

The determinants of business cycle correlations: a comparison
between OECD and non-OECD economies.

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Abstract

This paper examines empirically which factors determine output correlations in a sample of 76 economies over the period 1973-1997. We split our sample between OECD and non-OECD economies and examine explicitly which factors affect specifically each group. Emphasis is given to the role of policy variables examined only in studies for OECD economies so far. We use a large range of cross section and panel estimation techniques. Although we are able to replicate results for OECD economies, we are unable to identify which channels play a major role in the case of the non-OECD economies. The main findings of this paper are: 1) The determinants between OECD and non-OECD economies are different, 2) we are able to confirm the results of previous literature on OECD economies, 3) monetary policy has an indirect effect on business cycles through fostering bilateral trade, 4) labour market rigidities do not play a significant role on business cycle correlations, 5) law and order and legal origin similarity affect directly and indirectly the correlations depending on the sample used and 6) only regional effects seem to matter in a sample where the non-OECD economies are considered.

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1) INTRODUCTION

This paper examines empirically the potential determinants of business cycle correlations in a sample of OECD and non-OECD economies. Our sample consists of annual data for 76 economies for which consistent data could be collected. The first study was conducted by Frankel and Rose (1998) which triggered a vast literature on the area of business cycle correlations and their determinants. In this first study, the authors argue that business cycles and trade intensity are mutually determined. Countries with stronger trade links are more likely to form a currency union and to coordinate their macroeconomic policies. The latter could result in business cycle convergence. On the other hand, economies with more synchronized business cycles are better candidates for a currency union. Joining a currency union can potentially increase the trade links of the country- members. Therefore trade intensity and business cycles are determined by a third variable, the currency union membership. The authors use Instrumental variable techniques and conduct a large sensitivity analysis which reveals a significantly positive effect of trade intensity on business cycles.

From a theoretical point of view, the effect of trade on the business cycle is ambiguous and depends on the nature of the shocks and the pattern of specialization induced by opening to trade. If the nature of the shocks is demand shocks then the effect of trade on the business cycle is expected to be positive. If a positive demand shock takes place in one economy, then this will increase the demand for imports, causing a positive spillover effect via trade to its trading partners. This effect will be higher the stronger the trade links with the trading partners. Therefore trade acts here as a transmission channel of shocks from one economy to the other. If opening to trade causes specialization in production, then more inter-industry trade would arise between economies. If shocks are industry specific then only the sectors in one economy will be affected, leaving the rest of the sectors, in which the other economies specialize unaffected. A situation like this would give rise to business cycle divergence. If specialization results in more intra-

industry trade, then industry specific shocks would affect the same industries in the economies, resulting in higher output correlations. Therefore the overall effect of trade on business cycle correlations is theoretically ambiguous. The results of Frankel and Rose indicate that the positive effect of trade can be explained either as trade acting as a transmission channel or as trade creating intra-industry specialization and therefore affecting positively the business cycle.

Subsequent research focused on the robustness of this result, by considering additional determinants of business cycle correlations. Many alternative factors were proposed: 1) industrial specialization (Imbs (1998, 1999, 2003)) 2) production asymmetries (Calderon et al.(2002)) 3)monetary and fiscal policy (Inklaar et al.(2005), Shin and Wang(2004, 2005), Otto et al.(2001, 2003), Clark and Wincoop (2001)) 4)Financial integration (Imbs(2003), Inklaar et al.(2005), Shin and Wang(2004, 2005)), 5) country characteristics (Otto et al.(2001, 2003)) 6)currency union membership or free trade agreements (Frankel and Rose (2000), Engel and Rose(2002), Baxter and Kouparitsas (2004)) 6) distance, common border and other gravity model variables (Baxter and Kouparitsas(2004)) 7) Human capital differences (Kraay and Ventura (2001)) 8) Differences in abundance of production factors (Baxter et Kouparitsas (2004)). 9) exchange rate volatility (Frankel et Rose (1998), Inklaar et al. (2005)).

The above studies conclude that the positive and significant effect of trade intensity on business cycles found by Frankel and Rose is fairly robust when different combinations of the alternative factors are included in the analysis. The role of each factor can be significant or not depending on the specification, the estimation method and the sample used. The above studies use mainly Instrumental variable and cross sectional techniques. A few use system estimation techniques (Imbs (2003), Inklaar et al. (2005)). Data are mainly taken from developed economies. So the main results of the empirical studies until now focus on OECD economies. One of the main contributions of this paper is to extend the sample of economies to include developing economies as well. Our sample of 76 countries consists of countries from 7 different regions (see Appendix 1). Studying non OECD economies and comparing them with the OECD experience may reveal

different factors affecting the cycles of the former, with obvious implications about potential integration among them.

From the previous mentioned studies the two closest to our study are those of Calderon et al. (2002) and Baxter and Kouparitsas (2004). These two studies use a sample of both OECD and non-OECD economies to check the robustness of trade intensity as the main determinant of output correlations. Calderon et al (2002) extend Frankel and Rose's methodology to a sample of 147 countries. Apart from trade intensity, they consider a measure of asymmetries in the production structure. They find a positive effect of trade on business cycles, stronger for OECD country pairs, less intense for non-OECD country pairs. They also find that the measure of production asymmetries is a significant control for their analysis. Baxter and Kouparitsas (2004) conduct an extensive research on the potential determinants of business cycles correlations for a sample of 100 countries. They consider variables, such as trade intensity, total bilateral trade, specialization measures such as similarities in production and export/import similarities, CU membership and gravity variables such as distance, common language, and common border. They perform the Extreme Bounds Analysis based on Leamer (1983). They conclude that the only robust determinants for business cycle correlations are trade intensity, indicator variables for whether the two countries in the pairs considered are both industrialized and developing and the variable measuring the distance between two countries. However, two variables considered by the majority of the literature as important, the CU membership and the industrial similarity, were not found to be robust.

These two studies include non-OECD economies in their sample, but they exclude from their analysis variables that may be important for non-OECD economies. In our analysis we include monetary and fiscal policy coordination, financial integration and country characteristic variables not considered in the two studies analyzed above. This is our second contribution with this paper. More specifically, we introduce as institutional /country characteristics two variables: an index for labour market rigidities taken from La Porta et al. (1998), a composite index for contract enforcement and rule of law and an

index for law and order. To the best of our knowledge, these variables have not been addressed before, at least in a framework including a mix of economies.

Finally, the majority of the studies employs instrumental variables and cross sectional estimation in their analysis. As the interaction among the variables considered in studies like this one may extend outside the endogeneity between trade intensity and business cycle correlations, system estimation techniques are considered more appropriate to account for other potential endogeneity among the variables. We mainly account for potential endogeneity between monetary policy and business cycles, as monetary policy can be the cause or the result of a development in the business cycle. Panel data estimation is also performed for robustness reasons. Again, this has been conducted in OECD studies, we expand it here in the case of non-OECD economies and a mix sample of economies.

The main findings of this paper are the following: 1) The determinants between OECD and non-OECD economies are different, 2) we are able to confirm the results of previous literature on OECD economies, 3) monetary policy has an indirect effect on business cycles through fostering bilateral trade, 4) labour market rigidities do not play a significant role on business cycle correlations, 5) law and order and legal origin similarity affect indirectly the correlations depending on the sample used and 6) only regional effects seem to matter in a sample where the non-OECD economies are considered.

The remainder of the papers consists of the following parts. Section 2 includes a description of our dataset, variable definitions and data transformation. In section 3, we analyze our empirical methodology. Section 4, comments on our main results and section 5 concludes.

2) DATA AND VARIABLE DESCRIPTION

This section analyzes the data source, the transformation of the raw data series and the variable definitions used to construct our dataset. This dataset consists of 76 economies listed in appendix 1 and span the period 1973-1997. It should be noted that the choice of

the time period is merely due to data availability, as we consider the same set of variables for all countries, in order to be consistent across all the economies considered in our sample. Finally, for some of the institutional variables like the labour market tightness the sample had to be reduced to 58 countries as this index was available only for this number of countries in our sample.

To begin with, our dependent variable is a measure of output correlation between country pairs. Many ways have been proposed to construct a proxy for this measure. The usual practice is to detrend the real GDP series for each of the countries using one of the available filtering techniques and then compute the bilateral correlation coefficient over a span of years, for each country pair in the sample. By detrending the log of the real GDP series, only the cyclical component of the series is maintained, which is the subject of our interest in this study. That cyclical component could be viewed as the short run deviations from the long run trend of the GDP series. These short-run deviations of each country's GDP from its long run trend are identified as the business cycles in the economy. They can be the result of technology (productivity) changes, policy changes, preferences changes and so on.

In the literature there is no consensus on which detrending techniques is most appropriate to be used. Many studies including those of Frankel and Rose (1998), Calderon et al. (2002), Artis and Zhang (1997), use different filtering procedures and their results turn out to be robust regardless of the detrending technique used. Two of the most commonly used techniques in the literature are the Hodrick-Prescott (HP) filter and the Band-Pass filter introduced by Baxter and King (1999). There is a slight preference to the use of Band-Pass (BP) filter as it takes into account the properties of the business cycle, instead of just decomposing the series into the trend and cyclical component. According to Stock and Watson (1999), NBER has documented 90 complete cycles from 1858. The cycles with the shortest length were 6 quarters and the largest 39 quarters. Taking into account this feature of the business cycle history, Baxter and King constructed a filter that removes from a time series components with frequencies that are higher or lower than 6 or 32 quarters and puts them in the trend. The HP filter removes only components with

frequencies above 32 quarters leaving in the cycle components with relatively high noise. We will focus our analysis in those two detrending techniques.

The data for real GDP are taken from the World bank WDI and the UN common Dataset. Alternative source of GDP data is the Penn World Table. The series are GDP in constant prices (base year 2000). We take natural logarithms of the series, we detrend them using the HP and BP filters and then we compute bilateral correlation coefficients using the detrended GDP series. For the cross section estimation we compute the bilateral correlation coefficients using the whole 25 year sample. In this way we obtain one observation for each country pair (2850 observations in total). For the panel data estimation, we compute the bilateral correlation coefficients every 5 years. We end up with 5 observations for each pair (14250 Observations in total). In the description of results in section 5, the measure based on the World Bank data and the BP filter is reported.

Some authors (Otto et al., Inklaar et al.) prefer to transform the dependent variable using the following function:

$$C_t = \ln\left(\frac{1+C}{1-C}\right) \quad (1),$$

where C_t the transformed correlation coefficient and C is the initially computed correlation coefficient.

These authors use this transformation arguing that a regression with a dependent variable bounded between 0 and 1 may not result in residuals that are normally distributed. In the studies where the untransformed correlation coefficients are used, there is implicitly the assumption that deviation from normality is small.

To check whether this transformation proposed above is needed in our case, we provide below kernel estimates for the density functions, both for the transformed and the untransformed correlations coefficients. Figure 1 corresponds to the correlation coefficients computed using the 25 years span and figure 2 to the ones computed using 5

year intervals. From the first part of the figure, we observe that both the transformed and the untransformed correlation coefficients are fairly normally distributed. From the second part of figure 1, we observe that the distribution of the untransformed correlation coefficients does not resemble to a normal one, so it indicates that in this second case the transformation should take place. For consistency reasons we perform the transformation in both groups of correlation coefficients and we perform the analysis using both transformed and untransformed coefficients. The final results turn out to be qualitatively similar regardless of the type of correlation coefficients used. In the analysis of results in section 4, the results on the transformed correlation coefficients are reported.

Figure 1a: kernel Density of the 25 year correlation coefficients

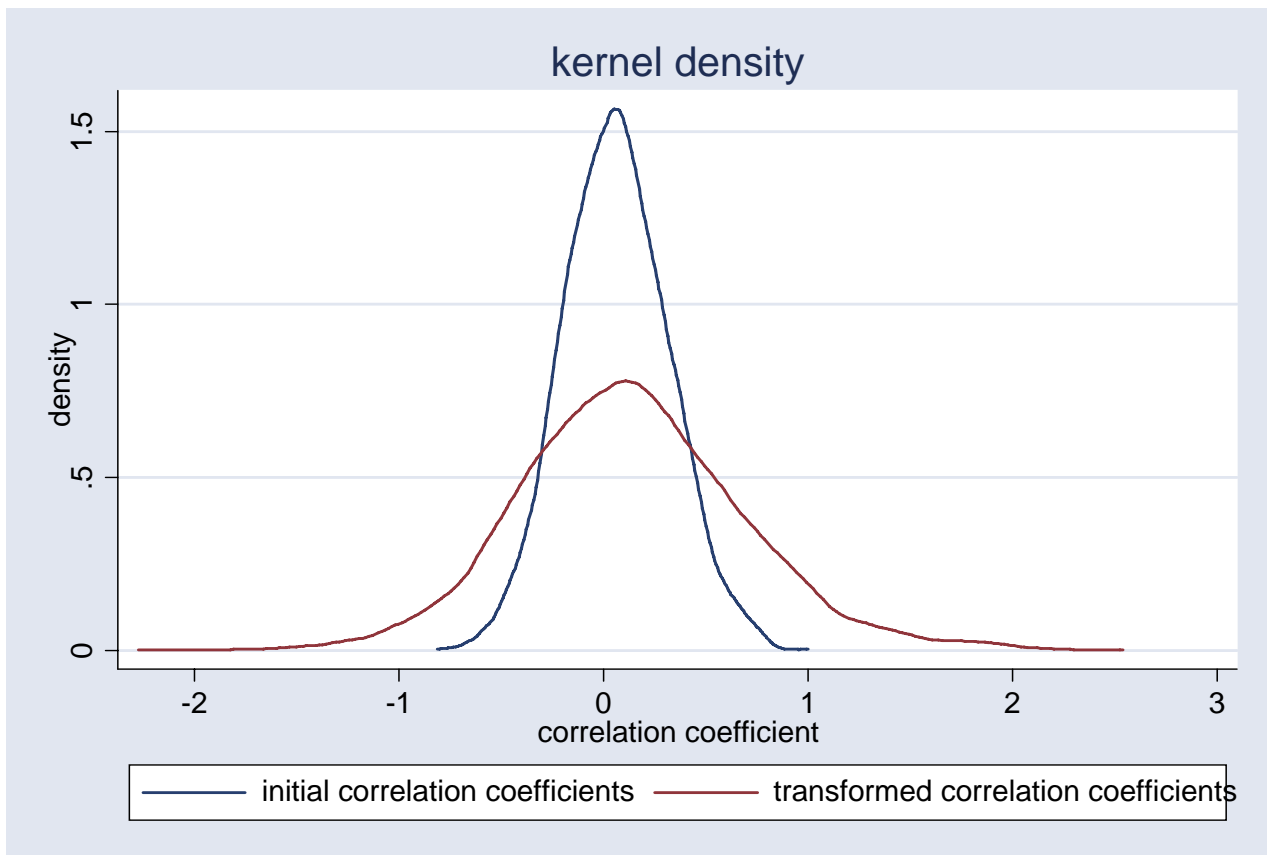
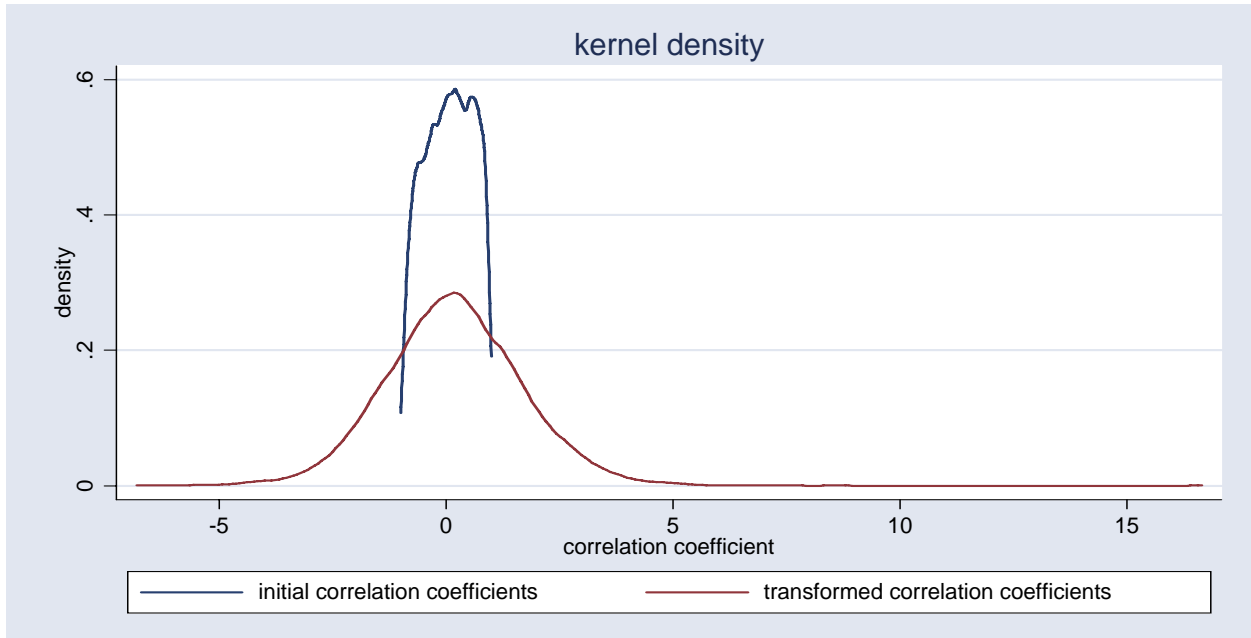


Figure 1b: kernel Density of the 5 year correlation coefficients



We turn now to the description of our set of independent variables. In the introduction it was mentioned that the determinant most frequently used by the majority of the literature is a measure of bilateral trade intensity. Several alternative proxies have been proposed for this variable. Different studies like Inklaar et al. (2005) have performed the analysis using alternative proxies and their results turned out to be robust. Following convention, we define as a measure of bilateral trade intensity the sum of bilateral imports and exports normalized by GDP or alternatively normalized by total trade:

$$BTI = \frac{X_{ij} + M_{ij}}{Y_i + Y_j} \quad \text{or} \quad BTI = \frac{X_{ij} + M_{ij}}{X_i + M_i + X_j + M_j} \quad (2)$$

where X_{ij} are nominal exports from country i to country j , M_{ij} are nominal imports to country i from country j , X_i (X_j) are total nominal exports from country i (j) to the rest

of the world, M_i (M_j) are total nominal imports to country i (j) from the rest of the world, Y_i (Y_j) is nominal GDP of country i (j).

The data were taken from the IMF Direction of Trade Statistics and from Feenstra et al. (2005) dataset. All bilateral and total trade flows are in nominal US dollars. The data for nominal GDP were taken from the World Bank WDI and the UN Common Dataset, and are in US dollars as well. The measures described in equation (2) are constructed and then averaged over a span of years (over the 25 years for the cross section and every five years for the panel estimation). Finally the natural logarithm of the averaged bilateral trade intensity is calculated and it gives us our final measure of bilateral trade intensity for this study. Since the volume of exports and imports from country i to country j reported from country i is not usually equal to those reported from country j , we take the average of the two numbers in the data set reported by the two trading partners in each pair for the same trade flow between them.

According to the literature, the effect of trade is ambiguous from a theoretical point of view, but the majority of the empirical literature supports the view of a positive effect of trade, acting either as a transmission mechanism or as inducing intra-industry trade specialization patterns. Since the majority of the studies are conducted for OECD economies, where more intra-industry trade takes place, a conclusion like this can be expected. For a sample of merely non-OECD economies, where more inter-industry patterns are more likely to rise, the effect of trade is expected to become ambiguous and less significant, as the majority of trade takes place in the North and not in the South.

In many studies, industrial structure is important both in determining the effect of trade and also in having a direct impact on the business cycles. Therefore, the next variable considered in our analysis is a measure of industrial structure or specialization. The measure used in our analysis is the index firstly proposed by Baxter and Kouparitsas (2004), which use indices of how similar, are the exports or imports shares per sector between countries. The rationale behind the use of this measure is that countries with similar traded goods will be similarly affected by industry specific shocks that affect both

economies. Therefore higher values of the index are associated with higher business cycle correlations. The data for the construction of this index are taken from the Feenstra et al. (2005) dataset. This dataset contains data for trade by commodity at the 4th digit level from 1962-2000. Due to the fact that many non-OECD countries have many missing values in this dataset, we finally aggregated the data to the 2nd and 1st digit as it is done in Baxter and Kouparitsas (2004). After this aggregation, the shares of exports of each sector to the total exports of the country are calculated for all the countries in the sample. Finally, three alternative versions at both the 2nd and 1st digit level are constructed for the index of bilateral exports similarity. These include the bilateral correlation coefficient of the country export shares (isc for the first digit aggregation and isc2 for the second digit aggregation), the bilateral absolute difference between the exports shares (isa and isa2 for the 1st and second digit aggregation respectively) and finally the bilateral square difference between the shares (iss and iss2 for the first and second digit aggregation.)

Each of the last two indices is subtracted from one such that higher values of the index are associated with more similar industrial structure and therefore higher business cycle correlations.

The empirical literature has been inconclusive about the significance of a measure of specialization. Imbs (2003), Shin and Wang (2005) and Inklaar et al (2005) find support for a positive effect of specialization structure, whereas Baxter et Kouparitsas (2004) and Otto et al. (2001, 2003) do not find any significant effect attributed to industrial similarity. Our prior is that specialization should matter for the non-OECD case, due to the different patterns of industrial structure across those countries.

Policy coordination can be also important in the way countries react to shocks. We consider measures of monetary policy similarity and fiscal policy similarity for the non-OECD sample as well. In the existing literature, data on the interest rates are available for countries that focus on the OECD economies. The majority of the studies use the correlation coefficient of the bilateral real interest rates to account for similarity of monetary policy. There are two issues arising in our study. Firstly, data on interest rates are not available for all the countries in our sample. Instead Shin and Wang (2004, 2005)

use as an alternative measure to the real interest rate correlations, the correlation coefficient between the money supply growth rates. Data on money supply are available for all the countries in our sample. We use annual data on the M2 measure of money supply reported in the World Bank WDI, the IMF International Financial Statistics, the UN Common dataset and Euro stat. The data are reported in local currency units. We deflate the M2 series using GDP deflator series, for which data are obtained from the same sources. Finally the annual money growth rates and the bilateral correlation coefficients are computed. The higher the value of this correlation coefficient might result in more correlated business cycles between the countries in the pair. The second issue is that even for OECD countries the interest rates series used are not homogeneous. For instance, there exist studies like Otto et al. (2001), in which for some countries the 3 month treasury bills, the 3 month money market rates or the discount rates are used. Moreover, Shin and Wang (2005) use either the treasury bills or the money market rates. Such a measure based on different interest rate series should not be expected to perform better than the M2 growth rates measure.

In the literature the effects of monetary policy are inconclusive. Inklaar et al. (2005) find an important role of monetary policy similarity, whereas Clark and Wincoop (2001) do not conclude that monetary policy plays an additional role in determining business cycles. Monetary policy can affect negatively or positively the business cycle correlations. If countries are subjected to similar shocks and have similar economic structures, then they might use monetary policy to battle recessions. We can view monetary policy as a common response to a shock. But if the shocks affecting the economies are different, then monetary policy may cause different responses and output divergence. Another example is that if countries are closely related through trade then monetary policy in one country could cause spillover effects to the other. Finally, if two countries have pegged their exchange rates then idiosyncratic shocks from one country can be transmitted to the other. Therefore, monetary policy can be viewed as response to shocks or as a transmission channel of shocks between countries.

The arguments for the role of fiscal policy are similar with the ones used in the analysis of monetary policy co-ordination. Fiscal policy can act as a transmission channel as well as a common response to shocks, increasing the output correlations. Data for budget deficits are obtained from the same sources as the money supply data. The budget deficit data are in local currency units and they are normalized by GDP in nominal terms expressed in local currency units. Then the bilateral correlation coefficients of the normalized budget deficits are computed.

Financial linkages have also been considered as a significant factor affecting output correlations. The effect of this variable is also ambiguous and a variety of proxies have been used again in this case. Inklaar et al. (2005) use 3 measures for financial integration: the correlation of changes in stock market indices, a dummy for capital account restrictions and the absolute differences between the Net Foreign Asset positions (NFA) of a country pair. The last two measures are employed by Imbs (2003) as well. Otto et al. (2001, 2003), consider measures based on differences in FDI positions, trade in equities and trade in long-term bonds. In our study, we are constrained by the access and availability of data to the third measure used in Inklaar et al. (2005). This is based on data on NFA. We collect our data from Lane and Milesi-Ferretti (2006), who used different sources of information to construct estimates for the NFA positions for a large number of countries and years. The data are in US dollars and are normalized by GDP. Then two measures are constructed: the bilateral absolute (NFA) and square difference (NFAS) in NFA for each country couple.

The effect of financial linkages on output correlation is ambiguous. If a country has access to more opportunities to diversify risk in production, then risk sharing through capital market integration can lead to more specialization in production. If shocks are industry specific then this could lead to business cycle divergence. This is the idea behind a series of papers by Kalemli et al. (2001, 2002), where the authors show that increased risk sharing leads to specialization and specialization to divergent business cycles. On the other hand, financial integration could act as transmission channel if trade in assets between the country pair is increased and therefore can cause higher output correlations.

This second spillover role can be seen in the cases where a fall in stock markets is followed by falls in other stock markets or by contagion effects. Finally, FDI linkages could act as transmission channel for technology and know-how, or for changes in the demand for final goods in one country to the demand for intermediate goods in another.

A set of gravity variables are used both as instruments for the potential endogeneity between trade intensity and output correlations and to check whether they affect directly the business cycle correlations. The variables considered here are distance (DIST), a dummy for common border (BORDER), a dummy for common language (LANG), the log of the product of GDP of the country pair (GDP product), the log of the product of GDP per capita of the country pair (GDP per capita), a dummy for whether a country in the pair is an island (ISL), a dummy for whether the countries in the pair are landlocked (LAND), a dummy for whether the two countries were colonies under the same colonizer (COL). The gravity model for trade flows has been widely studied and it is acknowledged that it explains quite a large extend of bilateral trade. The data are taken from A. Rose's website. We expect that distance and whether a country is an island to have a negative effect on trade and the remaining variables a positive one. Considering the business cycle correlations, variables like distance and common border may affect directly the business cycles. For example, countries that are closer or share a common borer may be more likely to form a currency union, and therefore have more correlated cycles. Moreover, sharing a common border enables shocks to be transmitted easier from one economy to the other. Finally, in the system estimation below we argue that gravity variables may affect other variables like monetary policy that affect the business cycle correlations.

Another two variables considered here are CU and Regional Trade Agreement (RTA) dummies. These are taken from A. Rose's website as well. There is rich literature on the positive effect of CU membership on trade and on business cycle correlations (Frankel and Rose (2000), Engel and Rose (2002), Rose (1999)). However the latest study by Baxter and Kouparitsas (2004) cast doubt on this result, since CU membership was not found to robustly determine the business cycle correlations. In our study we find evidence similar to those of Baxter and Kouparitsas for CU, whereas the effect a RTA is more

robust throughout the different specifications. Therefore, in section 4 the analysis focuses on the role of RTA on business cycle correlations.

The average years of schooling are used as a proxy for differences in labour skills and essentially proxy for differences in human capital. In the theoretical model of Kraay and Ventura (2001), countries with different types of labour force regarding their skills, experience asymmetric business cycles. Countries with more educated labour force can specialize in the production of more technologically advanced goods and therefore react differently if industry specific shocks are in place, than economies that due to abundance in unskilled labour force specialize in less technologically advanced goods. The data for the average years of schooling are drawn from the Barro-Lee dataset (2001) that contains data for a number of OECD and non-OECD economies every 5 years from 1960 to 2000. This is also the reason why in our panel estimation we consider five period intervals. Three measures of human capital differences are constructed. First the bilateral absolute and square differences for each country pair across the whole sample and every five years are computed. Secondly the log of the sum of the average years of schooling for each pair is calculated for every five years. We expect a negative coefficient for the first two measures and a positive for the last, as higher bilateral value indicates similar average years of schooling and therefore more synchronized business cycles. Imbs (2003) finds a positive effect of differences in educational attainment on output correlation, whereas Baxter and Kouparitsas (2004) find that differences in Human capital do not robustly determine output correlations. In the results presented in section 4, we consider the third measure of human capital similarities.

Otto et al. (2001, 2003) consider institutional/country characteristics like common legal origin, accounting standards and the propensity to adopt new technologies as affecting the business cycle correlations. In this paper, we consider two important, from our point of view, country characteristics: an index about the rule of law and contract enforcement and an index of labour market tightness (LMT). The index for the rule of law is taken from Kaufman et al. (2005) for the year 1996. Since our dataset spans until 1997, we consider only one yearly observation. The dataset contains data on the index for every

two years from 1996 to 2004. It is a composite index that takes value between -2.5 and 2.5 , with higher values indicating better contract enforcement and protection of patent rights. This index was used in the analysis of Levchenko (2004) about institutional quality and trade. The author builds a theoretical model and he concludes that countries with more protection of patent rights and contract enforcement are more likely to specialize in the production of goods that require such an enforcement to be present. These are goods that require many stages of production and therefore the more the stages the more particular the investment in the technology of the production of those goods will be. People will have an incentive to invest in such a particular relation only if their property rights are guaranteed by the country's legal system. So such a protection could cause specialization in production and divergence if shocks are industry specific. The absolute and square differences of this index are considered here. Since this measure is available only for 1 year, we consider an alternative dataset on law and order, measuring approximately the same thing as the previous index. The data are taken from the International Country Risk Guide (ICRG). The advantage of this index is that it exists from 1982 to 1997. This index takes values between 0 and 6, with higher values indicating less risk and lower values more risky countries. The absolute bilateral (LAW) and square difference (LAWS) are computed.

Labour market tightness data are obtained by La Porta et al. (2004) for the year 1997. This index takes values between 0 and 1. The higher its value the less flexible the labour market (higher protection of labour and stricter employment laws) of any particular country is considered. The absolute and square differences are again considered. This is a composite index, consisting of other four sub-indices measuring alternative employment contracts, cost of increasing hours worked, firing costs and dismissal procedures. The higher the differences the less correlated the business cycles as some countries will be able to adjust the number of the employed people easier to mitigate the consequences of such a shock. Also different labour market structures in Kraay and Ventura (2001) lead to different adjustment by the economies to similar shocks. An interaction term between labour market tightness and industrial similarity is considered as the theory suggests that differences in labour market rigidities interact with the structure of the economy.

Consider a case where two economies are identical in their industrial structure, but respond differently in an industry specific shock. It could be the case that due to different extent of labour protection, one country recovers easier from the other even though they are identical in industrial characteristics. The effect of this interaction term is therefore expected to be negative. It should be noted that when those two variables are considered then the sample contains only 58 countries, as data on this index are available only for these economies in our sample.

Data on the ideology of the government and the degree of central bank independence are also included in our study. These two variables are used as instruments to deal with potential endogeneity of monetary and fiscal coordination with the business cycle correlation. Monetary and fiscal policy may be the response to shocks or the causal effect of the shocks causing the cycle convergence or divergence. Data for the government ideology are taken from the Political Institutions Dataset (PID) constructed for the World Bank from Beck et al. (2001) and contains data from 1975 to 1995. We use in particular a variable about the ideology (Left, Right or Center) of the Chief executive of the party in power. We construct bilateral mean absolute difference (IDEOL) and we expect a negative sign as if the governments in the two countries share the same ideology the value of this bilateral difference will be small. Similar ideology leads to common conduct of monetary or fiscal policy. The data for the index of Central Bank independence are from Cukierman et al. (1992) and from De Haan and Sturm (2001) that they extend the Cukierman index for a considerable number of developing economies. Unfortunately we were able to get access to data for the index concerning its value during the decade 80-89. Therefore this variable will be used when instrumenting for monetary policy in the context of the system estimation described in the next section. The variable is defined as the turnover ratio of Central Bank governors and takes values between 0 and 1. Higher values indicate that the governors change more often as there is more political influence in the conduct of monetary policy. A bilateral index is constructed by the individual ones by computing their mean absolute difference (CBI). Higher values of this bilateral difference indicate that the countries in the pair share a different degree of independence characterizing their Central Bank governors. Lower values would be associated with common monetary targets (inflation stabilization or combat of output shocks) and

therefore use of monetary policy for a similar purpose. The expected sign of the effect on monetary policy similarity in this case would be a negative one.

Some dummy variables to control for time effects in the panel estimation are constructed as well one for each of the five time periods. Regional dummies are constructed as well. They are eight, as we consider the following division: North America (NA), Latin America and the Caribbean (SA), Europe (EU), Africa (AFR), Oceania (OCE), Middle East (ME), South Asia (SA) and Southeast Asia (SEA). This division is according to Kose and Yi (2001) and the World Bank. A complete list of the countries belonging to each category is given the appendix 1. These dummies account for the fact that there may be regional effects that enhance the propagation of shocks. There are studies like that of Shin and Wang (2004, 2005), Calderon et al. (2002), and many studies for Europe that show that countries in regions like the Southeast Asia, the Latin America and Europe are more integrated among them, than with any other third country. A final set of indicator variables is constructed. One indicator variable takes value 1 if both countries in a pair are industrialized, another one if both countries are developing and a final one if we have a mixed pair (one country being industrialized and the other developing). The distinction between industrialized based on the country classification as advanced or developing according to the IMF Economic Outlook in 1998. Finally, size dummies are constructed, in case that the results are driven by the fact that one of the two countries in a pair is relatively larger than the other. These dummies take value equal to one if at least one's of the two countries GDP is above the average GDP (SIZE) in particular year. For robustness reasons, we consider also dummies constructed using the median (SIZEM) and the 25th (SIZE25) and 75th (SIZE75) percentiles as cut off points in the GDP distribution.

Finally, we consider dummies reflecting common legal origin as in Otto et al. (2001, 2003). We construct a dummy with value 1 if the two countries in a pair share generally the same legal origin (ORIGIN). Moreover, four extra dummies are constructed, taking value one if both countries share an English (ENG), French (FREN), German (GER) or Scandinavian (SCAN) legal origin. This characteristic may act as a transmission channel,

as they can reflect similar financial market and institutions, similar economic structures and as La Porta et al (1998) emphasize it can reflect similar investor protection and labour market organization.

Tables 2 in Appendix 1 and Table 16 in Appendix 2 provide descriptive statistics and the correlation matrix between the variables. The correlation matrix reveals certain interesting points. Trade intensity is positively correlated with all the measures of bilateral business cycle correlations. Industrial specialization is again positively correlated with the measures of business cycle correlations, with correlation coefficients between 0.1082 and 0.34. Industrial Similarity is also positively correlated with trade intensity with correlations between 0.15 and 0.20. This is evidence that the countries with more similar industrial structures tend to trade more giving rise to an important role of intra-industry trade on business cycles correlations. Finally the correlations between the different measures of specialization range between 0.50 and 0.96. We include one measure per time in our regression. The results were robust irrespectively of the measure used. From the policy similarity variables, monetary policy is positively correlated with the business cycle correlations and trade intensity. Fiscal policy similarity is also positively correlated to a less extend. Financial integration (measured as absolute difference between NFA) is negatively correlated with the measures of output correlations but they are much smaller than the ones of monetary and fiscal policy similarity. From the new variables considered in this study, the indices for rule of law and law and order are negatively correlated with bilateral correlations, but the magnitude of these correlations range only between 0.02 and 0.09, and in one case it is positive. Moreover RULE and LAW have similar moments and extreme values, and they are highly correlated (0.73). Therefore we include one measure per time and report below the most significant of the results. Labour market tightness and the interaction term are presented in panel b of Table 7. It is obvious that the two measures are highly correlated with each other. But by observing the table, our prior that higher differences in labour market flexibility lead to lower business cycles correlation seems ambiguous. The re is a positive but small in magnitude correlation coefficient (0.014 and 0.09 respectively)

between these measures and the business cycle correlation measure. We rely on our analysis in section 5 for clearer conclusions.

Figures 3 and 4 in Appendix 1 provide a rough idea about the 20 most and 20 least correlated country pairs in our study. The general observation is that among the highest correlation coefficients belong pairs of OECD economies. In particular, the in the highest correlations belong couples like Canada and Australia, Canada and USA, USA and UK, pairs European economies, an Asian pair (Malaysia and Singapore) as well as pairs of countries in the Latin America region. On the other hand, on the bottom of the correlations distribution appear country pairs from the non-OECD sample. These are pairs of countries that may belong to different regions like Oman and Kenya, Paraguay and Iran and Colombia and Oman, or to a mixed pair like Japan and Bahrain, United Kingdom and Syria or USA and Syria. In Table 3 of Appendix 1, we have the highest and lowest Bilateral Trade Intensity figures. The main point here is that among the twenty highest values belong pairs that are among those with the highest bilateral correlations (Malaysia-Singapore, Germany-Netherlands, Canada-USA). These are mainly OECD economies pairs. Among the twenty highest trade intensity pair values are many European country pairs. This is a natural result of the many integration procedures taking place in the EU towards higher trade links among its country members. Therefore trade is likely to be an important factor for these economies. Among the highest Trade intensity values do not appear any non-OECD or mixed pairs. However, the situation is not the same when someone considers the lowest trade intensity values. Here the pairs are mainly non-OECD economies that belong to different regions. There is also not much overlapping between the pairs appearing in the lowest business cycle correlations and the lowest trade intensity values. Therefore, somebody could conclude that while trade foster business cycle correlations in the case of OECD pairs, this might not be the case when the non-OECD sample is considered. Here, apart from countries in a pair belonging to South America and South East Asia, developing economies experience divergent business cycles. Moreover trade may not play an important role for those countries, as trade intensity appears to be weaker among those economies. There the analysis that follows considers a wide range of determinants, beyond trade intensity.

In this section we described our data sources and the way we constructed our variables. We tried to give some intuition behind the use of every variable we use in our lengthy dataset and provide some priors for our analysis. We turn now to the estimation strategy used in this paper.

3) ESTIMATION METHODOLOGY AND CONCERNS

In this section we introduce our model specification and outline the estimation procedure followed.

We start by estimating the following linear model taking into account only the cross section dimension of the data.

$$\begin{aligned} \rho_{ij} = & \alpha_0 + \alpha_1 BTI + \alpha_2 IS + \alpha_3 MPS + \alpha_4 FPS + \alpha_5 RTA + \alpha_6 HK + \alpha_7 NFA + \alpha_8 RULE + \\ & + \alpha_9 LMT + \alpha_{10} TIME + \alpha_{11} IND + \alpha_{12} DEV + \alpha_{13} MIX + \alpha_{14} INTER + \alpha_{15} GRAV + \quad (6) \\ & + \alpha_{16} ORIGIN + u_{it} \end{aligned}$$

where ρ_{ij} is the correlation coefficient of detrended real output between countries i and j , BTI is bilateral trade intensity, IS is one of the six proxies of industrial similarity, MPS is the measure of monetary policy similarity, FPS is the measure of fiscal policy similarity, RTA is a dummy that takes value 1 if the countries in the pair are members of a regional trade agreement, HK is the measure of similarity in educational attainment, NFA is the measure for similarity in net foreign asset positions, RULE is the index of contract enforcement and LMT is the index for differences in labour market tightness, TIME are time dummies, IND, DEV and MIX are dummies equal to 1 if both countries are industrial and developing respectively, or at least one of the two is industrialized, INTER is an interaction term between industry similarity and labour market tightness, GRAV is a vector of gravity variables, u_{it} is a white noise disturbance term.

Many of the studies conducted so far take into account the endogeneity argument between business cycles and trade intensity, introduced by Frankel and Rose (1998). The authors use instrumental variables to deal with this endogeneity. They estimate bilateral trade intensity using the gravity model estimation of bilateral trade flows. This model is well documented to isolate to some extent the exogenous component of trade. In our

study we instrument for trade intensity using gravity type variables such as bilateral distance, common border, common language, a dummy for whether a country in a couple is landlocked, a dummy for whether the country in a pair is an island, a dummy indicating if the countries in a pair were colonies under the same colonizer, and the product of GDP and GDP per capita. Some authors like Imbs (2003) and Inklaar et al. (2005), have argued that other forms of endogeneity may exist among the variables considered in an analysis like the one attempted in this paper. Imbs (2003) has estimated a system of 4 equations in which he instruments additionally for financial integration and industrial specialization. Imbs (2003) considers interactions between trade intensity and industrial structure, so the industrial structure enters in the system as a direct determinant of the business cycle correlations and instruments trade intensity as well. Also specialization could be the result of trade so it should be instrumented on its own. Finally, Imbs instruments for financial integration, that apart from being a direct factor affecting business cycle correlations, it can act as an indirect one affecting specialization. Inklaar et al. (2005), pointed out that the gravity variables used to instrument for trade intensity may affect also other variables that determine the business cycle correlations. For example, countries that share a common border may implicitly or explicitly have common monetary policy targets. If such a case arises then monetary policy should be instrumented in a similar way like trade intensity. Moreover, monetary policy can affect the business cycle, but it can also be the response to shocks driving the business cycle. Therefore it becomes endogenous in a similar way like trade intensity. Such an argument might also arise for the case of fiscal policies. In this paper, we consider two forms of endogeneity, the one between trade intensity and business cycle correlations, and between policy variables and the business cycle. The other forms of potential endogeneity were considered as well but yielded poor evidence of its existence, especially in the non-OECD economies.

The method used to estimate our simultaneous system of equations is Three Stage Least Squares (TSLS) both for the cross section and the panel. The advantage of this method is that it accounts for both simultaneity and endogeneity. Compared to using a simple SURE system of equation, where only the simultaneity is considered, the TSLS method accounts also for the information that might exist from the cross-equation restrictions. This additional information comes from the fact that the cross-equation disturbances might be correlated, not only across time, but also across equations. Failure to account for this additional information would yield less efficient estimates. On the other hand, the TSLS estimation is essentially GLS estimation, and its performance depends very much on the validity of the instruments used in each equation, to isolate the exogenous component of each of the endogenous variables.

The TSLS is performed in three stages: 1) each equation in the simultaneous system is estimated by using two stage least squares. 2) The estimated residuals from the first step are used to construct the covariance matrix of equation disturbances. 3) In the final step, the matrix from step two is used as the appropriate weighting matrix to obtain the GLS estimator of the parameters in the system. TSLS essentially can account for the presence of heteroskedasticity due to potential endogeneity between the variables.

These two studies are methodologically the closest to our study. Their focus is mainly for an OECD sample of economies. We apply this method to a sample containing both OECD and non OECD economies and a sample with only non – OECD economies. The

instrumental variables procedure is followed in this study, by using the gravity variables to instrument for trade intensity. Moreover we account for potential endogeneity of the monetary policy. Monetary policy can be the source of shocks that cause business cycle convergence/divergence or the tool that is used as a reaction to shocks in the business cycle. Our system will contain a third equation instrumenting for monetary policy. The instruments used for monetary policy are an index of central bank independence, an index of how similar is the government ideology in the countries in each pair, a set of gravity variables, the rule of law index and the dummy variables indicating common legal origin, openness and in some cases human capital similarities. The reason for using human capital similarities is that in economies with relatively more educated populations, there may be more control on the executives of different policies. It may be the case that in such countries the policy objectives are similar and therefore the policies followed to achieve those objectives are similar as well. Gravity variables are considered by Inklaar et al. as they may foster similarity in policies. The rule of law and the legal origin may act as a proxy for structural characteristics in economies that may affect the decisions about which policy will be implemented. Finally, the more open the economies in a couple are, the more similar the policy they usually implement to battle shocks resulting due to terms of trade or foreign demand shocks.

The system to be estimated is the following:

$$\begin{aligned} \rho_{ij} = & \alpha_0 + \alpha_1 BTI + \alpha_2 IS + \alpha_3 MPS + \alpha_4 FPS + \alpha_5 RTA + \alpha_6 HK + \alpha_7 NFA + \alpha_8 RULE + \\ & + \alpha_9 LMT + \alpha_{10} TIME + \alpha_{11} IND + \alpha_{12} DEV + \alpha_{13} MIX + \alpha_{14} INTER + \alpha_{15} GRAV + \\ & + \alpha_{16} ORIGIN + u_{it} \end{aligned} \quad (7)$$

$$\begin{aligned} BTI = & \beta_0 + \beta_1 DIST + \beta_2 BORDER + \beta_3 LANG + \beta_4 ISL + \beta_5 LAND + \beta_6 COL + \\ & + \beta_7 GDPP + \beta_8 GDPPC + \omega_{it} \end{aligned} \quad (8)$$

$$MPS = \gamma_0 + \gamma_1 CBI + \gamma_2 IDEOL + \gamma_3 DIST + \gamma_4 OPEN + \gamma_5 RULE + \gamma_6 ORIGIN + \eta_{it} \quad (9)$$

Where DIST is the bilateral distance between the capitals of the two countries, BORDER is a dummy that takes value 1 if the countries in the couple share a common border, LANG is a dummy that takes value 1 if the pair shares a common language, ISL is a dummy that takes values 0 if no country is an island, 1 if the first country in the country pair is an island and 2 if the second country in the country pair is an island, LAND is a dummy that takes value 1 if , COL is a dummy that takes value 1 if both countries shared the same colonizer in the past, GDPP measures the product of the two countries' GDP to account for the role of country size on trade, GDPPC measures the product of the two countries' GDP per capita to account for the role of country development on trade. As mentioned above the above variables are well documented to isolate to an important extend the exogenous part of trade. The variables in the third equation are considered together or in subsets as explaining the exogenous part of monetary policy. CB measures the degree of similarity between the Central Banks in the two economies to account for how independent their governors are, IDEO is a variable as to how similar are the

governments of the country pair concerning their ideology, RULE is as defined in the previous section and ORIGIN is a dummy that takes value 1 if both countries have common legal origin. Five different legal origins are considered here: English, French, German, Scandinavian and Socialist. Another five dummies are considered and take value 1 if both countries in a pair share English legal origin, French legal origin and so on.

The system is first estimated using the cross section dimension of our sample. Then we use also some time variation in the sample to see whether we can achieve something better in terms of identifying the potential determinants of business cycle correlations and compare them across sub samples and estimation procedure. To achieve some time variation in our dataset we reconstructed the variables, whenever possible for every five years. Therefore we end up having 14250 observations (5 for every of 2850 country pairs) for the full sample.

Next, we turn to the analysis of our estimation results, focusing mainly on the effect of the monetary and fiscal policy, the labour market tightness and rule of law and the comparison between the two country sub-samples.

4. Empirical Results

In this section, we review the main results of the simultaneous equations estimation. We consider first the cross section analysis. Moreover, we consider the robustness of the results when the panel data estimation procedure is used. Finally, we compare the results across samples.

4.1) Cross Section Analysis

Table 1 in appendix 2 presents the results for the full sample of countries in our study. The first three columns correspond to the system without the human capital, labour market tightness/ interaction term between industrial structure and labour market tightness variables. The last three columns correspond to the sample with all the variables but fewer observations as the labour market tightness variable is available only for 58 countries. Therefore in our results the last three columns always correspond to the sample with less observation, due to unavailability of data on labour market rigidities for all the 76 countries in our initial sample.

Table 1, confirms that trade intensity is one of the main channels through which business cycles are correlated between economies. Our results show that the higher the volume of trade between two economies the more synchronized are their output cycles. This result confirms the argument of Frankel and Rose that trade acts as a transmission channel rather than causing specialization and therefore business cycle divergence. Industrial similarity also plays a positive role in business cycle convergence. Therefore, countries with more similar industrial structure experience more correlated business cycles. Monetary policy enters significantly but with a negative sign, while fiscal policy turns out to play no role for business cycle correlations. Monetary policy seems to have an indirect

positive effect on business cycles through fostering trade as we can see in the second column of Table 1. Financial integration has a small in magnitude (-0.008) but significant effect on business cycles. Membership in a Regional Trade Agreement (RTA), more open economies and larger economies in the same country pair experience higher business cycle correlations. Sharing a common border and being closer with each of the economies in the same pair has a direct positive effect on the synchronization of business cycles. Being in a couple where both countries are industrial economies enhances business cycle correlation, whereas the opposite is true for a couple where both countries are developing. The institutional variables like rule of law and legal origin dummies seem not to have a significant effect on output correlations. This is indicated by the insignificance of the F-statistic at the end of the table both for all the institutional variables considered together (4.11) and the one only for the legal origin dummies (1.57). The regional dummies, the gravity variables and the policy variables have a significant joined effect indicated by the values of the corresponding F-statistics. Finally the joint significance of the instruments in the other two equations of the system is high as indicated by the Chi-square statistics (2914 for the trade intensity equation and 430 for the monetary policy equation.)

Adding the last two variables for which less observations are available do not change the results very much. In the last three columns of Table 1, human capital and the interaction term between labour market rigidities and industrial similarity are reported together with all the previous variables. Here the interaction term and not the actual index of differences in labour market rigidities is reported. Regressions were performed with both variables including one at a time as they are highly correlated (correlation coefficient=0.82) and the best results in terms of joint significance are reported. In the last three columns of Table 1, industrial structure, belonging to an industrial and large economies couple and sharing a common border enhances the correlation of business cycles. Policy variables do not play any role, both individually and jointly (F statistic= 5.13). From the institutional variables, legal origin dummies have an insignificant joint effect. Human capital has an insignificant role as well. The new variables proposed by this study, the rule of law and the interaction term between industrial similarity and labour market tightness have no significant impact on business cycle correlation, both individually and jointly (F-statistic=1.91). Regional effects are quite strong, as well as the effect of gravity variables. Our conclusion for the full sample would be that economic structure, the volume of trade, physical characteristics and not policy and institutional characteristics determine whether the cycles in a pair of countries will be strongly correlated or not.

Table 2 in Appendix 2 contains the results for the OECD sample. This is a more homogeneous group of economies, with the majority of the volume of trade flows taking place among them. Bilateral trade intensity has in this case a positive and large in magnitude effect on business cycle correlations. Financial integration plays also a significant role. The larger the difference in the net foreign asset positions between economies the more divergent their business cycles. More open and larger economies experience greater output correlations in this case as well. Monetary and fiscal policy have no significant direct effect on the business cycle. From the second column, we can

attribute only an indirect positive effect of monetary policy similarity on the business cycle correlations through promoting trade intensity. Finally, the institutional variables and gravity variables appear to have an insignificant effect both individually and jointly in determining output correlations.

Introducing Human capital and the interaction term do not change the results very much. Trade intensity, openness, size and financial integration still have an important effect. Human capital similarity enters with the opposite expected sign in our analysis, a finding that is quite puzzling. Legal origin still plays no role. The variables proposed by this study remain insignificant. The F-statistic for their joint significance is merely 0.96). Finally, the policy variable seem to have a small significant joined effect (F-statistic=6.25) at the 10% level.

Finally, Table 3, contain results for the non-OECD sample. Trade intensity has an insignificant effect in this case, as well as industrial similarity. The coefficient on trade intensity is negative (-0.02). This indicates that trade intensity is not a strong determinant for this sample of countries. This may be due to the fact that not much trade is taking place among these economies. Monetary policy enters significantly but not with the expected sign. This may indicate failure to instrument sufficiently well monetary policy similarity for this sub-sample in our study. Alternatively, it may reflect that monetary policies are not correlated enough for this sample of countries, as this group of economies is economies experiencing usually different shocks and using monetary policy, if any, quite differently from each other. Therefore, we are unable to observe great cycle correlations in this sample due to monetary policy similarity. Gravity variables have a significant joined effect on business cycles, with countries sharing a common language experiencing higher business cycle correlations. Common language can reflect similarities in the structure or act as a transmission channel for things not captured by the already included variables in the model. Finally, there are strong regional effects as indicated by the F- statistic. We are unable to detect any important role played by institutions like legal origin or rule of law.

Adding human capital and the interaction term in the reduced sample of observation does not alter the results a lot. Again monetary policy enters with a negative sign. Regional effects are highly significant. From the institutional variables, the rule of law and the interaction term remain both individually and jointly insignificant (F-statistic=0.45).

In the next section we check the robustness of our results by performing system estimation using a panel dataset.

4.2) Panel data analysis

Tables 4 to 6 in Appendix 2 present the results on the panel data analysis. To begin with, Table 4 shows the results on the full sample with the policy and institutional variables included. Trade intensity has a positive but insignificant effect. Industrial similarity is very significant with a large positive effect on business cycle correlations (coefficient on industrial similarity= 0.281). Monetary policy has an insignificant direct effect, but a

significant positive indirect effect through fostering trade. Fiscal policy appears to play a role in the panel analysis, while this was not the case in the previous sub-section. Being a member in a RTA increases the likelihood of more convergent business cycles. Industrial country pairs do not appear to experience significantly higher output correlations, whereas developing economies couples are more likely to be subjected to divergent business cycles. From the gravity variables, sharing a common border enhances the synchronization. Distance enters with a positive sign, indicating that countries that are farther from each-other are more correlated in their output cycles. This is quite not expected, but it can be justified by thinking that countries far away from each-other are not subjected to contagion effects of shocks from one country to the other. Regional effects are quite important in this case as well. Institutions in the form of legal origin similarities and rule of law are not significant determinants in this case.

The last three columns of Table 4 contain results for the reduced sample of 58 countries, where human capital and the interaction term are included. In this case, the results are similar with the only difference being that industrial similarity is no longer significant. Additionally, belonging to a couple of industrial economies has a large positive and significant effect on the business cycle correlations. The effect of monetary policy is important via the trade channel and fiscal policy remains significant. From the institutional variables, human capital similarity, legal origin dummies do not play any significant role (f -statistic=5.99). The new variables proposed, the rule of law and the interaction term between industrial similarity and labour market rigidities, are insignificant both individually and jointly. We could conclude that economic structure, policy similarity and physical characteristic should be considered as the main determinants of business cycle correlations compared to various institutional similarities, in a sample of both OECD and non OECD economies.

Table 5, contains the analysis for the OECD sample. Trade intensity remains significant with a large positive effect on business cycle correlations. The coefficient on trade intensity (0.338) indicates that these economies are either subjected to shocks of similar nature or that trade links are very tight and they act as a transmission channel for demand shocks from one economy to the other. This is true if one considers the large volume of intra-industry trade taking place among these economies. Policy similarities are important. Fiscal policy remains significant for this sample of countries as well. Monetary policy seems again to work positively through fostering trade. Membership in a regional trade agreement increases business cycle correlations. Openness has a negative effect contrary to the expected one. From the institutional variable, rule of law enters significantly at merely 10% level with a positive effect, contrary to our prior. The joint significance of the institutional variables remains low with a P-value of 0.240.

Adding the two extra variables does not change the results dramatically. The last three columns of Table 5 indicate that policy variables remain significant. Adding human capital and the interaction term does not affect the results. The new variables (rule of law and the interaction term) remain insignificant with joint p-value of 0.248. For the OECD sample, policy variables, trade intensity and membership in a RTA play an important role

compared to the variables introduced in this study to account for similarities in institutions.

This section concludes with the panel results for the non-OECD sample. Table 6 in appendix 2 presents those results. In the first three columns of table 6, trade intensity has a positive effect on business cycle correlations, but of a smaller magnitude than that of the OECD economies case. The coefficient here is 0.082 compared to the 0.338 value in the OECD case. There are strong regional effects as indicated by the F-statistic at the end of the table. Gravity variables play a role, with economies sharing a common border experiencing more correlated business cycles. Distance appears to be significant with a positive sign, opposite to our prior. The joint significance of the gravity variables is quite high. Legal origin dummies are very significant. In this sample of non-OECD economies only English and French legal origin are considered (F-statistic p-value=0.003). The institutional variables appear to have an important joint effect as well (F-statistic p-value=0.081). Finally, the last three columns of Table 6 contain the results with the additional institutional variables. The conclusions are that apart from a positive indirect effect of fiscal policy through trade and strong regional effects, all other variables appear to be insignificant. From the new variables only labour market tightness is significant for the first time in this study at the 10% level. Larger differences in how flexible the labour market is, the higher the divergence for the business cycles. It could be said that unlike the case of the full and OECD sample, the determinants for the non-OECD are less robust and more difficult to detect.

5) Concluding remarks

In this paper, we examined empirically which factors appear to be the main determinants of business cycle synchronization. We employed cross section, panel data, and simultaneous equations techniques to assess the role of the different potential factors that might contribute to the bilateral cycle variations. Moreover we considered three samples: a sample with OECD and non-OECD economies (full sample), and two sub samples one containing only the OECD economies and one only the non-OECD economies. The main findings of our paper are the following:

- For the full sample and regardless of the methodology used the variables that explain to some extent the business cycle synchronization are Industrial similarity, membership in a regional trade agreement, whether the two countries in the couple belong geographically in the same region, and whether the two countries in a pair are industrialized or developed. The degree of openness of the two economies in the sample, the size of the two economies in the pair and financial integration have a significant role only in some specifications. From the Gravity variables, sharing a common border is enhancing business cycle correlations in all the specification. Distance has a direct effect, but not in all the specifications. The important point is that trade intensity does not appear to significantly determine the business cycles. This result is in contrast with the previous empirical literature that promoted trade as the main channel through which business cycles are correlated. Frankel and Rose (1998) found a very positive coefficient for trade

intensity. Even if we consider that the majority of the studies are conducted for OECD economies, the two studies conducted for OECD and non-OECD economies so far by Calderon et al. (2002) and Baxter and Kouparitsas (2004) give credit to bilateral trade intensity. Industrial similarity has been found to have ambiguous role in the previous studies. Baxter and Kouparitsas (2004) did not find a robust effect by industrial similarity, whereas Calderon et al. (2002) did find such an effect. CU membership was not found to be significant, whereas RTA has a prevalent role. This result is in contrast with the extensive literature on the positive effect of the CU, but in line with the results in Baxter and Kouparitsas (2004). The two indicator variables for whether the two countries are industrialized or developing were found to play a role also in Baxter and Kouparitsas (2004). Monetary policy coordination has only an indirect effect through trade on Business cycle correlations. Fiscal policy has sometimes a direct and indirect effect through trade on Business cycles. Finally, the institutional variables do not affect directly the business cycles. Only legal origin and educational attainment (human capital) similarities affect indirectly the output correlations through fostering more trade. The role of the rule of law, law and order and labour market tightness/ interaction term is insignificant.

- For the OECD economies the important factors are bilateral trade intensity, membership in a regional trade agreement and the degree of openness openness. Important factors in only some of the systems appear the size dummy, financial integration, fiscal policy similarity. Trade intensity is found to be important factor in line with the studies for the OECD economies. Industrial similarity has an effect only through affecting trade intensity. The more similar the economic structures the higher the bilateral trade intensity. This is in agreement with the patterns of intra-industry trade arising in OECD and particular in the EU members. This finding supports the study by Imbs who promoted in a series of papers the importance of industrial structure similarity and specialization on the business cycle correlations. The fact that similar institutional characteristics like legal origin, rule of law, law and order and labour market rigidities are insignificant, contrasts the work by Otto et al. (2001, 2003), who first considered country characteristics , together with the conventional factors. Monetary policy plays mainly an indirect role through promoting trade. Legal origin and human capital similarity have here also an effect through promoting trade.

- For the non-OECD economies, we fail to identify any determinants for their business cycle correlations. To the best of the cases we are able to identify regional effects mainly for countries in South America and Southeast Asia. Variables like trade intensity and gravity variables like common border and common language have an effect but this effect is less robust and is mainly observed in the panel estimation. From the institutions the degree of labour market rigidities plays a role only in the panel estimation. Legal origin dummies and institutions play a joint role in the panel estimation as well. Monetary policy has an opposite effect than expected on business cycles only in the cross section. The fact that trade intensity is not found to play a role, but in one specification, contradicts the results of Calderon et al. (2002), who for a sub sample of developing countries in their study, they find a small in magnitude positive effect

for trade intensity. Also the same authors find a negative effect for production asymmetries, a different proxy for industrial similarities for this sub sample of developing economies, whereas we fail to identify a role for industrial similarity here. We could say that the regional effects in South America found important are in line with Kose et al. (2003) who found that developing countries are characterized mainly from regional effects and that these effects were specifically important for the Latin America region.

The above results suggest that the determinants are different for a sample of OECD economies that those for a non-OECD sample. The importance of a membership in a regional trade agreement in the full and OECD samples, suggests that integration between OECD economies seems to be more likely than between non-OECD economies. Moreover, integration of non-OECD economies with OECD economies seems to benefit those economies more than integration with other non-OECD economies. The results on industrial similarity and trade intensity should not come as a surprise, as it is a fact that the North-North trade is higher in volume than the South-South one. This is revealed also from the case studies from Fiess (2007) and Sing and Wang (2005) that trade is more inter-industry among the economies of Central America and intra-industry in only a subset of the Asian economies, respectively. The case studies reveal that trade intensity between the Central American countries and USA is much higher, than among these countries. Considering that developing economies experience such patterns of trade intensity and industrial structure to a different extend, one could say that these countries are more correlated with OECD economies, even if that correlation is small, than with other developing economies.

As a conclusion, our study confirms the conventional wisdom for OECD economies, it finds a role for monetary policy through enhancing trade between the pair, but does not give any credit to the law and order, rule of law and labour market tightness variables considered here. For the last variable and legal origin variables, a significant effect was identified only in the panel specification of the non-OECD sample. We support that the determinants are different for the different sample of economies studied here. The shortcoming of this study is that, though the determinants are found to be different, more research is needed in identifying which factors, apart from regional effects, explain robustly the correlations among the developing countries.

NOTES

1. Other measures that were proposed include the normalization of the above measure by the product of two countries GDP or two countries total trade (Clark and Wincoop (2001)). They argue that this measure is not size dependent. Moreover Otto et al. (2001) suggest the maximum of:

$$\sum_t \left(\frac{X_{ijt} + M_{ijt}}{Y_{it}} \right), \sum_t \left(\frac{X_{ijt} + M_{ijt}}{Y_{jt}} \right) \quad (3)$$

What matters here is whether one country is exposed to the other.

2. Alternative indices are an index for differences in production structure (Imbs (2003)) and an index of intra-industry trade (Grubel and Loyd (1971)). The first index is defined as:

$$\frac{1}{T} \sum_t \sum_{n=1} |s_{in} - s_{jn}| \quad (4)$$

where s_{in} is the GDP of sector i in country n .

The second index is given by:

$$IIT = 1 - \frac{|\sum_k (E_{ij}^k - E_{ji}^k)|}{\sum_k (E_{ij}^k + E_{ji}^k)} \quad (5)$$

where intra-industry trade is measured as one minus the absolute difference between exports from country i to country j in industry k and exports from country j to country i for the same industry k , divided by total trade.

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Appendix I

Table 1: List of countries and Regions

country	Country code	region
USA (US)	111	NORTH AMERICA (NA)
CANADA (CAN)	156	NORTH AMERICA (NA)
ARGENTINA (ARG)	193	SOUTH AMERICA (SA)
BOLIVIA (BOL)	218	SOUTH AMERICA (SA)
BRAZIL (BRA)	223	SOUTH AMERICA (SA)
CHILE (CHI)	228	SOUTH AMERICA (SA)
COLOMBIA (COLO)	233	SOUTH AMERICA (SA)
COSTA RICA (CORI)	238	SOUTH AMERICA (SA)
DOMINICAN REPUBLIC (DR)	243	SOUTH AMERICA (SA)
ECUADOR (ECU)	248	SOUTH AMERICA (SA)
GUATEMALA (GUAT)	258	SOUTH AMERICA (SA)
HAITI (HAI)	263	SOUTH AMERICA (SA)
MEXICO (MX)	273	SOUTH AMERICA (SA)
PANAMA (PAN)	283	SOUTH AMERICA (SA)
PARAGUAY (PAR)	288	SOUTH AMERICA (SA)
PERU (PER)	293	SOUTH AMERICA (SA)
TRINIDAD & TOBAGO (TT)	369	SOUTH AMERICA (SA)
URUGUAY (URU)	298	SOUTH AMERICA (SA)
VENEZUELA (VEN)	299	SOUTH AMERICA (SA)
BURKINA FASO (BF)	748	AFRICA (AFR)
CAMEROON (CAM)	622	AFRICA (AFR)
EGYPT (EGY)	469	AFRICA (AFR)
GHANA (GHA)	652	AFRICA (AFR)

KENYA (KEN)	664	AFRICA (AFR)
MAURITIUS (MR)	684	AFRICA (AFR)
MOROCCO (MOR)	686	AFRICA (AFR)
NIGERIA (NIG)	694	AFRICA (AFR)
RWANDA (RWA)	714	AFRICA (AFR)
SOUTH AFRICA (SA)	199	AFRICA (AFR)
TANZANIA (TAN)	738	AFRICA (AFR)
TUNISIA (TUN)	744	AFRICA (AFR)
UGANDA (UGA)	746	AFRICA (AFR)
ZIMBABWE (ZIM)	698	AFRICA (AFR)
AUSTRIA (AUT)	122	EUROPE (EU)
DENMARK (DEN)	128	EUROPE (EU)
FINLAND (FIN)	172	EUROPE (EU)
FRANCE (FRA)	132	EUROPE (EU)
GERMANY (GER)	134	EUROPE (EU)
GREECE (GRE)	174	EUROPE (EU)
HUNGARY (HUN)	944	EUROPE (EU)
ICELAND (ICE)	176	EUROPE (EU)
IRELAND (IRE)	178	EUROPE (EU)
ITALY (ITA)	136	EUROPE (EU)
MALTA (MALT)	181	EUROPE (EU)
NETHERLANDS (NETH)	138	EUROPE (EU)
NORWAY (NOR)	142	EUROPE (EU)
PORTUGAL (POR)	182	EUROPE (EU)
ROMANIA (ROM)	968	EUROPE (EU)
SPAIN (SP)	184	EUROPE (EU)
SWEDEN (SWE)	144	EUROPE (EU)
SWITZERLAND (SWI)	146	EUROPE (EU)
UNITED KINGDOM (UK)	112	EUROPE (EU)
AUSTRALIA (AUS)	193	OCEANIA (OCE)
NEW ZEALAND (NZ)	196	OCEANIA (OCE)
FIJI (FJ)	819	OCEANIA (OCE)
BAHRAIN(BAHR)	419	MIDDLE EAST (ME)
IRAN (IRAN)	429	MIDDLE EAST (ME)
ISRAEL (ISR)	436	MIDDLE EAST (ME)
JORDAN (JOR)	439	MIDDLE EAST (ME)

KUWAIT (KUW)	443	MIDDLE EAST (ME)
OMAN (OM)	449	MIDDLE EAST (ME)
SYRIA (SYR)	463	MIDDLE EAST (ME)
TURKEY (TUR)	186	MIDDLE EAST (ME)
CYPRUS (CYPR)	423	MIDDLE EAST (ME)
INDIA (IND)	534	SOUTH ASIA (SA)
NEPAL (NEP)	558	SOUTH ASIA (SA)
PAKISTAN (PAK)	564	SOUTH ASIA (SA)
SRI LANKA (SR)	524	SOUTH ASIA (SA)
INDONESIA (INDO)	536	SOUTHEAST ASIA (SEA)
JAPAN (JAP)	158	SOUTHEAST ASIA (SEA)
MALAYSIA (MAL)	548	SOUTHEAST ASIA (SEA)
PHILIPPINES (PHI)	566	SOUTHEAST ASIA (SEA)
SINGAPORE (SING)	576	SOUTHEAST ASIA (SEA)
REPUBLIC OF KOREA (KOR)	542	SOUTHEAST ASIA (SEA)
THAILAND (THA)	578	SOUTHEAST ASIA (SEA)

Table 2: Descriptive Statistics

variable	description	mean	standard deviation	min	max
corrp	Correlation coefficient of detrended output using penn world table data	0.073661	0.287672	-0.74046	0.859041
corrptr	Transformed correlation coefficients using penn world table data	0.082219	0.317491	-0.95151	1.289673
corrwb	Correlation coefficient of detrended output using world bank data and BK filter	0.061387	0.266086	-0.82167	0.870673
corrwbtr	Transformed correlation coefficients using world bank data and BK filter	0.135753	0.584112	-2.32385	2.671707
Corrwb2	Correlation coefficient of detrended output using world bank data and HP filter	0.072191	0.277436	-0.84981	0.873276
Corrwb2tr	Transformed correlation coefficients using world bank data and HP filter	0.159454	0.612129	-2.51092	2.693435
BTI	Bilateral Trade Intensity	-9.23706	2.589307	-25.1974	-1.97802
isa	export similarity measure computed as the absolute difference of the export shares when the data are aggregated at the first digit	-0.1036	0.362366	-0.93017	0.894935
isa2	Export similarity measure as the absolute difference of the export shares for the data aggregated at the second digit	-0.34773	0.25792	-0.90953	0.854075
isc	Export similarity measure computed as the correlation coefficient for the export shares for data aggregated at the first digit	0.493332	0.255377	0.00682	0.998796
isc2	Export similarity measure computed as the correlation coefficient for the export shares for data aggregated at the second digit	0.255579	0.214405	0.000794	0.99859

iss	Export similarity measure computed as the square difference of the export shares for data aggregated at the first digit	0.608803	0.281605	-0.453	0.99638
iss2	Export similarity measure computed as the square difference of the export shares for data aggregated at the second digit	0.667222	0.240138	-0.33127	0.995293
MPS	Correlation coefficient of money supply growth rates	0.136092	0.277617	-0.6492	0.888363
FPS	Correlation coefficient of government budget deficits	0.066216	0.338635	-0.79953	0.886713
NFA	absolute differences of external asset positions	11.13264	11.83413	0.364431	88.30234
NFAS	square difference of external positions	13.44936	40.62865	0.025644	368.7229
OPEN	Correlation coefficient of degree of openness	0.301774	0.52087	-0.94269	0.994972
OPENA	Absolute difference of degree of openness	43.24845	43.11037	1.3368	237.434
SIZE	Size time equal 1 if at least one country's GDP above the average GDP value	0.270175	0.444128	0	1
SIZEM	Size time equal 1 at least one country's GDP above the medium GDP value	0.753333	0.431147	0	1
SIZE25	Size time equal 1 at least one country's GDP above the 25 th quartile GDP value	0.94	0.237529	0	1
SIZE75	Size time equal 1 at least one country's GDP above the 75 th quartile GDP value	0.44	0.496474	0	1
RTA	Regional Trade Agreement Dummy	0.012643	0.11175	0	1
ORIGIN	Legal Origin Dummy	0.364561	0.481391	0	1
ENG	English Legal Origin Dummy	0.132632	0.339236	0	1
FREN	French Legal Origin Dummy	0.221053	0.415029	0	1
GER	German Legal Origin Dummy	0.007368	0.085538	0	1
SCAN	Scandinavian Legal Origin Dummy	0.003509	0.059141	0	1
LAW	Absolute difference in law and order index	1.763768	1.101864	0.00E+00	4.6875
LAWS	Square difference in law and order index	4.957481	5.104255	0	22.71875
RULE	Absolute difference in rule of law index	1.158331	0.830138	0.0015	3.430134
RULES	Square difference in rule of law index	2.030617	2.400157	2.25E-06	11.76582
IND	Industrial economies couple dummy	0.105263	0.306946	0	1
DEVEL	Developing economies couple dummy	0.447368	0.49731	0	1
MIX	Industrial-developing couple dummy	0.447368	0.49731	0	1
NA	North America regional dummy	0.000351	0.018732	0	1
SA	South America Regional Dummy	0.047719	0.213209	0	1
AFR	Africa Regional Dummy	0.027368	0.163183	0	1
EU	Europe Regional Dummy	0.06	0.237529	0	1
OCE	Oceania Regional Dummy	0.001053	0.032433	0	1
ME	Middle East Regional Dummy	0.012632	0.111698	0	1
SEA	Southeast Asia Regional Dummy	0.019298	0.137595	0	1
SAS	South Asia Regional Dummy	0.002105	0.045843	0	1
CBI	Absolute difference in central bank independence index	0.208225	0.211326	0	1
CBIS	Square difference in central bank independence index	0.087998	0.157779	0	1
IDEOL	Absolute difference in government ideology index	0.671961	0.414174	0	2
DISTANCE	Log of bilateral distance	8.296749	0.769877 6	4.399464	9.419
GDP product	Log product of real GDP	49.23782	2.358737	42.9618	56.96595
GDP per capita	Log product of real GDP per capita	16.56905	1.328831	12.49599	19.33297

LAND	Landlocked country dummy	0.254286	0.466433	0	2
ISL	Island country dummy	0.345	0.530839	0	2
BORDER	Common border dummy	0.023571	0.151737	0	1
LANG	Common language dummy	0.215714	0.41139	0	1
COL	Common colonizer dummy	0.070714	0.256393	0	1

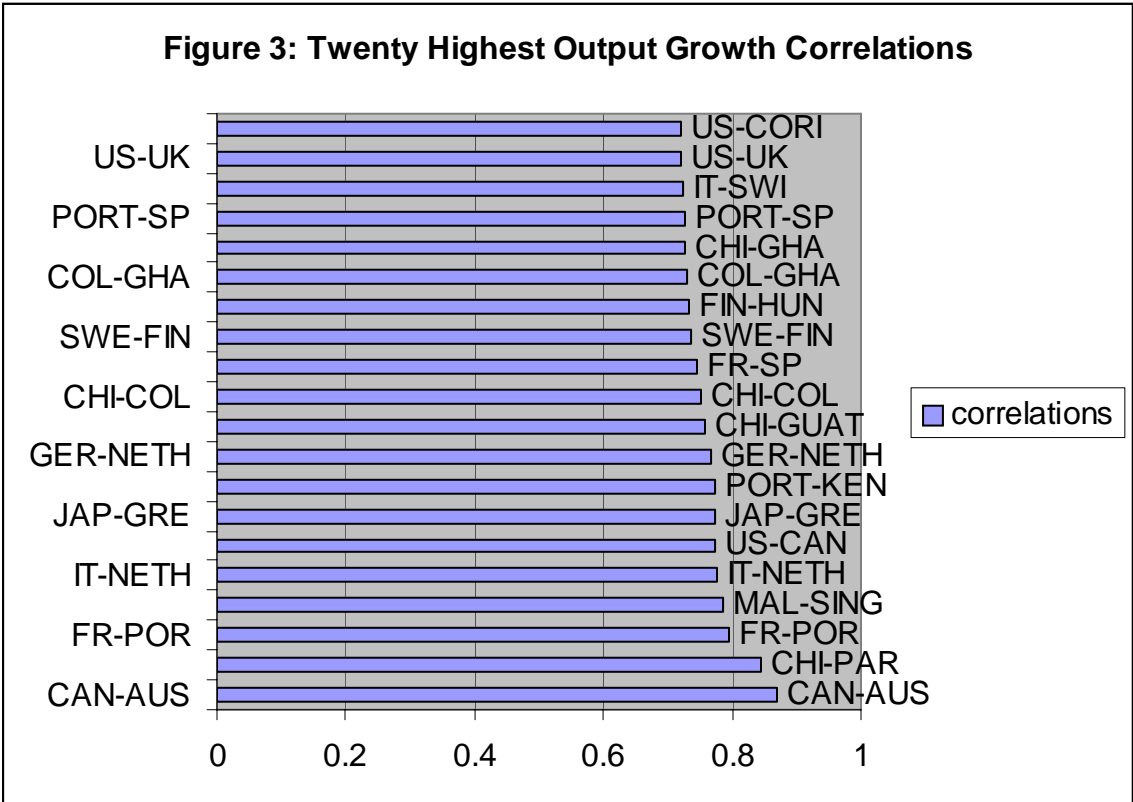


Figure 4: Twenty Lowest Output Growth Correlations

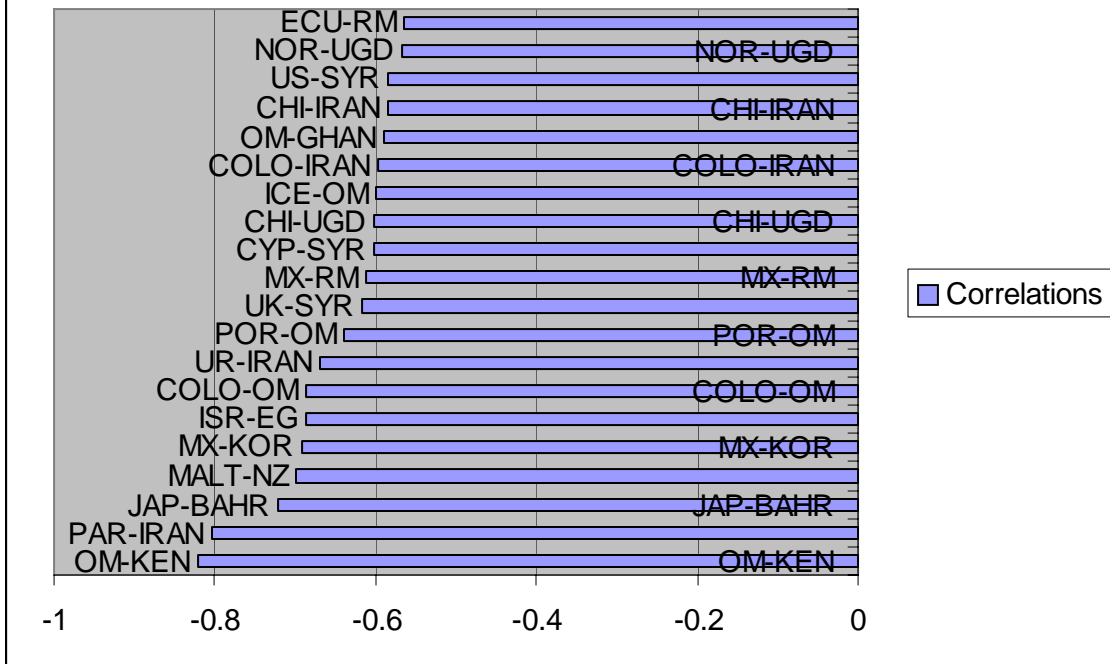


Table 3: Trade intensity extreme values

Twenty Highest Bilateral Trade Intensity values			Twenty Lowest Bilateral Trade Intensity values		
Malaysia	Singapore	-1.97802	Venezuela	Uganda	-25.1974
Germany	Netherlands	-3.37985	Venezuela	Rwanda	-20.7056
Singapore	Thailand	-3.52079	Guatemala	Rwanda	-19.3433
Indonesia	Singapore	-3.53176	Uruguay	Fiji	-19.2916
USA	Canada	-3.58466	Guatemala	Mauritius	-19.1973
France	Germany	-3.62692	Dom. Republic	Jordan	-19.1156
Norway	Sweden	-3.67297	Haiti	Ghana	-19.0207
Denmark	Sweden	-3.78172	Dominican R	Oman	-18.6915
Germany	Italy	-3.80782	Syria	Mauritius	-18.5813
France	Italy	-3.86813	Guatemala	Cameroon	-18.5327
UK	Netherlands	-3.88434	Dom. Republic	Iran	-18.4178
Sweden	Finland	-3.90006	Paraguay	Oman	-18.3407
UK	Germany	-4.02367	Guatemala	Tanzania	-18.3112
UK	Ireland	-4.08152	Ecuador	Mauritius	-18.2314
Austria	Germany	-4.11718	Venezuela	Tanzania	-18.1179
Germany	Switzerland	-4.12376	Mexico	Uganda	-18.0687
UK	Germany	-4.20945	Cameroon	Uganda	-17.9664
Germany	Netherlands	-4.21254	Phillipines	Rwanda	-17.9205
USA	Japan	-4.23455	Cameroon	Fiji	-17.8249
Kuwait	Singapore	-4.23689	Dom. Republic	Fiji	-17.7819

Appendix 2

Table 1: Determinants of business cycle correlations, Full sample, Three stage least squares, cross section

variables	Business Cycle	Trade Intensity	Monetary Policy	Business Cycle	Trade Intensity	Monetary Policy
trade intensity	-0.030* (0.084)			0.004 (0.913)		
industrial similarity	0.130* (0.07)	0.179 (0.225)		0.217** (0.043)	-0.148 (0.342)	
monetary policy	-0.930** (0.03)	0.948*** (0.002)		0.621 (0.104)	0.429 (0.102)	
fiscal policy	0.018 (0.689)	0.182** (0.049)		0.023 (0.672)	0.159* (0.076)	
industrial couple	0.410*** (0.000)			0.248*** (0.007)		
developing couple	-0.162*** (0.004)			-0.078 (0.336)		
RTA	0.317*** (0.005)			0.224* (0.061)		
size	0.108*** (0.004)			0.131*** (0.007)		
financial integration	-0.008*** (0.005)			-0.004 (0.263)		
openness	0.067* (0.072)		0.082*** (0.000)	-0.031 (0.510)		0.073*** (0.000)
rule of law	-0.048 (0.293)		-0.067*** (0.000)	0.058 (0.189)		-0.074*** (0.000)
common border	0.270*** (0.008)	0.082 (0.683)		0.335*** (0.004)	0.356** (0.042)	
common language	0.043 (0.420)	0.518*** (0.000)		0.041 (0.538)	0.465*** (0.00)	
distance	-0.091** (0.019)	-0.989*** (0.000)	-0.127*** (0.000)	0.140*** (0.004)	-0.952*** (0.000)	-0.128*** (0.000)
product of output		0.372*** (0.000)			0.299*** (0.000)	
output per capita		0.360*** (0.000)			0.199*** (0.000)	
landlocked		-0.616*** (0.000)			-0.547*** (0.000)	
island		-0.355*** (0.000)			-0.07 (0.357)	
common colonizer		-0.162 (0.333)			0.361* (0.096)	
Human Capital				-0.024 (0.737)	0.668*** (0.000)	0.048*** (0.004)
central independence	bank			-0.142*** (0.000)		-0.086** (0.028)

government ideology				0.021 (0.188)		0.048** (0.019)
origin		0.223*** (0.004)			0.135* (0.067)	
inter				-0.061 (0.761)		
Chi-square	284.19 (0.000)	2913.02 (0.000)	429.54 (0.000)	284.12 (0.000)	2396.09 (0.000)	343.09 (0.000)
Fstatistic for regional dummies	44.91 (0.000)			31.57 (0.000)		
Fstatistic for legal origin dummies	1.57 (0.814)					
Fstatistic for gravity variables	13.58 (0.0035)			13.95 (0.001)		
Fstatistic for policy variables	10.79 (0.013)			5.13 (0.162)		
Fstatistic for institutional variables	4.11 (0.533)			2.95 (0.3986)		
Fstatistic for new variables	-			1.91 (0.384)		
Observations	1449	1449	1449	1010	1010	1010

p values in parentheses

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

Table 2: Determinants of business cycle correlations, OECD sample, 3SLS, cross section						
	Business Cycle	Trade Intensity	Monetary Policy	Business Cycle	Trade Intensity	Monetary Policy
trade intensity	0.154** (0.027)			0.229*** (0.002)		
industrial similarity	0.449 (0.127)	0.522 (0.101)		0.35 (0.258)	0.497 (0.118)	
monetary policy	0.084 (0.853)	1.321** (0.021)		-0.993* (0.079)	1.834*** (0.000)	
fiscal policy	0.095 (0.444)	0.059 (0.688)		0.066 (0.599)	0.083 (0.565)	
openness	3.973*** (0.000)		-0.529 (0.115)	3.593*** (0.001)		-0.545 (0.107)
RTA	-0.029 (0.823)			0.035 (0.794)		
size	0.202** (0.033)			0.115 (0.223)		
financial integration	-0.029** (0.041)			-0.028** (0.044)		
rule of law	-0.036 (0.73)		0.086** (0.026)	-0.083 (0.444)		
common border	0.244 (0.158)	0.112 (0.572)		0.184 (0.299)	0.116 (0.559)	
common language	0.06 (0.68)	0.229 (0.154)		0.07 (0.643)	0.281* (0.07)	
distance	0.017 (0.891)	-0.799*** (0.000)	-0.199*** (0.000)	-0.06 (0.613)	-0.707*** (0.000)	-0.198*** (0.000)
product of output		0.248*** (0.000)			0.262*** (0.000)	
output per capita		-0.059 (0.683)			-0.04 (0.784)	
landlocked		-0.476*** (0.001)			-0.485*** (0.001)	
island		0.500*** (0.000)			0.456*** (0.000)	
origin		0.262** (0.026)			0.248** (0.034)	
central bank independence			0.353** (0.014)			0.408*** (0.006)
government ideology			0.161*** (0.002)			0.176*** (0.001)
law and order						0.02 (0.371)
Human capital		0.978*** (0.000)		-0.572*** (0.008)	1.066*** (0.000)	
Ind.similarity*labour rigidity				-0.382		

				(0.443)		
Chi-square	147.61	582.99	232.56	161.41	578.40	222.25
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Fstatistic for legal origin dummies	5.99			1.08		
	(0.199)			(0.896)		
Fstatistic for gravity variables	2.31			2.18		
	(0.510)			(0.53)		
Fstatistic for policy variables	5.02			6.25		
	(0.170)			(0.09)		
Fstatistic for institutional variables	6.24			13.41		
	(0.283)			(0.062)		
Fstatistic for new variables	-			0.96		
				(0.617)		
Observations	190	190	190	190	190	190
p values in parentheses						
* significant at 10%; ** significant at 5%; *** significant at 1%						

Table 3: Determinants of business cycle correlations, non-OECD sample, 3SLS, cross section						
variables	Business Cycle	Trade Intensity	Monetary Policy	Business Cycle	Trade Intensity	Monetary Policy
trade intensity	-0.021 (0.613)			0.001 (0.99)		
industrial similarity	0.17 (0.214)	0.099 (0.742)		0.176 (0.448)	0.286 (0.478)	
monetary policy	-0.680** (0.015)	-0.858 (0.162)		-0.981** (0.018)	-3.464*** (0.000)	
fiscal policy	-0.099 (0.269)	0.108 (0.577)		-0.2 (0.109)	-0.186 (0.457)	
financial integration	-0.006 (0.283)			-0.011 (0.259)		
mixed couple	-0.42 (0.456)			0 (0.000)		
developing couple	-0.561 (0.33)			-0.247 (0.168)		
openness	-0.036 (0.603)		0.023 (0.393)	0.043 (0.68)		0.067* (0.058)
size	0.079 (0.403)			0.072 (0.646)		
RTA	0.782 (0.154)			0 (0.000)		
distance	0.037 (0.646)	-1.546*** (0.000)	-0.044*** (0.002)	0.074 (0.559)	-1.424*** (0.000)	-0.031 (0.113)
product of output		0.364*** (0.000)			0.361*** (0.000)	
output per capita		0.234*** (0.002)			0.399*** (0.000)	
landlocked		-0.561*** (0.008)			-0.648** (0.039)	
island		-0.279* (0.062)			0.252 (0.231)	
common border	0.129 (0.377)	-0.07 (0.823)		0.222 (0.23)	0.046 (0.9)	
common language	0.253** (0.011)	0.049 (0.798)		0.222 (0.164)	0.411* (0.1)	
common colonizer		-0.221 (0.346)			-0.006 (0.986)	
government ideology			0.021 (0.395)			0.045 (0.116)
central bank independence			0.017 (0.731)			0.068 (0.255)
rule of law			-0.212*** (0.000)			-0.159*** (0.000)

origin		0.345**			0.175	
		(0.04)			(0.405)	
law and order	0.064			0.039		
	(0.169)			(0.541)		
Human capital				-0.005		
				(0.978)		
Ind.similarity*labour rigidity				0.212		
				(0.733)		
Chi-square	125.52	588.89	77.55	50.14	292.75	32.67
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Fstatistic for legal origin dummies	1.34			2.39		
	(0.511)			(0.302)		
Fstatistic for gravity variables	7.25			3.13		
	(0.064)			(0.371)		
Fstatistic for policy variables	7.70			8.08		
	(0.053)			(0.045)		
Fstatistic for institutional variables	3.16			2.67		
	(0.368)			(0.751)		
Fstatistic for regional dummies	14.70			7.41		
	(0.005)			(0.060)		
Fstatistic for new variables	-			0.45		
				(0.799)		
Observations	359	359	359	219	219	219
p values in parentheses						
* significant at 10%; ** significant at 5%; *** significant at 1%						

Table 4: Determinants of business cycle correlation panel analysis full sample

	Business Cycle	Trade Intensity	Monetary Policy	Business Cycle	Trade Intensity	Monetary Policy
trade intensity	0.031 (0.135)			0.065 (0.138)		
industrial similarity	0.281*** (0.001)	-0.042 (0.585)		0.037 (0.72)	-0.378*** (0.000)	
monetary policy	-0.295 (0.342)	0.900*** (0.000)		-0.319 (0.631)	1.421*** (0.000)	
fiscal policy	0.102*** (0.002)	-0.017 (0.585)		0.086** (0.039)	0.021 (0.433)	
financial integration	-0.019** (0.016)			-0.018 (0.172)		
openness	0.051 (0.132)		0.068*** (0.000)	0.047 (0.177)		0.033*** (0.001)
size	0.04 (0.439)			0.081 (0.249)		
RTA	0.434*** (0.003)			0.475*** (0.000)		
industrial couple	0.11 (0.228)			0.188** (0.031)		
developing couple	-0.133** (0.027)			0.006 (0.952)		
law and order	0.006 (0.105)					
common language	0.091 (0.12)	0.581*** (0.000)		0.041 (0.52)	0.480*** (0.000)	
common border	0.334** (0.015)	0.463*** (0.000)		0.227* (0.079)	0.341*** (0.001)	
distance	0.108** (0.012)	-0.945*** (0.000)	-0.122*** (0.000)	0.073 (0.139)	-0.926*** (0.000)	-0.116*** (0.000)
landlocked		-0.168*** (0.001)			-0.342*** (0.000)	
island		-0.06 (0.167)			0.406*** (0.000)	
common colonizer		0.750*** (0.000)			0.910*** (0.000)	
product of output		0.424*** (0.000)			0.283*** (0.000)	
output per capita		0.440*** (0.000)			0.490*** (0.000)	
origin		0.086** (0.046)			0.032 (0.376)	
rule of law			-0.048*** (0.000)	0.054 (0.229)		-0.014* (0.074)

central bank independence			-0.048 (0.126)			0.052* (0.088)
Human capital				0.077 (0.159)		
Ind.similarity*labour rigidity				-0.024 (0.914)		
Chi-square	358.18 (0.000)	7188.98 (0.000)	345.99 (0.000)	562.92 (0.000)	8830.83 (0.000)	240.81 (0.000)
Fstatistic for time dummies	45.96 (0.000)			52.10 (0.000)		
Fstatistic for regional dummies	38.43 (0.000)			19.74 (0.012)		
Fstatistic for legal origin dummies	6.40 (0.171)			1.14 (0.8876)		
Fstatistic for gravity variables	13.05 (0.0045)			4.99 (0.173)		
Fstatistic for policy variables	14.91 (0.0019)			6.91 (0.070)		
Fstatistic for institutional variables	9.38 (0.095)			5.99 (0.541)		
Fstatistic for new variables	-			1.51 (0.470)		
Observations	6077	6077	6077	6534	6534	6534

p values in parentheses

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

Table 5: Determinants of business cycle correlation panel analysis OECD sample

	Business Cycle	Trade Intensity	Monetary Policy	Business Cycle	Trade Intensity	Monetary Policy
trade intensity	0.338*** (0.000)			0.295*** (0.002)		
industrial similarity	0.131 (0.727)	0.298** (0.037)		0.189 (0.631)	0.303** (0.034)	
monetary policy	-0.76 (0.296)	0.112 (0.262)		-0.773 (0.297)	0.182* (0.069)	
fiscal policy	0.202** (0.03)	-0.017 (0.646)		0.203** (0.029)	-0.016 (0.669)	
financial integration	0.013 (0.829)			0.011 (0.856)		
openness	-0.256* (0.089)			-0.255* (0.095)		
size	0.097 (0.508)			0.126 (0.389)		
RTA	0.384** (0.023)			0.401** (0.02)		
rule of law	0.238* (0.082)		0.122*** (0.003)	0.221 (0.13)		0.118*** (0.004)
distance	0.232 (0.177)	-0.973*** (0.000)	-0.169*** (0.000)	0.198 (0.247)	-0.961*** (0.000)	-0.169*** (0.000)
common language	0.097 (0.602)	0.372*** (0.000)	-0.156*** (0.000)	0.094 (0.625)	0.384*** (0.000)	-0.157*** (0.000)
common border	0.001 (0.997)	0.152 (0.13)		0.004 (0.99)	0.152 (0.131)	
landlocked		-0.502*** (0.000)			-0.503*** (0.000)	
island		0.567*** (0.000)			0.564*** (0.000)	
product of output		0.235*** (0.000)			0.236*** (0.000)	
output per capita		0.185*** (0.000)			0.184*** (0.000)	
origin		0.242*** (0.000)			0.241*** (0.000)	
government ideology			-0.002 (0.911)			-0.002 (0.922)
central bank independence			0.118 (0.447)			0.136 (0.377)
Human capital				0.018 (0.941)		
Ind. Similarity*labour rigidity				-0.163 (0.75)		

Chi(square)	404.09 (0.000)	2583.41 (0.000)	189.30 (0.000)	191.68 (0.000)	2576.78 (0.000)	189.29 (0.000)
Fstatistic for time dummies	82.84 (0.000)			80.89 (0.000)		
Fstatistic for regional dummies	5.15 (0.161)			4.62 (0.202)		
Fstatistic for legal origin dummies	3.57 (0.467)			3.36 (0.500)		
Fstatistic for gravity variables	2.69 (0.441)			1.99 (0.575)		
Fstatistic for policy variables	5.90 (0.116)			5.84 (0.120)		
Fstatistic for institutional variables	6.76 (0.239)			6.66 (0.465)		
Fstatistic for new variables	-			2.79 (0.248)		
Observations	875	875	875	875	875	875

p values in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

	Business Cycle	Trade Intensity	Monetary Policy	Business Cycle	Trade Intensity	Monetary Policy
trade intensity	0.082** (0.047)			0.013 (0.873)		
industrial similarity	0.015 (0.914)	-0.136 (0.368)		-0.096 (0.661)	-0.339* (0.087)	
monetary policy	-0.259 (0.566)	-0.48 (0.223)		0.824 (0.302)	-0.125 (0.796)	
fiscal policy	-0.057 (0.342)	0.08 (0.251)		-0.132 (0.123)	0.139* (0.092)	
financial integration	-0.015 (0.174)			0.009 (0.808)		
openness	0.074 (0.197)			0.074 (0.342)		
size	0.131 (0.237)			0.249 (0.132)		
industrial couple	-0.34 (0.504)			-0.852 (0.36)		
developing couple	-0.16 (0.137)			-0.199 (0.2920)		
RTA	0.077 (0.882)			-0.55 (0.602)		
law and order	0.004 (0.706)			0.007 (0.705)		-0.008 (0.111)
distance	0.138** (0.039)	-1.389*** (0.000)	-0.02 (0.141)	-0.105 (0.446)	-1.544*** (0.000)	-0.021 (0.267)
common language	0.118 (0.182)	0.450*** (0.000)		0.133 (0.358)	0.258** (0.034)	

common border	0.487**	0.399*		0.349	0.128	
	(0.011)	(0.071)		(0.159)	(0.578)	
landlocked		0.044			-0.032	
		(0.751)			(0.848)	
island		0.213**			0.589***	
		(0.019)			(0.000)	
common colonizer		0.579***	0.091***		1.034***	
		(0.000)	(0.002)		(0.000)	
product of output		0.506***			0.398***	
		(0.000)			(0.000)	
output per capita		0.578***			0.567***	
		(0.000)			(0.000)	
origin		0.118			-0.127	
		(0.167)			(0.221)	
Human capital				0.029	0.627***	0.128***
				(0.857)	(0.000)	(0.000)
central bank independence			-0.005			0.112*
			(0.912)			(0.086)
Labour market rigidities				-0.717*		
				(0.055)		
rule of law			-0.066***			
			(0.000)			
Chi(square)	113.10	1647.67	26.21	122.58	1305.24	25.15
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Fstatistic for time dummies	8.20			6.02		
	(0.016)			(0.059)		
Fstatistic for regional dummies	20.55			14.82		
	(0.010)			(0.005)		
Fstatistic for legal origin dummies	11.25			0.36		
	(0.003)			(0.834)		
Fstatistic for gravity variables	10.63			4.03		
	(0.014)			(0.259)		
Fstatistic for policy variables	3.10			3.37		
	(0.377)			(0.338)		
Fstatistic for institutional variables	11.80			4.81		
	(0.081)			(0.440)		
Fstatistic for new variables				3.92		
				(0.141)		
Observations	2155	2155	2155	1147	1147	1147
p values in parentheses						
* significant at 10%; ** significant at 5%; *** significant at 1%						

Table 7a: Correlation Matrix

	corr	corrwb	Corrwb2	BTI	isa	isa2	isc	isc2	iss	iss2	MPS	FPS	NFA	NFAS	OPEN	OPENA	RTA
corr	1																
corrwb	0.5347	1															
Corrwb2	0.5399	0.9677	1														
BTI	0.1696	0.1887	0.1731	1													
isa	0.3371	0.188	0.1918	0.168	1												
isa2	0.3153	0.1807	0.1736	0.1504	0.7924	1											
isc	0.3409	0.1879	0.1904	0.1582	0.9617	0.7492	1										
isc2	0.251	0.1123	0.1082	0.2517	0.645	0.8225	0.6901	1									
iss	0.3322	0.1801	0.1925	0.1524	0.9266	0.6781	0.8953	0.5291	1								
iss2	0.3311	0.1915	0.2141	0.2	0.7836	0.665	0.7089	0.5022	0.9035	1							
MPS	0.2037	0.1495	0.1513	0.2144	0.2129	0.2123	0.1922	0.1719	0.189	0.1883	1						
FPS	0.0564	0.0753	0.0597	0.1024	0.0675	0.0749	0.0552	0.0507	0.0671	0.0824	0.0599	1					
NFA	(0.1178	(0.0527	(0.0666	0.0135	(0.2947	(0.1778	(0.2527	(0.0533	(0.3265	(0.2928	(0.0131	(0.0718	1				
NFAS	(0.0807	(0.0396	(0.0472	0.0108	(0.2319	(0.1229	(0.1843	(0.0007	(0.3008	(0.289	(0.0124	(0.077	0.9201	1			
OPEN	0.2058	0.2403	0.2436	0.2265	0.355	0.2969	0.3288	0.1966	0.363	0.4208	0.134	0.0779	(0.1553	(0.1288	1		
OPENA	(0.0787	(0.107	(0.1077	(0.019	(0.0778	(0.0586	(0.0827	(0.0201	(0.0588	(0.0405	0.0092	(0.0388	0.2514	0.1202	(0.1187	1	
RTA	0.2154	0.1683	0.1552	0.1998	0.1654	0.2159	0.1451	0.166	0.1224	0.1259	0.182	0.0338	(0.0455	(0.0308	0.1373	(0.0454	1
SIZE	0.1138	0.115	0.1304	0.2245	0.0849	0.1182	0.0513	0.1154	0.0941	0.2039	0.0276	0.0456	(0.0877	(0.0776	0.1643	(0.0743	0.1078
SIZEM	0.0882	0.0079	0.0294	0.2043	0.1307	0.0517	0.1151	0.0998	0.1723	0.2262	0.0836	(0.019	(0.1852	(0.1567	0.1345	(0.1946	0.0437
SIZE25	0.0414	0.0201	0.0257	0.1214	0.0423	0.0093	0.0456	0.0951	0.0477	0.0814	0.0436	0.0363	(0.0462	(0.0075	0.0707	(0.0894	0.0179
SIZE75	0.0974	0.0859	0.0923	0.2832	0.0817	0.0626	0.0551	0.064	0.1266	0.2453	0.1058	0.0524	(0.0474	(0.0703	0.1972	(0.0934	0.0848
RULE	(0.0559	(0.0648	(0.0598	(0.0709	(0.2229	(0.2254	(0.2201	(0.2598	(0.1621	(0.1242	(0.2203	(0.0405	0.0004	(0.0404	(0.164	(0.0518	(0.0917
RULES	(0.0488	(0.0479	(0.0447	(0.0663	(0.2265	(0.2034	(0.2223	(0.2473	(0.1703	(0.1326	(0.2087	(0.041	(0.0063	(0.05	(0.1651	(0.0594	(0.0797
LAW	(0.0212	(0.0908	(0.0716	(0.1119	(0.1335	(0.2404	(0.1365	(0.2691	(0.0673	(0.0691	(0.1485	(0.0404	(0.0104	(0.0335	(0.0967	(0.0776	(0.0915
LAWS	0.0137	(0.0585	(0.043	(0.0849	(0.11	(0.2091	(0.1155	(0.2529	(0.0512	(0.0587	(0.1231	(0.0279	(0.0129	(0.0349	(0.0727	(0.0884	(0.0763
ORIGIN	0.0034	0.0112	0.003	0.0335	0.0024	0.0459	0.0107	0.0569	(0.006	(0.0393	(0.0214	0.0615	0.0277	0.0394	(0.0426	0.017	(0.009
ENG	0.0114	(0.0124	(0.0254	0.0566	(0.0405	(0.0421	(0.0334	(0.0683	(0.0533	(0.1017	(0.0063	0.0562	(0.0042	(0.0393	(0.0234	0.1638	(0.0088
FREN	(0.016	0.0087	0.0107	(0.0479	0.0088	0.0521	0.0152	0.0919	0.0159	0.0114	(0.0562	0.0217	0.0421	0.0815	(0.0542	(0.0914	0.0002
GER	0.0482	0.0361	0.0338	0.1138	0.1075	0.1356	0.1017	0.1152	0.0798	0.0945	0.0781	0.0032	(0.0053	(0.0109	0.0895	(0.0446	(0.0108
SCAN	0.0028	0.0372	0.0337	0.1091	0.0134	0.0251	0.0064	0.011	0.009	0.0146	0.1227	0.0268	(0.0366	(0.0199	0.0254	(0.0465	(0.0078

	SIZE	SIZEM	SIZE25	SIZE75	RULE	RULES	LAW	LAWS	ORIGIN	ENG	FREN	GER	SCAN
SIZE	1												
SIZEM	0.3105	1											
SIZE25	0.1032	0.3323	1										
SIZE75	0.6656	0.4665	0.155	1									
RULE	0.0253	0.0932	0.0568	0.1131	1								
RULES	0.0166	0.0989	0.057	0.1136	0.9583	1							
LAW	0.0145	0.1299	0.0375	0.109	0.73	0.7085	1						
LAWS	0.0006	0.1431	0.0352	0.1185	0.6974	0.6992	0.9652	1					
ORIGIN	(0.0325	(0.1232	(0.0663	(0.1284	(0.1677	(0.1688	(0.147	(0.154	1				
ENG	(0.0522	(0.1737	(0.1441	(0.0851	0.0201	0.0209	0.0086	0.0093	0.4964	1			
FREN	(0.0075	(0.0197	0.0319	(0.0983	(0.1937	(0.1988	(0.1477	(0.1645	0.7198	(0.2002	1		
GER	0.0831	0.042	0.0139	0.09	(0.0074	(0.0113	(0.0496	(0.0424	0.1228	(0.0342	(0.0495	1	
SCAN	(0.0453	0.0304	0.0101	(0.0148	(0.082	(0.0573	(0.108	(0.0664	0.0889	(0.0247	(0.0359	(0.0061	1

Corrp is the correlation coefficients computed using the penn world table GDP data, Corrb is the correlation coefficient computed using the world bank data and detrended using the Baxter and King filter, Corrb2 is the correlation coefficients computed using the world bank data and detrended with the HP filter, BTI is the bilateral trade intensity normalized by GDP, isa is the export similarity measure computed as the absolute difference of the export shares when the data are aggregated at the first digit, isa2 is the same measure for the data aggregated at the second digit, isc is the correlation coefficient for the export shares at the first digit, isa2 is the same measure for the data aggregated at the second digit, iss is the square difference of the export shares at the first digit, iss2 is the same measure for the second digit, MPS is monetary policy similarity, FPS is fiscal policy similarity, NFA is the absolute differences for external position, NFAS is the square difference between external positions, OPEN is the correlation coefficient of the degree of openness between 2 economies in the pair, OPENA is the absolute difference between the degree of openness for two economies in a pair, RTA is a dummy taking value 1 if both countries are members in a regional trade agreement, SIZE SIZEM SIZE25 SIZE75 are dummies taking value one if at least one of the two countries in the country pair has GDP above the mean, median, 25th percentile and 75th percentile of the GDP distribution respectively, RULE RULES LAW LAWS are measures of rule of law and law and order respectively, RULE and LAW is the bilateral absolute difference, RULES and LAWS is the bilateral square difference, ORIGIN, ENG, FREN, GER, SCAN are dummies that take value 1 if both countries in a pair share the same, English, French, German, Scandinavian legal origin respectively.

Table 7b: Correlation Matrix reduced Sample						
	BCC	BCCT	TI	HK	LMT	INTER
Business cycle correlations (BCC)	1					
Business cycle correlations (transformed) (BCCT)	0.9959	1				
Trade intensity (TI)	0.2118	0.221	1			
Human capital (HK)	0.1728	0.174	0.4512	1		
Labour market tightness (LMT)	0.014	0.0103	0.0396	0.0657	1	
Industrial similarity*labour market tightness (INTER)	0.09	0.087	0.1514	0.1735	0.8291	1