Do Trade and Financial Links Foster Business Cycle Synchronization in a Small Economy?

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Abstract

We estimate a system of equations to analyze whether bilateral trade and financial linkages influence business cycle synchronization directly and/or indirectly. Out paper build upon the existing literature by using bilateral trade and financial flows for a small, open economy (Spain) as benchmark for the results, instead of the US as generally done in the literature. We find that both the similarity of productive structure and trade links promote the synchronization of cycles. However, bilateral financial links are inversely related to the co-movement of output. This might point to financial integration allowing an easier transfer of resources between two economies, which could enable their decoupling. Both the effects of trade and financial links on output synchronization are statistically significant and economically relevant.

Keywords: business cycle synchronization, trade linkages, financial linkages, productive structure, integration.

JEL classification: E32, F41, F12, E44.

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1. Introduction

The last few years have witnessed increasing economic globalization stemming from very rapid growth in trade and financial linkages, among other factors. At first sight, one would be tempted to think that tighter trade and financial linkages contribute to the synchronization of business cycles. However, theoretical models do not have a clear prediction regarding the relationship between these variables. In fact, the theoretical literature proposes both positive and negative effects of trade and financial links on the synchronization of cycles, which may, in principle, counteract each other. The question is therefore an empirical one, but the empirical literature also reflects these unclear theoretical predictions, as there are a number of diverging results when testing for the influence of trade and financial integration on business cycle co-movements, which could be due, in part, to the lack of data on bilateral financial flows. This paper estimates the effect of bilateral trade and financial links on output co-movement for a small, open economy, namely Spain. We assess whether these two types of linkages exert a positive or negative influence over the synchronization of output and whether the influence is not only statistically but also economically significant.

Assessing whether trade and financial flows foster business cycle synchronization is relevant for several reasons. First, more synchronized business cycles would presumably mean a stronger and faster transmission of shocks across countries, which could provide an important reason in favor of international policy coordination. Second, business-cycle synchronization has profound implications for the design and functioning of common currency areas. Third, if business cycles in a country are mostly driven by external factors, such as trade and financial linkages, domestic policy aimed at economic stabilization or even policy coordination itself is bound to have a smaller impact. In the same vein, if trade linkages lead to business cycle synchronization, external demand will not manage to dampen economic fluctuations, but quite the opposite. This implies that exchange rate policy will be unlikely to play an important role in boosting demand at times of low economic activity.

This paper contributes to the empirical literature mainly in two ways. First, most of the existing studies analyze the issue estimating a reduced-form equation. However, there are a number of effects between trade linkages, financial integration and business cycle synchronization –some of them bidirectional–, which need to be taken into account for meaningful results. Although, in principle, instrumental variables can solve these endogeneity problems, the possibility of conflicting indirect effects between these variables might lead to low net effects, even when partial effects are strong. We, therefore, use a system of equations to disentangle direct and indirect effects on the synchronization of business cycles.

Second, many studies suffer from the lack of bilateral data to measure financial linkages and use aggregate financial stocks or flows as a rough proxy. However, aggregate financial flows, which measure financial integration with the rest of the world, are clearly inadequate to explain business cycle co-movements between two countries. The few studies with bilateral data generally use US bilateral financial flows against the rest of the world (or those of the largest economies). There is an important caveat in using these data: such a large economy, or area, influences other countries through many channels other than trade and financial linkages, something that biases the estimated effect on synchronization of activity. To minimize this problem, we take a relatively small and open economy (Spain), as a benchmark and use a new dataset on bilateral financial flows between Spain and a large number of countries, from the Spanish Balance of Payments.

From our empirical exercise, we obtain several conclusions: as in Imbs (2004b) we find that, both the similarity of productive structure and trade links enhance the synchronization of business cycles. However, our use of bilateral financial flows gives us very different results from Imbs (2004b) —who uses aggregate financial flows. Contrary to him, we find that bilateral financial links are *inversely* related to the comovement of output, which might point to financial integration allowing an easier transfer of resources between two economies, something that could enable their decoupling, an effect highlighted by Heathcote and Perry (2003). Both the effects of trade and financial links on output synchronization are statistically and economically significant. In particular, in our benchmark regression we find that an increase in trade links or a reduction of financial links by one standard deviation increases business cycle synchronization by around 40% of one standard deviation. We also find indirect effects of financial linkages on output synchronization, through an increased similarity of productive structures in more financially integrated countries. This indirect effect of financial links on output co-movement, which has the opposite sign of the direct effect (i.e. a positive sign: closer financial integration is associated with more similar productive structures that, in turn, promote the synchronization of cycles) turns out to be of a lower magnitude than the latter.

The rest of the paper is organized as follows: the next section reviews recent literature on the relationship between trade and financial integration and business cycle synchronization; section 3 outlines the main theoretical predictions and the estimation strategy; section 4 presents the empirical results and section 5 concludes.

2 Related Literature and theoretical predictions

Although the synchronization of business cycles has been extensively analyzed in the literature, its determinants have not been unequivocally assessed.

Neither the theoretical nor the empirical literature offer a definitive answer on the direction or sign of potential channels by which trade or financial links may affect business cycle synchronization. Regarding real links, Kose and Yi (2001) suggest that higher trade integration might lead to more or less synchronization of cycles, depending on the nature of trade and the type of shocks affecting both economies. Countries will become more synchronized if there is an increase of intra-industry trade and industry-specific shocks are the main drivers of business cycles. However, if there were more inter-industry trade (i.e. higher specialization), then industry-specific shocks would reduce the co-movement of output in both countries. Empirical studies have found that higher trade integration increases cross-country output correlations, especially among advanced economies (Frankel and Rose, 1998; Clark and van Wincoop, 2001; Imbs, 2004a and 2004b), possibly reflecting the prevalence and increase of intra-industry trade rather than inter-industry trade.

There might also be some indirect effects of trade links on output synchronization, through the similarity of productive structure or through financial links. Thus, for example, stronger trade links might increase financial linkages because they promote FDI in export-oriented sectors, or because they foster international loans (Rose and Spiegel, 2004). In turn, stronger trade links might induce more or less similarity of economic structure —depending on whether it is mostly inter-industries or intra-industries— which, in turn, influences the co-movement of output.

As for financial linkages, some studies have pointed out a positive relationship between financial integration and business cycle co-movements both in output and consumption in the case of advanced economies (Imbs 2004a,b) but not so for developing economies (Kose, Prasad and Terrones (2003)). However, these results are challenged by potential reverse causality. In fact, Heathcote and Perri (2003) propose that higher financial integration may arise because of less correlated real shocks, since the diversification gains from asset trade are bigger. By fostering financial flows, financial integration, in turn, would dampen GDP correlations more than the reduction implied by the lower correlation of shocks, in effect decoupling both economies.

As it is the case of trade linkages, there might also be some indirect effects of financial links on output synchronization, through trade links or the similarity of productive structure. In the first case, stronger financial links might allow the relocation of capital by comparative advantage, thus increasing opportunities for trade. In the second case, more financial integration between two economies might increase the similarity of economic structures between the two countries, if FDI flows are concentrated on those sectors where the source country has a comparative advantage, thus replicating the productive structure at home. However stronger financial links also allow the unhinging of production and consumption, and therefore permit greater specialization in production and so differing economic structures (Kalemli-Ozcan et al, 2003).

The methodology generally used in the literature to test for the relevance of trade and financial channels is the estimation of a single equation. The fact that there may be indirect effects going in opposite directions might account for the generally small impact found in studies using single equation regressions. To our knowledge, Imbs (2004b) is the only one who estimates a system of simultaneous equations to take into account direct and indirect effects on the synchronization of output but there are a number of differences between his analysis and ours. First, he does not consider the possible two-way relationship between financial and trade linkages (Aizenman and Noy, 2001) or the incentives for financial linkages that might stem from a low correlation of business cycles (Heathcote and Perri, 2003). Second, he works with a limited set of 24 countries, with a very high proportion of rich economies in the sample. Having mostly developed countries in the sample might induce a selection bias in the results, as developing countries are also likely to have weak links, especially financial ones. Third, his measures of financial integration consider global financial flows for each country, instead of bilateral financial flows between a country-pair. Fourth, his estimated coefficients might be picking up some other channels through which big economies affect other countries' business cycles. Finally, Imbs (2004b) includes output correlations from the 80s and 90s. However, the existence of a number of global common shocks in the 80s (although less prevalent than in the 70s) makes it difficult to identify the source of output co-movements.

3 Data and estimation

We assess empirically whether bilateral trade and financial linkages foster or hinder output co-movement, while taking into account other potentially relevant determinants of business cycle synchronization.

As described in the previous section, both in the case of trade and financial linkages, there are arguments for and against their fostering synchronization. Such different arguments are based on multi-directional channels of influence. This implies potential endogeneity problems in reduced-form estimations. Moreover, the different directions of indirect effects might offset each other and lead to very small *net* effects if we just try to correct the endogeneity problem using instrumental variables. Thus, we shall use a system of equations to deal with this problem. We also control for other possible sources of synchronization, such as the convergence of economic policies —which we approximate with the volatility of exchange rates and the differences in inflation rates— or a similar exposure to global shocks, such as oil shocks.

As already mentioned, we use bilateral data to account for trade and financial linkages. While data on bilateral trade flows is readily available from the IMF's Direction of Trade Statistics, bilateral

financial flows are particularly difficult to find except for the US[2]. This paper uses a newly processed dataset for bilateral financial flows (including FDI, but also portfolio flows, including equity transactions other than those considered as FDI), obtained from the Spanish Balance of Payments. Choosing Spain as a benchmark country also has the advantage of using a small open economy whose financial markets are unlikely to have other channels of influence on other countries, limiting the problem of omitted variables in previous studies.

We thus estimate a system of four equations, in which we test for the determinants of output co-movement (eq. 1), those of trade and financial linkages (eqs. 2 and 3, respectively) and those of the similarity in productive structure (eq. 4). As previously explained, there are theoretical reasons to support the idea that the latter could be a key variable governing the indirect effects of trade and financial links on cycle comovements, as already found by Imbs (2004a,b):

(Eq. 1): $\log(\rho_{i,t}) = \alpha_0 + \alpha_1 \log(T_{i,t}) + \alpha_2 \log(S_{i,t}) + \alpha_3 \log(F_{i,t}) + \text{Controls}(\rho) + \varepsilon_\rho$

(Eq. 2): $\log(T_{i,t}) = \beta_0 + \beta_1 \log(S_{i,t}) + \beta_2 \log(F_{i,t}) + \text{Controls}(T) + \varepsilon_T$

(Eq. 3): $\log(F_{i,t}) = \delta_0 + \delta_1 \log(\rho_{i,t}) + \delta_2 \log(T_{i,t}) + \text{Controls}(F) + \varepsilon_F$

(Eq. 4): $\log(S_{i,t}) = \gamma_0 + \gamma_1 \log(T_{i,t}) + \gamma_2 \log(F_{i,t}) + \text{Controls}(S) + \varepsilon_S$

where:

$\rho_{i,t}$ is the correlation between Spain's output and country *i* at time *t*.

$T_{i,t}$ is bilateral trade integration between Spain and country *i* at time *t*.

$S_{i,t}$ is an index of the similarity of economic structure between Spain and country *i*.

$F_{i,t}$ is bilateral financial integration with country *i*.

As described in section 2, the expected sign of the direct effect of trade links on output co-movement (α_1 in Eq. 1) is ambiguous, depending on the nature of trade (intra- vs inter-industry) and of shocks (global versus industry specific). In the same vein, the coefficient of $F_{i,t}$ in the same equation (α_3) also has an ambiguous sign. The expected sign of the coefficient of $S_{i,t}$ in equation 1 (α_2) should in principle be positive as the more similar their economic structure the closer output co-movement between two countries.

[2] The CPIS matrix on bilateral financial flows compiled by the IMF provides data for a limited number of years, and is therefore not suitable for a study involving business cycle synchronization. Its data is also compiled by surveys and therefore its accuracy is relatively limited. The OECD compiles data on bilateral FDI flows, although we are interested in financial integration involving *total* flows.

Although optimally one should conduct a panel data regression with the structure outlined above, the poor quality of the Spanish balance of payment's bilateral financial data prior to 1997, leaves us with few observations, namely the period 1997-2003.[3] We, therefore, drop the time subindex for all variables considered.

There are large differences in how synchronization (ρ_i) is measured in the literature. Kose et al (2003) use correlations of output and consumption of countries with respect to the same aggregates in G-7 countries. They complement it with dynamic factor models to look for common components and assess whether their importance has increased over time, something that would signal a stronger synchronization. Heathcote and Perri (2003) measure cross-regional correlations of the log-difference of US GDP with that of an aggregate of Europe, Japan and Canada. They also propose and use a measure of correlation that corrects for the existence of high conditional volatility, based on Loretan and English (2000). Helbling and Bayoumi (2003) employ various indicators of synchronization, including a binary indicator of expansions and recessions, correlation coefficients and detrended series.[4] They finally use dynamic factor models to assess what is the role of common components on output synchronization. Finally, Imbs (2004b) measures synchronization using cross-country correlations of band-pass series of quarterly GDP over the last 20 years. In this paper, we choose to measure business cycle synchronization (ρ_i) as the correlation between detrended annual GDP in Spain and each partner country. Detrending is done using Baxter and King's (1999) band-pass filter.[5]

Measures of trade linkages also differ across studies. Some of the earlier studies used aggregate measures of trade openness (i.e., global trade integration instead of bilateral trade links between two countries). This is obviously less appropriate to investigate the determinants of business cycle synchronization between two countries. As for bilateral trade relations, some authors have used *de jure* measures, namely restrictions to trade, such as import duties (IMF 2002). Another alternative, non-standard measure is the dispersion between two countries' goods prices (IMF 2002). By far the most common *de facto* measure is the sum of bilateral exports and imports between two countries, divided by the sum of their GDPs (IMF, 2002; Frankel and Rose, 1998; Imbs, 2004b), which is the one we use in this paper for trade linkages (T_i) between Spain (in the subindex as *ESP*) and country *i*. Denoting this measure by $T^1_{ESP,i}$, we have:

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[3] The quality of data prior to 1997 is not very good, especially with respect to the geographical assignment of origin and destination of financial flows, especially portfolio transactions.

[4] Detrending is done using Baxter and King (1999) band-pass filter to eliminate low- and high-frequency components to keep business cycle components defined as those between 6 and 32 quarters. An alternative method used is log first differences (i.e. growth rates).

[5] GDP is measured at purchasing power parity and was obtained from the IMF's World Economic Outlook database. We also conducted the same exercise using the correlation of GDP growth rates or the correlation of HP-filtered annual GDP series. The qualitative results remain unchanged in both cases.

$$T^{1}_{ESP,i} = \frac{1}{T}\sum_{t}\frac{X_{ESP,i,t} + M_{ESP,i,t}}{GDP_{ESP,t} + GDP_{i,t}}$$

where $X_{ESP,i,t}$ are exports from Spain to country *i* at time *t*, $M_{ESP,i,t}$ are imports to Spain from country *i* at time *t*, and $GDP_{i,t}$ is country *i*'s GDP at time *t*.[6] Note that we are taking a time average (over the period under study) of this measure.

An alternative measure, proposed by Clark and van Wincoop (2001), which is independent of country size (and dependent only on trade barriers) includes also world GDP:[7]

$$T^{2}_{ESP,i} = \frac{\frac{1}{T}\sum_{t}\left(\frac{X_{ESP,i,t} + M_{ESP,i,t}}{GDP_{ESP,t} \times GDP_{i,t}}\right)GDP_{World,t}}{2}$$

The measures of financial linkages also differ in the literature.[8] As in the case of trade linkages, earlier studies used measures of global financial integration rather than measures of bilateral links. In fact, the use of measures of global integration is even more pronounced for financial links than for trade links, because of the difficulties in finding bilateral data of financial transactions. Among the aggregate measures, several authors have employed aggregate *de jure* indicators, namely a global index of capital account restrictions from the IMF Annual Report on Exchange Arrangements and Exchange Restrictions (Prasad et al., 2003; IMF, 2001b and 2002). Imbs (2004b) uses the sum of these indices in two countries as a bilateral *de jure* measure of their financial linkages. Another *de jure* measure of aggregate financial integration is an index of stock market liberalization (Prasad et al (2003)). Among *de facto* measures, there are quantity and price measures, most of which are aggregate and not bilateral. The most comprehensive aggregate quantity measure is the sum of stocks of external assets and liabilities of foreign direct investment and portfolio investment, constructed by Lane and Milesi-Ferretti (2001) from the accumulation of financial flows, with some valuation adjustments. (IMF, 2001b and 2002; Prasad et al., 2003[9] and Heathcote and Perri, 2003[10]). Other aggregate measures are total capital flows as a share of GDP, though they suffer from large volatility (Prasad et al (2003)). Others are proxies of risk sharing obtained regressing GDP on disposable income (Kalemli-Ozcan et

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[6] Data for exports and imports is obtained from the IMF's Direction of Trade Statistics. Data for GDP (at purchasing power parity) is obtained from the IMF's World Economic Outlook database. All data are annual.

[7] Note that if we use $T^{2}_{ESP,i}$ in the regressions, we can drop $GDP_{World,t}$ from the computation of the index, as it will be included into the constant term. All the results presented here are robust to measuring trade linkages in this alternative way.

[8] Edison et al (2002) and Prasad et al (2003) provide surveys of different measures of financial integration.

[9] Prasad et al (2003) also separate financial flows into its main constituents: FDI, bank loans and portfolio flows.

[10] Heathcote and Perri (2003) use, for assets, the sum of FDI plus the equity part of portfolio investment. They also test for separate measures (FDI on one side and equity holdings on the other).

al, 2003).[11] A bilateral quantity measure (i.e., of financial linkages) is the sum of gross asset positions between two countries, but this is only readily available for the US against the rest of the world (Imbs, 2004b). Alternative sources of bilateral data are equity transaction flows (Portes and Rey, 2003) although it is only available for a few countries, and equity holdings from the Coordinated Portfolio Investment Survey conducted by the IMF in 1997 and 2001, which also has geographical limitations, as well as some problems of underreporting (Lane and Milesi-Ferretti, 2004). There are also bilateral price measures, such as differences from covered interest rate parity, but with very limited data availability (Frankel, 1992), and asset price arbitrage based on rolling correlations of stock and bond prices (IMF, 2001a) which, however, suffers from potential reverse causality.

In order to measure financial integration through a bilateral *de facto* measure, we use total bilateral financial flows (portfolio and FDI flows) from the Spanish Balance of Payments. Although data on international financial positions (stocks) would have been a better indicator, it was not available for Spain on a bilateral basis. We measure financial integration by taking the sum of the absolute values of inward and outward financial flows and computing a time average over the period of study, dividing it over the sum of GDPs, to scale their importance relative to the size of economic activity:

$$F^1_{ESP,i} = \frac{1}{T}\sum_t \frac{I_{ESP,i,t} + I_{i,ESP,t}}{GDP_{ESP,t} + GDP_{i,t}}$$

where I_{ijt} represents financial flows from country *i* to country *j* (*ESP* denotes Spain) at time *t*. In our benchmark regressions we will use the sum of FDI and portfolio flows, but we also conduct robustness checks using only FDI flows and using total equity flows. Additional robustness checks are conducted using a level definition of financial linkages, as in previous literature:

$$F^2_{ESP,i} = \frac{1}{T}\sum_t I_{ESP,i,t} + I_{i,ESP,t}$$

The similarity in productive structure can be measured in several alternative ways. All of them are based on data of shares of each productive sector, and differ in the depth of disaggregation of economic activities and whether or not they concentrate on manufactures —at greater disaggregation[12]— or on all sectors —at lower disaggregation[13]—. Let $s_{n,i,t}$ be the share of industry *n* in country *i* at time *t*. Then the first measure of economic similarity can be expressed as

[11] The idea is that with perfect risk sharing, disposable income should be unrelated to GDP, whereas in the absence of risk sharing, they should be closely related. Kalemli-Ozcan et al (2003) also use measures of consumption risk sharing. Imbs (2004b) uses pair wise sums of this estimate of risk sharing as measure of bilateral financial integration

[12] Typically, 2- or 3-digit ISIC classification groups.

[13] Generally, 1-digit ISIC classification groups.

$$S^1{}_{ESP,i} = -\frac{1}{T}\sum_t \sum_{n=1}^{N} \left| s_{n,ESP,t} - s_{n,i,t} \right|$$

where N is the number of sectors. Note that $S^1{}_{ESP,i}$ represents the time average of discrepancies in economic structures, as in Imbs (2004b).[14] $S^1{}_{ESP,i}$ might take values between 0 for identical structures and –2 for disjoint productive structures. Therefore *higher* values for $S^1{}_{ESP,i}$ imply *more* similarity between the structure of Spanish production and that of country *i*. Clark and van Wincoop (2001) use a similar concept but taking time averages of structures before computing distances in shares.[15]

$$S^2{}_{ESP,i} = -\sum_{n=1}^{N} \frac{1}{T} \left| \sum_t s_{n,ESP,t} - \sum_t s_{n,i,t} \right|$$

Industry shares $s_{n,i,t}$ can be measured using a number of different indicators. The three main indicators are shares in total employment, shares of production or shares of value added. All the results presented in the next section use the definition $S^1{}_{ESP,i}$ described above applied to shares of value added, although the results are robust to using other definitions or data on employment or production, as they are highly correlated. We use data for the industrial sector at the two-digit ISIC level from UNIDO.[16]

We also use a number of controls in the regressions as suggested by existing literature. One potential source of business cycle synchronization is the similarity of macroeconomic policies and of exposure to global shocks such as movements in the price of oil. For the former we use a number of proxies: the volatility of the bilateral exchange rate, the average inflation differential and a dummy variable to account for use of the euro as official currency (in effect, a dummy for the use of the same currency). For the latter, we concentrate on oil shocks by introducing an index of similarity of oil dependency. More specifically, we take each country's net oil imports as a percentage of GDP and average that percentage for the period 1990-2002. We then multiply that measure with the equivalent one for Spain, which is positive[17]. In principle, countries that are more dependent of oil should have a high and positive dependency ratio, whereas oil-exporting countries have a highly negative indicator. A

[14] This is similar to Imbs (2004b) but we prefer to use a minus sign in front of the definition of similarity of productive structure so that a higher value of *S* implies higher similarity between the productive structures in both countries. This of course only changes the sign of its associated estimated parameter, but neither its size nor its significance.

[15] In this paper we present the empirical results using the first measure of similarity of productive structure. Both measures outlined here are highly correlated, thus using the second definition does not affect the results significantly.

[16] We could in principle use data at the three-digit ISIC level and increase the disaggregation of activities. However, some countries in the sample do not report data at that level of disaggregation, and therefore we opted for a lower level of disaggregation in order to increase the sample size.

[17] Details of the construction and sources used for this oil dependency index can be found in Appendix B.

high and positive product of both indicators indicates countries that are affected negatively by an oil shock, as Spain.

In the case of trade linkages, a number of studies have suggested that gravity variables play an important role in explaining trade links between two countries. We therefore include (the log of) distance between countries, land areas, and dummy variables to account for access to the sea, a common main language and membership in the European Union.[18]

Recent studies (e.g. Portes and Rey, 2003) have suggested that gravity variables might also explain bilateral financial linkages. Thus, we include (the log of) distance, the time difference between main financial centers, a dummy for common language and the partner's per capita GDPs. This last variable tries to capture the idea that richer countries tend to generate more financial flows (both inward and outward).

Surely the most difficult variable to explain is the similarity of productive structure. Following on Imbs and Wacziarg (2003) we use the pair-wise difference of per capita GDPs, based on the idea that rich countries tend to have a more diversified productive structure, but in a similar way among themselves, whereas poorer countries tend to be more specialized in production.

4 Estimation results

As a preliminary step we show some stylized facts of the main variables of interest in this study: business cycle synchronization, trade and FDI linkages.

The degree of bilateral business cycle synchronization between Spain and EU countries has increased substantially from 1960 to 1995 (figure 1). Since then, it has fallen somewhat and now hovers at 0.6 (in terms of Pearson correlation coefficient of annual growth rates). Bilateral synchronization between Spain and G7 countries also rose fast from 1970 to 1976 but then fell again. Since Spain's entry in EU in 1986, it has risen at a slower pace than synchronization with EU countries. Business cycles in Spain and in Latin American countries move in opposite directions since the late 1980s. All in all, the period of closer synchronization between Spain and other countries was from 1975 to 1985.

Trade linkages between Spain and EU countries started to rise already ten years before Spain's entry into EU but since then the increase has been exponential (Figure 2). Trade linkages with G7 countries began to grow later, in the mid 1980s and at a much lower pace, while trade linkages with Latin American countries haven remained relatively small throughout the period.

[18] Some studies include, instead of common language, a dummy variable capturing past colonial relationship. In the case of Spain both variables coincide.

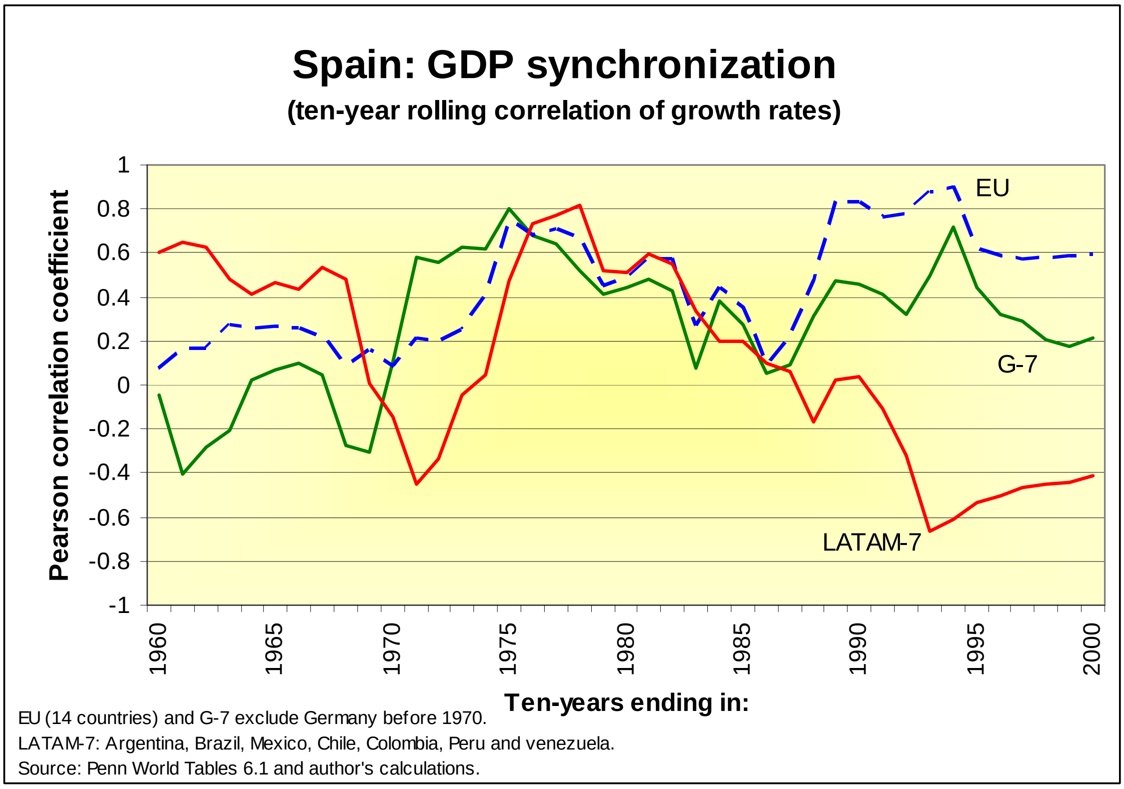

Figure 1: Evolution of GDP synchronization between Spain and selected regions.

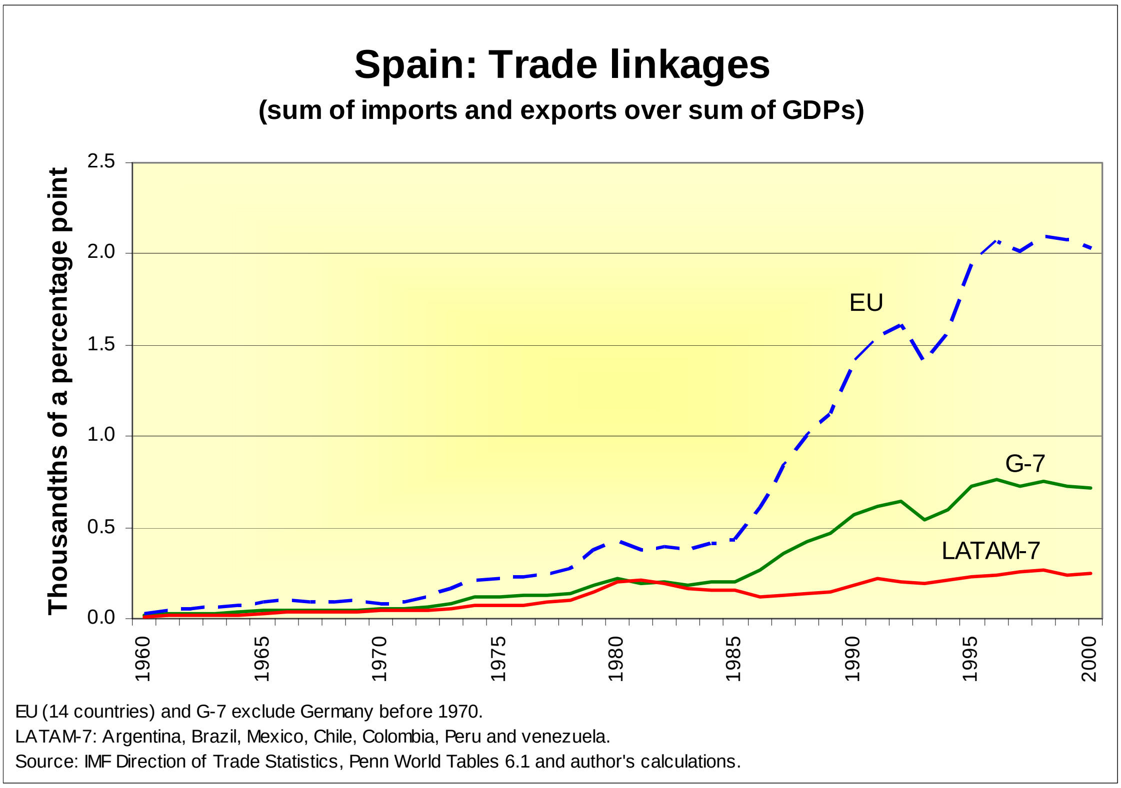

Figure 2: Evolution of trade linkages between Spain and selected regions.

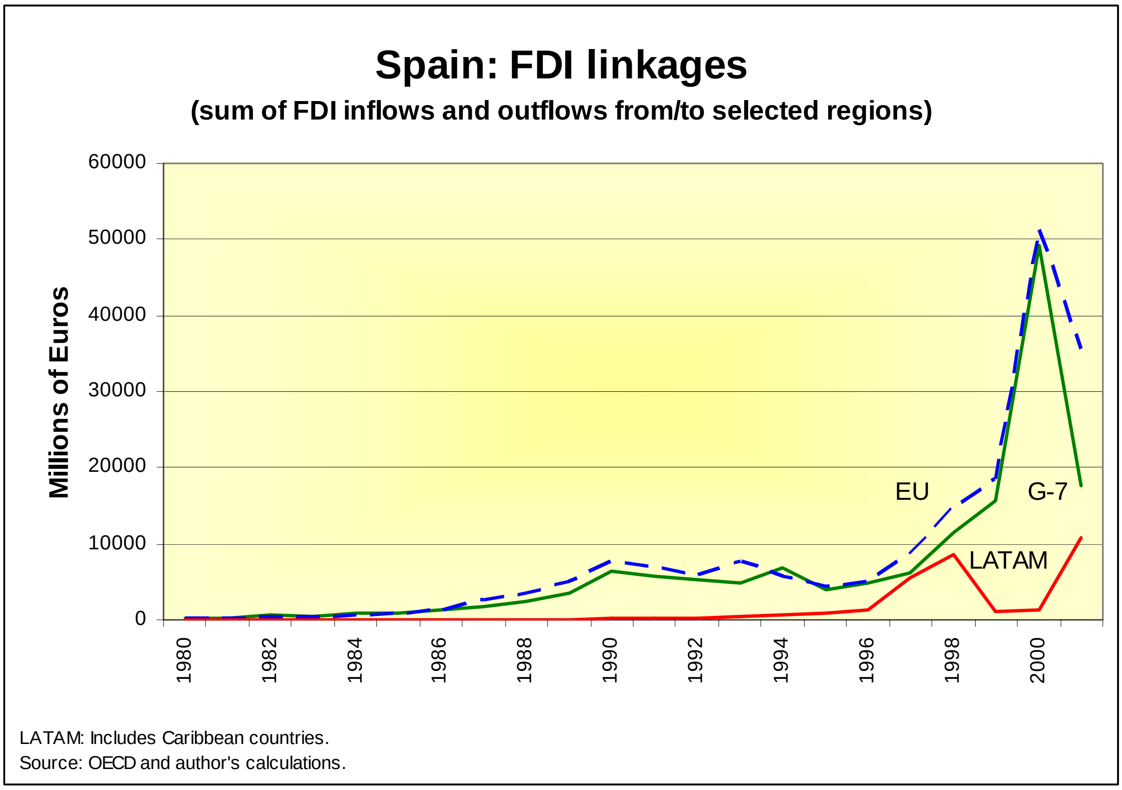

Figure 3: Evolution of FDI linkages between Spain and selected regions.

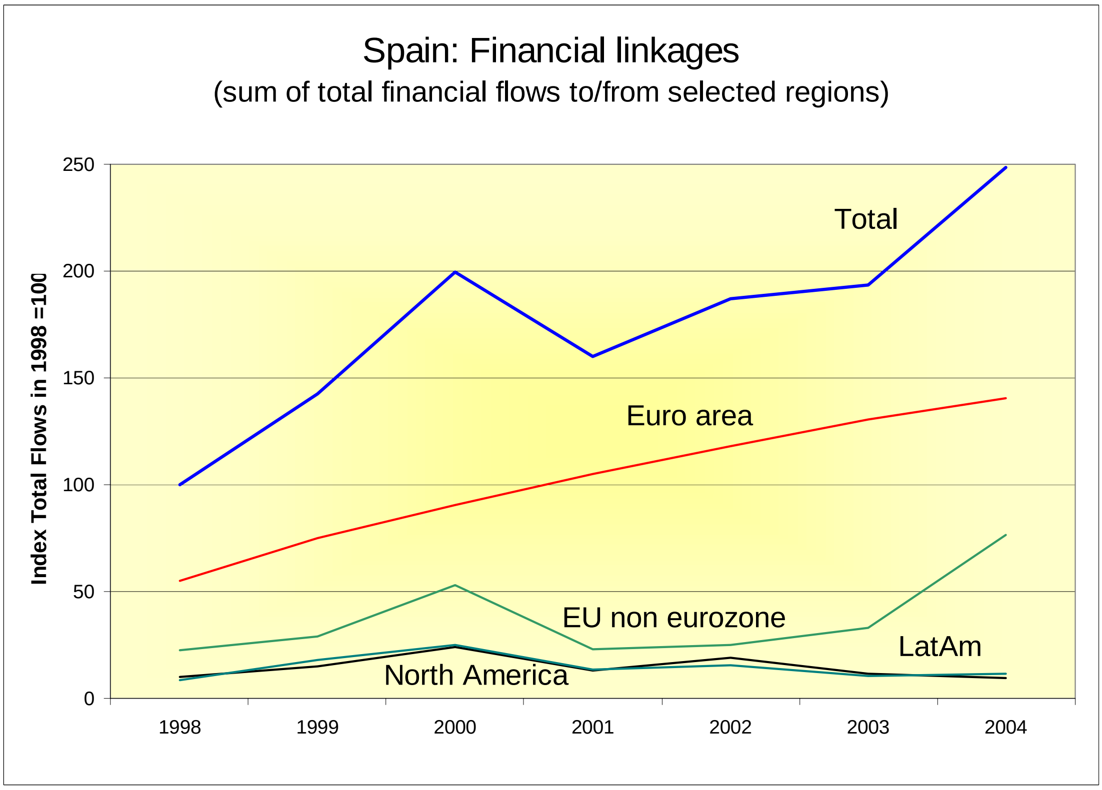

Figure 4: Evolution of total financial linkages between Spain and selected regions.

Before the mid-1908s, Spain's FDI linkages with the rest of the world were basically nonexistent. Since then, FDI with the EU and, to a lesser extent, G7 countries rose substantially (Figure 3). FDI linkages with Latin American countries also rose but at a lower pace. In 2000, there was a sharp fall of FDI linkages with all countries but it has recovered again in the last few years. As for total financial flows, they have risen substantially in the last six years (reliable bilateral data is only available from 1998). The surge concentrates on the euro area and, to a lesser extent, the United Kingdom (figure 4).[19] The importance of Latin America is much less than for FDI flows.

Turning to the estimation of our system of four equations, we first report the results of the estimation of equation 1 in section 3, our equation of interest, using OLS. Table 1 reports parameter estimates for different specifications. A salient feature of these estimations is the negligible role of financial integration or the similarity of productive structure in promoting a closer comovement of output between Spain and other countries. Only trade links seem to promote stronger output synchronization, and even that effect disappears once we control for membership of the euro area, which in turn might be increasing trade and financial flows.

There are good reasons to suspect endogeneity problems and thus biased estimates in table 1. Thus, we complement the estimation of equation 1 –the equation of interest to us– with the use of suitable instruments for the other three endogenous variables (trade and financial linkages –*T* and *F*– and the similarity of economic structure *S*).[20] Table 2 presents instrumental variable (IV) estimates for the same specifications as table 1, and a quick comparison hints that the endogeneity of regressors is indeed a severe problem. First, coefficient estimates differ significantly from those in table 1. In particular, financial integration and the similarity of productive structure are now statistically significant to explain output comovement, and the similarity of macro policies, as captured by inflation differentials also seem to play a role. Exchange rate differentials do not seem to play a role, but membership in the euro area is already used as instrument for trade and financial links. Second, the Anderson-Rubin test of significance of endogenous regressors also point to the importance of *T*, *F* and *S* as explanatory variables.

Estimation of equation 1 by instrumental variables, however, still pools together the direct and indirect effects of trade and financial linkages over business cycle synchronization, for example through their effect over the convergence of productive structures between Spain and the other countries in the sample. If indirect effects through different channels go in opposite directions, the net effect might become small, contributing to its statistical insignificance. We thus go a step further than the IV estimation in table 2 and try to disentangle the direct and indirect effects of trade and financial

[19] The United Kingdom accounts for almost 95 percent of total financial flows to EU countries outside the euro area.
[20] Instruments used in the IV estimation are the same as those used for three stage least squares, described next.

linkages on business cycle synchronization, as described in the previous section. Thus, we conduct a three-stage least-squares regression (3SLS) on the complete system of four equations.

The estimated parameters of equation 1 using 3SLS on the system of four equations (table 3) differ significantly (see e.g. estimation 7 in table 2, which is comparable), although signs are unchanged. Both trade links and the similarity of productive structures directly foster business cycle synchronization, possibly through external demand channels in the first case, and through similar exposure to external shocks (even is they are predominantly sector-specific) in the second. The negative influence of financial links on business cycle synchronization might reflect that an easier transfer of resources across countries allows a decoupling of business cycles, as highlighted by Heathcote and Perri (2003).

As for the control variables, our measure of similar fuel dependency is not statistically significant in explaining output correlations in this exercise, which might point to oil shocks not being an important factor driving global economic fluctuations in the period of study (1990-2003), as they probably were in the 70s or, to a lesser extent, in the 80s. The same is true for the inflation differential and the exchange volatility. However, being member of the euro area does seem to foster business cycle synchronization.

Table 3 also shows, in its second column, that trade linkages (Eq 2) do not seem to be significantly affected by financial linkages (i.e. we cannot reject that β_2=0), beyond what is predicted by standard gravity variables. These gravity variables, related to the cost of bilateral trade (e.g. distance, access to the seacoast and land area), are statistically significant and have the expected signs.

Financial linkages, estimated in column 3 of table 3, seem to be determined also by gravity variables, such as distance, a common language and a common currency –with the expected sign– in line with Portes and Rey (2003). Beyond these effects and those captured by the partner's GDP per capita (which significantly promotes financial links) trade linkages do not seem to be statistically significant in promoting financial linkages, as opposed to Aizenman and Noy (2004). Finally, a stronger correlation of business cycles is associated with lower financial flows as percentage of GDP. This might show that the risk-hedging opportunities are reduced as economies become more synchronized.

Finally, the last column in table 3 tries to identify the determinants of the similarity in productive structure (Eq. 4). As in Imbs and Wacziarg (2003) the absolute difference in percapita GDPs is a good explanatory variable, together with financial flows.

Beyond the direct effects on GDP correlation of our main variables of interest (equation 1), there are also possible indirect effects of trade and financial linkages on business cycle synchronization, both through their influence on each other and though their effect on the similarity of productive structures.

As described before, in table 3, our benchmark regression, we find no statistically significant effect from (to) trade links to (from) financial links, and only a significantly positive effect of financial links on the similarity of productive structure, which might point to the importance of FDI flows and its influence on production in the recipient country.

Considering all –direct and indirect– effects of financial links on business cycle synchronization, the net impact is negative, as summarized by $\alpha_3 + \alpha_2 \gamma_2 + \alpha_1 \beta_2 = -0.0083$[21]. As expected by the non-significance of the indirect effects of trade, including them does not significantly change the estimate of its total effect on business cycle synchronization, given by $\alpha_1 + \alpha_2 \gamma_1 + \alpha_3 \delta_2 = 0.113$.[22]

The positive influence of a similar economic structure and trade links on business cycle synchronization is in line with Imbs (2004b), though the effect of financial linkages is negative in our case and positive in his. This difference might be related both to the fact that we use a small open economy as a benchmark, a wider set of partner countries (including more emerging countries than in his sample), and bilateral financial links, instead of a broad proxy derived from aggregate financial integration in both partners as in his case. Another reason, as regard financial linkages, might be that our data includes FDI and portfolio flows which are only a part of all possible financial linkages, albeit possibly the most important ones that might influence the synchronization of economic activity.

There are few other findings worth highlighting from the system of equations we estimate. First, we do find a reverse causality from business cycle synchronization to financial linkages (i.e. δ_1 is significantly different from zero), as argued by Heathcote and Perri (2003). Second, the estimation does not find a double causality between trade and financial linkages (i.e. δ_1 and β_2 are not statistically significant from zero).

Figure 5 summarizes the statistically significant relations out of our four-equation system. They are all positive except for the direct impact of financial integration on output co-movement.

[21] Using the delta method, a test of significance of this estimate gives a t-statistic of –2.72, with a p-value of 0.007.

[22] Again using the delta method, this estimate has a t-statistic of 2.11, with a p-value of 0.036.

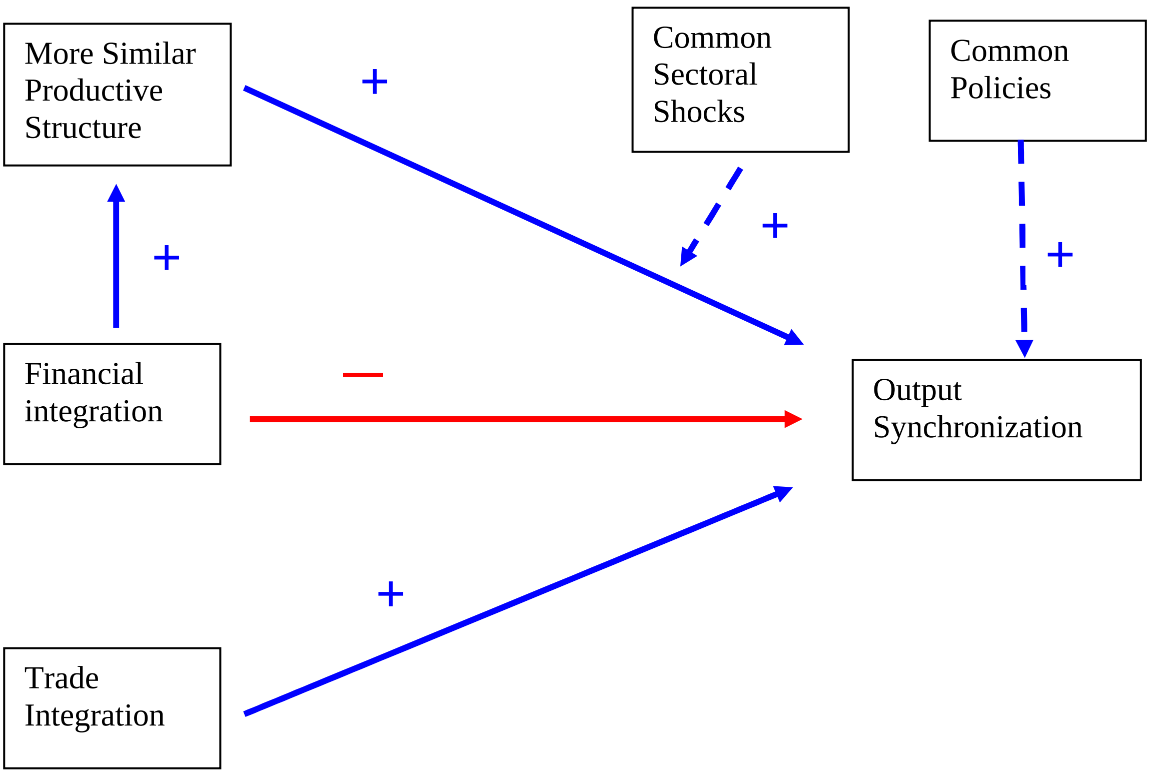

Figure 5: Statistically significant channels leading to business cycle synchronization found in the empirical exercise, and their associated signs.

Another important question concerns the economic relevance of the statistically significant effects found in the previous exercise. As described before, the total effect of trade and that of financial links on the synchronization of business cycles is given through their direct and indirect effects. Specifically, for our benchmark 3SLS regression in table 3, the effect of trade links on our measure of comovement of output is $\alpha_1 + \alpha_2\,\gamma_1 + \alpha_3\,\delta_2 = 0.113$ whereas the effect of financial links is $\alpha_3 + \alpha_2\,\gamma_2 + \alpha_1\,\beta_2 = -0.0083$. In order to gauge whether this effect on output synchronization is big or small, we can check the effect of increasing trade or financial links by one standard deviation, as described in table 11. Increasing trade links by one standard deviation starting from its mean raises bilateral cross-country correlation of GDP from 0.160 to 0.311. In turn, increasing financial links by one standard deviation lowers the correlation of output from 0.160 to 0.005. In both cases, this represents moving the correlation of output by around 40% of one standard deviation, an economically significant effect (table 10).

We conduct a number of additional tests to confirm the robustness of our results. Since the most interesting result probably is the negative impact of financial linkages on output co-movement, we explore alternative measures of financial links. First, we include total financial flows in levels (instead of measured as percentage of GDP, as described earlier), an indicator also used in the literature. The results of this regression are shown in table 4, where we can see that parameter estimates do not differ

strongly from previous estimates, and the total effects from trade or financial links to business cycle synchronization are very similar in magnitude.

We turn next to decompose total financial flows in two groups. First, we take all flows related to investment in productive capacity abroad, which might influence GDP and/or trade more directly than fixed-income instruments like bond purchases. In particular, in table 5 we describe the results of the 3SLS estimation taking as financial links the aggregate of equity purchases and FDI flows over GDP. As expected, this narrower definition of financial integration now significantly influences trade links, although in table 6, where we use just FDI flows, the effect is wiped out. In both cases, however, the total effects over the synchronization of business cycles are not very different from those obtained from table 2. More specifically, according to regression results in tables 5 and 6, an increase of trade links by one standard deviation from its mean would increase output correlation from 0.16 to 0.29 and 0.31, respectively. Equivalently, an increase in financial links by one standard deviation would reduce output correlation from 0.16 to 0.03 and 0.01, respectively. That is, when we use total equity flows as measure of financial integration, an increase of trade links or reduction of financial links by one standard deviation results approximately in an increase in output correlation equivalent to around one third of its standard deviation. When we use only FDI flows this ratio increases to around 40%, the same effect as in the benchmark regression (Table 10).

The other dimension in which we check for the robustness of our results is the normalization of trade and financial links as proportion of GDP. Since we are interested in measuring the effect of trade and financial links on the synchronization of output, it is perhaps more relevant to normalize the size of those links by the smaller of the two GDPs in the country pair under scrutiny. The idea is that, for the same size of trade flows, two countries might be more synchronized the more unequal they are in size, since then the bigger country can "pull" the other more strongly through external demand or financial links. Thus, we conduct the same estimations displayed in tables 3, 5 and 6 but with trade and financial links defined as percentage of the minimum of the two GDPs involved. The corresponding estimation results are presented in tables 7, 8 and 9. For the most part, the qualitative results are unchanged, except that now we do observe a bidirectional effect between trade and financial linkages mentioned in the literature (i.e. δ_1 and β_2 are statistically significant from zero). Both the signs and statistical significance of the effect of trade and financial links on output correlation are unchanged from the previous exercise, and the magnitude increases up to 60% of a standard deviation of GDP correlation, as summarized by table 10.

5 Conclusions

This paper assesses the role of trade and financial linkages in the output co-movement between two countries, while considering a large number of interrelations between relevant variables through a

system of equations. This allows us to identify direct and indirect effects of trade and financial linkages on output co-movements. While there are number of possible endogeneity problems associated with trade and financial linkages as explanatory variables for output synchronization, in theory one could eliminate those biases by using suitable and readily available instruments. However, the reduced form IV estimates might appear small or not significant because, in theory, direct and indirect effects might run in opposite directions, partially offsetting each other. When we conduct the estimation of a system of equations in order to separate direct and indirect effects of trade and financial linkages on output synchronization, we actually find conflicting direct and indirect effects of financial links, though, in the end, they do not reverse the sign of the negative direct effect on synchronization.

In line with Imbs (2004b) we find that, both the similarity of productive structure and trade links promote the synchronization of cycles. However, the main contribution of the paper is the use of bilateral financial flows to measure bilateral financial integration in a small, open economy. When we do this, we find that, contrary to Imbs (2004b) —which uses global financial flows—, bilateral financial links are inversely related to the comovement of output, which might point to financial integration allowing an easier transfer of resources between two economies, which could enable their decoupling. This is in line with results by Heathcote and Perry (2003), that point to financial integration fostering financial flows, and thus dampening GDP correlations as domestic investors seek out to diversify to less correlated economies abroad.

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Appendix A: Tables

Table 1

OLS regressions
Dependent variable: GDP correlation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Trade Integration (T)	0.090***	0.096**	0.093**	0.083**	0.015	0.026	0.027	0.019
	(0.033)	(0.037)	(0.037)	(0.034)	(0.034)	(0.037)	(0.038)	(0.033)
Financial Integration : all flows (F)		-0.001	-0.002			-0.002	-0.002	
		(0.002)	(0.002)			(0.002)	(0.002)	
Similarity of Prod. Structure (S)			0.105	0.058			0.035	-0.013
			(0.094)	(0.074)			(0.080)	(0.067)
Member of Euro Area					0.579***	0.603***	0.594***	0.575***
					(0.084)	(0.088)	(0.093)	(0.089)
Inflation differential					-0.063*	-0.059*	-0.061*	-0.064**
					(0.032)	(0.033)	(0.034)	(0.031)
Exchange Rate Volatility					0.018	0.016	0.019	0.022
					(0.052)	(0.052)	(0.053)	(0.050)
Similar Fuel Dependency					-0.001	-0.001	-0.001	
					(0.002)	(0.002)	(0.002)	
Constant	1.364***	1.429***	1.315***	1.238***	0.448	0.568	0.554	0.528
	(0.444)	(0.477)	(0.478)	(0.460)	(0.488)	(0.517)	(0.521)	(0.469)
Observations	109	109	109	109	109	109	109	109
R-squared	0.10	0.10	0.11	0.10	0.34	0.35	0.35	0.34

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
All variables measured in logs except dummy variables.

Table 2

IV regressions
Dependent variable: GDP correlation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Trade Integration (T)	0.127***	0.172***	0.180***	0.116***	0.108***	0.150***	0.169***	0.100**
	(0.034)	(0.044)	(0.047)	(0.040)	(0.036)	(0.046)	(0.049)	(0.042)
Financial Integration : all flows (F)		-0.004*	-0.011***			-0.004	-0.010***	
		(0.002)	(0.003)			(0.002)	(0.003)	
Similarity of Prod. Structure (S)			0.345**	0.064			0.315**	0.050
			(0.139)	(0.095)			(0.131)	(0.089)
Inflation differential					-0.074**	-0.069**	-0.081	-0.077**
					(0.032)	(0.035)	(0.049)	(0.034)
Exchange Rate Volatility					0.001	0.000	0.032	0.006
					(0.053)	(0.055)	(0.064)	(0.052)
Similar Fuel Dependency					0.000	0.001	0.002	0.000
					(0.002)	(0.002)	(0.002)	(0.002)
Constant	1.862***	2.406***	2.220***	1.669***	1.753***	2.257***	2.312***	1.626***
	(0.458)	(0.563)	(0.621)	(0.563)	(0.518)	(0.637)	(0.656)	(0.618)
Observations	109	109	109	109	109	109	109	109
R-squared	0.08	0.04	-0.05	0.09	0.18	0.14	0.05	0.19
Anderson (1984) LR-test of identification	108.85	62.46	45.76	80.52	106.78	62.05	41.61	88.23
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cragg-Donald Chi-sq test of identification	186.88	84.33	56.87	119.16	181.33	83.59	50.67	135.89
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Anderson-Rubin test of significance of endog. Regressors	436.13	436.13	436.13	436.13	206.64	206.64	206.64	206.64
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
All variables measured in logs except dummy variables.

Table 3

Three-stage least squares regression: system of four equations (1)-(4)
(Financial Linkages: total flows over GDP)

Equation Number Dependent variable	(1) Output Correlation (ρ)	(2) Trade Linkages (T)	(3) Financial Linkages (F)	(4) Similarity of Prod. Struct. (S)
GDP correlation (ρ)			-23.707* (12.939)	
Trade Integration (T)	0.110** (0.049)		-0.698 (2.916)	-0.023 (0.046)
Financial Integration:all flows (F)	-0.012*** (0.004)	0.017 (0.017)		0.011*** (0.004)
Similarity of Prod. Structure (S)	0.203* (0.123)	0.043 (0.582)		
Member of Euro Area	0.561*** (0.137)	0.190 (0.549)	17.934** (8.632)	
Inflation differential	-0.040 (0.035)			
Exchange Rate Volatility	0.003 (0.053)			
Similar Fuel Dependency	-0.000 (0.002)			
Distance		-0.856*** (0.155)	-10.080*** (3.747)	
EU-15		0.504 (0.527)		
Common Language		0.742 (0.526)	20.312*** (5.448)	
Access to sea		0.792*** (0.214)		
Partner's Land area		-0.103** (0.044)		
Absolute difference of GDP per capita				-0.213*** (0.051)
Absolute time difference			0.304 (0.229)	
Partner's GDP Per Cápita			8.799*** (1.556)	
Constant	1.337** (0.649)	-5.524*** (1.187)	-16.876 (36.245)	0.730 (0.576)
Observations	109	109	109	109
R-squared	0.20	0.59	0.44	0.45

Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
All variables measured in logs except dummy variables.

Table 4

Three-stage least squares regression: system of four equations (1)-(4) (Financial Linkages: flows in levels)

Equation Number Dependent variable	(1) Output Correlation (ρ)	(2) Trade Linkages (T)	(3) Financial Linkages (F)	(4) Similarity of Prod. Struct. (S)
GDP correlation (ρ)			-7.620 (11.850)	
Trade Integration (T)	0.095** (0.046)		-1.328 (2.553)	-0.086** (0.044)
Financial Integration : all flows (F)	-0.011*** (0.003)	0.035** (0.015)		0.017*** (0.003)
Similarity of Prod. Structure (S)	0.335*** (0.124)	-1.121** (0.524)		
Member of Euro Area	0.539*** (0.136)	0.073 (0.551)	6.889 (7.873)	
Inflation differential	-0.066* (0.037)			
Exchange Rate Volatility	0.035 (0.057)			
Similar Fuel Dependency	-0.001 (0.002)			
Distance		-0.793*** (0.154)	-10.665*** (3.333)	
EU-15		0.604 (0.517)		
Common Language		0.433 (0.484)	21.629*** (4.954)	
Access to sea		0.804*** (0.210)		
Common Border		0.394 (0.659)		
Partner's Land area		-0.082* (0.042)		
Absolute difference of GDP per capita				-0.126** (0.050)
Absolute time difference			0.125 (0.215)	
Partner's GDP			5.121*** (0.688)	
Partner's GDP Per Cápita			6.776*** (1.553)	
Constant	1.213* (0.619)	-5.382*** (1.184)	-93.813*** (33.553)	-0.173 (0.553)
Observations	109	109	109	109
R-squared	0.18	0.47	0.67	0.37

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

All variables measured in logs except dummy variables.

Table 5

Three-stage least squares regression: system of four equations (1)-(4)
(Financial Linkages: Equity flows [stocks + FDI] over partner's GDP)

Equation Number Dependent variable	(1) Output Correlation (ρ)	(2) Trade Linkages (T)	(3) Financial Linkages (F)	(4) Similarity of Prod. Struct. (S)
GDP correlation (ρ)			-10.026 (12.648)	
Trade Integration (T)	0.101** (0.049)		0.348 (2.844)	-0.016 (0.045)
Financial Integration:Equity+FDI (F)	-0.011*** (0.004)	0.029* (0.017)		0.009*** (0.003)
Similarity of Prod. Structure (S)	0.188 (0.121)	-0.316 (0.555)		
Member of Euro Area	0.558*** (0.136)	0.116 (0.555)	10.124 (8.386)	
Inflation differential	-0.049 (0.036)			
Exchange Rate Volatility	0.012 (0.056)			
Similar Fuel Dependency	-0.001 (0.002)			
Distance		-0.818*** (0.152)	-7.069* (3.676)	
EU-15		0.504 (0.536)		
Common Language		0.411 (0.517)	23.041*** (5.347)	
Access to sea		0.798*** (0.215)		
Partner's Land area		-0.087** (0.044)		
Absolute difference of GDP per capita				-0.225*** (0.049)
Absolute time difference			0.251 (0.230)	
Partner's GDP Per Cápita			8.501*** (1.522)	
Constant	1.266* (0.654)	-5.542*** (1.197)	-28.193 (35.541)	0.820 (0.568)
Observations	109	109	109	109
R-squared	0.24	0.57	0.54	0.46

Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
All variables measured in logs except dummy variables.

Table 6

Three-stage least squares regression: system of four equations (1)-(4)
(Financial Linkages: FDI flows over partner's GDP)

Equation Number Dependent variable	(1) Output Correlation (ρ)	(2) Trade Linkages (T)	(3) Financial Linkages (F)	(4) Similarity of Prod. Struct. (S)
GDP correlation (ρ)			-23.313* (12.722)	
Trade Integration (T)	0.109** (0.049)		-0.763 (2.870)	-0.019 (0.046)
Financial Integration:FDI (F)	-0.012*** (0.004)	0.017 (0.018)		0.010*** (0.004)
Similarity of Prod. Structure (S)	0.191 (0.121)	0.054 (0.584)		
Member of Euro Area	0.555*** (0.137)	0.192 (0.549)	17.025** (8.488)	
Inflation differential	-0.039 (0.035)			
Exchange Rate Volatility	0.002 (0.053)			
Similar Fuel Dependency	-0.000 (0.002)			
Distance		-0.856*** (0.157)	-10.070*** (3.685)	
EU-15		0.515 (0.525)		
Common Language		0.733 (0.538)	20.682*** (5.363)	
Access to sea		0.793*** (0.214)		
Partner's Land area		-0.103** (0.044)		
Absolute difference of GDP per capita				-0.218*** (0.050)
Absolute time difference			0.304 (0.225)	
Partner's GDP Per Cápita			8.594*** (1.531)	
Constant	1.322** (0.647)	-5.527*** (1.186)	-16.494 (35.665)	0.793 (0.573)
Observations	109	109	109	109
R-squared	0.21	0.59	0.44	0.45

Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
All variables measured in logs except dummy variables.

Table 7

Three-stage least squares regression: system of four equations (1)-(4)
(Financial Linkages: Total flows over minimum of Spain's and partner's GDP)

Equation Number Dependent variable	(1) Output Correlation (ρ)	(2) Trade Linkages (T)	(3) Financial Linkages (F)	(4) Similarity of Prod. Struct. (S)
GDP correlation (ρ)			-8.737	
			(11.957)	
Trade Integration: trade over min(GDP_i, GDP_{Spain}) (T)	0.131**		6.565***	0.021
	(0.055)		(2.520)	(0.049)
Financial Integration: all flows over min(GDP_i, GDP_{Spain}) (F)	-0.013***	0.057***		0.008**
	(0.004)	(0.017)		(0.004)
Similarity of Prod. Structure (S)	0.134	-0.828		
	(0.122)	(0.582)		
Member of Euro Area	0.538***	0.138	5.184	
	(0.138)	(0.550)	(8.038)	
Inflation differential	-0.039			
	(0.036)			
Exchange Rate Volatility	-0.001			
	(0.054)			
Similar Fuel Dependency	-0.001			
	(0.002)			
Distance		-0.622***	-1.406	
		(0.159)	(3.218)	
EU-15		0.433		
		(0.513)		
Common Language		-0.471	17.309***	
		(0.518)	(4.817)	
Access to sea		0.678***		
		(0.220)		
Partner's Land area		0.012		
		(0.043)		
Absolute difference of GDP per capita				-0.210***
				(0.050)
Constant	1.636**	-7.299***	27.278	1.267**
	(0.709)	(1.219)	(34.514)	(0.609)
Absolute time difference			0.174	
			(0.204)	
Partner's GDP Per Cápita			6.286***	
			(1.540)	
Observations	109	109	109	109
R-squared	0.18	0.45	0.49	0.45

Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
All variables measured in logs except dummy variables.

Table 8

Three-stage least squares regression: system of four equations (1)-(4)
(Financial Linkages: Equity flows [stocks + FDI] over minimum of Spain's and partner's GDP)

Equation Number Dependent variable	(1) Output Correlation (ρ)	(2) Trade Linkages (T)	(3) Financial Linkages (F)	(4) Similarity of Prod. Struct. (S)
GDP correlation (ρ)			1.288 (11.746)	
Trade Integration: trade over min(GDP_i, GDP_{Spain}) (T)	0.112** (0.055)		6.836*** (2.513)	0.032 (0.049)
Financial Integration: Equity + FDI flows over min(GDP_i, GDP_{Spain}) (F)	-0.011*** (0.004)	0.065*** (0.016)		0.007* (0.004)
Similarity of Prod. Structure (S)	0.130 (0.121)	-0.961* (0.549)		
Member of Euro Area	0.545*** (0.137)	0.176 (0.537)	-0.028 (7.872)	
Inflation differential	-0.048 (0.037)			
Exchange Rate Volatility	0.009 (0.056)			
Similar Fuel Dependency	-0.001 (0.002)			
Distance		-0.622*** (0.156)	0.458 (3.161)	
EU-15		0.284 (0.490)		
Common Language		-0.700 (0.500)	20.215*** (4.820)	
Access to sea		0.666*** (0.221)		
Partner's Land area		0.016 (0.042)		
Absolute difference of GDP per capita				-0.221*** (0.049)
Absolute time difference			0.114 (0.197)	
Partner's GDP Per Cßpita			6.055*** (1.553)	
Constant	1.428** (0.715)	-7.054*** (1.226)	14.916 (34.673)	1.416** (0.601)
Observations	109	109	109	109
R-squared	0.24	0.42	0.50	0.45

Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
All variables measured in logs except dummy variables.

Table 9

Three-stage least squares regression: system of four equations (1)-(4)
(Financial Linkages: FDI flows over minimum of Spain's and partner's GDP)

Equation Number Dependent variable	(1) Output Correlation (ρ)	(2) Trade Linkages (T)	(3) Financial Linkages (F)	(4) Similarity of Prod. Struct. (S)
GDP correlation (ρ)			-8.582	
			(11.727)	
Trade Integration: trade over min(GDP_i, GDP_{Spain}) (T)	0.130**		6.337**	0.026
	(0.055)		(2.473)	(0.049)
Financial Integration: FDI flows over min(GDP_i, GDP_{Spain}) (F)	-0.012***	0.058***		0.008**
	(0.004)	(0.017)		(0.004)
Similarity of Prod. Structure (S)	0.123	-0.820		
	(0.121)	(0.587)		
Member of Euro Area	0.531***	0.160	4.517	
	(0.138)	(0.552)	(7.884)	
Inflation differential	-0.038			
	(0.036)			
Exchange Rate Volatility	-0.002			
	(0.054)			
Similar Fuel Dependency	-0.001			
	(0.002)			
Distance		-0.617***	-1.571	
		(0.161)	(3.157)	
EU-15		0.449		
		(0.515)		
Common Language		-0.512	17.759***	
		(0.532)	(4.727)	
Access to sea		0.686***		
		(0.221)		
Partner's Land area		0.011		
		(0.043)		
Absolute difference of GDP per capita				-0.214***
				(0.050)
Absolute time difference			0.175	
			(0.200)	
Partner's GDP Per Cßpita			6.146***	
			(1.513)	
Constant	1.619**	-7.305***	26.425	1.342**
	(0.706)	(1.223)	(33.869)	(0.603)
Observations	109	109	109	109
R-squared	0.19	0.45	0.49	0.45

Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
All variables measured in logs except dummy variables.

Table 10

Effect on GDP correlation from increase by 1 standard deviation in trade or financial links

Specification as in:	**Table 3**	**Table 5**	**Table 6**	**Table 7**	**Table 8**	**Table 9**
Absolute variation of GDP correlation						
Trade Integration (T)	0.1509	0.1254	0.1527	0.1750	0.1496	0.1737
Financial Integration (F)	-0.1550	-0.1222	-0.1538	-0.2439	-0.2037	-0.2207
Percentage of standard deviation of GDP correlation						
Trade Integration (T)	39.3%	32.7%	39.7%	45.6%	38.9%	45.2%
Financial Integration (F)	-40.4%	-31.8%	-40.0%	-63.5%	-53.0%	-57.5%

Memo:

Mean GDP correlation in sample:	0.160
Standard deviation of GDP correlation:	0.384

Table 11

Summary Statistics

Variable	No. Observ.	Mean	Std. Dev.	Min	Max	Coeff. of Variation	Percentiles 5%	Percentiles 50%	Percentiles 95%
Output correlation with Spain, 1990-2004 (ρ)	109	0.160	0.384	-0.846	0.898	2.401	-0.528	0.173	0.838
Trade Linkages over partner's GDP 1997-2003[1] (T)	109	-13.379	1.336	-17.188	-10.143	-0.100	-15.711	-13.256	-11.584
Trade Linkages over min(GDP_i, GDP_{Spain}) 1997-2003[1] (T)	109	-13.274	1.355	-17.188	-10.143	-0.102	-15.665	-13.184	-11.184
Total Financial Linkages over partner's GDP 1998-2003[2] (F)	109	-16.350	18.676	-36.841	6.554	-1.142	-36.841	-2.503	3.242
Total Financial Linkages over min(GDP_i, GDP_{Spain}) 1998-2003[2] (F)	109	-16.255	18.760	-36.841	6.554	-1.154	-36.841	-2.362	3.650
Equity Financial Linkages over partner's GDP 1998-2003[2] (F)	109	-16.894	18.515	-36.841	6.139	-1.096	-36.841	-2.846	2.759
Equity Financial Linkages over min(GDP_i, GDP_{Spain}) 1998-2003[2] (F)	109	-16.894	18.515	-36.841	6.139	-1.096	-36.841	-2.846	2.759
FDI Financial Linkages over partner's GDP 1998-2003[2] (F)	109	-16.751	18.312	-36.841	5.635	-1.093	-36.841	-3.136	2.536
FDI Financial Linkages over min(GDP_i, GDP_{Spain}) 1998-2003[2] (F)	109	-16.655	18.394	-36.841	5.635	-1.104	-36.841	-3.136	2.536
Similarity in Productive Structure 1980-2000[3] (S)	109	0.594	0.489	-0.281	1.666	0.824	-0.158	0.497	1.401
Member of Euro Area (1=yes)	109	0.101	0.303	0.000	1.000	2.999	0.000	0.000	1.000
Member of the EU	109	0.128	0.336	0.000	1.000	2.617	0.000	0.000	1.000
Average Inflation differencial 1990-2003	109	1.994	1.530	-0.630	7.298	0.767	0.446	1.713	5.053
Exchange rate volatility 1990-2003[4]	109	-1.415	0.998	-3.302	1.668	-0.706	-2.697	-1.612	0.779
Similar fuel dependency 1990-2002	109	-0.621	14.837	-73.975	13.445	-23.884	-28.360	3.481	11.020
Distance to main city (km)	109	8.424	0.785	6.217	9.883	0.093	7.140	8.672	9.365
Spanish spoken (1=yes)	109	0.156	0.364	0	1	2.337	0	0	1
Access to seacoast (1=yes)	109	0.807	0.396	0	1	0.491	0	1	1
Sharing a land border	109	0.018	0.135	0	1	7.348	0	0	0
Partner's Land area	109	12.032	2.154	5.756	16.653	0.179	7.621	12.378	15.855
Absolute time difference to main financial centre	109	-2.786	6.557	-13.816	2.398	-2.354	-13.816	0.000	2.079
Average GDP 1990-2003	109	17.877	1.928	13.594	22.877	0.108	15.206	17.622	20.978
Average per capita GDP 1990-2003	109	8.610	1.104	6.133	10.615	0.128	6.729	8.642	10.149
Absolute difference of percapita GDPs 1990-2003	109	1.271	0.946	0.043	3.616	0.745	0.150	1.106	3.019

[1] Average over the period of the sum of bilateral exports plus imports over the sum of GDPs
[2] Average over the period of total bilateral inflows and outflows to and from Spain
[3] Computed from value added from the industrial sector only. Higher values imply more similarity.
[4] Coefficient of variation of the bilateral exchange rate with Spain (monthly average).

Table 12

Table of Cross Correlations

(Based on common 109 observations. Star: correlations significantly different from zero at 95% confidence level)

	Output correlation with Spain, 1990-2004 (r)	Trade Linkages over partner's GDP 1997-20031 (T)	Trade Linkages over min(GDPi, GDP Spain) 1997-20031 (T)	Total Financial Linkages over partner's GDP 1998-20032 (F)	Total Financial Linkages over min(GDPi, GDP Spain) 1998-20032	Equity Financial Linkages over partner's GDP 1998-20032 (F)	Equity Financial Linkages over min(GDPi, GDP Spain) 1998-2003:	FDI Financial Linkages over partner's GDP 1998-20032 (F)	FDI Financial Linkages over min(GDPi, GDP Spain) 1998-20032 (	Similarity in Productive Structure 1980-20003 (S)	Member of Euro Area (1=yes)	Member of the EU	Average Inflation differencial 1990-2003	Exchange rate volatility 1990-20034	Similar fuel dependency 1990-2002	Distance to main city (km)	Spanish spoken (1=yes)	Access to seacoast (1=yes)	Sharing a land border	Partner's Land area	Absolute time difference to main financial centre	Average GDP 1990-2003	Average per capita GDP 1990-2003	Absolute difference of percapita GDPs 1990-2003
Output correlation with Spain, 1990-2004 (ρ)	1.0000																							
Trade Linkages over partner's GDP 1997-2003[1] (T)	0.3130*	1.0000																						
Trade Linkages over min(GDP_i, GDP_{Spain}) 1997-2003[1] (T)	0.3065*	0.9615*	1.0000																					
Total Financial Linkages over partner's GDP 1998-2003[2] (F)	0.1094	0.4711*	0.5299*	1.0000																				
Total Financial Linkages over min(GDP_i, GDP_{Spain}) 1998-2003[2] (F)	0.1088	0.4674*	0.5312*	0.9998*	1.0000																			
Equity Financial Linkages over partner's GDP 1998-2003[2] (F)	0.1026	0.4692*	0.5288*	0.9833*	0.9832*	1.0000																		
Equity Financial Linkages over min(GDP_i, GDP_{Spain}) 1998-2003[2] (F)	0.1026	0.4692*	0.5288*	0.9833*	0.9832*	1.0000*	1.0000																	
FDI Financial Linkages over partner's GDP 1998-2003[2] (F)	0.0990	0.4676*	0.5245*	0.9997*	0.9994*	0.9832*	0.9832*	1.0000																
FDI Financial Linkages over min(GDP_i, GDP_{Spain}) 1998-2003[2] (F)	0.0984	0.4639*	0.5260*	0.9996*	0.9997*	0.9833*	0.9833*	0.9998*	1.0000															
Similarity in Productive Structure 1980-2000[3] (S)	0.1675	0.3243*	0.3992*	0.5765*	0.5792*	0.5823*	0.5823*	0.5714*	0.5742*	1.0000														
Member of Euro Area (1=yes)	0.5396*	0.4803*	0.4977*	0.3491*	0.3493*	0.3462*	0.3462*	0.3379*	0.3382*	0.3506*	1.0000													
Member of the EU	0.5415*	0.5260*	0.5468*	0.3974*	0.3977*	0.3945*	0.3945*	0.3847*	0.3851*	0.4020*	0.8727*	1.0000												
Average Inflation differencial 1990-2003	-0.3608*	-0.1796	-0.2133*	-0.0294	-0.0321	-0.0428	-0.0428	-0.0208	-0.0236	-0.0442	-0.3132*	-0.3573*	1.0000											
Exchange rate volatility 1990-2003[4]	-0.3272*	-0.2167*	-0.2284*	-0.0903	-0.0913	-0.0781	-0.0781	-0.0822	-0.0832	-0.1321	-0.3501*	-0.3892*	0.8362*	1.0000										
Similar fuel dependency 1990-2002	-0.0264	-0.1379	-0.1302	0.0606	0.0609	0.0486	0.0486	0.0598	0.0601	-0.0086	0.0653	0.0646	-0.0450	-0.1174	1.0000									
Distance to main city (km)	-0.5098*	-0.5828*	-0.5669*	-0.2913*	-0.2896*	-0.2732*	-0.2732*	-0.2853*	-0.2836*	-0.3396*	-0.4993*	-0.5420*	0.1624	0.2564*	0.0326	1.0000								
Spanish spoken (1=yes)	-0.3669*	0.0830	0.0511	0.3455*	0.3419*	0.3592*	0.3592*	0.3572*	0.3534*	-0.1353	-0.1440	-0.1650	0.3252*	0.2391*	0.0189	0.3568*	1.0000							
Access to seacoast (1=yes)	-0.1792	0.2897*	0.3233*	0.1593	0.1611	0.1494	0.1494	0.1567	0.1585	0.1624	0.0092	0.0485	-0.0019	0.0062	-0.1670	0.0690	0.0818	1.0000						
Sharing a land border	0.2604*	0.2897*	0.3076*	0.1437	0.1446	0.1443	0.1443	0.1411	0.1420	0.1683	0.4081*	0.3561*	-0.1254	-0.1593	0.0318	-0.3215*	-0.0588	0.0668	1.0000					
Partner's Land area	-0.1366	-0.1403	-0.0432	0.1980*	0.2034*	0.2070*	0.2070*	0.2002*	0.2057*	0.2638*	-0.0919	-0.0827	0.2355*	0.2984*	-0.2674*	0.1477	0.1106	0.0657	0.0186	1.0000				
Absolute time difference to main financial centre	-0.3595*	-0.3881*	-0.3659*	-0.1070	-0.1055	-0.1093	-0.1093	-0.1024	-0.1010	-0.2768*	-0.3083*	-0.3585*	0.1068	0.2557*	0.2668*	0.6481*	0.2984*	0.1633	-0.0863	0.0636	1.0000			
Average GDP 1990-2003	0.0432	0.1432	0.2977*	0.5698*	0.5777*	0.5788*	0.5788*	0.5658*	0.5740*	0.7358*	0.2496*	0.2986*	-0.0639	-0.0464	-0.0985	-0.1104	-0.0172	0.2448*	0.1442	0.5999*	-0.0394	1.0000		
Average per capita GDP 1990-2003	0.2126*	0.4840*	0.5340*	0.6007*	0.6018*	0.5902*	0.5902*	0.5932*	0.5945*	0.6243*	0.4208*	0.4866*	-0.3277*	-0.4053*	0.0120	-0.2851*	-0.0378	0.2369*	0.1475	-0.1603	-0.2194*	0.4433*	1.0000	
Absolute difference of percapita GDPs 1990-2003	-0.1353	-0.4583*	-0.4883*	-0.5616*	-0.5615*	-0.5493*	-0.5493*	-0.5563*	-0.5563*	-0.6089*	-0.3440*	-0.3943*	0.2526*	0.3682*	-0.0128	0.2418*	-0.0164	-0.2841*	-0.1584	0.1784	0.1653	-0.4047*	-0.9665*	1.0000

[1] Average over the period of the sum of bilateral exports plus imports over the sum of GDPs

[2] Average over the period of total bilateral inflows and outflows to and from Spain

[3] Computed from value added from the industrial sector only. Higher values imply more similarity.

[4] Coefficient of variation of the bilateral exchange rate with Spain (monthly average).

Table 13

Countries included in the regressions (total=109)

ISO code	Country Name	ISO code	Country Name	ISO code	Country Name	ISO code	Country Name
ALB	Albania	**ECU**	**Ecuador**	KEN	Kenya	**POL**	**Poland**
ARG	**Argentina**	**EGY**	**Egypt**	**KOR**	**Korea**	**PRT**	**Portugal**
AUS	**Australia**	ETH	Ethiopia	LCA	St. Lucia	**PRY**	**Paraguay**
AUT	**Austria**	**FIN**	**Finland**	LKA	Sri Lanka	**ROU**	**Romania**
BDI	Burundi	FJI	Fiji Is.	**LUX**	**Luxemburg**	**RUS**	**Russia**
BEL	**Belgium**	**FRA**	**France**	**LVA**	**Latvia**	RWA	Rwanda
BEN	Benin	GAB	Gabon	**MAR**	**Morocco**	SEN	Senegal
BFA	Burkina Faso	**GBR**	**UK**	MDG	Madagascar	**SLV**	**El Salvador**
BGD	Bangladesh	**GER**	**Germany**	**MEX**	**Mexico**	**SVK**	**Slovakia**
BGR	**Bulgaria**	GHA	Ghana	MKD	Macedonia	**SVN**	**Slovenia**
BLZ	Belize	GMB	Gambia	**MLT**	**Malta**	**SWE**	**Sweden**
BOL	**Bolivia**	**GRC**	**Greece**	MUS	Mauritius	SWZ	Swaziland
BRA	**Brazil**	**GTM**	**Guatemala**	MWI	Malawi	SYC	Seychelles
BRB	Barbados	**HKG**	**Hong Kong**	**MYS**	**Malaysia**	SYR	Syria
BWA	Bostwana	**HND**	**Honduras**	NAM	Namibia	TGO	Togo
CAN	**Canada**	HRV	Croacia	NER	Niger	THA	Thailand
CHE	**Switzerland**	**HUN**	**Hungary**	NGA	Nigeria	TTO	Trinidad and Tobago
CHL	**Chile**	**IDN**	**Indonesia**	**NIC**	**Nicaragua**	**TUN**	**Tunisia**
CHN	**China**	**IND**	**India**	**NLD**	**Netherlands**	**TUR**	**Turkey**
CIV	Cote d'Ivoire	**IRL**	**Ireland**	**NOR**	**Norway**	TZA	Tanzania
CMR	Cameroon	IRN	Iran	NPL	Nepal	UGA	Uganda
COG	Congo Brazzaville	**ISL**	**Iceland**	NZL	New Zealand	**URY**	**Uruguay**
COL	**Colombia**	ISR	Israel	PAK	Pakistan	**USA**	**USA**
CRI	**Costa Rica**	**ITA**	**Italy**	**PAN**	**Panama**	**VEN**	**Venezuela**
CZE	**Czech Rep.**	JAM	Jamaica	**PER**	**Peru**	ZAF	South Africa
DNK	**Denmark**	JOR	Jordan	**PHL**	**Phillipines**	ZMB	Zambia
DOM	Dominican Republic	**JPN**	**Japan**	PNG	Papua New Guinea	ZWE	Zimbabwe
DZA	**Algeria**						

In boldface: countries with total financial flows greater than zero.

Appendix B: Definition of Variables and Sources.

Output Synchronization (ρ): Measured as the Pearson correlation between the filtered series of GDP for Spain and for the partner country. GDP data was filtered using Baxter and King's band-pass filter. Alternative specifications use H-P filtered data or the log difference (growth rates) of annual GDPs. Data for annual GDP at purchasing power parity was taken from the IMF's World Economic Outlook database.

Trade Linkages (T): Measured as the sum of imports and exports between Spain and a given country, over the partner's GDPs. This measure is then averaged over the denoted period. That is,

$$T_{ESP,i} = \frac{1}{T}\sum_t \frac{X_{ESP,i,t} + M_{ESP,i,t}}{GDP_{i,t}}$$

Data for exports and imports was obtained from the IMF's Direction of Trade Statistics. GDP data was taken from the Penn World Tables version 6.1.

Financial Linkages (F): Measured as the sum of inflows and outflows of FDI and portfolio flows between Spain and a given country, divided over the partner's GDP. Alternative specifications use just the level of inflows plus outflows, or divide them over the minimum of Spain's and the partner's GDP. This measure is then averaged over the duration of the period. This measure can also be constructed for Equity flows (Stock + FDI) or for FDI flows. Data obtained from the Spanish Balance of Payments.

Similarity in productive structure (S): Measured as the time average of discrepancies in economic structures. In particular, we take the shares $s_{n,i,t}$ of value added for industrial sector n in country i at time t and construct the following indicator of distance:

$$S^1_{ESP,i} = -\frac{1}{T}\sum_t \sum_{n=1}^{N} \left| s_{n,ESP,t} - s_{n,i,t} \right|$$

For value added, we take industrial sectors at 2-digit ISIC level. Data was obtained from the United Nations Industrial Development Organization (UNIDO).

Distance to main city: Computed at the great circle distance (in km) between Madrid (Spain), and the main city of a given country. In general, we take the capital city as the main city, except for the US (New York), Pakistan (Karachi), Brazil (Sao Paulo), China (Shanghai), Canada (Toronto), Switzerland (Zurich), Germany (Frankfurt), Turkey (Istambul), Israel (Tel Aviv), India (Mumbay), Australia (Sydney), Cote d'Ivoire (Abidjan), Kazakhstan (Almaty), Morocco

(Casablanca), New Zealand (Auckland), Nigeria (Lagos), South Africa (Johannesburg) and Yemen (Aden). Data was obtained from http://www.indo.com/distance/index.html.

Spanish spoken: dummy variable that takes value 1 if a given country has Spanish as the main language. Data was elaborated by the authors.

Access to seacoast: dummy variable that takes value 1 if a country has sovereign access to the seacoast. Data elaborated by the authors.

Absolute time difference to main financial center: Absolute value of the standard time zone difference between the main city used for "distance" and mainland Spain. Source: http://www.timeanddate.com/worldclock/

Member of Euro Area: dummy variable that takes value 1 if a given country has joined the Euro. Data elaborated by the authors.

Member of European Union: dummy variable that takes value 1 if a given country has joined the European Union (before 2004). Data elaborated by the authors.

Average Inflation Differential: Computed as the time average over the period referred of the absolute difference of quarterly inflation rates between Spain and a given country. Annual inflation data was obtained from the IMF's International Financial Statistics.

Exchange Rate Volatility: Computed as the standard deviation (over the period referred) of the bilateral nominal exchange rate (monthly average) between Spain and a given country. Monthly exchange rate data was obtained from the IMF's International Financial Statistics using bilateral exchange rates for both countries vis-à-vis the US dollar.

Land area: Partner's land area (in square km). Data for land areas was obtained from http://www.infoplease.com/ipa/A0004379.html and the CIA World Factbook.

Population: Average population of partner country for the period chosen (in millions). Data on countries' population was obtained from the World Bank.

Average GDP: Partner's average GDP measured at PPP. GDP data at PPP was obtained from the Penn World Tables 6.1.

Per capita GDPs: Partner's average per capita GDP. Data was obtained from the Penn World Tables 6.1.

Absolute difference of per-capita GDPs: (between Spain and the partner country) measured as the time average over the referred period. Data was obtained from the Penn World Tables 6.1.

Similarity of oil dependency: constructed as the product of average oil dependency in Spain and a given country *i*:

$$\left(\frac{1}{T}\sum_{t}\frac{Moil_{i,t}-Xoil_{i,t}}{GDP_{i,t}}\right)\times\left(\frac{1}{T}\sum_{t}\frac{Moil_{ESP,t}-Xoil_{ESP,t}}{GDP_{ESP,t}}\right)$$

where $Moil_{i,t}$ and $Xoil_{i,t}$ are imports and exports of oil in country i at time t and *ESP* represents Spain. Data for oil imports and exports as well as nominal GDP (all in current US dollars) was obtained from the World Bank.