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Financial integration within Europe and the international transmission of business cycles among industrialized countries

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We exploit a dataset on financial integration within Europe to answer a novel question in the international Real Business Cycle (RBC) literature. Does financial integration within Europe matter for the international transmission of business cycles between the United States and Europe? We find that it does, and that as European countries become more financially integrated among themselves, European business cycles start to 'decouple' from those in the United States. We show that this is true for three macro indicators of economic activity: Gross Domestic Product (GDP), consumption and investment, and for five alternative measures of the degree of financial integration. We also show that the effect of trade linkages becomes insignificant once financial factors are accounted for. Our work has interesting policy implications since it unveils the importance of further integration in the EU to slow down the transmission of aggregate shocks among industrialized nations.

Keywords: international real business cycles; financial integration; EU

JEL Classification: E32; F41; F42

I. Introduction

The 'decoupling' theory holds that European economies have deepened to the point that their business cycles have become increasingly insulated from those in the US. The implications of this theory are wide and extremely relevant, since it implies that even a fully fledged recession in the US would not necessarily affect the rest of the developed world. In particular, the followers of this theory used to believe that because of the strong Gross Domestic Product (GDP) growth of many of these countries, their markets will remain 'bullish' even at a time of recession in the US.[1]

Heathcote and Perri (2003) study this issue, and they document the fact that over the last 40 years the US business cycle has become less synchronized with the cycle in the rest of the world (see Table 1 for a summary of their results). Helbling and Bayoumi (2003) and Bordo and Helbling (2010) also document that output correlations have decreased in recent

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[1] It is fair to note though, that using the year-by-year index of Cerqueira and Martins (2009) (which better measures permanent synchronization and corrects for the effects of data outliers), Cerqueira (2010) finds that high income countries have shown increasing business cycle synchronization since the 1960s.

Table 1. Cross-country correlations of HP-filtered series

	GDP	Investment**	Consumption*	Employment**	Productivity
Period 1: January 1960–January 1981	0.516	0.558	0.448	0.532	0.335
Period 2: February 1981–February 2002	0.314	0.135	0.131	0.138	0.337

Source: Heathcote and Perri (2003).
Notes: HP: Hodrick–Prescott.
* and ** indicate that the hypothesis of equal correlation in the two subsamples is rejected at the 5 and 1% levels, respectively.

decades, largely on account of a cycle de-synchronization among industrialized countries in the late 80's and early 90's. Schirwitz and Walde (2004) show that while business cycles have become less synchronized for G3 and maybe G7 countries, this is not true for countries of the EU. Heathcote and Perri (2003) argue that it is an increase in the diversification of financial portfolios in the US what contributes to this changing feature of the data. Building on the evidence provided by Schirwitz and Walde (2004), in this article we suggest an explanation related to that of Heathcote and Perri (2003). Our story is that increased financial integration among European countries themselves might be playing a significant role in this 'decoupling'.[2]

Previous work by Andreou *et al*. (2000), Kalemli-Ozcan *et al*. (2001), Artis *et al*. (2003), Bordo and Helbling (2003), Hoffman (2004) and Imbs (2003) has produced mixed results regarding the relationship between financial integration and the international transmission of business cycles. The reason is that there are fundamentally two channels through which increased financial integration can play a role in the spillover of shocks across countries. First, there is the common notion that an increased mobility of capital leads to faster spillovers, and to a higher degree of business cycle synchronization. However, simultaneously, more developed financial markets also provide increased possibilities for insurance and risk sharing across countries, which allows them to engage in more production specialization. The latter effect makes these countries more vulnerable to their own idiosyncratic shocks, and can lead to a de-synchronization of their cycles from those of the rest of the world. Thus, the relationship between stronger financial channels and the international transmission of business cycles is not unambiguous and it is ultimately, an empirical matter.[3]

Furthermore, in our opinion these studies present a common limitation, i.e. the fact that they lack accurate measures of the degree of financial integration, and that the proxies they use provide inconclusive evidence on its role in shaping international co-movements. Heathcote and Perri (2003) point to the difficulty in measuring increased international portfolio diversification in the US and work around it by using the model to estimate the degree of diversification. Bordo and Helbling (2003) use the removal of capital controls to proxy for increased financial integration, but they still point to this as a limitation of their work.

In this article we address this limitation of previous work by exploiting a novel dataset on financial integration within Europe published by the European Central Bank (ECB). We then ask the following question: Does financial integration within Europe matter for the international transmission of business cycles between the United States and Europe? To the best of our knowledge, this question has not been answered before.

[2] Several other papers study alternative explanations for the international transmission of business cycles. Bejan (2007) shows that participation in free trade agreements contributes to raise cross-country correlations of GDP, consumption and investment. Baxter and Kouparitsas (2005) find that business cycle comovement increases with the level of bilateral trade, and when the two countries are both classified as either developed or developing. They also show that industrial similarity, participation in a currency union, total trade in each country, measures of similarity in export and import baskets, and measures of factor intensity are not robust determinants of business cycle comovement. Tomljanovich and Ying (2005) show that both trade liberalization and financial market integration positively influence the synchronization of business cycles among G7 countries. Flood *et al*. (2010) find evidence for convergence in rates of consumption growth among countries, although not necessarily for the synchronization of consumption at business cycle frequencies. They interpret this finding as a result of improved international risk sharing in a more globalized world. In general, studies find that trade is able to explain only a small fraction of the variability in business cycle correlations.

[3] This issue has also been studied from a theoretical standpoint by the literature started by Backus *et al*. (1992), and followed by Baxter and Crucini (1995), Kollman (1996), Heathcote and Perri (2004), Kehoe and Perri (2002) and Olivero (2010), among others.

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To study this issue we build a simple empirical model of the co-movement of macroeconomic variables between the US and Europe, as a function of both financial and trade linkages. We test the model using quarterly data for the period 1994–2009. Doing so, we find that as European countries become more financially integrated among themselves, European business cycles start to 'decouple' from those in the US. This is true not only for GDP, but for consumption and investment as well. Also, we find this conclusion to be consistent across several alternative measures of financial integration within Europe.

Our results have relevant policy implications. They unveil the importance of the formation of the EU and of further consolidation within Europe in slowing the international transmission of aggregate shocks among industrialized countries. To conclude, our results suggest that it is becoming more and more true that 'when Europe sneezes, the United States do not need to catch a cold'.

Following this introduction the structure of this article is as follows: Section II presents the empirical methodology and the data, Section III discusses the results, and Section IV concludes.

II. Empirical Strategy

Methodology

To answer the question of how financial integration within Europe affects the international transmission of business cycles between the US and Europe, we write a very simple empirical model given by Equation 1

$$mv_{US,t} = \alpha + \beta_1 mv_{EU,t} + \beta_2 FII_t + \beta_3 mv_{EU,t} \times FII_t + \beta_4 trade_t + \beta_5 mv_{EU,t} \times trade_t + \sum_{j=1}^{K} \beta_j X_{j,t} + \epsilon_t \quad (1)$$

The dependent variable is a macroeconomic variable in the US (mv_{US}), while the independent variables are the same indicator for the EU (mv_{EU}), both in natural logarithms, and a financial integration indicator (FII_t). The macroeconomic variables we work with are GDP, consumption (C) and Gross Fixed Capital Formation (GFCF).

One reason why European and American business cycles are still heavily synchronized is clearly related to trade linkages. The US remains the major trading partner for many of these countries, such that a recession in the US will lead to recession in all these countries. Baxter and Kouparitsas (2005, 2006) thoroughly document the significant role that trade in goods and services plays in the international transmission of business cycles.[4] Thus, we include a trade intensity measure ($trade_t$) in the model to capture the effect of bilateral trade in goods and services on the correlation between macroeconomic variables in the US and Europe. In this way we study the effects of financial integration after having controlled for the obvious effect of trade on the international transmission of business cycles.

The variable measuring the interaction between mv_{EU} and the financial integration measure is intended to capture the marginal effect of increased integration within Europe on the correlation between European and American indicators of macroeconomic activity.

The matrix X includes a set of additional control variables that can explain the macroeconomic indicator in the US on the left-hand side. These K variables indexed by j include inflation, a measure of the stance of monetary policy given by the change in the federal funds rate, a measure of fiscal performance given by the ratio of government deficit to GDP and a financial depth indicator given by credit to the private sector as a share of GDP.

It can be conjectured that the estimates of model (1) could be biased by the presence of endogeneity of the regressor mv_{EU}. To account for this possibility, we estimate Equation 1 using Two-Stage Least Squares (2SLS), and we instrument the variable mv_{EU} using three quarterly lags of itself as well as other contemporaneous macroeconomic aggregates in the EU.

Last, the fact that, by construction, the macroeconomic indicator in the EU is highly correlated with the interaction variables results in multicollinearity. Therefore, we follow Jaccard and Turrisi (2003) by mean centering the regressors on the right-hand side before constructing the interaction variables. This results in a product term that is not significantly correlated with the macroeconomic aggregate in the EU (mv_{EU}).

The data

Macroeconomic data on GDP, C and GFCF for the period 1994–2009 are from the International Financial Statistics (IFS) of the International Monetary Fund (IMF). All variables are measured in billions of 2000 US dollars using Consumer Price Index (CPI) and exchange rate data from the same source. To construct macroeconomic variables for the European region we add the national series for the

[4] They show that bilateral trade is the only 'robust' variable in explaining the co-movement of macroeconomic variables.

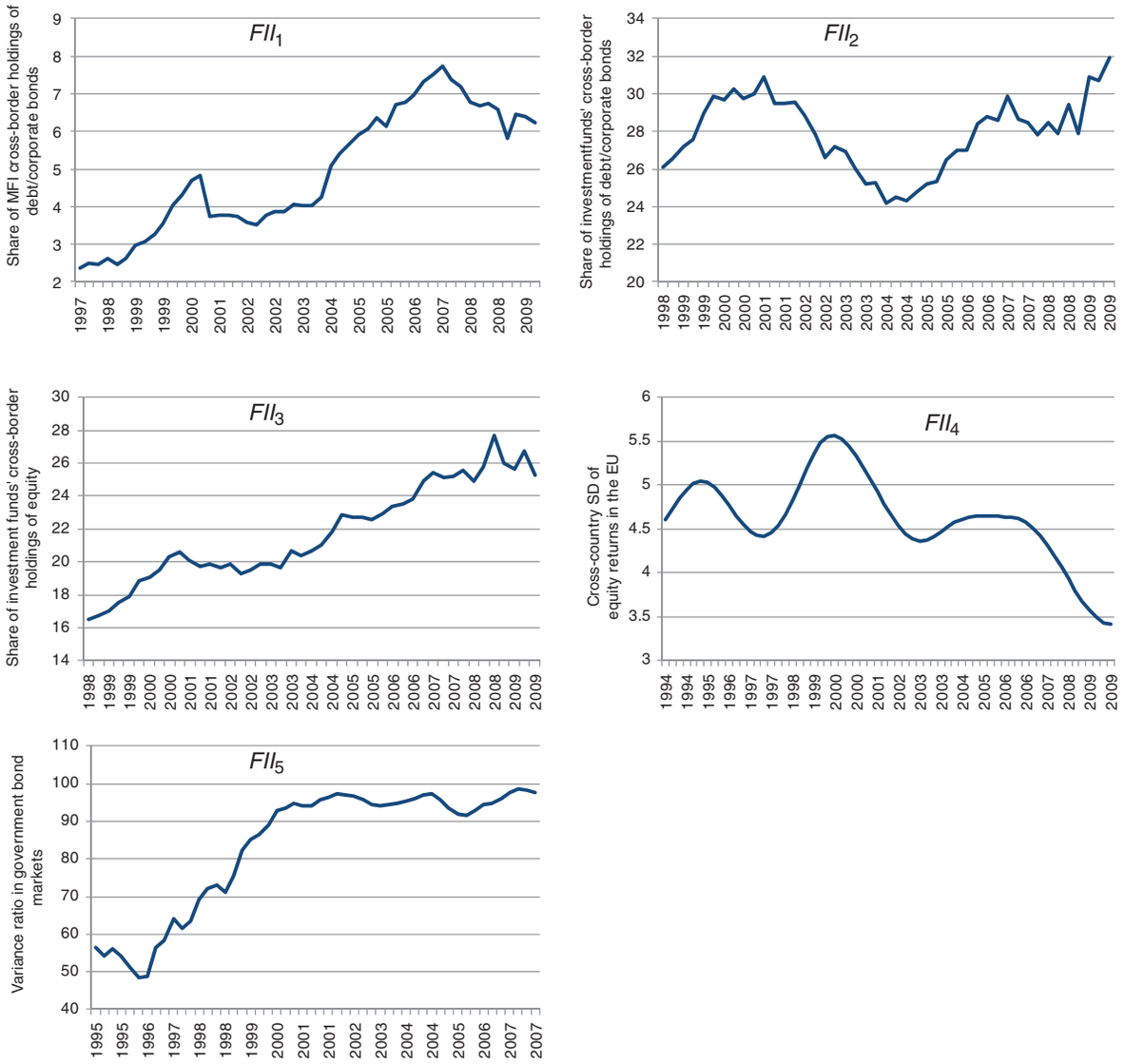

Fig. 1. Indicators of financial integration among european countries
Source: 'Indicators of financial integration in the Euro area', European Central Bank.

following countries: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Poland, Portugal, Slovac Republic, Spain, Sweden and the United Kingdom.

To remove the cycles of frequencies that are not of interest to us, we filter the data using the HP filter, which removes cycles of length approximately longer than 8 years.

Trade data are from the Direction of Trade (DOT) statistics of the IMF. For most member countries of the IMF, these data present current figures on the value of merchandise exports and imports, disaggregated according to their most important trading partners. Using these data and following Baxter and Kouparitsas (2005), we build a measure of bilateral trade intensity, calculated as the sum of bilateral trade between the US and Europe as a share of overall trade in Europe (i.e. $\frac{(X_{EU,US}+IM_{EU,US})}{(X_{EU}+IM_{EU})}$, where $X_{EU,US}$ denotes European exports to the US, $IM_{EU,US}$ denotes European imports from the US, X_{EU} denotes total European exports, and IM_{EU} denotes total European imports).

To measure the degree of financial integration within Europe, we resort to the 'Indicators of Financial Integration in the Euro Area' published biannually by the ECB. This dataset contains both price-based and quantity-based indicators of financial integration. Quantity-based indicators are used to study the degree of portfolio diversification across

Table 2. Data summary statistics

Variable	Obs.	Mean	SD	Min.	Max.	Period
FII_1	50	4.91	1.64	2.35	7.73	1997.III–2009.IV
FII_2	45	27.90	1.98	24.20	31.90	1998.IV–2009.IV
FII_3	45	21.75	2.96	16.53	27.66	1998.IV–2009.IV
FII_4	64	3.71	1.09	1.94	5.51	1994.I–2009.IV
FII_5	52	83.30	16.82	48.59	98.56	1995.I-2007.IV
GDP_{US}	64	9953.09	1266.25	7715.06	11869.23	1994.I–2009.IV
GDP_{EU}	64	2002.25	192.81	1647.59	2302.70	1994.I–2009.IV
C_{US}	64	6879.91	998.72	5184.18	8346.32	1994.I–2009.IV
C_{EU}	64	1147.01	108.03	950.27	1295.82	1994.I–2009.IV
$GFCF_{US}$	64	1868.20	253.48	1350.53	2247.48	1994.I–2009.IV
$GFCF_{EU}$	64	396.45	44.09	313.96	483.53	1994.I–2009.IV
trade	64	0.07	0.01	0.05	0.09	1994.I–2009.IV
$inflation_{US}$	64	0.62	0.66	−2.83	2.20	1994.I–2009.IV
$FFrate_{US}$	64	3.79	1.96	0.12	6.52	1994.I–2009.IV
$\frac{deficit}{GDP}_{US}$	64	−0.03	0.03	−0.13	0.02	1994.I–2009.IV
$\frac{privatecredit}{GDP}_{US}$	64	1.69	0.26	1.21	2.11	1994.I–2009.IV

Notes: Macroeconomic variables are measured in billions of 2000 US dollars.
Due to data limitations, the countries included to compute the EU aggregates are Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Italy, the Netherlands, Poland, Slovac Republic, Spain, Sweden and the United Kingdom.
trade is a measure of bilateral trade intensity, calculated as $\frac{(X_{EU,US}+IM_{EU,US})}{(X_{EU}+IM_{EU})}$, where X denotes exports and IM denotes imports.

euro area countries, as investors increase their holdings of non-domestic assets to maximize the benefits from international diversification. Price-based indicators are based on the time-series properties of interest rates and government and corporate bond yields.

The quantity-based indicators measure integration by the share of cross-border activity in financial markets. The first two indicators that we use, FII_1 and FII_2, deal with the market for long-term debt instruments, specifically bond markets. FII_1 is calculated as the share of Monetary Financial Institutions' (MFIs)[5] cross-border holdings of debt securities (government and corporate bonds) issued by euro area and EU non-MFIs. FII_2 is calculated as investment funds' holdings of debt securities issued in other euro area countries as a share of total holdings of debt securities in the rest of the world. FII_3 deals with equity markets, and it is calculated as investment funds' holdings of equity issued in other euro area countries as a share of total holdings of equity.

The last two indicators are price-based indicators. FII_4 is related to equity markets, and it is calculated as the cross-country SD of equity returns among euro area countries. FII_5 is the variance ratio in government bond markets, defined as the proportion of the variance of local (country-specific) yields that can be explained by the variance of the benchmark (German) 10-year government bond yields. In particular, for this study we choose the average of the variance ratio across 10 reporting countries.

The evolution of these five financial indicators for the period that we study is presented in Fig. 1. The effect of the formation of the EU is evident first, from the upward trend followed by the quantity-based indicators FII_1 and FII_3 and by the variance ratio (FII_5) after 1999; and second, from the downward trend in the cross-country SD of equity returns (FII_4). Worthy of note is that investment funds' cross-border holdings of corporate bonds (FII_2) took a longer time to respond, and started exhibiting an upward trend only after 2004.

The data on inflation in the US are from the IFS of the IMF, and the data on the federal funds rate are from the Board of Governors of the Federal Reserve System.

The data on credit to the private sector in the US are from the January 2010 dataset, an update of the Beck *et al.* (2000) financial structure dataset, which provides the ratio of private credit by deposit money banks and other financial institutions to GDP.

[5] According to the ECB, MFIs are central banks, resident credit institutions as defined in Community law, and other resident financial institutions whose business is to receive deposits and/or close substitutes for deposits from entities other than MFIs and, for their own account, to grant credits and/or make investments in securities. Money market funds are also classified as MFIs.

Table 3. Dependent variable: GDP_{US}

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Quantity-based indicators						Price-based indicators			
	FII_1		FII_2		FII_3		FII_4		FII_5	
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
GDP_{EU}	0.504***	0.598***	0.481**	0.612***	0.579***	0.714***	0.256***	0.173**	0.215*	0.181*
	(0.141)	(0.136)	(0.213)	(0.210)	(0.178)	(0.174)	(0.0825)	(0.0706)	(0.110)	(0.104)
FII	−0.00750***	−0.00813***	−0.00102	−0.00135	−0.00543***	−0.00600***	0.00669***	0.00630***	5.23e−05	0.000104
	(0.00264)	(0.00240)	(0.00107)	(0.000979)	(0.00187)	(0.00169)	(0.00106)	(0.000824)	(0.000239)	(0.000221)
$trade$	−0.904***	−0.951***	−0.326	−0.357	−0.746**	−0.843***	−0.940***	−0.986***	−0.236	−0.294
	(0.261)	(0.236)	(0.350)	(0.311)	(0.316)	(0.286)	(0.168)	(0.132)	(0.255)	(0.235)
$GDP_{EU} \times FII$	−0.0753	−0.0759	−0.0497	−0.0605	−0.0597	−0.0590	0.408***	0.410***	−0.00154	−0.000539
	(0.111)	(0.100)	(0.0781)	(0.0697)	(0.0760)	(0.0676)	(0.0852)	(0.0664)	(0.00762)	(0.00692)
$GDP_{EU} \times trade$	7.298	9.759	8.099	12.20	15.88	21.10	−30.11***	−27.11***	2.467	2.363
	(13.87)	(12.54)	(10.72)	(9.935)	(20.54)	(18.48)	(6.604)	(5.182)	(7.855)	(7.069)
$inflation_{US}$	0.00125	0.00108	0.00145	0.00129	0.000636	0.000369	0.000395	0.000882	0.000912	0.00107
	(0.00129)	(0.00116)	(0.00153)	(0.00136)	(0.00140)	(0.00126)	(0.00101)	(0.000793)	(0.00151)	(0.00137)
$FFrate_t - FFrate_{t-1}$	0.00520*	0.00609**	0.000689	0.000899	0.000138	0.000634	0.00803***	0.00542***	0.00692***	0.00676***
	(0.00259)	(0.00238)	(0.00277)	(0.00246)	(0.00241)	(0.00216)	(0.00166)	(0.00140)	(0.00180)	(0.00163)
$\frac{deficit}{GDP}_{US}$	0.292***	0.276***	0.231***	0.210***	0.179***	0.148**	0.198***	0.250***	0.320***	0.334***
	(0.0571)	(0.0521)	(0.0688)	(0.0628)	(0.0626)	(0.0580)	(0.0378)	(0.0318)	(0.0675)	(0.0622)
$\frac{privatecredit}{GDP}_{US}$	0.0590***	0.0592***	0.0153	0.00953	0.0882**	0.0877***	0.0111***	0.0166***	0.0113	0.00719
	(0.0210)	(0.0189)	(0.0263)	(0.0237)	(0.0354)	(0.0315)	(0.00313)	(0.00267)	(0.0196)	(0.0180)
Constant	−0.0955**	−0.0962***	−0.0197	−0.00982	−0.156**	−0.156***	−0.0122**	−0.0209***	−0.0115	−0.00432
	(0.0372)	(0.0334)	(0.0470)	(0.0423)	(0.0652)	(0.0580)	(0.00562)	(0.00469)	(0.0341)	(0.0314)
Observations	50	50	45	45	45	45	63	60	52	52
R^2	0.802	0.800	0.762	0.759	0.804	0.801	0.844	0.892	0.827	0.826
Hausman p-value		0.477		0.0591		0.0496		2.10e−05		0.998

Note: SEs are shown in parentheses.
***, ** and * denote significance at the 1, 5 and 10% levels, respectively.

Table 4. Percent change in GDP_{US} after a 1% increase in GDP_{EU}

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Quantity-based indicators						Price-based indicators			
	FII_1		FII_2		FII_3		FII_4		FII_5	
FII value	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Min	0.697	0.792	0.665	0.836	0.891	1.022	−0.468	−0.555	0.268	0.200
Min $+\sigma$	0.573	0.667	0.567	0.716	0.714	0.847	−0.023	−0.107	0.243	0.191
Mean (μ)	0.504	0.598	0.481	0.612	0.579	0.714	0.256	0.173	0.215	0.181
Max-σ	0.416	0.509	0.381	0.490	0.403	0.540	0.543	0.461	0.217	0.182
Max	0.292	0.384	0.282	0.370	0.226	0.365	0.989	0.909	0.192	0.173

Note: Since the variables are mean centered, the coefficients in this table are obtained as $\hat{\beta}_1 + \hat{\beta}_3 * (FII - \mu_{FII})$.

Last, budget deficits in the US are calculated as the difference between current government expenditures and receipts, using Table 3.1 of the National Income and Product Accounts (NIPA) from the Bureau of Economic Analysis.

The data summary statistics and the period for which each indicator is available are presented in Table 2.

III. Results

Tables 3 and 4 present the results from estimating Equation 1 for GDP in the US as the dependent variable (mv_{US}) and GDP in Europe as the independent variable (mv_{EU}). Tables 5–8 do the same for C and GFCF, respectively.

In each case we present the results of both Ordinary Least Squares (OLS) and 2SLS estimation to account for endogeneity. The *p*-values of the Hausman test for endogeneity presented in the tables indicate that in general, the specifications do not suffer from endogeneity, such that OLS estimates are still unbiased. In any case, the results obtained with both estimation techniques are qualitatively consistent. Therefore, in the discussion that follows, we only refer to the OLS results.

The positive association between American and European business cycles is evident from the positive and significant coefficient on the macroeconomic variables for the EU (GDP_{EU}, C_{EU} and $GFCF_{EU}$) in the regression.

Ex-ante, our hypothesis is that the correlation of macroeconomic variables between the US and Europe is significantly reduced as the economies in the EU become more financially integrated with each other. We are able to prove this hypothesis in three ways.

First, we obtain negative coefficients on the interaction variables for the three quantity-based indicators, for which an increase in the indicator implies an increase in the degree of financial integration.

Second, we obtain positive coefficients on the interaction variable for the price-based indicator FII_4, for which increased financial integration is measured by a reduction in the cross-country SD of equity returns.

Third, we obtain negative coefficients on the interaction variables for the price-based indicator FII_5, for which an increased financial integration is measured by an increase in the proportion of the variance of country-specific government bond yields that can be explained by the variance of German 10-year government bond yields.

Notice that in the case of consumption the coefficient on the interaction variable is often positive for the quantity-based indicators, which is at odds with the negative coefficient expected based on our research hypothesis. This can be explained through the fact that agents use international financial markets not only for intertemporal consumption smoothing, but also to reduce deviations from the optimal mix between home and foreign goods in this bundle. The former implies that increased portfolio diversification should lead to higher cross-country correlations in consumption levels, but the latter implies that more diversification leads to less synchronized consumption (see Heathcote and Perri (2003) and references therein for a detailed discussion of this argument).

In Tables 4, 6 and 8 we measure the economic significance of our regression results for GDP, C and GFCF, respectively. These tables show the percent change in the macroeconomic variable in the US after

Table 5. Dependent variable: C_{US}

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Quantity-based indicators						Price-based indicators			
	FII_1		FII_2		FII_3		FII_4		FII_5	
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
C_{EU}	0.597***	0.692***	0.563***	0.710***	0.643***	0.778***	0.571***	0.485***	0.478***	0.503***
	(0.111)	(0.111)	(0.167)	(0.173)	(0.145)	(0.146)	(0.0862)	(0.0836)	(0.101)	(0.100)
FII	−0.00621***	−0.00675***	−6.01e−05	−0.000373	−0.00272*	−0.00310**	0.00350***	0.00323***	0.000230	0.000204
	(0.00196)	(0.00179)	(0.000727)	(0.000674)	(0.00135)	(0.00122)	(0.000934)	(0.000760)	(0.000190)	(0.000176)
$trade$	−0.336*	−0.381**	−0.0616	−0.0637	−0.186	−0.246	−0.334**	−0.346***	−0.103	−0.0691
	(0.196)	(0.179)	(0.257)	(0.229)	(0.234)	(0.211)	(0.146)	(0.121)	(0.204)	(0.192)
$C_{EU} \times FII$	0.159	0.170*	0.00123	−0.0162	−0.0294	−0.0285	0.267**	0.266***	−0.00130	−0.00184
	(0.0966)	(0.0874)	(0.0738)	(0.0666)	(0.0732)	(0.0654)	(0.106)	(0.0874)	(0.00687)	(0.00624)
$C_{EU} \times trade$	19.94	21.04*	−4.738	−2.622	2.841	4.963	−28.73***	−25.63***	−5.613	−6.420
	(12.25)	(11.07)	(8.373)	(7.570)	(17.68)	(15.82)	(8.175)	(6.665)	(7.356)	(6.750)
$inflation_{US}$	0.00330***	0.00311***	0.00340***	0.00322***	0.00285**	0.00259***	0.00284***	0.00317***	0.00273**	0.00265**
	(0.000931)	(0.000846)	(0.00109)	(0.000978)	(0.00107)	(0.000962)	(0.000924)	(0.000761)	(0.00129)	(0.00117)
$FFrate_t - FFrate_{t-1}$	0.00330*	0.00416**	−6.30e−05	0.000334	−6.58e−05	0.000618	0.00396***	0.00214*	0.00311**	0.00327**
	(0.00186)	(0.00174)	(0.00191)	(0.00172)	(0.00174)	(0.00159)	(0.00146)	(0.00130)	(0.00152)	(0.00139)
$\frac{deficit}{GDP}_{US}$	0.139***	0.122***	0.101**	0.0757*	0.0640	0.0333	0.0596*	0.0951***	0.158***	0.150***
	(0.0391)	(0.0363)	(0.0486)	(0.0458)	(0.0478)	(0.0454)	(0.0329)	(0.0296)	(0.0543)	(0.0507)
$\frac{privatecredit}{GDP}_{US}$	0.0605***	0.0597***	0.0103	0.00666	0.0522*	0.0512**	0.00766**	0.0125***	−0.00582	−0.00390
	(0.0154)	(0.0139)	(0.0184)	(0.0166)	(0.0260)	(0.0233)	(0.00289)	(0.00261)	(0.0152)	(0.0140)
Constant	−0.106***	−0.105***	−0.0166	−0.0108	−0.0948*	−0.0942**	−0.0127**	−0.0206***	0.0117	0.00831
	(0.0274)	(0.0247)	(0.0331)	(0.0297)	(0.0481)	(0.0430)	(0.00515)	(0.00454)	(0.0264)	(0.0244)
Observations	50	50	45	45	45	45	63	60	52	52
R^2	0.857	0.854	0.816	0.812	0.835	0.831	0.822	0.864	0.806	0.806
Hausman p-value		0.998		0.998		0.998		0.998		0.786

Notes: SEs are shown in parentheses.
***, ** and * denote significance at the 1, 5 and 10% levels, respectively.

Table 6. Percent change in C_{US} after a 1% increase in C_{EU}

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Quantity-based indicators						Price-based indicators			
	FII_1		FII_2		FII_3		FII_4		FII_5	
FII value	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Min	0.190	0.257	0.558	0.770	0.796	0.927	0.097	0.013	0.523	0.567
Min $+\sigma$	0.452	0.537	0.561	0.738	0.709	0.842	0.389	0.303	0.501	0.536
Mean (μ)	0.597	0.692	0.563	0.710	0.643	0.778	0.571	0.485	0.478	0.503
Max-σ	0.784	0.891	0.565	0.677	0.556	0.694	0.759	0.672	0.480	0.506
Max	1.045	1.171	0.568	0.645	0.469	0.609	1.050	0.963	0.458	0.475

Note: Since the variables are mean centered, the coefficients in this table are obtained as $\hat{\beta}_1 + \hat{\beta}_3 * (FII - \mu_{FII})$.

a 1% increase in the corresponding variable in the EU, for several different levels of the financial integration indicators.

For example, when the quantity-based indicator FII_1 is at its sample minimum, a 1% increase in European GDP causes GDP in the US to rise by 0.697%. However, when financial integration rises to reach its mean level, the same increase in European economic activity causes American GDP to rise by only 0.504%. When integration is measured through the price-based indicator FII_4, the implied change in GDP_{US} rises from -0.468% when FII_4 is at its minimum to 0.256% when it reaches its mean level. Notice here that an increase in the cross-country volatility of equity returns implies less integration (see Table 4).

These effects are even more marked in the case of consumption. For example, when the quantity-based indicator FII_3 is at its minimum value, a 1% increase in European consumption causes US consumption to rise by 0.796%. When the degree of financial integration rises to its mean level, the corresponding response in consumption falls to only 0.643% (see Table 6).

For investment, when financial integration is measured by the first quantity-based indicator, a 1% increase in European investment causes US investment to increase by 1.42% when FII_1 is at its minimum, while it causes only a 0.525% increase when FII_1 rises to its mean level (see Table 8).

It is important to highlight that since we have included a bilateral trade measure as a control in Equation 1, the effect of financial integration that we uncover here is isolated from the role that international trade in goods and services plays on international co-movements. Moreover, notice that we are not able to obtain consistent results regarding the effects of trade, i.e. the coefficients on the interaction of macroeconomic indicators with the bilateral trade measure frequently change signs with the specification. This fact is consistent with the results in previous work that show that while trade is an important factor explaining business cycle comovement, its effect becomes quite small once other determinants of co-movement are controlled for (see Imbs, 2000, 2004; Otto *et al*., 2001; Kose *et al*., 2003). As a robustness check, we also work with a measure of trade intensity that is calculated as the ratio of bilateral trade (imports + exports) between the US and Europe to total trade for the US. These results are consistent with those presented here, and available from the authors upon request.

To summarize, our results show that financial integration within the EU plays a significant role in the international transmission of business cycles. Specifically, increased integration within Europe contributes to the 'decoupling' of business cycles between the US and Europe.

IV. Conclusions

In this article we ask a novel question in the international real business cycles literature. Does financial integration among European countries themselves matter for the international transmission of business cycles among industrialized nations? We find that it does, and that as the European economies become more integrated among themselves, European business cycles start to 'decouple' from those in the US. Also, our results allow us to conclude that this is true even after controlling for the important role that trade in goods and services plays on this transmission. Thus, we show that the effect of financial linkages is independent from that

Table 7. Dependent variable: $GFCF_{US}$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Quantity-based indicators						Price-based indicators			
	FII_1		FII_2		FII_3		FII_4		FII_5	
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
$GFCF_{EU}$	0.525***	0.394**	0.679***	0.578***	0.472**	0.329*	0.427***	0.261**	0.357***	0.350***
	(0.162)	(0.162)	(0.182)	(0.179)	(0.174)	(0.171)	(0.106)	(0.115)	(0.109)	(0.107)
FII	−0.0106	−0.00874	−0.0110***	−0.0103***	−0.0171***	−0.0158***	0.00711*	0.00793**	−0.00154**	−0.00151**
	(0.00792)	(0.00721)	(0.00261)	(0.00237)	(0.00471)	(0.00424)	(0.00411)	(0.00375)	(0.000659)	(0.000614)
$trade$	−2.383***	−2.313***	1.449	1.387*	−0.340	−0.244	−3.151***	−3.576***	−0.927	−0.957
	(0.736)	(0.664)	(0.904)	(0.802)	(0.822)	(0.733)	(0.622)	(0.583)	(0.722)	(0.679)
$GFCF_{EU} \times FII$	−0.350***	−0.339***	−0.157**	−0.154***	−0.121	−0.133**	0.420***	0.430***	0.00366	0.00374
	(0.115)	(0.104)	(0.0582)	(0.0516)	(0.0716)	(0.0641)	(0.0995)	(0.0902)	(0.00609)	(0.00550)
$GFCF_{EU} \times trade$	−18.45	−19.68	32.39***	29.87***	10.85	4.852	−14.68*	−15.37**	35.92***	35.81***
	(14.19)	(12.81)	(8.653)	(7.913)	(18.35)	(16.62)	(8.238)	(7.541)	(8.369)	(7.556)
$inflation_{US}$	−0.000325	−9.89e−06	0.000700	0.000763	−0.00289	−0.00257	0.000535	0.00128	0.00262	0.00269
	(0.00389)	(0.00351)	(0.00374)	(0.00331)	(0.00398)	(0.00355)	(0.00365)	(0.00333)	(0.00444)	(0.00402)
$FFrate_t - FFrate_{t-1}$	0.0133	0.00991	−7.14e−05	−0.000861	0.00497	0.00294	0.0133**	0.00760	0.0184***	0.0183***
	(0.00798)	(0.00742)	(0.00676)	(0.00602)	(0.00676)	(0.00610)	(0.00611)	(0.00599)	(0.00520)	(0.00471)
$\frac{deficit}{GDP}_{US}$	1.163***	1.264***	0.945***	1.028***	0.816***	0.950***	0.957***	1.163***	0.834***	0.844***
	(0.192)	(0.181)	(0.200)	(0.188)	(0.211)	(0.200)	(0.146)	(0.152)	(0.232)	(0.220)
$\frac{privatecredit}{GDP}_{US}$	0.160**	0.164***	0.332***	0.340***	0.526***	0.529***	0.0242**	0.0373***	0.153***	0.151***
	(0.0649)	(0.0585)	(0.0673)	(0.0599)	(0.103)	(0.0913)	(0.0117)	(0.0119)	(0.0527)	(0.0489)
Constant	−0.241**	−0.244**	−0.569***	−0.580***	−0.929***	−0.929***	−0.00978	−0.0272	−0.235**	−0.231***
	(0.115)	(0.104)	(0.121)	(0.107)	(0.189)	(0.168)	(0.0207)	(0.0204)	(0.0929)	(0.0865)
Observations	50	50	45	45	45	45	63	60	52	52
R^2	0.871	0.869	0.897	0.896	0.890	0.888	0.843	0.854	0.894	0.894
Hausman p-value		0		0.279		0.0152		0.997		0.998

Note: SEs are shown in parentheses.
***, ** and * denote significance at the 1, 5 and 10% levels, respectively.

Table 8. Percent change in $GFCF_{US}$ after a 1% increase in $GFCF_{EU}$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Quantity-based indicators						Price-based indicators			
	FII_1		FII_2		FII_3		FII_4		FII_5	
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Min	1.420	1.261	1.261	1.149	1.104	1.023	−0.318	−0.502	0.230	0.220
Min $+\sigma$	0.845	0.704	0.950	0.844	0.745	0.630	0.140	−0.033	0.292	0.283
Mean (μ)	0.525	0.394	0.679	0.578	0.472	0.329	0.427	0.261	0.357	0.350
Max-σ	0.114	−0.004	0.362	0.267	0.115	−0.064	0.722	0.563	0.351	0.344
Max	−0.461	−0.561	0.051	−0.038	−0.244	−0.458	1.181	1.033	0.413	0.407

Note: Since the variables are mean centered, the coefficients in this table are obtained as $\hat{\beta}_1 + \hat{\beta}_3 * (FII - \mu_{FII})$.

of trade linkages. Even more interestingly, we show that once the effect of financial integration within Europe is accounted for, trade no longer plays a significant role in the international transmission of business cycles between Europe and the US.

Importantly, by exploiting a rich dataset by the ECB on financial integration we are able to address one of the limitations of previous work in this field, namely, the difficulty to measure the degree of financial diversification.

Our work has interesting policy implications on the importance of a process of further integration within the EU. This process should significantly help to slow down the transmission of aggregate shocks between Europe and the US.

One interesting area for further research is to provide a theoretical framework that can account for the empirical fact uncovered in this article. More specifically, our results call for a model that can show how increased financial integration between two economies results in their business cycles being less correlated with those in the rest of the world.

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