Financial Integration and International Transmission of Business Cycles: Evidence from Dynamic Correlations

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Abstract

We estimate determinants of dynamic correlations of output comovement of OECD countries between 1990 and 2008. We show that trade intensity, degree of financial integration and specialization pattern have significantly different effects on comovements at different frequencies. This can bias the results using aggregate data or statistical filters. For example, financial integration is showed to have the highest positive effect for middle business frequencies, while it is insignificant for short-term frequencies.

JEL-Numbers: E32, F15, F41.
Key words: Business cycle, Transmission, Financial Integration, Dynamic Correlation.

1 Introduction

The impact of economic integration on the international transmission of business cycles is not unambiguous. On the one hand, higher trade and financial openness might strengthen the comovement of economic fluctuations across countries, implying a higher degree of business cycle convergence. Positive shocks support also growth in

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other countries, while negative shocks can affect negatively also the partner economies through contagion effects. On the other hand, however, trade and financial integration may support the degree of specialization of countries.

Similarly, financial linkages could increase comovement via supply and contagion effects. The supply of foreign capital causes a positive correlation between source and target countries. In turn, positive productivity shocks in target country are likely to attract investment from other economies (Backus et al., 1995) and to increase sectoral specialization. Thus the effects of financial integration are also unclear.

Using dynamic correlations for different frequencies, we show that the traditional determinants of international business cycles have statistically different effects: The short-run cycles, which are responsible for a large part of aggregate fluctuations, cannot be explained well by financial integration and trade specialization pattern, while short-run trade demand effects may play a significant role.

The paper is structure as follows. The next section discusses different measures of business cycles. Section 3 presents a framework of analysis which follows specially the earlier work by Imbs (2004) and Inklaar et al. (2009). These authors propose to use a system of equation for output correlation, trade intensity and specialization, and financial integration. We extend this framework for analysis of comovements at different frequencies and receive better results that those reported in the previous literature, as is shown in Section 4. The last section concludes.

2 Methods for Business Cycles Analysis

The previous literature has concentrated mainly on testing whether various indicators influence correlation of international business cycles. The majority of the papers follows Frankel and Rose (1998) and use simple de-trended (differenced) indicators of economic activity, which are used for computation of standard correlations of business cycles between the countries. However, this measure of business cycles is likely to be influenced by random events including regional-specific or global shocks. Fiscal consolidations and for example the recent financial crisis increase correlation of output between countries, while business-cycles are likely to be less affected by these shocks.

Therefore, several papers have used various statistical filters which distinct between business cycles and short-run fluctuations. The most standard measure is the Hodrick-Prescott filter. However, this filter has been often criticized for generating spurious cycles when filtering macroeconomic time series (Harvey and Jaeger, 1993, Canova, 1998). Baxter and King (1995) suggest that the band-pass filter should exclude frequencies lower than those corresponding to a periodicity of 8 years and higher than those corresponding to a frequency of 1.5 years. However, Benati (2001) shows that also band-pass filter may markedly distort key business cycle stylized facts, as captured by the cross-correlations and the cross-spectral statistics between the variables of interest.

We apply dynamic correlations proposed by Croux et al. (2001). For two variables y_i and y_j with spectral density functions S_i^λ and S_j^λ and a co-spectrum C_{ij}^λ defined for frequencies λ over the interval $-\pi \leq \lambda \leq \pi$, the dynamic correlation, ρ_{ij}^λ, is

$$\rho_{ij}^\lambda = \frac{C_{ij}^\lambda}{\sqrt{S_i^\lambda S_j^\lambda}}. \tag{1}$$

Dynamic correlations do not cover only contemporaneous comovements but also possible time phase shifts in business cycles because they use the information from spectral density functions.

3 Empirical Framework

We estimate a system of equations showing the importance of trade, specialization pattern and financial integration (Imbs, 2004, Inklaar et al., 2008) for dynamic correlations at different frequencies,

$$\rho_{ij}^\lambda = \alpha_1^\lambda + \alpha_2^\lambda T_{ij} + \alpha_3^\lambda S_{ij} + \alpha_4^\lambda F_{ij} + \varepsilon_{ij}^\lambda \tag{2}$$

where ρ_{ij} stands for the bilateral dynamic correlations of quarterly seasonally adjusted output in countries i and j, and T, S, and F are indicators of trade intensity, specialization pattern and financial integration.

However, the explanatory variables may be endogenous. Therefore we estimate a system of equations. Trade intensity, denoted by T, is defined as the average ratio of exports, X, and imports, M, related to output, Y,

$$T_{ij} = \frac{1}{T}\sum_{t=1}^{T} \frac{X_{ij} + M_{ij}}{Y_i + Y_j}.$$

This indicator is explained by the specialization pattern, S, distance between the capital cities, D, a dummy for geographic contingency, B, a dummy for common languages, L, and GDP per capita, y,

$$T_{ij} = \beta_1^\lambda + \beta_2^\lambda S_{ij} + \beta_3^\lambda D_{ij} + \beta_4^\lambda B_{ij} + \beta_5^\lambda L_{ij} + \beta_6^\lambda (y_i + y_j) + \eta_{ij}^\lambda. \tag{3}$$

Similarly to Imbs (2004) and Inklaar et al. (2008), we use the index of industrial similarity,

$$S_{ij} = \frac{1}{T}\sum_{t=1}^{T}\sum_{n=1}^{N}\left|s_{in} - s_{jn}\right|$$

This index computes the average deviation of industrial shares for countries i and j using the GGDC total economy database. The trade pattern is explained as

$$S_{ij} = \beta_1^\lambda + \beta_2^\lambda Y_i Y_j + \beta_3^\lambda \left|y_i - y_j\right| + \beta_4^\lambda T_{ij} + \beta_5^\lambda F_{ij} + \vartheta_{ij}^\lambda, \qquad (4)$$

where $|y_i - y_j|$ is the difference of GDP per capita, which is taken as a proxy for different factor equipment between the countries. Furthermore, the explanatory variables include also aggregate output, trade intensity, and the intensity of financial integration.

Finally, we use asset holdings according to IMF to measure the financial integration,

$$F_{ij} = \frac{1}{T}\sum_{t=1}^{T}\frac{F_{ij}^A + F_{ij}^L}{Y_i + Y_j},$$

where F^A and F^L are bilateral financial assets and liabilities. This indicator is explained by institutional indices of legal origin, *LP*, according to La Porta et al. (1998),

$$F_{ij} = \beta_1^\lambda + \sum_{k=2}^{7}\beta_k^\lambda (LP_i^k + LP_j^k) + \varsigma_{ij}^\lambda. \qquad (4)$$

We estimate the system of equations by three-stage least squares which reflects the endogeneity of analyzed variables between 1990 and 2008. All variables are taken preferably from the IMF and World Bank until other source was declared above.

4 Estimations

Tables 1 to 3 report the results of three-stage least squares estimation of system of equations defined by (2) to (4) for different frequency intervals. The output equation, (Table 1) confirms that there are important differences between determinants of comovements at various frequencies. The best results are found for the business cycle frequencies, while short-run frequencies cannot be explained well by standard determinants of comovements.

All standard determinants of comovements are correctly signed and highly significant for the business cycle frequencies. Trade integration is found to have a positive sign, which is consistent with previous findings. Specialization index is negative and significant which also follows earlier literature. This implies that intra-industry trade is the forcing drive of synchronization of business cycles while trade specialization leads to more divergent output movements. Financial integration is found to be positive and highly significant in our analysis.

We find slightly different determinants for comovements at the long-run frequencies. Trade and trade specialization have similar effects on business-cycle and long-run frequencies. In turn, the coefficient for financial integration becomes insignificant for the long-run and short-run frequencies. Furthermore, only trade integration is significant for short-run frequencies. The picture confirms that trade links work also through the immediate demand channel, while trade pattern and financial integration need more time for coming into force.

Our sensitivity analyses for country groups confirm these results. For the European countries, specialization and financial integration are highly significant for business cycles. Trade integration is only marginally significant, but it remains highly significant for selected frequencies. All these variables are important also for the long-run comovements. Neither determinant, including trade integration, is significant for the short-run comovements.

The detailed estimations for selected business cycle frequencies show that trade integration and specialization are significant for all frequencies. By contrast, financial integration seems to have hump-shaped effects. The largest effects of the financial integration are found for medial-range frequencies.

The remaining equations of the system are the same for all frequencies. Table 2 estimates the trade equation. The distance and the geographical adjacency are highly significant, while language variable is insignificant. Moreover, trade depends positively on specialization. In turn, trade is insignificant in the specialization equation defined by (4), which depends especially on size of trading economies (Table 4). Finally, the results for the financial integration equation (5) confirm that the rule of law and accounting standards are significantly supporting the degree of financial integration (Table 5).

5 Conclusions

The transmission of business cycles represents an important field of international economic and economic policy. The previous literature documented that trade flows and specialization pattern play an important role in this process. However, less evidence has been so far found for financial integration.

A possible reason for this, as shown in this paper, may be that financial integration may have different effects for comovements at different frequencies. In particular, financial integration is insignificant for the short-run dynamic correlations, while it reaches a peak at the medium business cycle frequencies. In turn, trade is found to be an important determinant for the whole range of frequencies.

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Table 1: Output Correlation Equation

Variable	Short-Run Frequencies	Business Cycle Frequencies	Long-Run Frequencies	π/3	π/5	π/16
A. All Countries						
Intercept	0.208	0.460 *	1.152 ***	0.010	0.402	1.067
	(0.148)	(0.247)	(0.354)	(0.215)	(0.265)	(0.343)
Trade	0.059 **	0.124 ***	0.140 **	0.049	0.148 ***	0.142
	(0.025)	(0.041)	(0.059)	(0.036)	(0.044)	(0.057)
Specialization	-0.003	-0.010 **	-0.027 ***	0.000	-0.009 *	-0.025
	(0.003)	(0.005)	(0.007)	(0.004)	(0.005)	(0.007)
Financial Integration	-0.756	4.857 **	3.756	4.118 **	5.461 **	4.022
	(1.334)	(2.225)	(3.189)	(1.936)	(2.392)	(3.093)
B. European Countries						
Intercept	0.101	0.549 ***	0.851 ***	0.081	0.637 ***	0.841 ***
	(0.118)	(0.200)	(0.316)	(0.173)	(0.205)	(0.305)
Trade	0.020	0.074 *	0.123 **	0.018	0.080 **	0.119 **
	(0.022)	(0.038)	(0.059)	(0.033)	(0.039)	(0.058)
Specialization	-0.001	-0.013 ***	-0.023 ***	-0.002	-0.015 ***	-0.022 ***
	(0.002)	(0.004)	(0.007)	(0.004)	(0.004)	(0.006)
Financial Integration	0.999	6.714 ***	8.125 ***	4.773 ***	6.933 ***	8.042 ***
	(1.037)	(1.814)	(2.852)	(1.547)	(1.868)	(2.759)

Notes: Long-run frequencies correspond to the low frequency below π/16. Business cycle frequencies correspond to the traditional business cycle frequency between π/16 and π/3 (a period between 1.5 and 8 years). Short-run frequencies represent the frequencies over π/3.

Table 2: Trade Equation

Variables	OECD		Europe	
Intercept	0.327		8.026	***
	(2.053)		(1.332)	
Distance	-0.518	***	-1.306	***
	(0.200)		(0.196)	
Border	5.252	***	1.604	***
	(0.838)		(0.387)	
Common Language	-0.586		0.156	
	(0.943)		(0.552)	
GDP per capita Product	0.033		-0.346	*
	(0.074)		(0.199)	
Specialization	0.087	**	0.033	**
	(0.035)		(0.013)	

Table 2: Specialization Equation

Variables	OECD		Europe	
Intercept	44.815	***	51.229	**
	(1.308)		(22.224)	
GDP Product	0.113	**	0.093	
	(0.046)		(0.114)	
GDP per capita Difference	0.024		0.607	
	(0.031)		(0.801)	
Trade	0.250		2.049	
	(0.904)		(16.764)	
Financial Integration	-0.003		-0.005	
	(0.002)		(0.010)	

Table 3: Financial Integration Equation

Variables	OECD		Europe	
Intercept	-0.038	**	0.037	
	(0.017)		(0.035)	
Rule of law	0.195	**	-0.095	
	(0.082)		(0.183)	
Rating on accounting standards	0.181		0.059	
	(0.132)		(0.169)	

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