Stock market synchronisation and monetary integration

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Abstract

This paper evaluates the connection between stock market return comovements and monetary integration. A panel specification is used to explain time-varying bilateral stock market return correlations between fifteen developed economies over the time period 1975 to 2004. Our model includes time fixed effects to capture common international sources of comovement, controls for propagation channels such as international trade linkages and international financial integration, and assesses the impact of monetary integration on bilateral correlations. The adoption of a single currency affects correlations through the elimination of exchange rate volatility as well as through the inherent single monetary policy and the convergence of inflation expectations.

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Keywords: Stock markets, comovement, currency union, exchange rate regime, financial integration.

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1 Introduction

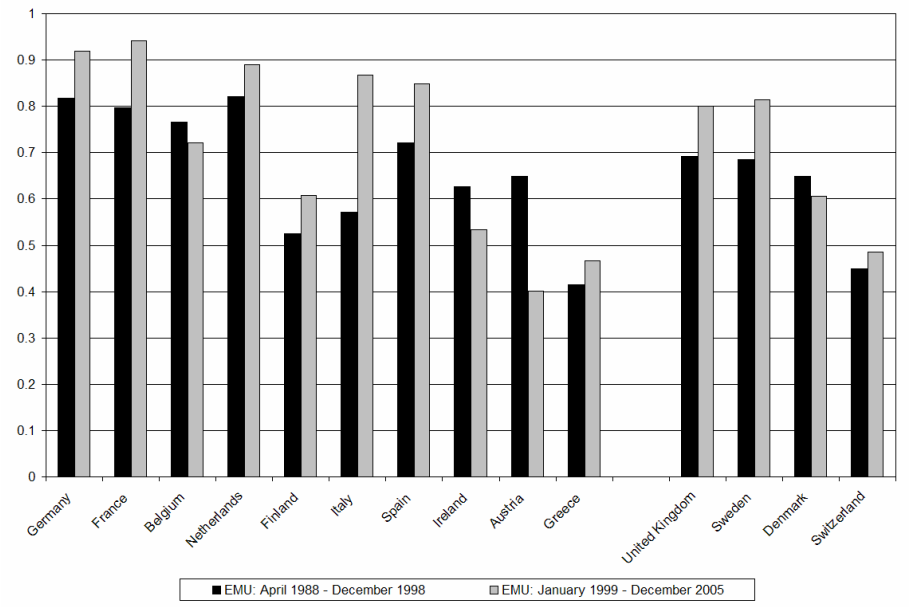
The process of monetary integration in Europe is a unique experiment since the rise and the fall of the Gold Standard in the nineteenth and early twentieth centuries. At the same time, the last thirty years have also witnessed a tremendous increase in the strength of economic linkages across the economies of the world. Along with common international shocks, such as sharp movements in world interest rates or significant changes in oil prices, the higher level of economic interdependence has led to a greater synchronisation of national economies arising from the international transmission of country-specific shocks through international trade and international financial markets.

This paper focuses on the connection between asset return comovements and monetary integration. Most of the available evidence relies on mean correlations between national stock market returns, before the creation of the euro and afterwards (Adjaouté and Danthine, 2003, 2004), or on time-varying return correlations (Cappiello et al., 2006). This approach remains problematic for several reasons. Figure 1 sets the main issues that are dealt with in this paper by showing mean correlation coefficients between the stock market returns of individual countries and the return on an EMU index, both before the creation of the euro and afterwards[1]. The hypothesis that the euro has brought higher stock market comovements should translate into higher correlations between EMU participants' returns and the EMU return after the creation of the euro, and relatively stable correlations for European non-EMU countries across both sub-periods.

Correlation coefficients between the returns of most individual EMU participants and the EMU return have generally increased after the introduction of the euro, except for Belgium, Ireland and Austria. Although these results could be interpreted as evidence that the euro has indeed led to greater stock market comovements, they could also arise

[1]This sample consists of ten EMU countries, namely Germany, France, Belgium, the Netherlands, Finland, Italy, Spain, Ireland, Austria and Greece, and four European non-EMU countries, namely the United Kingdom, Sweden, Denmark and Switzerland, which should be seen as a control group. The return on the EMU index is computed as a weighted average of the returns of the ten EMU countries above, excluding the country with respect to which the correlation coefficient is calculated. The weights for each country are obtained as the ratio of this country's market capitalisation to the total market capitalisation of the ten EMU countries.

Figure 1: Return correlations to an EMU return for two sub-periods



Source: Lane and Wälti (2006).

from a more general tendency towards trade and financial integration at the global level. It remains therefore crucial to consider other European countries that do not belong to the euro area as a control group. Figure 1 shows that correlations between the respective returns of the United Kingdom, Sweden and Switzerland, and the EMU return have also increased after the introduction of the euro.

This informal evidence raises several issues of interest. First, any analysis of the relationship between asset return comovements and monetary integration should consider both participating and non-participating countries into the process of monetary integration. Focusing too closely on EMU participants could lead us to attribute a role to the euro when other excluded factors remain significant. Second, mean correlations over long time periods might not provide adequate evidence about stock return comovements in so far as they could hide significant time variation. As a result, we should instead focus on time-varying correlation coefficients (Cappiello et al., 2006). Third, it remains unclear whether January 1999 is the right turning point. Fratzscher (2002) concludes that stock

market integration has risen during the convergence period that preceded the introduction of the euro, that is starting around 1996. Fourth, stock market return correlations contain both a common component and an idiosyncratic component. In other words, stock markets could be synchronised because they are affected by common international shocks, or because idiosyncratic shocks are transmitted across highly integrated countries. Therefore, any model of stock return comovements must allow for both sources of synchronisation, and for different propagation channels of country-specific shocks.

This paper relies on a panel specification to explain time-varying bilateral stock market return correlations between fifteen developed economies over the time period 1975 to 2004. The panel specification is naturally appropriate since it allows for the introduction of time fixed effects to control for common international sources of comovement, for the control for propagation channels such as international trade linkages and international financial integration, and for the assessment of the impact of monetary integration on bilateral correlations. We do not restrict our analysis to the short time period after the creation of the euro. Instead, we take advantage of the European experiment with monetary integration during the past thirty years or so, starting with the creation of the European Monetary System in 1979. Our econometric specification also takes account of the fact that trade integration and financial integration could be endogenous variables. Exogenous instruments based on geography and institutions are used as a remedy.

We find strong evidence that trade integration and international financial integration raise stock market return comovements. Monetary integration also increases bilateral correlations. The adoption of a single currency affects correlations through the elimination of exchange rate volatility as well as through the inherent single monetary policy and the convergence of inflation expectations. Our results are robust to the introduction of several control variables such as a common language, distance, a common legal origin, and a dummy variable for joint EU membership.

The remainder of this paper is organised as follows. Section 2 reviews the ambiguous theoretical predictions about the role of different types of integration on synchronisation. Section 3 presents the econometric specification and discusses the measurement of the

different variables which are used in our regressions. Section 4 presents the results from our estimations and provides some further interpretation. Section 5 deals with robustness checks and section 6 contains concluding remarks.

2 Theoretical background

Comovement is the result of common international disturbances such as movements in the level of world interest rates, sharp changes in the volatility and the level of the price of oil, greater political uncertainty which is of concern for many nations, or common institutional characteristics such as similar strategies for economic policymaking. It also arises from the transmission of country-specific shocks through various economic linkages such as trade in goods and financial assets. This section reviews the predicted theoretical effects of monetary integration, trade integration, and financial integration. Trade and finance affect business cycle synchronisation, which in turn translates into stock market comovements. In general, theoretical predictions remain ambiguous and assessing the net contribution of economic linkages to comovements remains ultimately an empirical question.

2.1 Monetary integration

Monetary integration affects stock market return correlations in several ways. First, lower exchange rate volatility means lower transaction costs in cross-border investment. Furthermore, participation into a monetary union implies a single monetary policy and convergence in inflation expectations. Consequently, real risk-free rates will converge and lead to more homogeneous valuations. Finally, lower exchange rate volatility could lead to enhanced business cycle synchronisation, thereby leading to higher stock market comovements. Conversely, monetary authorities could use exchange rate flexibility to reduce the macroeconomic effects stemming from the transmission of country-specific real shocks, thereby delivering lower output comovements across countries.

Bordo and Helbling (2003) find that although a fixed exchange rate induces higher output correlations, this result is not robust to the inclusion of other control variables such

as trade linkages or a European Union dummy variable. The authors thus conclude that fixing by itself does not make any difference for the degree of synchronization of business cycles. Rose and Engel (2002) reach the opposite conclusion and show that currency unions bring about higher business cycle synchronisation, even after controlling for other factors including trade relations. Bodart and Reding (1999) distinguish between ERM and non-ERM countries and make use of a GARCH specification for bond and stock market returns. They find evidence that bond and stock markets correlations depend negatively on exchange rate variability. Overall, we would conclude that exchange rate volatility affects synchronisation but it remains necessary to control for other factors such as trade linkages and financial integration.

2.2 Trade linkages

Although the contribution of international trade in goods is usually recognized as increasing the extent of business cycle synchronization, its overall effects remain theoretically and empirically ambiguous. On the demand side, higher aggregate demand in one country will partially fall on imported goods, thereby raising output and income in trading partners' economies and inducing output comovements across countries. 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. The net impact of international trade on comovements is therefore ambiguous.

Frankel and Rose (1998) find strong evidence that closer trade linkages lead to an increase in the correlation of business cycles. Calderon et al. (2002) find similar evidence for developing countries, for which we could expect that specialization along the lines of comparative advantage is more important. Otto et al. (2001) and Bordo and Helbling (2003) conclude that international trade affects output comovements in a positive and sig-

nificant way, although it does not explain very much. Imbs (2004) refines the analysis of the impact of international trade by estimating the respective contributions of both types of trade effects and concludes that a sizable part of the impact of trade on bilateral correlations works through intra-industry trade, although there are some smaller but significant inter-industry effects. Chinn and Forbes (2004) assess the role of direct trade flows, competition in third markets, bank lending and foreign direct investment in explaining stock market comovements. They conclude that direct trade linkages remain the predominant determinant of the effect of large markets on other markets.

2.3 Financial linkages

At a theoretical level financial integration carries an ambiguous impact on business cycle synchronization. On the one hand, to the extent that equities of a given country are widely held internationally, a fall in that country's stock market will trigger a negative wealth effect for asset holders in the world, thereby affecting consumer demand and in turn, output comovements. On the other hand, international diversification of portfolios allows to smooth consumption patterns without having to diversify production, thereby leading to the possibility of greater specialization. The former effect would increase business cycle synchronization, whereas the latter effect would tend to reduce comovements.

Empirical evidence on the role of financial linkages for business cycle synchronization is somewhat mixed. Bordo and Helbling (2003) conclude that financial integration does not affect business cycle synchronization. Imbs (2004, 2006) and Kose et al. (2003) show that financial integration impacts positively on business cycle comovements. However, Kalemli-Ozcan et al. (2001) show that capital market integration also leads to greater specialisation in production structures and thus, a lower degree of output comovements.

3 Econometric specification and data

This paper assesses the impact of common international shocks, trade integration, financial integration and monetary integration on bilateral time-varying correlations between the

stock market returns of fifteen developed economies over the period 1975 to 2004[2]. The baseline regression model is a panel specification allowing for time fixed effects in order to control for common international shocks. This specification is written as

$$\rho_{i,j,t} = \gamma_t + \beta_1 T_{i,j,t} + \beta_2 F_{i,j,t} + \beta_3 M_{i,j,t} + \eta_{i,j,t} \tag{1}$$

where $\rho_{i,j,t}$ is the correlation coefficient between the stock market returns of country i and country j during year t, γ_t captures common international effects, $T_{i,j,t}$ measures the intensity of trade relations between country i and country j during year t, $F_{i,j,t}$ stands for the degree of international financial integration between country i and country j during year t, and $M_{i,j,t}$ measures the degree of monetary integration between country i and country j during year t. The remainder of this section discusses the measurement of these variables.

3.1 Measuring comovements

Common practice measures stock market comovements by the correlation coefficient between two series of stock returns during a given time period. We make use of MSCI stock market indices measured on the Thursday of each week and transform these into stock market returns through log-differentiation. Stock market indices are retrieved from Datastream and expressed in U.S. dollars, thereby taking the perspective of an international investor. Correlation coefficients are calculated for each year based on the weekly observations contained in this year, thereby avoiding potential issues pertaining to overlapping observations. In so far as correlation coefficients are not normally distributed, we follow Otto et al. (2001) and adopt the following transformation of the dependent variable:

$$w_{i,j,t} = \ln \frac{1 + \rho_{i,j,t}}{1 - \rho_{i,j,t}} \tag{2}$$

[2]These countries are the United States, the United Kingdom, Austria, Denmark, France, Germany, Italy, the Netherlands, Norway, Sweden, Switzerland, Canada, Japan, Spain and Australia.

3.2 Measuring trade linkages

Frankel and Rose (1998) and Bordo and Helbling (2003) measure bilateral trade intensity as the sum of exports and imports between countries i and j during year t, scaled by total exports and imports of each country. Bilateral trade data are obtained from the IMF's *Direction of Trade Statistics*. Making use of bilateral trade intensity as an explanatory variable gives rise to a problem of endogeneity. Countries will tend to link their currencies with their most important trading partners. We make use of a two-step approach to focus on the contribution of bilateral international trade to stock market comovements. The first step consists of regressing the measure of bilateral trade intensity on a set of exogenous determinants identified in the literature on gravity equations of international trade. Five instruments are selected, namely the natural logarithm of the distance between the main business centers of each country, the logarithm of the product of country sizes as measured by gross domestic product, a dummy variable for a common border, a dummy variable for common language, and a dummy variable for joint EU membership. The second step consists of introducing the predicted values of bilateral trade intensity into the panel specification for bilateral correlations.

3.3 Measuring financial integration

Increasing the degree to which both domestic and foreign residents are allowed to acquire domestic and foreign assets is only a necessary but not a sufficient condition for international financial integration. Other factors such as investment opportunities, institutional characteristics and political stability are also important. Moreover, Bekaert and Harvey (2003) have noted that the announcement of financial liberalization may not coincide with the completion of its implementation, so that international capital flows will start rising some time after the announcement of the liberalization. As a result, the degree of financial market integration can be measured along several different dimensions and there is no widespread agreement about a single correct measure (Adam et al., 2001; Baele et al., 2004). De jure measures of financial market integration rely on the dating of financial

market liberalisations initiated by policymakers, whereas de facto measures focus instead on the outcomes of such liberalisations. In so far as the impact of policy decisions will develop into outcomes gradually over time, it is likely that de jure and de facto measures will provide different views about the extent of financial market integration.

De facto measures focus either on volumes, be it stocks or flows of equity, debt or foreign direct investment, or on asset prices or returns. Volume-based measures rely on the idea that a higher level of international financial integration will result in higher cross-border holdings (stocks) of foreign assets. Lane and Milesi-Ferretti (2001, 2006) propose to measure the level of international financial integration for a given country by dividing the sum of its total foreign assets and total foreign liabilities by its gross domestic product. Our measure of bilateral financial integration is calculated as the logarithm of the product of two countries' respective measures of financial integration. The use of this bilateral variable raises an obvious problem of endogeneity since our dependent variable consists of bilateral return correlations and international financial integration is measured according to quantities of foreign assets. Again, we make use of a two-step approach where the first step consists of regressing the measure of international financial integration on a set of exogenous determinants. Imbs (2006) makes use of (among others) the logarithm of the product of gross domestic products per capita, an indicator of creditor rights, and an index of corruption taken from La Porta et al. (1998). Lane and Milesi-Ferretti (2004) show that bilateral cross-border equity holdings depend upon distance and a common language. Portes and Rey (2005) argue that the former variable could capture the extent of informational asymmetries involved in cross-border investment. Finally, we also include a dummy variable for joint EU membership since there have been several directives at the EU level aiming at achieving the liberalisation of capital movements. The second step consists of introducing the predicted values of international financial integration into the panel specification for bilateral correlations.

3.4 Measuring monetary integration

The European experience with monetary integration provides for an opportunity to assess its connection with asset return comovements. It started with the creation of the European Monetary System in 1979 and culminated with the adoption of a single currency in 1999. Our first measure of monetary integration is an indicator of exchange rate stability. It is calculated as the yearly standard deviation of weekly exchange rate percentage changes during that year.

The central component of the European Monetary System was the Exchange Rate Mechanism. An important feature of this mechanism was joint intervention and mutual support. Exchange market pressure would always affect two countries, and both countries would intervene jointly to eliminate misalignments. Moreover, mutual support was guaranteed in the case of shortfalls in foreign exchange reserves. Consequently, monetary integration was more than simply achieving bilateral exchange rate stability. There was an underlying institutional mechanism that would support it. Accordingly, our second measure is a dummy variable for joint participation of two countries in the Exchange Rate Mechanism.

The creation of the monetary union goes beyond the coordination of national monetary policies, in that it entails a single monetary policy for all participating countries. Although it remains unclear whether a single monetary policy will make national economies more synchronised, the convergence of inflation expectations and the convergence of nominal interest rates mean that valuations should become more homogeneous. Our third measure is a dummy variable for joint EMU membership.

The introduction of these three variables into the regression specification provides a lot of information on the role of monetary integration. Having controlled for the reduction in exchange rate risk, the dummy variables for joint ERM membership and joint EMU membership will indicate the contribution of the particular institutional mechanism underlying the exchange rate arrangement. It is likely that the benefits of a currency union extend beyond the simple elimination of exchange rate risk.

Table 1: Gravity equations for bilateral trade intensities

Regressors	(I)	(II)
Constant term	−14.62	−14.51
	(41.16)***	(39.77)***
Distance	−0.55	−0.53
	(52.33)***	(42.51)***
Product of GDPs	0.26	0.26
	(40.06)***	(36.37)***
Common language	0.24	0.26
	(5.63)***	(5.94)***
Common border	0.66	0.66
	(17.01)***	(17.12)***
EU dummy		0.09
		(2.95)***
R^2 statistic	0.627	0.628
Number of obs.	3150	3150

Absolute values of t-stats in parentheses.

*Significant at 10%; ** significant at 5% level; *** significant at 1% level.

4 Results

This section presents our baseline results. We account for the possible endogeneity of bilateral trade intensity and international financial integration by running preliminary regressions for both these variables. Table 1 and Table 2 contain the estimation results for the determinants of trade integration and financial integration, respectively[3]. Robust standard errors are used to take into account potential heteroscedasticity and serial correlation.

The estimated gravity equation for bilateral trade shows that all the coefficients carry the expected sign and are statistically significant at the 1% level. Distance has a negative effect on bilateral trade flows, whereas a greater size, a common language, a common border and common EU membership contribute positively to the intensity of trade relations. Together these five variables explain about two thirds of the total variation in trade intensity. The estimated equation for international financial integration also performs very well empirically. All the coefficients carry the expected sign and are statistically significant at

[3]The sample contains fifteen countries for the time period 1975 to 2004. As a result, we have $\frac{15*(15-1)}{2} * 30 = 3150$ observations.

Table 2: Estimating equations for bilateral financial integration

Regressors	(I)	(II)
Constant term	−8.76	−10.19
	(23.50)***	(26.32)***
Product of GDPs per capita	0.89	0.87
	(69.61)***	(67.13)***
Distance	−0.27	−0.19
	(21.71)***	(12.45)***
Creditor rights	0.04	0.04
	(8.18)***	(6.93)***
Corruption index	0.72	0.98
	(9.60)***	(13.26)***
Common language	0.37	0.46
	(8.49)***	(10.23)***
EU dummy		0.44
		(10.22)***
R^2 statistic	0.667	0.679
Number of obs.	3150	3150

Absolute values of t-stats in parentheses.

*Significant at 10%; ** significant at 5% level; *** significant at 1% level.

the 1% level. Our six explanatory variables explain about two thirds of the total variation in bilateral financial integration. Predicted values from both equations are retrieved and are used below as explanatory variables instead of the original measures.

Our main econometric specification is given by equation (1). The dependent variable is a transformed correlation coefficient since raw correlation coefficients are not normally distributed. Figures 2 and 3 in the appendix show that the transformation brings about a statistical distribution closer to the normal distribution. Several variants of our baseline specification are estimated to assess the stability of the results. Every estimation contains time fixed effects and makes use of robust standard errors to account for potential heteroscedasticity and serial correlation. Table 3 presents our results.

Our baseline specification performs very well. Almost all time fixed effects are statistically different from zero, thereby indicating that part of the correlations arises from common international effects. All F statistics are statistically significant, so that we can always reject the null hypothesis that the coefficients on our explanatory variables are

Table 3: Stock market comovements: baseline results

Regressors	(I)	(II)	(III)	(IV)	(V)
Trade integration	0.20	0.19	0.18	0.13	0.13
	$(14.95)^{***}$	$(13.85)^{***}$	$(13.88)^{***}$	$(9.83)^{***}$	$(9.49)^{***}$
Financial integration	0.12	0.12	0.14	0.09	0.10
	$(7.40)^{***}$	$(7.38)^{***}$	$(8.31)^{***}$	$(5.07)^{***}$	$(5.73)^{***}$
ERM membership		0.04			−0.03
		(1.48)			(1.21)
EMU membership			0.44		0.26
			$(5.09)^{***}$		$(2.92)^{***}$
Exchange rate volatility				−0.22	−0.20
				$(11.37)^{***}$	$(9.90)^{***}$
R^2 statistic	0.415	0.415	0.426	0.441	0.445
F statistic	65.99^{***}	64.68^{***}	67.39^{***}	69.81^{***}	70.27^{***}
Number of obs.	3150	3150	3150	3150	3150

Absolute values of t-stats in parentheses. *Significant at 10%; ** significant at 5% level; *** significant at 1% level.

jointly insignificant. The R^2 statistic is relatively high for a panel specification. Our simple specification explains almost one half of the total variation in bilateral correlations.

Trade integration and financial integration contribute positively to stock market comovements. Despite the ambiguous predictions from the theory, there is strong evidence that a higher level of real and financial integration across two countries raises bilateral stock market return correlations. The coefficients on these two variables remain stable across all baseline specifications. Our variables measuring monetary integration are initially introduced sequentially and then simultaneously. The dummy variable capturing ERM membership appears to be insignificant throughout all specifications. At first sight, we might conclude from this result that monetary integration does not affect stock market comovements. However, EMU membership raises stock market comovements in an statistically significant manner, while lower exchange rate volatility coincides with higher bilateral return correlations. The simultaneous introduction of all three monetary variables provides clear evidence that monetary integration affects bilateral stock market comovements in a positive and significant manner.

Interestingly, the coefficient for EMU membership decreases substantially when the level of exchange rate volatility is controlled for. Yet, it remains positive and highly significant. We would argue on the basis of this result that monetary integration affects stock market return comovements in two different ways. On the one hand, lower exchange rate volatility reduces transaction costs arising from uncertainty about future exchange rates. On the other hand, the common monetary policy and the convergence of inflation expectations leads to more homogeneous valuations, thereby increasing comovements. The common currency might also raise business cycle synchronisation, although the evidence about this relationship remains mixed (Artis and Zhang, 1997, 1999; Inklaar and de Haan, 2001). Overall, our evidence suggests that bilateral return correlations are affected by different channels of monetary integration.

Beyond statistical significance, can we say anything about the economic significance of our results? The interpretation of estimated coefficients is complicated by the transformation of the dependent variable. However, we can obtain the raw correlation coefficient

by working backwards from the transformed correlation coefficient (see appendix A). The coefficient for EMU membership in specification (III) of Table 3 is equal to 0.4333. This estimate implies that EMU membership raises the raw correlation coefficient by an amount equal to 0.2133. We would argue that this magnitude is economically significant. Roughly half of this effect is due to reduced exchange rate volatility.

5 Robustness analysis

This section assesses the robustness of our baseline results in three different dimensions. First, Otto et al. (2001) and Stock and Watson (2003) report the emergence of an English-speaking group of countries among which business cycle synchronisation is more pronounced. Higher business cycle synchronisation should lead to greater stock market comovements and thus, a common language may induce higher stock return correlations. Moreover, Portes and Rey (2005) argue that informational asymmetries translate into transaction costs that affect bilateral equity cross-border flows. We control for these two effects by introducing a dummy variable for a common language and distance between the main business centers of two countries as explanatory variables. Second, a common origin of the legal system might give rise to more homogeneous legislations and reduce transaction costs. We control for this effect by introducing a dummy variable for a common legal origin taken from La Porta et al. (1998). Finally, the dummy variable for EMU membership could possibly capture the effect of EU membership, clearly not a monetary phenomenon. We extend our baseline specification by introducing a dummy variable for joint EU membership. Table 4 presents the results for our sensitivity analysis.

Our baseline results remain largely unaffected by the introduction of further explanatory variables. Two countries having a common language will exhibit higher stock market return correlations, other things being equal. The relationship between language and comovement found at the real level of the economy carries further at the financial level of the economy. Distance as a proxy for informational asymmetries does not enter significantly. The dummy variable for a common legal origin features a positive and statistically significant coefficient

Table 4: Stock market comovements: sensitivity analysis

Regressors	(I)	(II)	(III)	(IV)	(V)
Trade integration	0.12 (8.54)***	0.15 (8.23)***	0.13 (8.91)***	0.13 (8.99)***	0.11 (5.46)***
Finance integration	0.09 (5.14)***	0.11 (5.82)***	0.10 (5.71)***	0.10 (5.66)***	0.08 (4.25)***
ERM membership	−0.01 (0.44)	−0.03 (1.20)	−0.04 (1.23)	−0.05 (1.36)	−0.06 (1.47)
EMU membership	0.27 (2.99)***	0.26 (2.90)***	0.25 (2.82)***	0.25 (2.69)***	0.23 (2.47)***
Exchange rate volatility	−0.20 (10.22)***	−0.21 (9.48)***	−0.20 (9.93)***	−0.20 (9.86)***	−0.20 (9.16)***
Common language	0.10 (3.60)***				0.10 (3.11)***
Distance		0.02 (1.30)			−0.001 (0.09)
Common legal origin			0.05 (2.17)**		0.02 (0.74)
Joint EU membership				0.02 (0.69)	0.06 (1.85)*
R^2 statistic	0.447	0.445	0.446	0.445	0.448
F statistic	68.78***	68.22***	68.46***	68.38***	63.32***
Number of obs.	3150	3150	3150	3150	3150

Absolute values of t-stats in parentheses. *Significant at 10%; ** significant at 5% level; *** significant at 1% level.

when included separately. It becomes insignificant when included together with other variables testing for the robustness of our baseline results. Finally, joint EU membership remains insignificant when included separately, and it is statistically significant at the 10% level only when introduced with other explanatory factors.

6 Concluding remarks

This paper studies the connection between stock market return comovements and monetary integration. The recent European experience with monetary integration offers a unique opportunity to assess its role in raising return correlations. We make use of a panel specification to control for common international shocks with time fixed effects, and to take account of the respective importance of trade and financial integration at the global level. Our sample contains fifteen industrialised countries over the time period 1975 to 2004. Bilateral trade intensity measures and the level of international financial integration raise bilateral time-varying stock market return correlations. At least part of this effect should be attributed to the effect of these two variables on business cycle synchronisation, in turn leading to stock market synchronisation.

Lower exchange rate volatility and the presence of a monetary union both coincide with stronger stock market comovements. A single currency contributes to comovement for half through lower exchange rate volatility, and for half through a single monetary policy and convergence in inflation expectations. A sensitivity analysis shows that our baseline results are robust to the inclusion of other determinants such as a common language, distance as a proxy for informational asymmetries, a common legal origin, and joint EU membership.

One implication of our results pertains to globalisation and the international transmission of shocks. An increasing number of countries are integrating into the global economy and country-specific shocks are therefore very likely to be transmitted internationally with greater scope and strength. Not only will stock market comovements increase during episodes of financial turbulence, but cross-country linkages bring about transmission of country-specific shocks at all times. Another implication of our results pertains to mone-

tary integration and the benefits of international portfolio diversification. The traditional approach to portfolio diversification has been to allocate wealth firstly across countries and secondly within each country. There is widespread historical evidence that country factors dominate industry factors in explaining stock market returns (Heston and Rouwenhorst, 1994; Griffin and Karolyi, 1998; Rouwenhorst, 1999). Yet, higher stock market return correlations across countries would imply lower benefits of portfolio diversification across countries and would mean that an investment strategy based on diversification across industries may become more appealing. Several studies have documented the fall in the dominance of country factors over time (e.g. Brooks and Del Negro, 2004) and some studies conclude that the introduction of the euro coincides with a greater dominance of industry factors (Brooks and Del Negro, 2002; Isakov and Sonney, 2004; Flavin, 2004). The latest evidence points to the fact that the recently identified dominance of industry factors appears to be a temporary phenomenon and that both types of factors affect returns to the same extent lately (Adjaouté and Danthine, 2004; Lane and Wälti, 2006).

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A Transformation of the dependent variable

Otto et al. (2001) suggest a transformation of the dependent variable given as

$$w_{i,j,t} = \ln \frac{1 + \rho_{i,j,t}}{1 - \rho_{i,j,t}}$$

Figures 2 and 3 show that the transformation brings about an empirical distribution that is closer to the normal distribution. The coefficient β_3 in equation (1) measures the effect of the presence of a monetary union and/or a system of fixed exchange rates on the transformed dependent variable. However, the variable of interest is the original dependent variable, that is the bilateral correlation coefficient. It is therefore necessary to disentangle the transformation of the dependent variable to interpret the contribution of monetary integration to bilateral correlations. Starting from the transformation,

$$w_{i,j,t} = \ln \frac{1 + \rho_{i,j,t}}{1 - \rho_{i,j,t}}$$

$$\exp(w_{i,j,t}) = \frac{1 + \rho_{i,j,t}}{1 - \rho_{i,j,t}}$$

$$1 + \rho_{i,j,t} = \exp(w_{i,j,t})(1 - \rho_{i,j,t})$$

we obtain

$$\rho_{i,j,t} = \frac{\exp(w_{i,j,t}) - 1}{1 + \exp(w_{i,j,t})}$$

Figure 2: Raw correlation coefficients

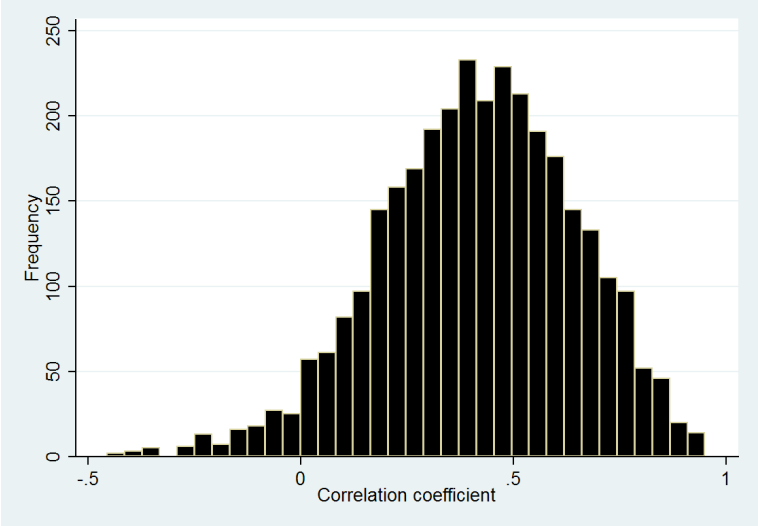

Figure 3: Transformed correlation coefficients