Business cycle synchronicity, amplitude and the euro: one size does not yet fit all

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Abstract

This paper focuses on the impact of the euro on the degree of business cycle synchronisation between nineteen advanced economies over the period 1980-2008. In contrast with the existing evidence based on correlation coefficients, we assess the impact of the euro on the synchronicity and the relative amplitude of business cycles separately. We find that although the introduction of the euro has raised the likelihood of business cycle synchronicity, it has not affected the relative amplitude of business cycles. Hence, the common monetary policy has become increasingly suitable for members in terms of the needed direction of policy moves, but not in terms of the required magnitude of these moves.

JEL Classification: C25, E32, F15, F36, F41.

Keywords: Euro, monetary union, business cycle, synchronisation, probit.

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1 Introduction

When a country joins a monetary union, the resulting loss of the monetary policy instrument at the national level creates an economic cost in the presence of asymmetric shocks. When countries are affected by asymmetric shocks, the dynamics of their business cycles will differ. In this case, the common monetary policy will deliver imperfect macroeconomic stabilisation for at least some countries and thus, these will suffer an economic cost. Therefore, business cycle synchronisation is one criterion, among others, to judge the desirability for a country to join a monetary union. Countries with more correlated business cycles are more likely to form a monetary union; they are less sensitive to asymmetric shocks, so the cost associated with the central monetary policy is lower.

Frankel and Rose (1998) have challenged this view and have argued that this criterion is endogenous. Forming a monetary union will foster economic integration, in such a way that business cycles will become more synchronised as a result of the introduction of a common currency. This hypothesis has been tested extensively and the evidence remains rather mixed (see Baxter and Kouparitsas (2005) and de Haan, Inklaar and Jong-A-Pin (2008) for overviews of the literature). Business cycle synchronisation has typically been measured by the correlation coefficient between the business cycles of two countries, or one country and a reference cycle. Our starting point is that correlation coefficients feature several important drawbacks. First, correlation coefficients must be estimated over sub-periods of the sample. Different sub-periods could lead to very different estimates of the euro effect on business cycle synchronisation[1]. Moreover, the euro era remains relatively short and we will have at best only one observation on business cycle correlation for each pair of countries. Second, correlation coefficients mix two characteristics of the business cycle: synchronicity, defined as the coincidence of positive or negative output gaps, and amplitude. Greater synchronicity means that countries will increasingly need monetary

[1]Artis and Zhang (1997, 1999) have concluded that participation in the Exchange Rate Mechanism of mutually fixed exchange rates raised business cycle synchronisation, while Inklaar and de Haan (2001) reached the opposite conclusion using the same dataset but splitting the sample in different sub-periods of time.

policy moves in the same direction. However, this is a necessary but not a sufficient condition for a harmonious monetary union. Strong synchronicity does not mean that all countries demand policy moves of the same magnitude. The amplitude of business cycles may still differ across countries, so that even if synchronicity is perfect, one size still does not fit all. Because correlation coefficients mix these two aspects, they are not informative on the suitability of the common monetary policy in terms of both direction and magnitude of policy moves.

This paper addresses the shortcomings of correlation coefficients by using two alternative measures of business cycle synchronisation. Both measures do not require estimation over sub-periods of the data and vary year to year. The first measure is the concordance indicator proposed by Mink et al. (2007). This measure is computed as the product of the output gap of two countries divided by the absolute value of this product. When two countries have coinciding output gaps (both positive or both negative), their business cycles are said to be synchronous and the measure is equal to one. When one country has a positive output gap and the other country has a negative output gap, the measure is equal to minus one. The second measure is simply the distance between the output gaps of two countries in a given year. In contrast with the concordance indicator, this measure captures differences in the amplitude of business cycles. While the first measure will allow us to assess whether the common monetary policy is increasingly adequate in terms of the required direction of policy moves, the second measure provides information about the required magnitude of policy moves.

These two measures are the dependent variables in otherwise standard econometric specifications. The explanatory variables include euro membership, ERM membership, EU membership, the intensity of trade relations, bilateral financial integration, the similarity in the fiscal stance, and economic specialization. Our sample contains nineteen advanced economies: EMU participants (Germany, Spain, France, Italy, Netherlands, Austria, Finland, Ireland and Portugal), EU non-EMU members (United Kingdom, Denmark and Sweden), non-EU non-EMU European countries (Norway and Switzerland) and other countries (United States, Canada, Japan, Australia and New Zealand). The time period

runs from 1980 to 2008.

Our results show that joint euro membership increases the probability of observing coincident output gaps but has no effect on the distance between output gaps. Therefore, the common monetary policy is increasingly suitable for member countries in terms of the needed direction of policy changes, but not in terms of the magnitude of these changes. One size does not yet fit all.

The remainder of this paper is organised as follows. Section 2 presents the two annual measures of synchronicity and relative amplitude of business cycles. Section 3 deals with the empirical specification, and discusses the estimation procedures and the data. Section 4 presents the results from our estimations and section 5 concludes.

2 Measuring the synchronisation of business cycles

Business cycle synchronisation is usually measured as the correlation coefficient between pairs of business cycles. This measure has several shortcomings. The computation of a correlation coefficient at a given frequency requires higher frequency data. For example, suppose that we are interested in obtaining a correlation coefficient for each year. We would need quarterly or monthly data. Quarterly data on gross domestic product would provide only four observations for each correlation coefficient, thereby yielding a very imprecise measure of synchronisation (Doyle and Faust, 2002). Some researchers have focused on monthly industrial production. However, industrial production is far from representing the whole economy.

Since we have quarterly data on GDP for many industrialised countries, we could compute correlations over sub-periods of the data. For example, one could use five years of quarterly observations, that is twenty observations (e.g. Flood and Rose, 2009). This is problematic for at least three reasons. First, the choice of sub-periods remains largely arbitrary and estimation results may not be robust to different choices. Second, the euro era is still relatively short. Having only one observation for that era implies a substantial, undesirable loss of variation in the data. Third, we would also lose variation in the data by

having to average the values of explanatory variables over five-year intervals. One potential solution is to calculate rolling correlation coefficients. But this is not without problems too. Econometric estimates may depend on the length of the relevant time window, and on which particular year we center the window.

Moreover, correlation coefficients mix two characteristics of the business cycle: synchronicity and amplitude. Synchronicity refers to the coincidence of output gaps and occurs when two countries have either both positive or both negative output gaps. Yet, the correlation coefficient contains more information than that; correlation coefficients can change even when the pattern of synchronicity does not change, because of changes in the relative amplitude of business cycles. Many countries have experienced a decrease in the volatility of their business cycles over the last twenty years (the Great Moderation), although not at the same time and not to the same extent. Hence, correlation coefficients will change because both the synchronicity and the amplitude change. Ideally, therefore, we should use two separate measures that cast light on these two aspects of business cycle synchronisation separately. Such a distinction remains appropriate to assess whether the common monetary policy has become increasingly adequate for the euro area members.

In this paper, we follow Mink et al. (2007) and measure synchronicity with a concordance indicator. This binary measure of concordance between the business cycles of two countries i and j in a given year t is given by

$$\varphi_{ij}(t) = \frac{g_i(t)g_j(t)}{|g_i(t)g_j(t)|} \tag{1}$$

where $g_i(t)$ denotes the output gap of country i in year t. When both business cycles are in the same phase, that is when both output gaps are positive or when both are negative, they are synchronous and the indicator is equal to 1. Otherwise, it is equal to -1. Our second measure focuses on the relative amplitude of business cycles. The difference in the amplitude of the business cycles of two countries i and j in a given year t is based on distance:

$$\psi_{ij}(t) = |g_i(t) - g_j(t)| \tag{2}$$

Both measures can be computed for every year on the basis of annual gross domestic product, avoiding many of the technical pitfalls associated with correlation coefficients. There is no need for higher frequency data and it is not necessary to define arbitrary sub-periods of the data.

3 Empirical specification

The synchronicity measure proposed by Mink et al. (2007) can be easily turned into a binary variable, taking a value of unity when the indicator is equal to 1 - when both business cycles are in the same phase - and zero otherwise. The binary nature of the indicator naturally leads to a panel probit specification which relates the binary dependent variable to a set of explanatory variables:

$$Prob\left(\varphi_{ij}(t) = 1 | x_{ij}(t), \beta\right) = \Phi(x'_{ij}(t)\beta) \tag{3}$$

where the function $\Phi(.)$ is the cumulative distribution function of the standard normal distribution. The matrix $x_{ij}(t)$ contains bilateral explanatory variables in a given year t. Similarly, the distance measure enters as the dependent variable in a linear model which can be estimated by ordinary least squares:

$$\psi_{ij}(t) = x'_{ij}(t)\gamma + \varepsilon_{ij}(t) \tag{4}$$

The concordance indicator is calculated according to equation (1) and the distance measure according to equation (2). It is necessary to calculate the output gap for each country. First, we extract the business cycle from annual data on real gross domestic product using the Hodrick-Prescott filter. We make use of the power value of 4 suggested by Ravn and Uhlig (2002). Second, the resulting series are divided by their respective

trend components to obtain a measure of the output gap[2].

We construct a dummy variable taking a value of unity when both countries have adopted the euro, and zero otherwise. We also control for membership in the Exchange Rate Mechanism. Furthermore, to avoid attributing an effect to the euro that may arise from membership in the European Union, another dummy variable is also included, taking a value of unity when both countries are members of the EU, and zero otherwise.

Business cycle synchronisation could also result from greater real and financial integration. Theoretically, the expected signs of the associated regression coefficients remain ambiguous. Starting with trade integration, higher aggregate demand in one country will partially fall on imported goods, thereby raising output and income in trading partners' economies and inducing synchronisation. On the supply side, however, there are two opposite effects which relate to two different approaches to modeling international trade. Intra-industry models of trade emphasize economies with similar production structures and factor endowments. To the extent that trade occurs mostly within industries, an expansion in some industries will raise output comovements across countries. However, trade integration may also lead economies to specialize in the production of goods for which they have a comparative advantage, hence reducing comovements. Bilateral trade intensity is measured as the sum of bilateral exports and imports between two countries in a given year, scaled by the sum of total exports and imports of each country during that year (Frankel and Rose, 1998).

Financial integration means that cross-border holdings of financial instruments can have wealth effects for asset holders in the world, thereby affecting consumer demand and output comovements. On the other hand, a greater degree of financial integration allows to smooth consumption patterns without having to diversify production, thereby leading to the possibility of greater specialization (Kalemli-Ozcan et al., 2001). The former effect would increase business cycle synchronization, whereas the latter effect would tend to reduce comovements. Bilateral financial integration is measured in three different ways. Bond market integration is measured as the correlation coefficient between the long-term

[2]Figure A1 in the Appendix shows the output gaps.

government bond yields of two countries in a given year, while equity market integration is computed as the correlation coefficient between the weekly returns on the MSCI equity market indices in a given year. Lower financial market segmentation means that the proportion of domestic asset return volatility explained by the volatility of idiosyncratic shocks decreases, thereby leading to stronger asset return comovements reflected in higher correlations. Finally, the third measure of bilateral financial integration is computed as the absolute value of the difference in net foreign asset positions (Imbs, 2004). Countries with more divergent NFA positions are more likely to lend and borrow from each other than countries with similar NFA positions.

Two other factors may have an effect on business cycle synchronisation. Fiscal convergence could lead to greater business cycle synchronisation because of lower idiosyncratic fiscal shocks. Moreover, a higher degree of similarity in the economic structure of countries could also enhance business cycle synchronisation. Fiscal convergence is measured as the absolute value of the difference between the general government balances of two countries. The degree of economic similarity is defined as the sum of absolute values of differences in the share of each of seven sectors in total value added.

Importantly, trade integration, financial integration and economic specialisation are likely to be endogenous to the presence of a single currency[3]. As a remedy, we make use of a two-step approach. The first step consists of regressing each endogenous variable (trade integration, financial integration, similarity of economic structure) on a set of exogenous determinants. In the second step, the predicted values of bilateral trade integration, bilateral financial integration and economic specialisation are introduced into our econometric specifications. Since this second step involves the estimation of a model with generated regressors, standard errors are bootstrapped. We regress trade integration on the standard gravity variables, namely the logarithm of the product of gross domestic products, the

[3]For example, Rose (2000), Glick and Rose (2002), Micco et al. (2003) and Baldwin (2006) estimate versions of gravity equations to examine the impact of a common currency on the intensity of trade, and find a statistically significant, positive relationship. Baele et al. (2004), Lane and Milesi-Ferretti (2007a) and Cappiello et al. (2006) show that the introduction of the euro has also led to greater financial integration.

logarithm of the product of gross domestic products per capita, the bilateral distance between the main business centers of each country, a dummy variable for a common border, and a dummy variable for common language. All measures of bilateral financial integration are regressed on the logarithm of the product of gross domestic products per capita, the bilateral distance between the main business centers of each country, and a dummy variable for common language. The similarity of economic structure is regressed on the logarithm of the product of gross domestic products per capita, and the logarithm of the absolute difference in the levels of gross domestic products per capita. All these first-step regressions also include time dummy variables.

Finally, synchronisation will result not only from the transmission of country-specific shocks through trade and financial linkages, but also from exposure to common external shocks. The literature notably emphasizes significant movements in the level of world interest rates, sharp changes in the volatility and the level of the price of oil, or common institutional characteristics such as similar strategies for economic policymaking. This common source of synchronisation, not resulting from economic and monetary integration, is captured by including time dummy variables in the main empirical specifications.

The sample consists of nineteen advanced economies: EMU participants (Germany, Spain, France, Italy, Netherlands, Austria, Finland, Ireland and Portugal), EU non-EMU members (United Kingdom, Denmark and Sweden), non-EU non-EMU European countries (Norway and Switzerland) and other countries (United States, Canada, Japan, Australia and New Zealand). The time period extends from 1980 until 2008.

4 Results

Figures 1 and 2 show the cross-sectional averages of the concordance binary indicator of Mink et al. (2007) and the distance between output gaps, respectively. Both figures point to the same conclusion. Synchronicity increased and distance decreased over the last thirty years. This conclusion is consistent with the view that globalisation has fostered business cycle comovements across countries. But such simple cross-sectional averages do not allow

us to assess in a meaningful manner whether euro membership has also contributed to greater synchronisation.

Table 1 turns to the econometric evidence about synchronicity. Almost all coefficient estimates on the time dummy variables are statistically different from zero, showing that it remains very important to account for global sources of disturbances. The Wald test indicates that for all regressions, the null hypothesis that none of the coefficients are significant is rejected. All regressions feature robust standard errors. Since the sample consists of nineteen countries over 29 years, we have a total of 4959 observations. Some missing data imply that the number of observations can be somewhat smaller in some regressions but it never goes below 4400 observations.

Specification (I) simply regresses the binary dependent variable on a set of time dummy variables and a dummy variable capturing joint euro membership. The estimated coefficient is positive and statistically significant at the 1% level. Other things equal, two countries in the eurozone are more likely to have synchronous business cycles. This finding supports the hypothesis that this optimum currency area criterion is endogenous. The marginal effect is equal to 0.18. Joint euro membership thus raises the probability that two member countries exhibit synchronous business cycles by 18 percent, a very significant amount in economic terms.

Specifications (II) to (IX) add further control variables. Joint EU membership also raises the likelihood that business cycles are synchronous (column II). The coefficient estimate for euro membership declines by half but it remains statistically highly significant and positive. The coefficient estimate for ERM membership is statistically significant but unexpectedly negative. One possible explanation is recurrent waves of speculative attacks that often affected a subset of ERM participants, thereby inducing divergent business cycle trajectories during that era. Trade integration (column III) and bond and equity market integration (columns IV and V) generally increase the probability of observing coincident output gaps. This finding is consistent with much of the literature on the determinants of business cycle synchronisation.

Figure 1: Synchronicity: cross-sectional average, 1980-2008

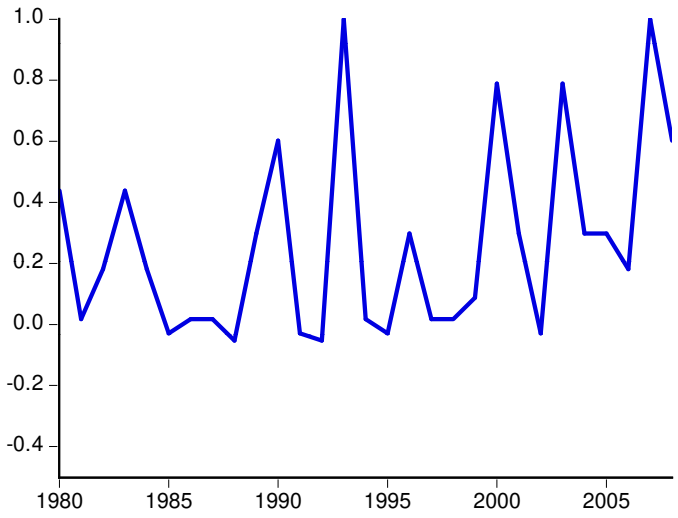

Figure 2: Distance: cross-sectional average, 1980-2008

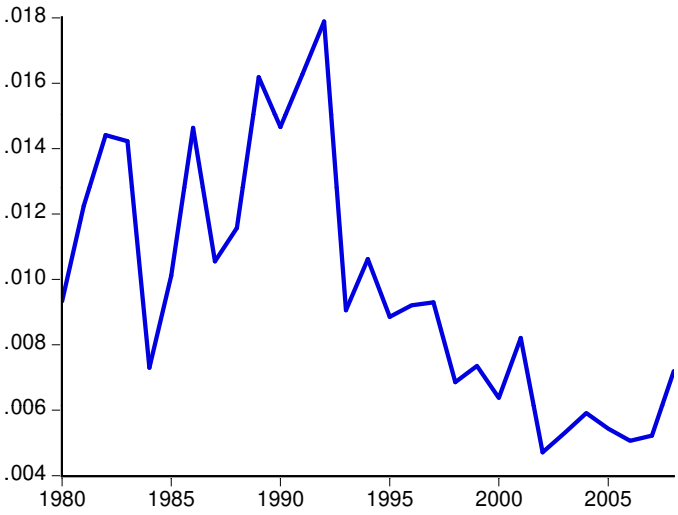

Table 1: Probit regressions: synchronicity[a,b,c]

Regressors	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)	(XI)	(XII)
Euro dummy	0.56***	0.26***	0.27***	0.25**	0.27**	0.45***	0.44***	0.46***	0.47***	0.25**	0.26**	0.28***
	(0.086)	(0.101)	(0.102)	(0.103)	(0.106)	(0.107)	(0.108)	(0.111)	(0.108)	(0.107)	(0.102)	(0.110)
ERM dummy		−0.22**	−0.21**	−0.21**	−0.16*	−0.23**	−0.22**	−0.18*	−0.22**	−0.21**	−0.20**	−0.21**
		(0.088)	(0.089)	(0.090)	(0.095)	(0.091)	(0.091)	(0.097)	(0.091)	(0.085)	(0.090)	(0.089)
EU dummy		0.37***	0.25***	0.23***	0.26***	0.27***	0.24***	0.28***	0.26***	0.12*	0.22***	0.39***
		(0.064)	(0.067)	(0.068)	(0.071)	(0.070)	(0.070)	(0.073)	(0.071)	(0.073)	(0.068)	(0.075)
Trade intensity			0.09***	0.08***	0.04**	0.10***	0.09***	0.05**	0.09***	0.07***	0.04***	0.12***
			(0.017)	(0.017)	(0.020)	(0.017)	(0.018)	(0.020)	(0.017)	(0.021)	(0.023)	(0.019)
Bond market integration				0.23***			0.23***			1.85***		
				(0.050)			(0.051)			(0.205)		
Equity market integration					0.62***			0.60***			2.16***	
					(0.124)			(0.127)			(0.333)	
NFA diff						−0.00			−0.01			2.12***
						(0.053)			(0.054)			(0.319)
Fiscal stance							0.01	0.01	0.01	−0.01	−0.01	0.00
							(0.006)	(0.007)	(0.006)	(0.005)	(0.006)	(0.006)
Specialisation							−0.86***	−0.73***	−0.91***	0.19	−2.13*	−1.18
							(0.233)	(0.245)	(0.229)	(1.315)	(1.254)	(1.300)
Observations	4959	4959	4941	4798	4617	4770	4577	4402	4717	4905	4905	4905
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$Prob > \chi^2$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

[a] Robust standard errors in parentheses. * Significant at 10%; ** significant at 5% level; *** significant at 1% level.

[b] The binary dependent variable takes a value of one when business cycles are synchronous, and zero otherwise.

[c] Bootstrapped standard errors are used for specifications (X) to (XII) (500 replications).

Adding the measure of financial integration based on differences in the NFA position, similarity in the fiscal stance and economic specialisation leads to a substantial increase in the coefficient estimate on joint euro membership. Yet, this results from the fact that data on NFA positions and economic specialization are missing for 2008. Estimating specifications (I) to (V) omitting the year 2008 produces coefficient estimates close to 0.45 for the euro dummy variable, similar as the results for specifications (VI) to (IX). The similarity in the fiscal stance does not appear to have any statistically significant effect on business cycle synchronisation. However, countries with more similar economic structures are more likely to have synchronous business cycles. Between specifications (I) and (IX), estimated marginal effects range from a minimum of 0.06 to a maximum of 0.18.

Estimations using generated regressors confirm the simple probit regressions[4]. The coefficient estimate on joint euro membership remains highly stable and statistically significant. It is noteworthy that all other coefficients also retain their signs and statistical significance, with the exception of economic specialisation.

Our evidence shows that joint euro membership raises the probability of observing synchronous business cycles. This result is good news for the single monetary policy since member countries will increasingly need monetary policy changes in the same direction. Countries sharing positive output gaps will want contractionary monetary policy, while countries with negative output gaps will both want an expansionary policy. But will they want policy moves of the same magnitude? Table 2 presents results on the determinants of the distance between output gaps.

Specification (I) includes time effects as well as the dummy variable capturing joint euro membership. The coefficient estimate is statistically different from zero and negative. Thus, it seems that euro membership also reduces the distance between output gaps. However, this finding is not robust to the inclusion of further control variables. Specifications (II) to (IX) show that the statistical significance of joint euro membership largely disappears[5].

[4]Table A1 in the Appendix presents results from the first stage of estimations.

[5]Even though there is some statistical significance at the 10% level in Specifications (VI), (VII) and

Table 2: OLS regressions: relative amplitude[a,b,c]

Regressors	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)	(XI)	(XII)
Euro dummy	−0.13***	−0.03	−0.04	−0.03	−0.04	−0.07*	−0.07*	−0.07*	−0.08**	−0.03	−0.03	−0.03
	(0.029)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.039)	(0.036)
ERM dummy		−0.19***	−0.20***	−0.21***	−0.19***	−0.19***	−0.22***	−0.19***	−0.21***	−0.18***	−0.18***	−0.18***
		(0.045)	(0.045)	(0.045)	(0.045)	(0.046)	(0.046)	(0.046)	(0.046)	(0.045)	(0.046)	(0.043)
EU dummy		−0.13***	0.01	0.02	−0.00	−0.01	0.03	0.00	0.02	−0.00	0.05	−0.01
		(0.030)	(0.032)	(0.033)	(0.031)	(0.035)	(0.035)	(0.033)	(0.035)	(0.036)	(0.033)	(0.035)
Trade intensity			−0.12***	−0.12***	−0.10***	−0.12***	−0.12***	−0.10***	−0.12***	−0.19***	−0.15***	−0.15***
			(0.009)	(0.010)	(0.011)	(0.010)	(0.010)	(0.012)	(0.010)	(0.015)	(0.015)	(0.011)
Bond market integration				−0.10***			−0.07*			0.80***		
				(0.036)			(0.037)			(0.253)		
Equity market integration					−0.21***			−0.17**			−0.14	
					(0.070)			(0.071)			(0.284)	
NFA diff						−0.01			−0.00			−0.68***
						(0.029)			(0.029)			(0.230)
Fiscal stance							0.00	0.00	0.00	0.01***	0.01***	0.01***
							(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)
Specialisation							0.70***	0.50***	0.81***	1.64**	1.89**	1.92***
							(0.139)	(0.138)	(0.136)	(0.782)	(0.743)	(0.703)
Observations	4959	4959	4941	4798	4617	4770	4577	4402	4717	4905	4905	4905
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$Prob > F$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
$Prob > \chi^2$										0.00	0.00	0.00

[a] Robust standard errors in parentheses. * Significant at 10%; ** significant at 5% level; *** significant at 1% level.

[b] The dependent variable is the distance between business cycles of two countries in a given year.

[c] Bootstrapped standard errors are used for specifications (X) to (XII) (500 replications).

More intense trade relations and stronger bilateral financial integration make business cycle amplitudes more similar and less similar economic structures increase the distance between output gaps. Regressions using generated regressors largely confirm all these results. In particular, joint euro membership has no effect on the relative amplitude of business cycles. Hence, even though the euro may have strengthened the synchronicity of business cycles, it has not had any effect so far on the relative amplitude of business cycles. Despite the fact that member countries will need monetary policy moves going in the same direction, they still demand moves of different magnitudes.

5 Concluding remarks

According to the optimum currency area theory, countries with more synchronous business cycles are more likely to form a monetary union. However, it has been argued that this criterion should be treated as endogenous, in the sense that joining a monetary union would, ex post, enhance business cycle synchronisation and reduce the costs associated with asymmetric shocks. In this paper, we have tested the endogeneity of this criterion. Given the conceptual and technical shortcomings of correlation coefficients, we have used two measures focusing separately on synchronicity and relative amplitude. Both measures exhibit yearly variation, which is ideal given the relatively short euro era. The sample consists of nineteen advanced economies between 1980 and 2008.

Our results show that joint euro membership raises the likelihood of observing countries with coincident output gaps. This is good news for the single monetary policy since countries will increasingly need policy changes in the same direction. This being said, greater synchronicity is a necessary but not a sufficient condition for a harmonious monetary union. Countries should need policy moves of the same direction but also of the same magnitude. Our results show that so far, joint euro membership has had no effect on the relative amplitude of business cycles. One size does not yet fit all.

(VIII), and at the 5% level in Specification (IX), this results again from missing data for the year 2008.

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A Data sources and definitions

Annual gross domestic product: constant prices, domestic currency. Source: IMF World Economic Outlook database, April 2009.

Annual gross domestic product: current prices, U.S. dollars. Source: IMF World Economic Outlook database, April 2009.

Annual gross domestic product per capita: current prices, U.S. dollars. Source: IMF World Economic Outlook database, April 2009.

Bilateral exports and imports: U.S. dollars. Source: IMF Direction of Trade Statistics.

Long-term government bond yields: IMF International Financial Statistics.

MSCI Stock market indices: domestic currency. Source: Datastream.

Net foreign asset position: updated and extended version of dataset constructed by Lane and Milesi-Ferretti (2007b).

Sectoral distribution of value added: National Accounts Main Aggregates database, United Nations Statistics Division.

Fiscal stance: general government fiscal balance. Source: IMF World Economic Outlook database, April 2009.

Bilateral distance between the main business centers of the relevant countries: Rose (2000).

Common language: Otto, Voss and Willard (2001).

Common border: Otto, Voss and Willard (2001).

Table A1: First-stage estimations[a]

Regressors	Trade intensity	Bond market integration	Equity market integration	NFA differential	Specialisation
$Ln(GDP_i * GDP_j)$	0.376^{***}				
	(0.005)				
$Ln(GDPCAP_i * GDPCAP_j)$	0.064^{***}	-0.026^{**}	0.068^{***}	0.077^{***}	0.010^{***}
	(0.018)	(0.013)	(0.006)	(0.011)	(0.003)
$Ln(\lvert GDPCAP_i - GDPCAP_j \rvert)$					0.014^{***}
					(0.001)
Distance	-0.693^{***}	-0.060^{***}	-0.038^{***}	0.026^{***}	
	(0.007)	(0.005)	(0.002)	(0.005)	
Common language	0.373^{***}	0.032^{**}	0.068^{***}	0.115^{***}	
	(0.037)	(0.016)	(0.008)	(0.017)	
Common border	0.451^{***}				
	(0.036)				
Observations	4941	4815	4617	4788	4788
Time effects	Yes	Yes	Yes	Yes	Yes
R-squared	0.7725	0.3931	0.5473	0.0680	0.0607
F statistic	628.51^{***}	146.13^{***}	226.61^{***}	11.45^{***}	9.70^{***}

[a] Robust standard errors in parentheses. * Significant at 10%; ** significant at 5% level; *** significant at 1% level.

Figure A1: Output gaps, 1980-2008