Trade, Finance, Specialization and Synchronization: Sensitivity Analysis

Jean Imbs
London Business School and CEPR

September 2003

Abstract

This note contains sensitivity analyses for the results described in the main paper. All conclusions continue to prevail with a variety of alternative measurement strategies, using different data sources, in an intranational dataset pertaining to U.S States, and when alternative controls for cycle synchronization are included.

1 Alternative Measures

The first specification in Table 1 implements the exact same specification as in the main paper's Table 5, but using a GMM estimator instead of 3SLS. The results are very similar. The second specification in Table 1 contains the alternative measure of trade T^2 introduced in Deardorff (1998). T^2 is not scale dependent, which manifests itself in the sudden reversal of the coefficient on GDP product in I_2. This measure of trade does once again affect directly cycles correlations, with an estimate for α_1 in line with earlier results. Results pertaining to other channels are unchanged: they are, if anything, stronger than in the 3SLS case with T^1. Note also that T^2 does not appear to correlate at all with specialization patterns, confirming the sensitivity of the earlier negative point estimates. Specification (iii) uses the Hodrick-Prescott filter to isolate the cyclical component of GDP fluctuations. None of the results change significantly. The last column in Table 1 reports estimates when S is computed using sectoral value added at the one-digit level for all sectors in the economy. The main difference has to do with the smaller importance of financial variables in the system.

2 Alternative Data Sources

Table 2 reproduces the previous robustness checks, using instead yearly data since 1960 to compute cycles correlations. The estimates are virtually identical to those in Table 1.

Table 3 reports three-stage least squares estimates for U.S states data, where equation (2) is subsumed in implementing a gravity model to predict inter-state trade. This does not come at zero cost. First of all, all results depend on the reliability of a gravity model for inter-state trade. The gravity model has reached almost universal validity, and is probably particularly appropriate for intranational data given the absence of any tariffs: it is hard to think of any impediments to commerce between U.S states that are not related to geography. Second, not having any estimates for the coefficients β in equation (2) prevents a separate assessment of the effects of inter- and intra-industry trade on ρ.

On the upside, however, a dataset where trade treatment to all third parties can be taken as equal in the cross-section is a precious gift, since it helps quantifying the extent of a potentially important bias. Anderson and van Wincoop (2002) have shown that bilateral trade flows are heavily influenced by the trade treatment each party is imposing on the rest of the world. Correcting for this "multilateral resistance" effect is crucial when investigating the determinants, as well as the impact of bilateral trade. The previous estimates of α_1 in equation (1) may have suffered from this bias, to an extent that estimates based on intranational data can help evaluate. Finally, inter-state data provides an important robustness check. Indeed: the data is coming from completely different sources, the sectoral information is more disaggregated, the sample universe is more complete, as there is data on the whole of an economic entity, and the measure of financial integration is conceptually and practically different from an index of capital account restrictions.

Yet, as Table 3 reports, the results are largely unchanged. Perhaps the largest alteration pertains to the estimates for α_1, which are still significantly positive but much smaller in magnitude. Given the manner in which inter-state trade was simulated, there is no way of discriminating between inter- and intra-industry trade. Estimates for α_1 are however almost half those implied by international data. Doubling inter-state trade (as predicted by a gravity model) results in GSP correlations being higher by 0.021, which is well into the range implied by standard (real) international business cycles models with plausible parameters. This suggests the bias demonstrated by Anderson and van Wincoop (2002) is prevalent in the international dataset. But trade does affect significantly cycles synchronization even after it is corrected for.

The other coefficients, however, remain largely unaffected by the use of an alternate dataset. In particular: (i) states with similar specialization patterns do display significantly more synchronized GSP, and quite remarkably the estimates for α_2 in Table 3 are not significantly different from their international equivalents. Specialization patterns continue to be an economically and statistically important determinant of business cycles synchronization. (ii) States with high risk-sharing, as measured by an index of income insurance, tend also to be more synchronized even though they also become more specialized. Both these channels remain significant in all specifications, in a way that is reminiscent of estimates based on international data.

Finally, the last two columns in Table 3 present some robustness analysis for inter-state data. In particular, three checks are performed. First the possibility that the economic size of each state be independently and significantly affecting ρ is investigated, without any sizeable changes. Second the Hodrick-Prescott filter is used to isolate the cyclical component of GSP when computing ρ (and the indices of risk-sharing), again without any noticeable effects. Third GMM is implemented instead of 3SLS. This affects the estimates of financial integration's specialization effect, γ_2, which then becomes non-significantly different from zero. Importantly, however, the estimates of the effects of finance between U.S states suffer from potential endogeneity bias, and therefore should at most be viewed as a confirmation of international results.

3 Controls

The first two specifications in Table 4 report estimates where convergence in monetary policies is proxied and controlled for in equations (1) and (2). Identifying monetary policy is the object of an enormous literature, whose purpose is to track the effect of exogenous monetary policy decisions over time. There is fortunately no purpose in being that ambitious in the present context. Rather, this sub-section purports to ensure that the channels identified in the previous section are not but a manifestation of similar monetary policies. This is unlikely, as converging monetary policies, manifested by a stable exchange rate for instance, are known to result in more trade and more synchronized business cycles, but there is no obvious theoretical link with countries' specialization patterns.[1] In other words, these controls will most likely affect the estimates of α_1 only, as suggested indeed by the inter-state estimates in Table 3. The fact that intranational results are almost identical to international ones suggests monetary policy is not driving the results in this paper.

Specifications (i) and (ii) in Table 4 control for the volatility in the (growth rate of the) nominal exchange rate, and for five-year averages of inflation differentials, respectively. The results are unchanged, even if the direct effects of finance become weaker both statistically and economically. Interestingly, the effects of a stable exchange rate and/or small inflation differentials seem to work through trade, as trade is estimated to significantly increase in the face of stable and similar monetary policies.

Specifications (iii)-(v) in Table 4 report estimates once the relative size and advancement of the two economies is controlled for in equation (1). This is meant to check whether the size or development level of countries have a direct impact on business cycles correlation,

[1] See for instance Rose (2000) on the effects of monetary union.

beyond the indirect channels via trade or specialization, and to verify that the results carry through. For instance, Kalemli-Ozcan et al (2001) find GDP per capita and human capital to have a significant effect on business cycle correlations. Their results are (partly) confirmed here, as large countries with high stocks of human capital are more synchronized, but none of these controls alter the main results of the paper, with the possible exception of weaker indirect effects of financial integration on specialization patterns. The direct effects of finance on ρ continue to be significant, however. This is reassuring, for it suggests finance matters over and beyond its reflection of high levels of development. In other words, the instruments for F reflect more than merely high levels of GDP per capita.

Table 1:				
	(i) T^1	(ii) T^2	(iii) HP Filter	(iv) S_{YB}
(1) Correlation ρ				
T	0.105 (5.21)	0.109 (2.75)	0.071 (3.04)	0.062 (2.09)
S	-0.322 (2.35)	-2.161 (16.82)	-1.141 (12.12)	-0.836 (9.82)
F	1.415 (4.63)	3.463 (7.39)	2.098 (7.12)	0.686 (1.68)
(2) Trade T				
Distance	-0.727 (14.52)	-0.873 (19.77)	-0.857 (19.68)	-0.909 (14.46)
Border	0.132 (1.05)	-0.163 (1.04)	-0.059 (0.38)	0.335 (1.71)
Language	0.321 (2.82)	0.354 (2.73)	0.357 (2.77)	0.595 (3.60)
GDP Product	0.230 (5.61)	-0.140 (3.89)	-0.159 (4.29)	-0.100 (2.38)
S	-2.013 (5.24)	1.118 (3.61)	0.988 (3.19)	-0.143 (0.35)
(3) Specialization S				
GDP/cap Product	-0.048 (2.78)	-0.080 (6.72)	-0.091 (6.26)	-0.262 (6.98)
GDP Gap	1.092 (4.83)	0.160 (1.12)	0.391 (2.20)	1.054 (3.69)
T	-0.069 (4.62)	0.012 (0.71)	0.016 (0.96)	0.018 (0.62)
F	1.025 (5.97)	1.356 (7.11)	1.392 (7.17)	0.054 (0.12)

Notes: All estimations are run using GMM, with t-statistics reported between parentheses. The specifications are altered sequentially, i.e. changing one component of the estimation at a time. For instance, (i) is equivalent to column (iii) in the main paper's Table 5, but using GMM. Then column (ii)-(iv) change the trade measure to T^2, specifications (iii) and (iv) use HP-filtered series, and (iv) uses sectoral data on all sectors in the economy from UNYB. As in Table 5 in the main paper, T and S are measured in logarithms and averaged over time. F is an index of bilateral discrepancies in cumulated current accounts. Intercepts are not reported. t-statistics between parentheses. F is instrumented using the institutional variables in LaPorta et al (1998). In particular, the instruments reflect shareholder rights (with variables capturing whether one share carries one vote, the distribution of dividends is mandatory, proxy vote by mail is allowed, the percentage of capital necessary to call an extraordinary shareholders' meeting), creditor rights, and an assessment of accounting standards and the rule of law.

Table 2: Yearly Data				
	(i) T^1	(ii) T^2	(iii) HP Filter	(iv) S_{YB}
(1) Correlation ρ				
T	0.084 (5.71)	0.078 (1.87)	0.110 (3.02)	0.084 (2.59)
S	-0.464 (4.70)	-2.512 (28.54)	-2.031 (18.57)	-0.976 (8.26)
F	1.498 (6.56)	4.376 (8.53)	3.412 (8.10)	0.039 (0.07)
(2) Trade T				
Distance	-0.747 (14.71)	-0.854 (19.66)	-0.850 (19.76)	-0.911 (14.14)
Border	0.136 (1.04)	-0.052 (0.33)	-0.081 (0.52)	0.918 (3.25)
Language	0.240 (2.11)	0.311 (2.52)	0.386 (3.01)	0.740 (4.01)
GDP Product	0.233 (5.33)	-0.140 (3.74)	-0.147 (3.94)	-0.133 (3.02)
S	-2.074 (5.27)	0.924 (2.92)	0.791 (2.52)	-0.297 (0.72)
(3) Specialization S				
GDP/cap Product	-0.066 (4.06)	-0.051 (6.10)	-0.068 (5.45)	-0.265 (6.90)
GDP Gap	0.913 (4.29)	0.034 (0.03)	0.160 (1.06)	1.278 (3.97)
T	-0.058 (4.03)	-0.007 (0.41)	0.049 (0.29)	0.021 (0.70)
F	1.024 (6.05)	1.405 (7.39)	1.433 (7.67)	0.347 (0.78)

Notes: This Table mimics Table 1, using instead yearly data to compute bilateral cycle correlations. All the other variables are identical.

Table 3: U.S States	(i) 3SLS	(ii) 3SLS	(iii) 3SLS	(iv) HP	(v) GMM
(1) Correlation ρ					
$\hat{T}$	0.031 (13.74)	0.032 (14.09)	0.031 (13.84)	0.029 (12.65)	0.028 (7.44)
S		-0.351 (8.49)	-0.326 (7.64)	-0.571 (13.11)	-0.571 (8.52)
F		0.063 (2.28)	0.051 (1.86)	0.140 (4.95)	0.142 (4.60)
Size			-0.049 (3.51)	-0.056 (3.94)	-0.042 (2.47)
R^2	0.176	0.267	0.277	0.338	0.341
(3) Specialization S					
GDP/cap Product	-0.185 (17.22)	-0.206 (18.21)	-0.206 (18.23)	-0.205 (18.33)	-0.460 (8.03)
GDP Gap	0.400 (9.55)	0.405 (9.09)	0.404 (9.08)	0.406 (9.23)	-0.131 (0.99)
$\hat{T}$	-0.033 (17.66)	-0.035 (17.96)	-0.035 (17.97)	-0.035 (17.98)	-0.103 (6.46)
F		0.050 (2.81)	0.050 (2.81)	0.050 (2.81)	0.014 (0.44)
R^2	0.628	0.624	0.624	0.624	0.471

Notes: ρ is computed using annual Gross State Product data from the BEA. $\hat{T}$ denotes (log) trade as implied by a gravity model estimated on cross-country data; in particular, $\hat{T} = -1.355*$ ln(Distance) + 1.057$*$ ln(GDP Product) $-$ 0.635$*$ ln(Population Product) $-$ 29.834. S is constructed using Bureau of Economics Analysis data on sectoral value added at the three-digit level. F measures income insurance between US states, and reports the pairwise sum of β from the regression $\ln GSP_t - \ln y_t = \alpha + \beta \ln GSP_t$, where the cyclical component of all variables is isolated using the Baxter-King filter (except in (iv) and (v), where the HP filter is used instead, both for this purpose and in computing ρ). Size is measured by the pairwise discrepancy in GSP. Intercepts are not reported, and t-statistics are between parentheses.

Table 4: Additional Controls	(i) NER	(ii) Inflation	(iii) Size	(iv) GDP/cap	(v) Education
(1) Correlation ρ					
T	0.048 (1.82)	0.048 (1.83)	0.092 (2.61)	0.051 (2.01)	0.088 (3.84)
S	-0.929 (7.75)	-0.942 (7.68)	-0.639 (3.40)	-0.908 (6.20)	-0.639 (6.78)
F	0.798 (1.66)	0.766 (1.56)	1.238 (2.40)	0.900 (1.92)	1.406 (3.23)
Monetary Policy	-0.002 (0.15)	0.002 (0.16)			
GDP Product			0.041 (1.79)		
GDP/cap Product				-0.008 (0.15)	
Human Capital					0.167 (3.31)
(2) Trade T					
Distance	-0.881 (13.45)	-0.869 (13.42)	-0.871 (13.04)	-0.876 (13.13)	-0.935 (14.28)
Border	0.030 (0.11)	0.051 (0.19)	0.030 (0.11)	0.026 (0.10)	0.042 (0.16)
Language	0.553 (3.28)	0.532 (3.20)	0.546 (3.21)	0.543 (3.17)	0.635 (3.83)
GDP Product	-0.142 (3.14)	-0.138 (3.07)	-0.133 (2.88)	-0.128 (2.76)	-0.069 (1.65)
S	0.339 (0.75)	0.540 (1.16)	0.038 (0.09)	0.070 (0.16)	1.233 (3.37)
Monetary Policy	-0.075 (1.94)	-0.075 (2.71)			
(3) Specialization S					
GDP/cap Product	-0.271 (6.48)	-0.272 (6.47)	-0.284 (6.73)	-0.281 (6.38)	-0.265 (6.14)
GDP Gap	1.227 (3.11)	1.204 (3.04)	1.503 (3.61)	1.311 (3.19)	1.312 (3.13)
T	-0.000 (0.02)	-0.002 (0.06)	0.007 (0.25)	0.003 (0.12)	0.030 (1.12)
F	-0.194 (0.37)	-0.310 (0.60)	0.100 (0.19)	0.016 (0.03)	-0.288 (0.57)

Notes: All estimations are run using 3SLS, with t-statistics reported between parentheses. ρ is computed using Baxter-King filtered quarterly series. T is (log) T_2, S is based on UNYB sectorial data, F is an index of bilateral discrepancies in cumulated current accounts. F is instrumented using the institutional variables in LaPorta et al (1998). In particular, the instruments reflect shareholder rights (with variables capturing whether one share carries one vote, the distribution of dividends is mandatory, proxy vote by mail is allowed, the percentage of capital necessary to call an extraordinary shareholders' meeting), creditor rights, and an assessment of accounting standards and the rule of law. Specification (i) includes the volatility in the (growth rate of the) nominal exchange rate, and and (ii) controls for five-year averages of inflation differentials. Human Capital is measured by the (pairwise sum of log) average schooling years of education in the working population in 1970, from the Barro-Lee dataset.