

Does More International Trade Result in Highly Correlated Business Cycles?

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Abstract

This paper investigates whether trade intensity is a determinant of business cycle correlations. We find that the greater economic convergence experienced by a sample of 24 countries from 1959 to 2003 is strongly influenced by the increased amount of bi-lateral trade they have undertaken. However, the magnitude and significance of the estimated relationship is not the same for all countries. Our evidence indicates that trade amongst the European countries has had the most beneficial effect on business cycle comovements, which from optimal currency area (OCA) theory would support the decision of most of these economies to join European Monetary Union (EMU).

I. Introduction

In deciding whether to join a currency union policy makers need to compare the benefits and costs of membership (Mundell, 1961; McKinnon, 1963; Kenen, 1969). The main advantage of a single currency is the potential gains to trade and international investment that could arise from eliminating currency conversion costs and removing the uncertainty arising from unexpected exchange rate movements. The costs depend upon the degree of business cycle synchronization between member countries. The gains from monetary autonomy are minimized if member countries are exposed to symmetric shocks or if they can absorb the effects of asymmetric shocks for example, by having flexible labour markets.

Frankel and Rose (1998) argue that the costs of currency union membership depend upon the benefits i.e. the optimal currency criteria are endogenous. Greater bi-lateral trade intensity can affect the synchronization of business cycles in one of two ways. Firstly, greater specialization in those goods and services for which a country has a comparative advantage, causing a rise in inter-industry trade and therefore more idiosyncratic business cycles, as economies become more exposed to industry specific shocks (Eichengreen, 1992, Krugman, 1993). In this case, having an independent monetary policy is advantageous. Alternatively, greater trade intensity could reflect a larger amount of intra-industry exports and imports, meaning more similar business cycle movements (Frankel and Rose, 1998). This effect will be reinforced if countries join a regional trade agreement alongside a currency union. Moreover, endogeneity of business cycle synchronization is likely to be strengthened after joining a monetary union, when the gains to trade are realized (Frankel and Rose, 2002).¹ Using data for 21 OECD countries from 1959 to 1993 Frankel and Rose (1998) estimated the relationship between business cycle correlations and bi-lateral trade intensity. Using real GDP, industrial production, employment and the unemployment rate as measures of economic activity, they found a positive and statistically

¹ Micco et al. (2003) suggest that the gains to trade arising from the introduction of the Euro are between 4 per cent and 10 percent for intra-EMU trade and from 8 per cent to 16 per cent for trade between EMU and non-EMU countries.

significant relationship between the size of the business cycle correlation and the level of trade intensity.²

Imbs (2004) also found an important role for trade in explaining GDP correlations, alongside specialisation of production. Using data for 24 OECD countries from 1980 to 1999, he concludes that i) doubling trade intensity raises the business cycle correlation by 0.048; ii) greater financial integration has no effect on business cycle synchronization and iii) countries with similar economic structures will have more highly correlated business cycles.

While most of this literature has focused on developed countries, Baxter and Kouparitsas (2005) find the OCA criteria are endogenous for 100 developing and industrialised countries from 1970 to 1992. Babetskii (2004) also finds supporting evidence for ten Central and Eastern European countries. Higher trade intensity and lower exchange rate volatility contribute to the convergence of demand shocks, though the impact on supply shocks is somewhat ambiguous.

Even if further international trade leads to greater economic integration between countries, Clark and van Wincoop (2001) show that national borders are likely to be important, since evidence suggests that business cycle correlations and intra-national trade between regions of a country are greater than those occurring between countries. This is because *'national borders have economic relevance to the extent that economic policies and institutions differ across those borders and discriminate between residents on different sides of the border'* (Clark and van Wincoop, 2001, p. 59). Despite this finding, Partridge and Rickman (2005) found that synchronization of business cycles between US states has declined since the late 1980s, indicating that the USA was moving away from the OCA criteria. The policy implication of both of these studies is that removing barriers to foreign trade is likely to lead to more strongly synchronized business cycles.

² Kose and Yi (2002) report similar empirical estimates to Frankel and Rose (1998), using the same group of countries but a sample period of 1970 to 2000. However, they question the magnitude of their estimates, since they cannot be replicated from theory using a standard international business cycle model. A positive estimate is also provided by Otto *et al.* (2001), while Kose *et al.* (2003) find a negative relationship. However, the methodology adopted by both of these studies is different to Frankel and Rose (1998).

In this paper we estimate the relationship between business cycle correlations and trade intensity for a sample of 24 countries³ over the period 1959 to 2003. The research makes two significant contributions to the literature. Firstly, as well as deriving estimates for the pooled sample of observations, we regress our model for each country and particular geographic regions, thus identifying whether differences in the estimated relationship arise between economies. Our results suggest that trade is an important determinant of economic convergence for the 17 European countries in the sample, but for the remainder, only China has a statistically significant coefficient. This is perhaps not surprising because most of the European countries are members of the EU⁴ and 12 are Euro members. Further, evidence of regional convergence is found from the estimates for each European country against the remaining 16 economies in our sample from Europe.

Secondly, the econometric methodology we adopt is a random effects panel estimation technique that allows for endogenous regressors and unobservable country-pair specific effects. For historical or political reasons two countries may trade a lot with each other or have significant economic convergence for reasons that are independent of the economic determinants of trade intensity.⁵ Glick and Rose (2002) have argued in favour of modelling specific effects at the level of a country-pair rather than using country-level dummies, since they are likely to detect for example, two countries that trade intensively with one another despite, on average, one or both of the economies having low trade openness. Current literature, while allowing for endogeneity of trade intensity fails to account for differences in the relationship across trading partners.

³ The countries are Australia, Austria, Belgium & Luxembourg, Canada, China, Denmark, Finland, France, Germany, Greece, Hong Kong, Republic of Ireland, Italy, Japan, Mexico, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the UK and the USA.

⁴ Norway is a member of the European Economic Area and Switzerland has a free trade agreement with the EU member states.

⁵ For example, in estimating gravity models of foreign trade some authors (for example Frankel and Rose, 2002, Klein and Shambugh, 2004 and Rose, 2000) have recognised the importance of political and regional factors, such as whether one country was a colony of the other, membership of a free trade agreement or political union.

The remainder of the paper is organised as follows: Section II discusses the empirical model, the data used and econometric methodology. Section III presents the empirical results and section IV provides concluding remarks.

II. Model and Data

To investigate the relationship between real GDP correlations and trade intensity, we estimate the following system of equations:

$$\text{Corr}(y_i, y_j)_t = \alpha + \beta \text{ti}_{ijt} + \varepsilon_{ijt} \quad (1)$$

$$\text{ti}_{ijt} = \delta_0 + \delta_1 \text{LAN}_{ij} + \delta_2 \text{dis}_{ij} + \delta_3 \text{ADJ}_{ij} + \delta_4 \text{FTA}_{ijt} + \delta_5 (y_i y_j / \text{pop}_i \text{pop}_j)_t + \delta_6 \text{FIX}_{ijt} + \omega_{ijt} \quad (2)$$

Lower case letters denote natural logarithms of each variable. $\text{Corr}(y_i, y_j)_t$ is the bilateral real GDP correlation between countries i and j and ti_{ijt} is bilateral trade intensity. The slope parameter β is expected to be positive if intra-industry trade accounts for a high proportion of total trade or negative if more trade leads to greater specialisation (Frankel and Rose, 1998).

Estimating (1) using pooled OLS is not feasible for two reasons. Firstly, trade intensity is likely to depend upon a variety of economic factors such as membership of a fixed exchange rate system or a free trade agreement. To allow for potential endogeneity, ti_{ijt} is assumed to be a function of dummy variables, the distance between the capital cities of the two partner countries (dis_{ij})⁶, and the product of GDP per capita $(y_i y_j / \text{pop}_i \text{pop}_j)_t$. LAN_{ij} takes the value of 1 if both countries share a common language⁷, ADJ_{ij} is a dummy variable that isolates countries with a common border to another partner in the sample and FTA_{ij} equals unity when both countries participate in a bilateral free trade agreement.⁸ FIX_{ij} is an indicator variable used to identify country pairs that attempt control movements in their own currency either directly with another foreign currency or indirectly through

⁶ Source: <http://www.eiit.org/>.

⁷ Source: <http://www.cia.gov/>.

⁸ Specifically, a regional trade agreement under the General Agreement on Tariffs and Trade (GATT) or notified to the World Trade Organisation (WTO). Source: <http://www.wto.org/>.

a third currency. Rather than relying on official classification of exchange rate agreements we use data from Reinhart and Rogoff (2004) that classifies *de facto* bilateral exchange rate agreements based on movements in official and parallel market exchange rates.⁹ *A priori* we expect $\delta_2 < 0$ but δ_1 and δ_3 to δ_6 should be positive.

Secondly, pooled OLS estimation ignores potentially important unobservable country-pair specific effects. For example, the decision to join a currency union may be dependent on factors that are specific to a particular country-pair. We therefore use a random effects Generalised Least Squares (GLS) estimator that allows for endogenous regressors (Balestra and Varadharajan-Krishnakumar, 1987). Since the instruments, LAN_{ij} , dis_{ij} and ADJ_{ij} , are time-invariant, a fixed effects estimator would drop these variables from the first stage regression, potentially resulting in the loss of important exogenous determinants of bilateral trade intensity. We find that dropping the instruments leads to an upward bias in the β estimate of (1).

Bi-lateral GDP correlations and average bi-lateral trade intensity are measured over 5 periods: 1959-1967, 1968-1976, 1977-1985, 1986-1994 and 1995-2003, for the 21 OECD countries suggested by Frankel and Rose (1998) plus China, Hong Kong and Mexico.¹⁰ The latter were added to ensure that each country was paired with a representative group of trading partners.¹¹

Two proxies represent bi-lateral trade intensity. Firstly, total bi-lateral trade between countries i and j divided by the aggregate trade of both countries:

$$TI_{ijt} = \frac{(X_{ijt} + M_{ijt})}{(X_{it} + X_{jt} + M_{it} + M_{jt})} \quad (3)$$

X_{ij} and M_j are total nominal bilateral exports and imports between countries i and j , X_i (X_j) is aggregate exports for country i (j). M_i (M_j) represent total imports into country i (j).

⁹ We treat all non-floating exchange rate regimes equally, so the dummy variable only equals 0 when the currency is freely floating, managed floating or freely falling.

¹⁰ All trade data are taken from the IMF's Direction of Foreign Trade data set, whereas real GDP observations are from the OECD's Economic Outlook. 23 observations were obtained for each country and for the 5 periods, except for 3 missing observations. Thus the total sample size is $[(24 \times 23) / 2] \times 5 - 3 = 1377$.

¹¹ We found a strong correlation (0.69 for the full sample) between the total bilateral trade of each country with the other 23 nations and the amount of trade with their 23 most important trading partners.

Secondly, we use total bilateral trade divided by joint nominal GDP (Y_i+Y_j):

$$TI_{ijt} = \frac{(X_{ijt} + M_{ijt})}{(Y_{it} + Y_{jt})} \quad (4)$$

Differences between both measures will arise when at least one of the economies has a low level of openness. Table 1 presents data on average trade openness for each country. 12 out of the 24 countries are found to have a high level of openness, defined as 50% or more of nominal GDP accounted for by international trade. Moreover, foreign trade has become increasingly important for some countries e.g. China, Hong Kong and Mexico. It is not surprising therefore that a strong correlation (0.91) is found between both measures.

TABLE 1 NEAR HERE

Business cycle correlations are measured using real GDP data (expressed in US dollars), converted to natural logarithms and de-trended with either a Hodrick-Prescott filter or first differences.¹² Table 2 presents the average GDP correlation for each country *vis-à-vis* the other 23 trading partners. It is apparent that convergence has increased over time, particularly for the European countries, a factor that could potentially be explained by a greater volume of trade between partner countries. Indeed, table 3 indicates that from 1959-67 to 1995-03, 20 of the 24 countries have experienced more than a 50% rise in average trade intensity.

TABLES 2 & 3 NEAR HERE

III. Estimation results

We first identify what instruments are important determinants of trade intensity. The GLS estimates (table 4) are all statistically significant.¹³ Estimates are correctly signed and have reasonable magnitudes, though there is some variation across trade normalisations for the FIX_{ij} , FTA_{ij} and

¹² To test the robustness of our results we also used industrial production, employment and the unemployment rate as alternative measures of economic activity. Similar conclusions are obtained to those generated using real GDP. The results are available from the authors upon request.

¹³ We do not report R^2 for the GLS results since it is not bounded between 0 and 1.

$(y_i y_j / \text{pop}_i \text{pop}_j)_t$ estimates. The impact of a fixed exchange rate on trade intensity is 15% using the GDP normalisation (32% using the total trade normalisation). Geographical factors are important determinants of trade bi-lateral trade intensity. Distance is negatively correlated with trade intensity,¹⁴ while the estimate for ADJ_{ij} indicates the gain to trade from adjacency is approximately 233%. If two countries participate in a bilateral free trade agreement then the increase in trade intensity is on average 85% using the GDP normalisation or 36% using the total trade normalisation. Finally, the product of GDP estimates are positive suggesting that economic growth in either one or both of the economies acts as a stimulus to international trade.

TABLE 4 NEAR HERE

The results in table 5 show a positive and statistically significant relationship exists between the real GDP correlation and trade intensity, for all de-trending methods and trade normalisations. From table 5, the average slope estimate is 0.25, suggesting a doubling of trade intensity would raise the business cycle correlation by 0.174.¹⁵ The size of the β estimate is greater in each case than the maximum estimate reported by Frankel and Rose (1998), 0.103 using a differencing de-trending method and a total trade normalisation. This increase in magnitude can be explained by the extended group of countries and sample period we use for estimation and the panel data estimation technique rather than a pooled instrumental variable estimation method. These results suggest that the increased bi-lateral trade observed in tables 1 and 3 is the result of expanding intra-industry trade feeding through to greater economic convergence.

TABLE 5 NEAR HERE

However, it is possible that the observed relationship between business cycle correlations and trade intensity is spurious. As Frankel and Rose (1998) note, countries that trade more

¹⁴ A country-pair that is twice the geographical distance compared to another would be expected on average to have one third less trade intensity.

¹⁵ Using the fixed-effects technique the average β estimate was 0.33. Similar estimates are obtained from the random effects estimator when dropping the LAN_{ij} , dis_{ij} and ADJ_{ij} instruments. A Hausman test also indicates a preference for the random effects estimator.

intensively with one another are more willing to join a bi-lateral fixed exchange rate agreement, which may influence the real GDP correlation directly through the coordination of monetary policy. Moreover, they maybe more financially integrated (Imbs, 2004). This hypothesis can be tested by including the fix_{ijt} variable in (1) but not (2), so that:

$$\text{Corr}(y_i, y_j)_t = \alpha + \beta ti_{ijt} + \phi Fix_{ijt} + \varepsilon_{ijt} \quad ..5$$

If the business cycle correlation is directly affected by a fixed exchange rate rather than trade intensity then it follows that $\beta=0$ and $\phi \neq 0$. However, the results in table 5 show that β remains positive and ϕ is statistically insignificant, suggesting that bi-lateral pegging of a pair of currencies only affects economic integration indirectly through its impact on international trade.

Whether the relationship between business cycle correlations and trade intensity varied across sub-periods was tested using a cross section regression of (1) and (2) with country-pair data for each of the sub-periods (see table 6). β is statistically insignificant for the first time period, but significance and magnitude increases progressively over time up until the 1986-94 period, when the maximum marginal effect occurs. This result is perhaps not surprising given tables 1 to 3 show that many of the countries are now undertaking a greater amount of bi-lateral trade and becoming more economically integrated in terms of business cycle comovements. In explaining the observed rise in trade intensity, it is apparent from the first-stage regressions that the marginal effect of the ADJ_{ij} and dis_{ij} variables has grown in importance. Interestingly, the gains from membership of free trade agreements and fixed exchange rate have fallen in magnitude.

TABLES 6 & 7 NEAR HERE

Variation in the size of β could also take place between countries or regions of the world, particularly given the importance of gravity variables in the determination of trade intensity. Table 7 presents the individual country regressions. A relatively strong and consistent relationship is found amongst the European countries, a result in part explained by membership of the European

Union by nearly all of these countries.¹⁶ The average β estimate for the European countries is 0.22. For the remaining countries, only China has a statistically significant slope parameter but its value (0.06) is relatively low. China's trade openness has increased significantly since the late 1970s and the real GDP correlation was 0.46 for the 1995-03 period. A number of explanations could be provided for the statistically insignificant β estimates. Firstly, for the Asia-Pacific economies (Australia, New Zealand, China and Hong Kong) a significant amount of trade also takes place with Indonesia, South Korea, Malaysia, Singapore and Thailand, as well as our 23 countries. By extending the sample to include these countries only Hong Kong now has a positive and statistically significant β estimate (see table 8). Secondly, regional factors could be so important that trade with the European countries is not particularly important for the NAFTA and Asia-Pacific economies. Table 9 present estimates for trade amongst countries within European, NAFTA and the Asia-Pacific region. Again only the β estimate for the European countries remains significant.

TABLES 8 & 9 NEAR HERE

As a further test of our hypothesis we estimated the model for each European country with their European trading partners (see table 10). While all of the slope estimates remain positive, the magnitude falls quite considerably compared to the full sample estimates and in some cases the coefficients are not statistically significant. Thus it would appear that the gain in economic convergence arising from trade is larger for the European countries when they trade with countries from outside the continent. Interestingly, the slope estimate is largest for the UK that has not adopted the Euro. Denmark also has a statistically significant coefficient. When (1) and (2) are estimated exclusively for Denmark, Sweden and the UK vis-à-vis their EMU trading partners, we find a substantial increase in the value of the β estimate for Denmark, from 0.09 to 0.16, although no significant changes for Sweden and the UK. This implies that a doubling of trade intensity

¹⁶ From the estimates of (2) (available from the authors upon request), all EU countries except Austria have a positive and statistically significant coefficient for FTA_{ijt} . For 13 EU countries, the estimate for dis_{ij} was negative and statistically significant. ADJ_{ij} estimates were positive and significant for every EU country.

between Denmark and the EMU countries would increase the relevant business cycle correlations by 0.110, compared to 0.062 for trade between Denmark and all of the European countries.

TABLES 10&11 NEAR HERE

IV. Conclusions

In this paper, we have investigated the relationship between business cycle comovements and trade intensity to ascertain the suitability of an economy for membership of a currency union. We show that economic convergence has increased among the world's major economies and at the same time international trade markets have become more open.

To test the endogeneity of the optimal currency area criteria, data was obtained for a group of 24 countries over the sample period 1959 to 2003. We find a significant and positive relationship between business cycle correlations and trade intensity using the full sample of countries and all of the time periods. The marginal effect from more trade has also increased over time. However, our detailed investigation indicates that it is not appropriate for all of the countries to form a monetary union. A significant relationship is found for each European country against all of the other trading partners from our sample and from 14 out of the 17 regressions for the European countries against the other trading partners within continental Europe. This evidence would support the decision of most of the European countries to adopt the Euro as their national currency. Interestingly, the significant β estimates for the UK and Denmark would suggest that there are likely to be substantial benefits from membership of EMU through trading more with one another. Outside, continental Europe however, we only find a significant slope estimate for China, thus raising doubts about the suitability of other currency unions being formed, for example based around the US dollar for the NAFTA economies or a Japanese Yen zone for the Asia-Pacific countries.

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Table 1 Average trade openness

Country	Period						Change(%):	Full
	1959-1967	1968-1976	1977-1985	1986-1994	1995-2003	1959-1967 to 1995-03	sample: 1959-2003	
Australia	0.242	0.237	0.266	0.282	0.336	39	0.298	
Austria	0.326	0.440	0.515	0.520	0.657	102	0.574	
Belgium& Luxembourg	0.660	0.910	1.106	1.100	1.217	84	1.129	
Canada	0.307	0.404	0.473	0.480	0.675	120	0.548	
China	0.002	0.000	0.180	0.367	0.461	26329	0.358	
Denmark	0.478	0.483	0.533	0.493	0.550	15	0.523	
Finland	0.346	0.443	0.512	0.426	0.581	68	0.504	
France	0.166	0.291	0.366	0.354	0.428	157	0.378	
Germany	0.281	0.372	0.470	0.432	0.487	73	0.455	
Greece	0.208	0.269	0.314	0.321	0.321	54	0.314	
Hong Kong	1.037	1.351	1.526	2.231	2.433	135	2.249	
Ireland	0.551	0.718	0.933	0.973	1.174	113	1.070	
Italy	0.205	0.315	0.391	0.319	0.400	95	0.361	
Japan	0.151	0.217	0.230	0.153	0.173	15	0.174	
Mexico	0.096	0.108	0.182	0.286	0.599	525	0.404	
Netherlands	0.635	0.755	0.868	0.822	0.993	56	0.899	
New Zealand	0.351	0.404	0.478	0.432	0.468	33	0.450	
Norway	0.435	0.508	0.534	0.488	0.509	17	0.505	
Portugal	0.297	0.346	0.469	0.522	0.541	82	0.512	
Spain	0.142	0.207	0.263	0.286	0.405	186	0.332	
Sweden	0.345	0.446	0.481	0.434	0.609	77	0.509	
Switzerland	0.425	0.474	0.550	0.539	0.601	41	0.561	
UK	0.291	0.391	0.432	0.403	0.415	43	0.409	
USA	0.068	0.107	0.147	0.155	0.188	176	0.163	
Average	0.335	0.425	0.509	0.534	0.634	81	0.570	

Notes: trade openness is calculated as $(X+M)/Y$, where X and M are aggregate exports and imports and Y is nominal GDP.

Table 2: Average GDP Correlations

Country \ Period	1959-1967	1968-1976	1977-1985	1986-1994	1995-2003	Full sample: 1959-2003
Australia	-0.005	0.63	0.42	0.25	0.65	0.39
Austria	0.33	0.71	0.71	0.59	0.67	0.60
Belgium& Luxembourg	0.29	0.70	0.76	0.62	0.68	0.61
Canada	0.23	-0.03	0.36	0.21	0.41	0.24
China	0.20	0.15	0.05	0.01	0.46	0.18
Denmark	0.26	0.69	0.71	0.57	0.68	0.58
Finland	0.34	0.47	0.72	0.54	0.69	0.55
France	0.28	0.58	0.77	0.61	0.68	0.58
Germany	0.16	0.67	0.73	0.50	0.67	0.55
Greece	0.16	0.52	0.74	0.56	0.69	0.53
Hong Kong	0.24	0.30	0.55	0.19	-0.12	0.23
Ireland	0.19	0.52	0.75	0.59	0.67	0.54
Italy	-0.38	0.62	0.76	0.58	0.61	0.44
Japan	-0.21	0.46	0.42	0.20	0.32	0.24
Mexico	0.24	0.42	0.27	-0.40	-0.40	0.03
Netherlands	0.20	0.67	0.72	0.59	0.67	0.57
New Zealand	0.27	0.56	0.66	0.41	0.62	0.50
Norway	0.20	0.54	0.75	0.62	0.62	0.54
Portugal	0.06	0.59	0.60	0.53	0.69	0.49
Spain	0.16	0.60	0.75	0.54	0.67	0.54
Sweden	0.27	0.50	0.75	0.59	0.68	0.56
Switzerland	0.23	0.69	0.71	0.58	0.59	0.56
UK	0.33	0.61	0.75	0.63	0.46	0.56
USA	0.16	0.37	0.15	0.16	-0.09	0.15
Average	0.17	0.52	0.61	0.43	0.51	0.45

Notes: average GDP correlation calculated using the individual correlations from each country *vis-à-vis* their 23 trading partners.

Table 3: Average Trade Intensity

Country \ Period	1959-1967	1968-1976	1977-1985	1986-1994	1995-2003	Change(%): 1959-1967 to 1995-2003	Full sample: 1959-2003
Australia	0.0022	0.0021	0.0021	0.0021	0.0025	14	0.0022
Austria	0.0018	0.0027	0.0030	0.0033	0.0039	117	0.0029
Belgium& Luxembourg	0.0065	0.0082	0.0097	0.0097	0.0107	65	0.009
Canada	0.0024	0.0027	0.0028	0.0029	0.0037	52	0.0029
China	0.0004	-	0.0025	0.005	0.0053	-0.94	0.0013
Denmark	0.0035	0.0041	0.0043	0.0041	0.0049	42	0.0042
Finland	0.0019	0.0027	0.0029	0.0029	0.0038	102	0.0028
France	0.0029	0.0055	0.0067	0.0072	0.0082	179	0.0061
Germany	0.0065	0.0086	0.0108	0.0106	0.0134	107	0.01
Greece	0.0008	0.001	0.0011	0.0012	0.0014	83	0.0011
Hong Kong	0.0012	0.0019	0.003	0.0088	0.00102	762	0.005
Ireland	0.0009	0.0013	0.002	0.0025	0.0038	337	0.0021
Italy	0.0030	0.0044	0.0055	0.0058	0.0076	148	0.0053
Japan	0.0015	0.0024	0.0028	0.0026	0.0029	90	0.0025
Mexico	0.0004	0.0005	0.0008	0.0011	0.0022	480	0.001
Netherlands	0.0068	0.0083	0.0097	0.0095	0.01	47	0.0088
New Zealand	0.0011	0.0011	0.0011	0.001	0.0011	4	0.0011
Norway	0.0029	0.0038	0.0042	0.0039	0.0044	54	0.0038
Portugal	0.0008	0.0012	0.0013	0.0023	0.0027	228	0.0017
Spain	0.0012	0.0018	0.0023	0.0038	0.0057	376	0.0029
Sweden	0.0046	0.0062	0.0062	0.0052	0.0071	55	0.0145
Switzerland	0.0036	0.0042	0.0046	0.0047	0.0066	85	0.0047
UK	0.0055	0.0070	0.0083	0.0079	0.008	44	0.0074
US	0.0019	0.0028	0.0037	0.0041	0.0053	184	0.0035
Average	0.0063	0.0045	0.0042	0.0065	0.0056	148	0.0025

Notes: Trade intensity is obtained using $TI_{ijt} = \frac{(X_{ijt} + M_{ijt})}{(Y_i + Y_j)}$ and an average value obtained using the values from the country-pairs.

Table 4: Trade Intensity Equations

	Bi-lateral Trade normalised by GDP	Bi-lateral Trade normalised by total trade
Constant	-7.13 (-14.07)	-3.95 (-8.16)
FIX _{ijt}	0.14 (2.41)	0.28 (4.95)
LAN _{ij}	0.33 (3.56)	0.28 (3.16)
dis _{ij}	-0.36 (-10.01)	-0.33 (-9.46)
ADJ _{ij}	1.11 (7.82)	1.30 (9.60)
FTA _{ijt}	0.62 (9.12)	0.31 (4.69)
$(y_i y_j / \text{pop}_i \text{pop}_j)_t$	0.18 (9.14)	0.05 (2.63)

Notes: T-statistics are shown in parentheses.

Table 5: Business cycle correlation equations

De-trending method		Bi-lateral Trade normalised by GDP		Bi-lateral Trade normalised by total trade	
HP filter	Constant	1.96 (18.24)	1.97 (16.56)	1.74 (15.43)	1.71 (14.12)
	\hat{t}_{ijt}	0.24 (14.24)	0.24 (13.44)	0.24 (11.59)	0.23 (11.13)
	FIX _{ij}	-	-0.009 (-0.29)	-	-0.01 (-0.22)
First differences	Constant	2.08 (18.96)	2.00 (17.09)	1.83 (16.33)	5.64 (7.86)
	\hat{t}_{ijt}	0.26 (15.37)	0.25 (14.41)	0.26 (12.79)	0.92 (7.30)
	FIX _{ij}	-	0.03 (0.81)	-	-0.17 (-3.16)

Notes: T-statistics are shown in parentheses.

Table 6: IV estimations of the business cycle correlation equation for each sub-period

	Period	Constant	FIX _{ijt}	LAN _{ij}	dis _{ij}	ADJ _{ij}	FTA _{ijt}	$(y_i y_j / \text{pop}_i \text{pop}_j)_t$
Bi-lateral Trade normalised by GDP	1959-67	-4.67 (-3.89)	0.61 (3.97)	0.60 (2.80)	-0.44 (-5.55)	0.66 (2.01)	0.81 (2.96)	0.05 (1.01)
	1968-76	-5.91 (-5.44)	0.78 (3.97)	0.42 (2.36)	-0.40 (-5.54)	0.78 (2.79)	0.98 (4.38)	0.11 (2.53)
	1977-85	-5.03 (-4.35)	0.34 (1.77)	0.38 (2.28)	-0.38 (-4.71)	1.10 (4.30)	0.64 (3.49)	0.07 (1.67)
	1986-94	-4.29 (-3.52)	0.09 (0.41)	0.27 (1.66)	-0.42 (-5.02)	1.13 (4.64)	0.36 (1.64)	0.06 (1.30)
	1995-03	-3.79 (-2.66)	0.09 (0.42)	0.23 (1.30)	-0.38 (-4.15)	1.17 (4.59)	0.51 (2.38)	0.03 (0.48)
Bi-lateral Trade normalised by total trade	1959-67	-2.41 (-2.08)	0.78 (5.22)	0.56 (2.74)	-0.33 (-4.34)	0.99 (3.15)	0.65 (2.45)	-0.05 (-1.14)
	1968-76	-2.71 (-2.67)	1.01 (5.51)	0.38 (2.26)	-0.29 (-4.34)	0.95 (3.65)	0.75 (3.56)	-0.05 (-1.30)
	1977-85	-3.36 (-2.80)	0.14 (0.72)	0.35 (2.02)	-0.33 (-3.97)	1.32 (5.01)	0.42 (2.19)	0.02 (0.41)
	1986-94	-4.17 (-3.19)	-0.17 (-0.73)	0.11 (0.60)	-0.38 (-4.32)	1.38 (5.29)	0.33 (1.37)	0.10 (1.90)
	1995-03	-3.78 (-2.43)	0.04 (0.15)	0.05 (0.28)	-0.40 (-4.03)	1.37 (4.93)	0.19 (0.82)	0.08 (1.38)

	Period	HP filter		First differences	
		Constant	\hat{t}_{ijt}	constant	\hat{t}_{ijt}
Bi-lateral Trade normalised by GDP	1959-67	0.45 (2.51)	0.04 (1.56)	0.47 (2.54)	0.05 (1.83)
	1968-76	1.39 (11.67)	0.13 (7.33)	1.43 (12.24)	0.14 (8.12)
	1977-85	1.98 (14.37)	0.22 (10.06)	2.08 (13.75)	0.25 (10.61)
	1986-94	2.54 (14.20)	0.34 (11.93)	2.61 (14.45)	0.35 (11.97)
	1995-03	2.20 (10.77)	0.28 (8.36)	2.33 (10.83)	0.31 (8.68)
Bi-lateral Trade normalised by total trade	1959-67	0.36 (2.31)	0.03 (1.23)	0.39 (2.42)	0.05 (1.60)
	1968-76	1.21 (10.02)	0.13 (5.71)	1.27 (10.63)	0.14 (6.58)
	1977-85	1.80 (11.54)	0.22 (7.72)	1.91 (11.43)	0.26 (8.58)
	1986-94	2.27 (12.33)	0.35 (10.13)	2.36 (12.72)	0.36 (10.31)
	1995-03	2.00 (9.99)	0.28 (7.52)	2.12 (10.11)	0.31 (7.90)

Notes: IV estimates obtained for each period using the instruments defined by (2). T-ratios are shown in parentheses. R² not reported since for IV estimation it is not bounded between 0 and 1.

Table 7: Individual country results

Bi-lateral Trade normalised by GDP						Bi-lateral Trade normalised by total trade					
Country	constant	t_{ijt}	Country	Constant	t_{ijt}	Country	constant	t_{ijt}	Country	Constant	t_{ijt}
Australia	0.39 (1.10)	0.00 (-0.01)	Italy	2.27 (6.00)	0.31 (4.90)	Australia	0.28 (1.04)	-0.02 (-0.39)	Italy	1.81 (5.23)	0.29 (4.02)
Austria	1.90 (8.94)	0.20 (6.20)	Japan	1.21 (1.96)	0.15 (1.58)	Austria	1.71 (7.34)	0.20 (4.83)	Japan	0.68 (1.56)	0.09 (1.02)
Belgium & Luxembourg	1.67 (9.46)	0.19 (6.14)	Mexico	-0.46 (-1.16)	-0.06 (-1.23)	Belgium & Luxembourg	1.47 (7.78)	0.17 (4.65)	Mexico	0.29 (0.86)	0.04 (0.78)
Canada	0.25 (0.79)	0.00 (0.05)	Netherlands	1.89 (9.27)	0.24 (6.57)	Canada	0.17 (0.86)	-0.01 (-0.38)	Netherlands	1.85 (7.70)	0.26 (5.41)
China	0.64 (2.73)	0.06 (1.99)	New Zealand	0.93 (2.47)	0.06 (1.13)	China	0.41 (1.59)	0.04 (0.90)	New Zealand	0.71 (2.09)	0.03 (0.61)
Denmark	1.65 (9.51)	0.17 (6.25)	Norway	2.14 (8.19)	0.25 (6.16)	Denmark	1.51 (8.43)	0.17 (5.27)	Norway	2.03 (4.89)	0.27 (3.60)
Finland	1.60 (6.34)	0.16 (4.21)	Portugal	1.95 (8.95)	0.21 (6.77)	Finland	1.45 (6.79)	0.16 (4.26)	Portugal	1.94 (7.39)	0.24 (5.57)
France	1.77 (6.20)	0.20 (4.24)	Spain	2.32 (5.95)	0.27 (4.61)	France	1.56 (5.75)	0.21 (3.68)	Spain	2.39 (4.94)	0.35 (3.85)
Germany	1.94 (7.48)	0.27 (5.47)	Sweden	1.51 (7.39)	0.17 (4.76)	Germany	1.67 (7.08)	0.26 (4.85)	Sweden	1.34 (6.15)	0.16 (3.67)
Greece	2.06 (8.26)	0.21 (6.17)	Switzerland	1.92 (6.63)	0.23 (4.73)	Greece	1.98 (6.80)	0.23 (5.00)	Switzerland	1.44 (4.89)	0.18 (3.02)
Hong Kong	0.21 (1.03)	0.00 (-0.08)	UK	1.81 (4.42)	0.24 (3.08)	Hong Kong	0.39 (2.20)	0.03 (0.93)	UK	1.14 (2.90)	0.14 (1.49)
Ireland	2.11 (9.15)	0.23 (6.93)	USA	0.13 (0.55)	0.00 (-0.10)	Ireland	2.39 (8.03)	0.30 (6.30)	USA	0.18 (1.06)	0.01 (0.17)

Notes: Second stage estimation results from an instrumental variable random effects panel estimator. 115 observations for each regression except for the China estimates. T-ratios are in parentheses.

Table 8: Revised estimates for the Asia-Pacific countries

Bi-lateral Trade normalised by GDP			Bi-lateral Trade normalised by total trade		
Country	constant	t_{ijt}	Country	constant	t_{ijt}
Australia	0.30 (0.89)	-0.01 (-0.22)	Australia	0.28 (0.96)	-0.02 (-0.34)
Japan	0.90 (2.02)	0.10 (1.41)	Japan	0.71 (2.12)	0.09 (1.30)
New Zealand	0.72 (1.31)	0.04 (0.51)	New Zealand	0.72 (1.47)	0.04 (0.58)
China	0.80 (3.38)	0.08 (2.33)	China	0.80 (3.38)	0.08 (2.33)
Hong Kong	0.77 (3.72)	0.07 (2.18)	Hong Kong	0.77 (3.72)	0.07 (2.18)

Notes: estimates derived using the 23 countries plus Indonesia, South Korea, Malaysia, Singapore and Thailand. T-ratios in parentheses.

Table 9: Regional Results

Bi-lateral Trade normalised by GDP			Bi-lateral Trade normalised by total trade		
Region	constant	t_{ijt}	Region	constant	t_{ijt}
Europe	1.30 (13.22)	0.11 (6.09)	Europe	1.09 (12.01)	0.08 (4.28)
Asia-Pacific	0.80 (2.23)	0.098 (1.41)	Asia-Pacific	0.45 (1.45)	0.03 (0.50)
NAFTA	0.39 (1.79)	0.03 (0.67)	NAFTA	0.32 (2.76)	0.03 (0.72)

Notes: T-ratios in parentheses.

Table 10: European countries

Bi-lateral Trade normalised by GDP						Bi-lateral Trade normalised by total trade					
Country	constant	t_{ijt}	Country	Constant	t_{ijt}	Country	constant	t_{ijt}	Country	Constant	t_{ijt}
Austria	1.38 (6.28)	0.10 (2.82)	Italy	1.32 (3.61)	0.13 (1.96)	Austria	1.06 (5.01)	0.06 (1.39)	Italy	0.99 (2.97)	0.09 (1.15)
Belgium & Luxembourg	1.30 (7.38)	0.11 (3.07)	Netherlands	1.63 (6.83)	0.19 (3.79)	Belgium & Luxembourg	1.07 (6.70)	0.07 (1.92)	Netherlands	1.39 (5.77)	0.15 (2.74)
Denmark	1.23 (5.05)	0.09 (2.06)	Norway	1.44 (4.39)	0.12 (2.19)	Denmark	0.96 (4.06)	0.05 (0.98)	Norway	1.08 (3.63)	0.07 (1.18)
Finland	0.99 (3.78)	0.05 (1.16)	Portugal	2.37 (4.80)	0.27 (3.51)	Finland	0.88 (3.36)	0.04 (0.74)	Portugal	1.68 (3.54)	0.19 (2.19)
France	1.02 (4.59)	0.05 (1.25)	Spain	1.61 (4.11)	0.15 (2.29)	France	0.79 (3.79)	0.01 (0.20)	Spain	1.23 (3.01)	0.11 (1.26)
Germany	1.51 (6.26)	0.17 (3.38)	Sweden	0.71 (3.73)	0.02 (0.38)	Germany	1.20 (5.22)	0.13 (2.17)	Sweden	0.67 (3.44)	-0.11 (-0.16)
Greece	2.03 (3.82)	0.20 (2.57)	Switzerland	1.25 (4.62)	0.10 (2.00)	Greece	0.92 (1.83)	0.04 (0.50)	Switzerland	0.87 (3.87)	0.03 (0.72)
Ireland	1.72 (9.09)	0.15 (5.32)	UK	2.62 (3.45)	0.39 (2.57)	Ireland	1.58 (7.90)	0.15 (4.32)	UK	1.66 (2.46)	0.24 (1.47)

Table 11: Estimates for Denmark, Sweden and the UK versus the EMU countries

Bi-lateral Trade normalised by GDP			Bi-lateral Trade normalised by total trade		
	constant	t_{ijt}		constant	t_{ijt}
Denmark	1.66 (5.26)	0.16 (2.92)	Denmark	1.36 (4.06)	0.12 (1.86)
Sweden	0.81 (3.44)	0.02 (0.41)	Sweden	0.66 (3.02)	-0.01 (-0.23)
UK	2.62 (3.32)	0.39 (2.47)	UK	1.81 (2.51)	0.28 (1.58)