrowing gap of consumer sentiment – Greece's sentiment improved relative to euro area core – and the rising consumption growth. In Spain, the contemporaneous correlation appears less evident. However, some closer correlation can be detected if one assumes that survey evidence leads consumer expenditure by half a year. A much closer correlation is obvious in the case of Ireland and, particularly, Portugal. In these two countries, a more rapid deterioration in consumer confidence relative to the core euro countries is reflected in a more rapid decline in consumer demand.

All in all, it appears that the information provided by different confidence indicators can be usefully included in the assessment of the cyclical juncture of a country relative to the euro area. However, this is but a first attempt to include such analysis for understanding cyclical adjustment in the euro area and further work seems necessary .

Convergence on the basis of ESI components

As mentioned before, the ESI is calculated on the basis of industry, consumer, construction and retail trade confidence indicators. We finally [could] look at these specific components of the ESI for the euro area as a whole and for the individual euro area countries. (...)

With respect to the idea of business cycle synchronisation it appears that the results are more promising in the case of the industrial confidence indicator. In other words, industrialists' confidence in all euro area countries seems to have moved in parallel with that of the euro area as a whole. On the other hand, the results are less encouraging for the other indicators, especially for the peripheral countries. Their pattern deviates markedly from the euro area as a whole. More detailed analysis would be needed to see as to whether the information provided by this data could be usefully employed in business cycle analysis.

5. Summary and conclusions

In this paper we analysed the cyclical convergence in the economies of the euro area in the terms of the BCS data published by the European Commission over the period 1988-2003. As a first step, we examined cyclical convergence in the euro area as a

whole on the basis of a cross-correlation analysis. We concluded that core euro area countries are highly correlated with the euro area as a whole. Secondly, we examined the extent to which the business cycles of the five euro area core countries have been in synchronisation over the 1988-2003 period, and how this has altered over this period. The aim was to identify the degree of cyclical association and synchronisation, with the euro area core as the reference series. The analysis of the correlation and turning points provided evidence for the existence of cyclical convergence over the sample period. However, while in the core countries cyclical convergence tended to increase, this was not the case for the peripheral countries.

Further work on the issue of cyclical convergence on the basis of the BCS data seems worthwhile. In a first step, the four main components of the ESI have to be analysed more extensively in the same framework. Non-euro area countries could also be considered. In particular, due to eventual EMU participation, the usefulness of this exercise for the future member states should be tested. In addition to bilateral correlation coefficient, non-parametric tests could be used to identify the main features of the business cycles, such as their duration, the degree of correlation in the frequency domain and the identification of leading and lagging countries with respect to the cycles of a reference series. Moreover, recent methods used to evaluate business cycle convergence with "hard" data (e.g. the common converging cycle model proposed by Harvey and Koopman) could also be usefully applied with BCS data.

Finally, a caveat seems to be in order. The results from the analysis presented in this paper are not so positive in some countries regarding cyclical convergence. This could be caused by two factors. First, in the light of the harmonised questionnaire of BCS, its structure appears to be different in some specific questions from country to country. Second, survey methodologies differ widely between countries. Therefore, cyclical divergence could be more apparent in those countries that have applied deviating methodologies.

References

Agresti A.M., B. Mojon. 2001. "Some Stylised Facts of the Euro-area Business Cycle." *ECB Working Paper* 95.

Altissimo F., *et. al.* 2001. "The Construction of Coincident and Leading Indicators for the Euro Area Business Cycle." *Termi di discussione* 434. Banca d'Italia.

Artis M.J., W. Zhang. 1997. "International Business Cycles and the ERM: Is There a European Business Cycle?" *International Journal of Finance and Economics* 38, 1471-87.

Bayoumi T., B. Eichengreen. 1993. "Shocking Aspects of European Monetary Unification." In: F. Torres, F. Giavazzi (eds.), *Adjustment and Growth in the European Monetary Union*, Cambridge University Press.

Belo F. 2001. "Some Facts about the Cyclical Convergence in the Euro Zone." *Banco de Portugal Working Paper.*

Bjorksten N. 2000. "Real Convergence in the Enlarged Euro Area: A Coming Challenge for Monetary Policy." *Bank of Finland Working Papers.*

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

Carvalho V.M., A.C. Harvey. 2002. "Convergence and Cycles in the Euro-zone." Paper presented at the Colloquium on Modern Tools for Business Cycle Analysis. Luxembourg: Eurostat.

Christodoulakis N., S.P. Dimelis, T. Kollintzas. 1995. "Comparisons of Business Cycles in the EC: Idiosyncrasies and Regularities." *Economica* 62, 1-27.

Döpke J. 1998. "Stylised Facts of Euroland's Business Cycle." *Kiel Working Paper* 887.

Huchet M. 2003. "Does a Single Monetary Policy Have Asymmetric Real Effects in EMU." *Journal of Policy Modelling* 25, 151-78.

Forni M., L. Reichlin 1997. "National Policies and Local Economies: Europe and the US." *CEPR Working Paper* 1632.

Luginbuhl R., S.J. Koopman 2002. "The Common Converging Trend-cycle Model: Estimation, Modelling and an Application to European Convergence." Paper presented at the Colloquium on Modern Tools for Business Cycle Analysis. Luxembourg: Eurostat.

Lumsdaine R.L., E.S. Prasad 1997. "Identifying the Common Component in International Economic Fluctuations." *NBER Working Paper* 5984.

Mitchel J., K. Mouratidis 2002. "Is There a Common Euro-zone Business Cycle?" Paper presented at the Colloquium on Modern Tools for Business Cycle Analysis. Luxembourg: Eurostat.

Ormerod P., C. Mounfield. 2001. *The Convergence of European Business Cycles 1978-2000.* Voltera Consulting Ltd.

Plerou V., *et. al.* 1999. "Universal and Non-universal Properties of Cross-correlations in Financial Time Series." *Physical Review Letter* 83, 1471.

Valle e Azevedo J. 2002. "Business Cycles: Cyclical Comovement within the European Union in the Period 1960-1999 – A Frequency Domain Approach." *Banco de Portugal Working Paper.*

Zarnowitz V., A. Ozyildirim 2002. "Time Series Decomposition and Measurement of Business Cycles, Trends and Growth Cycles." *NBER Working Paper* 8736.

Appendix 1: Cross-country correlation

Period 88:1 - 91:4

	EA	BE	DE	GR	ES	FR	IE	IT	LU	NL	PT	FI
EA	1											
BE	0.952	1										
DE	0.611	0.481	1									
GR	0.632	0.558	0.217	1								
ES	0.678	0.709	-0.11	0.516	1							
FR	0.877	0.876	0.196	0.666	0.896	1						
IE	0.825	0.835	0.307	0.824	0.626	0.816	1					
IT	0.744	0.793	-0.03	0.569	0.853	0.886	0.7542	1				
LU	0.735	0.68	0.235	0.428	0.752	0.777	0.5211	0.665	1			
NL	0.963	0.935	0.501	0.587	0.78	0.891	0.7763	0.765	0.755	1		
PT	0.186	0.221	-0.48	0.079	0.732	0.527	0.1635	0.549	0.588	0.275	1	
FI	0.744	0.758	-0.02	0.671	0.928	0.945	0.7751	0.866	0.797	0.789	0.644	1

Period 92:1 - 95:2

	EA	BE	DE	GR	ES	FR	IE	IT	LU	NL	PT	FI
EA	1											
BE	0.939	1										
DE	0.959	0.863	1									
GR	0.118	0.14	0.194	1								
ES	0.958	0.931	0.853	0.101	1							
FR	0.987	0.955	0.911	0.083	0.966	1						
IE	0.867	0.84	0.778	-0.05	0.869	0.88	1					
IT	0.973	0.904	0.898	-0	0.964	0.962	0.85	1				
LU	0.921	0.852	0.842	-0.11	0.898	0.921	0.8327	0.937	1			
NL	0.969	0.897	0.925	0.219	0.925	0.973	0.8382	0.918	0.878	1		
PT	0.813	0.826	0.834	0.033	0.687	0.801	0.676	0.759	0.683	0.747	1	
FI	0.859	0.882	0.693	-0.01	0.951	0.903	0.8123	0.893	0.845	0.822	0.591	1

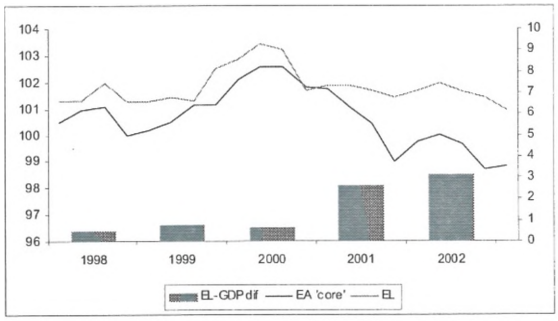
Period 95:3 - 98:4

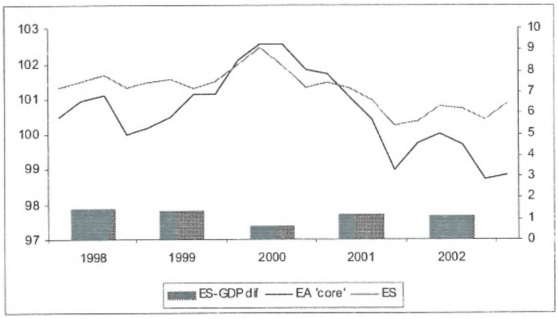
	EA	BE	DE	GR	ES	FR	IE	IT	LU	NL	PT	FI
EA	1											
BE	0.86	1										
DE	0.969	0.74	1									
GR	0.796	0.782	0.754	1								
ES	0.92	0.896	0.831	0.834	1							
FR	0.99	0.834	0.958	0.79	0.917	1						
IE	0.557	0.679	0.414	0.769	0.674	0.55	1					
IT	0.735	0.544	0.739	0.377	0.499	0.682	0.2669	1				
LU	0.901	0.909	0.809	0.724	0.848	0.871	0.6421	0.76	1			
NL	0.897	0.956	0.797	0.776	0.92	0.862	0.7063	0.586	0.903	1		
PT	0.795	0.866	0.661	0.747	0.874	0.759	0.7499	0.516	0.865	0.89	1	
FI	0.739	0.903	0.615	0.656	0.79	0.688	0.6173	0.467	0.878	0.886	0.881	1

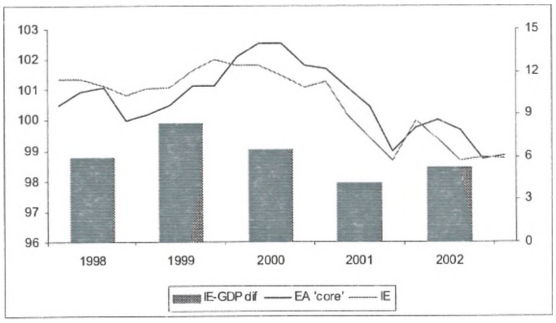
Period 99:1 - 03:1

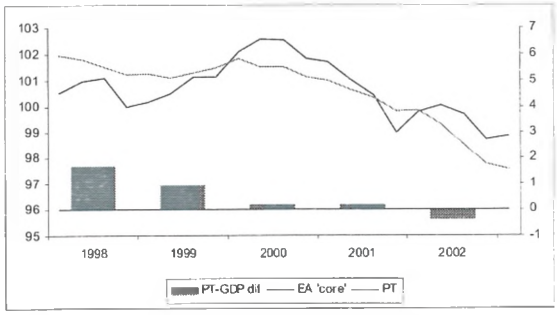
	EA	BE	DE	GR	ES	FR	IE	IT	LU	NL	PT	FI
EA	1											
BE	0.94	1										
DE	0.98	0.899	1									
GR	0.81	0.806	0.729	1								
ES	0.864	0.72	0.862	0.671	1							
FR	0.96	0.946	0.914	0.848	0.751	1						
IE	0.863	0.878	0.876	0.571	0.703	0.794	1					
IT	0.79	0.734	0.71	0.803	0.626	0.81	0.4782	1				
LU	0.899	0.928	0.884	0.757	0.821	0.858	0.9119	0.599	1			
NL	0.901	0.869	0.912	0.682	0.732	0.855	0.9346	0.529	0.925	1		
PT	0.811	0.759	0.835	0.576	0.667	0.741	0.9159	0.414	0.849	0.968	1	
FI	0.832	0.86	0.768	0.805	0.73	0.825	0.6753	0.701	0.798	0.687	0.527	1

Appendix 2: Economic Sentiment Indicator in relation with GDP









Note: GDP dif indicates the difference of annual percentage change between euro area GDP and GDP for each country