Regional Business Cycles and National Economic Borders: What are the Effects of Trade in Developing Countries?♦

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This version: March 2005

Abstract

Does trade lead to increased cross-country regional business cycle synchronization? Does the intensity of trade relationships help to explain observed national economic borders? The theory does not really provide an unambiguous answer. Our paper addresses empirically this question using Argentina and Brazil as case studies of developing countries. These countries liberalized unilaterally trade since the mid-1980s and also established MERCOSUR (a regional integration agreement with Paraguay and Uruguay) in 1991. As a consequence, the intensity of trade between Argentina and Brazil rose significantly. The answer to the initial question is *no*. The increase in bilateral trade between Argentina and Brazil did not translate into significantly more synchronized regional business cycles. Using Gross Provincial Product for Argentina and Gross State Product for Brazil for the period 1961 to 2000, we find that within-country regional business cycle synchronization is substantially larger than cross-country regional business cycle synchronization. Moreover, this difference has increased over time. These results are mainly driven by Argentina's behavior, and hold even after controlling for factors such as distance, size, sectoral specialization, and the degree of regional fiscal policy coordination. The answer to the second question is *yes.* GMM single and multiple equation estimates based on Brazilian states and Argentina as a whole suggest that the higher level of trade among regions within a country is an important factor that accounts for the observed border effect. In the case of Argentina additional factors such as monetary policy and large country-specific shocks have also played a significant role.

Keywords: Trade, Regions, Business Cycles, Border, Argentina, Brazil
JEL-Classification: F15, F42, E32, R11

♦ We thank Luciano Di Gresia and Carlos Azzoni for providing us with regional GDP data for Argentina and Brazil, respectively. We are also indebted to André Maia, who kindly provided us with inter-regional trade data for Brazil and to Fernando Blanco Cossio and Ricardo Markwald for providing us with fiscal and international trade data for Brazilian states, respectively. We would like also to thank Kristian Behrens, Michael Massmann, Sandra Poncet, and Juan Ruiz for helpful discussions and participants at the 6th Annual Meeting of the Trade Study Group (Nottingham) for useful suggestions. Finally, we owe gratitude to Todd Clark, who provided us with his RATS codes and data on output for the U.S. and European countries. The usual disclaimers apply.

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1 Introduction

In recent years a growing empirical literature has provided evidence on the degree of synchronization of economic fluctuations within and across developed economies.[1] A general conclusion of this literature is that intra-national business cycles are substantially more synchronized than international business cycles, i.e. there is a significant border effect. Furthermore, some studies highlight that this border effect has tended to decrease as economies became more integrated.

What does this literature tell us about the extent of synchronization of business cycles in developing countries? Has the degree of synchronization increased as trade barriers declined? The evidence on cross-country correlations is scarce, while that on relative within-country correlations is almost inexistent.[2] It is well known that regions are natural benchmarks to study fluctuations of economic activity and that trade liberalization tends to be associated with significant changes in cross-regional specialization patterns. However, there is no direct evidence on the evolution of cross-country regional business cycles as economic integration proceeds among developing countries. This paper aims at filling this gap by documenting the magnitude of the synchronization of business cycles within and across two developing countries, Argentina and Brazil. In particular, it measures the size of the border effect using regional output data over the period 1961-2000. It also shows the evolution of this effect over a period of increasing trade integration between these two countries. In doing so, we explicitly assess the role played by trade and other potential determinants suggested by economic theory, namely relative sectoral specialization and the degree of coordination of fiscal policies.

Why is it interesting to look at developing countries? One fundamental reason is that macroeconomic fluctuations are much stronger in developing than in developed countries (see, e.g., Lane, 2003). Also, higher volatility is often associated with lower growth rates (see Fatás, 2002, and Imbs, 2004a) and worsened income distribution (see Breen and García-Penaloza, 2004). Moreover, the welfare costs of aggregate fluctuations are substantially larger for developing countries (see Pallage and Robe, 2003). In addition, specialization patterns are significantly different between developing and developed countries. The evolution of sectoral diversification along the development path seems to be characterized by an inverted U-shaped pattern. This means that countries first diversify so that the distribution of economic activity across sectors becomes more uniform and at relatively high level of income per capita they start specializing again so that the degree of inequality in sectoral shares in total economic activity increases (see Imbs and Wacziarg, 2003). This, in turn, has important

[1] See, e.g., Fatás (1997), Hess and Shin (1997), Wynne and Koo (2000), Clark and van Wincoop (2001), Barrios and de Lucio (2003), and Barrios et al. (2003).
[2] Loyza et al. (1999), Calderón et al. (2003), and Imbs (2003) show that business cycles are more correlated between developed countries than between developing countries.

implications for the impact of trade liberalization on business cycle correlations. In particular, increasing international trade relationships could result in either tighter or looser synchronization of business cycles. If trade liberalization results in countries becoming more specialized in those goods in which they have comparative advantage, as suggested by the traditional trade theory, there will be an increased specialization in production along industry lines and inter-industry patterns of international trade. Countries will therefore become more sensitive to industry-specific shocks and this will translate into more idiosyncratic business cycles. This would be the typical scenario for developing countries.[3] On the contrary, if, as frequently observed in the developed world, countries were specialized more within than across industries, reducing the obstacles to trade may induce deeper intra-industry specialization. In this case, the result would be more symmetric impact of shocks and higher synchronization of cycles.

What are the advantages of working at the regional level? Economic policies and institutions differ across national borders and discriminate between residents on different sides of these borders. Moreover, while migration, one adjustment mechanism to shocks (see Obstfeld and Peri, 1998), is allowed among regions within a country, it is more restricted across nations. Furthermore, especially in the developing world, each country has its own currency. Hence, intra-national business cycles provide natural case studies of economic fluctuations between (almost and in theory) frictionless economies. Therefore, regional data allow comparing within and across country fluctuations. This, in turn, it is useful to assess the importance of national economic borders in business cycle fluctuations. In particular, this regional dimension is worth exploring because, as subunits within already existent currency and economic unions, regions are natural benchmarks to examine adjustment patterns to asymmetric shocks and they may provide relevant insights on the implications of international macroeconomic coordination schemes.

The topic we deal with has, then, policy relevance, especially for the countries we are examining. Since the devaluation of the Brazilian currency (Reai) in 1999, the discussion on the feasibility and desirability, i.e. the benefits and costs of macroeconomic coordination in MERCOSUR has intensified.[4] As already pointed out by Mundell (1961), one key element in this discussion is the business cycle symmetry.[5] By looking at the degree of business cycle synchronization among regions within and across the two largest members of MERCOSUR, we believe that our paper provides valuable insights to shed light on this controversy.

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[3] As shown theoretically by Kraay and Ventura (2001), if comparative advantage causes countries to specialize in different industries (e.g. developed countries specialize in industries that use new technologies operated by skilled workers and developing countries in industries that use traditional technologies operated by unskilled workers), then asymmetries in industry characteristics (e.g. new technologies are difficult to imitate so that industries in developed countries enjoy more market potential and face more inelastic product demands than those of developing countries) can generate cross-country differences in business cycles. Calderón et al. (2003) and Imbs (2003) provide some econometric evidence supporting this theoretical hypothesis.

[4] See, e.g., Eichengreen (1998), Budnevich and Zahler (1999), Carrera and Sturzenegger (2000), Escaith et al. (2002), Fernández-Arias et al. (2002), and Escaith and Paunovic (2003).

[5] According to Mundell (1961), business cycle symmetry is exogenous to monetary integration with the former determining the desirability of the latter. Frankel and Rose (1998) have, however, shown that these criteria for an optimum currency area may be endogenous.

We address four main questions: How large is the border effect between Argentina and Brazil? How has this border effect changed over time? Does the level of trade help to understand it? What are the others determinants of this border effect?

In addressing these questions, we use annual output data on 24 Argentinean provinces and 21 Brazilian states. We de-trend these raw data using conventional procedures in the literature -i.e., Hodrick and Prescott (1997) filter and band-pass filter proposed by Baxter and King (1999) - and we calculate the correlation of the resulting cyclical components. Differences between within-country and cross-country correlations are seen as raw measures of the border effect. In accounting for this border effect, we explicitly assess the role of trade levels. We also consider the effect of regional sectoral specialization and the degree of fiscal policy coordination as well as the influence of national monetary and exchange rate policies.

We find that average within-country business cycle correlation is substantially higher than cross-country correlation, i.e. we do find a significant border effect between Argentina and Brazil, and that the magnitude of this effect has increased over time. Furthermore, bilateral distance accounts for a significant part of the border effect, and regions with more similar production structures tend to have larger co-fluctuations. Production similarity and the degree of coordination of regional fiscal policies are not, however, decisive to explain a significant part of the border effect. Moreover, once the interactions of the main endogenous variables are accounted for in a simultaneous equation setting, they do not seem to significantly affect the regional patterns of economic fluctuations either. In addition, GMM single and multiple equation estimations considering Brazilian states and Argentina as whole show that more intense trade links are associated with a higher degree of synchronization of business cycles. More specifically, a higher level of trade among Brazilian states helps explaining the national border effect between this country and Argentina. Finally, our results suggest that, especially in the case of Argentina, additional factors, such as monetary and exchange rate policies and large country-specific shocks, are also important to understand the patterns of economic fluctuations and the detected national border effect.

The remainder of the paper is organized as follows: Section 2 describes the empirical methodology. Section 3 reports our main empirical findings. Section 4 discusses and compares these results with previous studies based on developed countries, and Section 5 concludes.

2 Empirical Methodology

We start with a direct comparison of within-country and cross-country business cycles synchronization using regional GDP data for Argentina and Brazil over the period 1961-2000. Appendix A presents a detailed description of our dataset and the data sources we use.

We first isolate the fluctuations at business cycle frequencies by filtering the regional GDP data through both the Hodrick and Prescott (1997), henceforth HP, and the band-pass filter proposed by Baxter and King (1999), henceforth BK.[6] In applying these filters, we choose the parameters following those recommended by Baxter and King (1999). This means that for the BK filter we admit periodic components between two and eight years with a maximum lag length equal to three, while we set the smoothing parameter of the HP filter is set at ten.[7] Second, we measure the degree of synchronization of business cycles using estimated correlation coefficients on the de-trended (natural logarithm of) real regional GDP. Formally, let $\hat{\rho}_{ij}$ be the estimated correlation between the cyclical components of regions *i* and *j*, y_i^c and y_j^c, respectively :

$$\hat{\rho}_{ij} = cov\left(y_i^c, y_j^c\right) \Big/ \sqrt{var\left(y_i^c\right) var\left(y_j^c\right)}$$

We then regress the correlation of regional business cycles on a constant and a border dummy. Formally, we estimate the following equation by ordinary least squares (OLS):

$$\hat{\rho}_{ij} = \beta_0 + \beta_1 border_{ij} + \varepsilon_{ij} \quad (1)$$

where *border* is a dummy variable that takes the value of 1 when regions *i* and *j* are located in the same country and 0 otherwise. The standard errors of the parameters are estimated using White (1980)'s correction for heteroskedasticity.[8]

The impact of economic integration can also translate into changes in the relative influence of explanatory variables over time. In particular, the magnitude of the border dummy, which measures to what extent the degree of within-country business cycles synchronization is larger than cross-country synchronization, may have changed as a consequence of trade liberalization. Therefore, we split the sample in two size-symmetric sub-samples and carry out a Wald test to assess the presence of structural breaks. Since we indeed find such a break, we perform separate regressions for the sub-period starting in 1985. We have chosen this year because Argentina and Brazil began to move towards unilateral and preferential trade liberalization since the mid-1980s.[9] In addition, for some explanatory variables, such as sectoral regional GDP at the nine-sector disaggregation and the fiscal policy indicator, data are only available from 1985 onwards.

The estimated coefficient on *border* provides a *raw* measure of the magnitude of the border effect, through the difference between the average degree of within-country versus cross-country correlation. This is a raw measure, because it does not control for the influence of *exogenous* factors

[6] Detrending data with the BK filter implies the loss of the first and last three observations (years) of the sample. Hence, correlations correspond to 1964-1997 when looking at the whole sample period (and to 1964-1980 and 1981-1997 when looking at sub-periods). On the other hand, the HP filter allows us to use the whole sample (1961-2000). Some authors recommend that these "additional" observations are to be dropped (see, e.g., Baxter and King, 1999). We do not find, however, significant differences in the main results and thus decide to work with all observations.

[7] In the case of the HP filter, we have set the smoothing parameter (lambda) at 10. We have also replicate the calculations using de-trended data after setting this parameter at 6.25, as suggested in Ravn and Uhlig (2002). Results are essentially the same, and can be obtained from the authors upon request.

[8] We follow Frankel and Rose (1998), Imbs (2003), and Calderón et al. (2003) in using White (1980) heteroskedasticity-consistent standard errors for hypothesis testing purposes. However, as stated in Clark and van Wincoop (2001), there are also likely interdependences among the correlations which should be controlled for. Otherwise, standard errors will be substantially understated. They suggest using the Newey and West (1987) correction for autocorrelation in the standard errors. We do not, however, find significant differences in our sample. In particular, out of 990 pairwise correlations calculated from cyclical components obtained with the Baxter and King (1999) filter, only 431 (43.54%) have larger standard errors when using this methodology. These estimates are available from the authors upon request.

[9] Argentina and Brazil signed up the "Economic Integration and Cooperation Program (PICE) in 1986 and the "Treaty for Integration, Cooperation, and Development" in 1988.

that are not (necessarily) related to the existence of national economic borders. For example, a higher correlation between regions within Argentina could be the consequence of a lower average distance between these regions than those between Argentinean and Brazilian regions. Similarly, a higher correlation between Brazilian regions could be the result of their larger sizes. Distance and size are central explanatory variables of bilateral trade flows in gravity models, and thus they can be seen as variables capturing the impact of trade on co-movement of economic activity (see Barrios and de Lucio, 2003). Trade can affect the degree of regional business cycle synchronization in several ways. Trade integration can induce changes in specialization patterns and can also accentuate spillover effects from aggregate demand shocks (e.g., surges in income in one country lead to higher demand for both foreign and domestic goods). This effect might be even stronger if trade integration leads to more coordinated policy shocks (see Frankel and Rose, 1998). Moreover, trade may facilitate knowledge and technology diffusion and thus speed up the spread of productivity shocks (see Coe and Helpman, 1995). Therefore, as a first approximation to account for the effect of trade on output correlations, our next step is to incorporate two additional explanatory factors: the distance between the regions and a variable that capture combined size.[10] Formally, the model becomes:

$$\hat{\rho}_{ij} = \beta_0 + \beta_1 border_{ij} + \beta_2 distance_{ij} + \beta_3 size_{ij} + \varepsilon_{ij} \quad (2)$$

where $distance_{ij}$ is the natural logarithm of the distance between region *i*'s capital and region *j*'s capital cities and $size_{ij}$ is the natural logarithm of the (average over time of the) combined population of regions *i* and *j*.

The theory suggests various additional variables that can explain the remaining size of the border. One important factor is sectoral specialization. As stressed by Kenen (1969) and Krugman (1993), in the presence of industry-specific shocks, a higher degree of dissimilarity in production structures across regions is likely to be associated with more idiosyncratic business cycles.[11] This means that, if regional production structures are more similar within than across countries, this border effect can be at least partially explained by different patterns of sectoral specialization. Following Clark and van Wincoop (2001), we accordingly expand the original model to include a measure of structural dissimilarity proposed by Krugman (1991):

$$\hat{\rho}_{ij} = \beta_0 + \beta_1 border_{ij} + \beta_2 distance_{ij} + \beta_3 size_{ij} + \beta_4 dissimilarity_{ij} + \varepsilon_{ij} \quad (3)$$

where:

$$dissimilarity_{ij} = \sum_{k=1}^{M} \left| s_{ik} - s_{jk} \right| \quad (4)$$

with s_{ik} (s_{jk}) denoting the share of activity *k* in region *i* (*j*)'s GDP and *dissimilarity* is calculated from (the average over time of) sectoral shares in regional GDP. Available data allow us to use a measure that covers five sectors (Dissimilarity 5) for the whole period, 1961-2000, and a more

[10] We had also included a dummy for adjacency, but since it was not significant we decided to drop it.

[11] Imbs (2003), Clark and van Wincoop (2001), and Calderón et al. (2003) present evidence that confirms this hypothesis. Consistently, Kalemli-Ozcan et al (2001) find that U.S. states with a higher degree of sectoral specialization have lower correlation with U.S. aggregate GDP.

disaggregated one that covers nine sectors (Dissimilarity 9) for the period 1985-2000 (see Table A1 in Appendix A for more details).

As suggested by Fatás (1997), monetary and fiscal policies can also be key factors determining fluctuations of economic activity. The impact of an increased coordination of economic policies on national cycles is, however, ambiguous because it depends on the type of shocks that drive economic fluctuations and the ability of stabilize output. Thus, if macroeconomic policies are themselves a source of business cycles, then the existence of a single monetary policy and a single federal fiscal policy could potentially lead to a higher synchronization of economic fluctuations within a country. On the other hand, since in a monetary union the exchange rate is not available as an adjustment tool, local governments have less flexibility to dampen regional business cycles, which can result in less synchronized business cycles. Evidently, the question is an empirical one, and to answer it we add an indicator of fiscal policy coordination:

$$\hat{\rho}_{ij} = \beta_0 + \beta_1 border_{ij} + \beta_2 distance_{ij} + \beta_3 size + \beta_4 dissimilarity_{ij} + \beta_5 fiscal\ policy\ differential_{ij} + \varepsilon_{ij} \qquad (5)$$

where *fiscal policy differential* is the standard deviation of the primary budget deficit differential between regions *i* and *j* over the period 1985-2000. Given that this fiscal policy variable can be simultaneously determined with the degree of business cycle synchronization, endogeneity is likely to be a problem. In particular, larger asymmetric shocks can lead to larger differences in fiscal policy. This is especially valid for countries like Argentina and Brazil, which implemented several stabilization programs and faced several macroeconomic crises, especially during the period we consider. Hence, we also perform generalized method of moments (GMM) estimations, which yield efficient estimates in the presence of heteroskedasticity (see Hayashi, 2000). We instrument those fiscal policy differentials by the absolute difference in average government size. As argued by Clark and van Wincoop (2001), this is a valid instrument, because average size of government will likely affect how policy is conducted over the cycle. Moreover, our sample period is long enough for business cycle variation not to influence this average size.

Even though data on trade flows between Brazilian states, and between these states and Argentina as a whole are available for 1998, there are no figures of exports to and imports between Argentinean provinces. Therefore, a direct assessment of the impact of trade links on regional business cycle synchronization is only possible for a reduced sample formed by Brazilian states plus Argentina as an additional region. Specifically, we estimate the following model:

$$\hat{\rho}_{ij} = \beta_0 + \beta_1 border_{ij} + \beta_6 trade_{ij} + \varepsilon_{ij} \qquad (6)$$

where $trade_{ij}$ is the natural logarithm of a measure of bilateral trade intensity defined as follows (see Frankel and Rose, 1998):

$$trade_{ij} = \frac{X_{ij} + M_{ij}}{X_i + X_j + M_i + M_j} \qquad (7)$$

where X_{ij} (M_{ij}) denotes total shipments of goods and services from region *i* (*j*) to region *j* (*i*), X_i (X_j) denotes total shipments of goods and services from region *i* (*j*), and M_i (M_j) denotes total shipments of good and services to region *i* (*j*).

Endogeneity is likely to be problem in this setting, either strengthening or weakening the measured effect of trade. On the one hand, higher business cycle synchronization may result in relative price stabilization (i.e., real exchange rates), thus increasing trade. On the other hand, it is argued that non-synchronized economies may tend to trade more (see Imbs, 2004b). Hence, we perform OLS and GMM estimations using distance and size as instruments.

We next estimate the following model that allows us to explicitly measure the influence of trade once the degree of symmetry in production structures is controlled for:

$$\hat{\rho}_{ij} = \beta_0 + \beta_1 border_{ij} + \beta_6 trade_{ij} + \beta_4 dissimilarity + \varepsilon_{ij} \tag{8}$$

Trade can influence the degree of synchronization of economic fluctuations both directly and indirectly through the changes induced in regional sectoral specialization. In particular, trade liberalization may lead to increased specialization at the country level, resulting in more pronounced national business cycles. At the same time, economic integration may foster changes in industry location patterns, thus raising specialization at the regional level. If specialization takes place at this level and trade liberalization increases the interdependence between regions of different countries, then national economic borders will vanish over time. In this case, the effect of closer trade relationships on national economic business cycles will be the opposite. Furthermore, different degrees of dissimilarities in production structures may be associated with different degrees of intensity of trade relationship. Thus, diverging production structures may induce deeper trade relationships, which will be of inter-industry nature. Disentangling these direct and indirect effects calls for a simultaneous equation methodology (see Imbs, 2004, and Guerrero and Ruiz, 2004). In particular we estimate the following system:

$$\hat{\rho}_{ij} = \beta_0 + \beta_1 border_{ij} + \beta_6 trade_{ij} + \beta_4 dissimilarity_{ij} + \varepsilon_{ij} \tag{9}$$

$$dissimilarity_{ij} = \phi_0 + \phi_1 trade_{ij} + \phi_2 size\ differential_{ij} + \mu_{ij} \tag{10}$$

$$trade_{ij} = \gamma_0 + \gamma_1 distance_{ij} + \gamma_2 size_{ij} + \gamma_3 dissimilarity_{ij} + \upsilon_{ij} \tag{11}$$

We first estimate this system by three-stages least squares (3SLS). These estimates are efficient under conditional homoskedasticity and use the same set of instruments across equations (see Hayashi, 2000). According to Clark and van Wincoop (2001), correlation of business cycles are measured with error, and sampling errors are likely to be correlated across observations leading to interdependencies that the standard White (1980) correction is not able to account for. Ignoring this particular type of heteroskedasticity results in understated standard errors for the estimates in Equation (9) and, due to simultaneous estimation, in the rest of the system as well (see Imbs, 2004). We therefore also estimate this system by GMM, which allow us to account for heteroskedascticity and cross-sectional correlation of unknown form and thus to address the aforementioned concern, and test the chosen specification using the Hansen J statistic for overindentifying restrictions.

Finally, we also explore the impact of fiscal policy differentials in the reduced sample of Argentina and Brazilian states. We first estimate the following equation

$$\hat{\rho}_{ij} = \beta_0 + \beta_1 border_{ij} + \beta_6 trade_{ij} + \beta_4 dissimilarity_{ij} + \beta_5 fiscal\ policy\ differentials_{ij} + \varepsilon_{ij} \tag{12}$$

by OLS and, to address the endogeneity problems mentioned above, by GMM. Furthermore, also in this case, a single equation approach may be unable to uncover all relevant patterns of interactions in our data. In particular, to isolate the different components of the endogenous variables and identify direct and indirect channels of influence, we resort again to a multiple equation strategy, i.e., we estimate the following model by 3SLS and GMM:

$$\hat{\rho}_{ij} = \beta_0 + \beta_1 border_{ij} + \beta_6 trade_{ij} + \beta_4 dissimilarity_{ij} + \beta_5 fiscal\ policy\ differentials_{ij} + \varepsilon_{ij} \qquad (13)$$

$$dissimilarity_{ij} = \phi_0 + \phi_1 trade_{ij} + \phi_2 size\ differential_{ij} + \mu_{ij} \qquad (14)$$

$$trade_{ij} = \gamma_0 + \gamma_1 distance_{ij} + \gamma_2 size_{ij} + \gamma_3 dissimilarity_{ij} + \upsilon_{ij} \qquad (15)$$

$$fiscal\ policy\ \ differentials_{ij} = \theta_0 + \theta_1 \hat{\rho}_{ij} + \theta_2 government\ \ size\ differentials_{ij} + \nu_{ij} \qquad (16)$$

3 Econometric Results

This section presents our main empirical results. We first report evidence on the magnitude of the raw border effect between Argentina and Brazil over the whole sample period, 1961-2000. Second, we describe the changes in the size of this effect over time. In particular, we split the sample period in two sub-periods of equal length, 1961-1980 and 1981-2000, and we also consider specifically the sub-period 1985-2000, which is characterized by increased trade integration between the two countries under examination. We then introduce distance and size in a first approximation to measure trade's impact on business cycle synchronization and its power to explain the observed border effect. Finally, we turn to the direct assessment of the role played by trade relationships using a reduced sample formed by Argentina as a whole and the Brazilian states. We present evidence from OLS and GMM-single equation as well as 3SLS and GMM-multiple equation estimations that explicitly model the interplay between business cycle correlation, trade, sectoral specialization, and the degree of regional fiscal policy coordination.

3.1 *The Size of the Raw Border Effect and its Changes over Time*

We first estimate Equation (1) by OLS. Results are reported in Table 1. Column one of this table shows average within-country and cross-country correlations, as well as their difference (border), over the whole sample period, 1961-2000. Estimation results using data de-trended with the two alternative methods, HP and BK, are very similar. Average within-country correlation is significantly larger than the cross-country correlation (between 0.160 and 0.179 higher), implying that business cycles are more synchronized among regions within a same country than among regions in different countries.

This result may be the consequence of a similar degree of regional business cycle synchronization within each country, but it also may be hiding substantial differences in the level of synchronization. In other words, is the internal correlation of business cycles similar in both countries?

To answer this question, we re-estimate Equation (1), but including two dummy variables instead of a common border dummy: Argentina (Brazil), which is equal to one if the two regions are located in Argentina (Brazil) and zero otherwise. Estimation results are reported in Rows three and four of Table 1. Average within-country correlation is significantly higher in Argentina than in Brazil (more than two times higher), leading us to conclude that regional business cycles are substantially more synchronized among Argentinean provinces than among Brazilian states.

As mentioned before, Argentina and Brazil started their trade integration process in the mid-1980s. Figure 1 shows declining most-favored nation (MFN) and bilateral preferential tariffs as well as intensified bilateral trade relationships between these two countries as measured by the index defined in Equation (7) above. The border effect is then likely to have experienced a significant change over our period of analysis. Figure 2 presents preliminary visual evidence. It displays kernel density estimates of the distribution of correlation coefficients among regions for two sub-periods of equal length: 1961-1980 and 1981-2000.[12] One outstanding feature is an emerging bimodality in the distribution, which suggests an increasing polarization across region pairs.

Are these increasingly differentiated groups of regions within the same country or are they in different countries? Estimation results reported in columns two and three of Table 1 provide a clear answer: the border effect has increased from the first to the second sub-period. This increase is significant and can be attributed to higher within-country correlations (between 0.128 and 0.165). On the other hand, average cross-country correlation does not seem to have changed significantly over time. Therefore, we witness an enlargement of the border effect during a period characterized by declining trade barriers. Results further indicate that the higher within-country correlations, which drive the larger border effect, are essentially explained by Argentina, since we do not observe significant differences in average within-country correlation across sub-periods in Brazil.

Given that most trade liberalization initiatives took place since 1985 and that for some of our explanatory variables data are only available for the period beginning in that year, we also present estimates that focus only on the period 1985-2000 in the last column of Table 1. Interestingly enough, average cross-country correlation is slightly higher than in previous columns. Note, however, that the border effect is even larger than before. Higher within-country correlations, mainly in Argentina, account for this result.

Figure 3 summarizes the discussion above. It shows the evolution of the border effect and the average cross-country correlation obtained from “moving regressions” over 13-year-periods starting in 1964-1976 and finishing in 1985-1997, together with their respective confidence intervals. We observe a steady increase in the border effect since the mid-1980s, as well as a decline in cross-country correlations between 1991 and 1994, and an increase since 1995.

[12] Densities were estimated using the Gaussian kernel smoothing and the automatic bandwidth choice (see Silverman, 1986).

3.2 *The Role of Trade: An Indirect Assessment through Distance and Size*

As pointed out in the last section, estimated differences in average within-country and cross-country correlations based on Equation (1) provide a raw measure of the true border effect. Does the level of trade help us to understand this border effect? Since, as noticed above, we do not have data on trade between Argentinean provinces and Brazilian state, our first strategy consists of controlling for exogenous factors related to trade. Hence, the idea is to considered indirect variables to assess the impact of increasing trade on the degree of business cycle synchronization within and across countries, and thus on the size of the border effect. Being traditionally included as explanatory variables of bilateral trade volumes in gravity models, distance and size are natural candidates. Thus, as mentioned before, a higher correlation among regions within a country may be explained by a lower average distance among these regions, and this is, indeed, what happens in our case. The average bilateral distance among regions within the same country is 1,317.9 km., while that among regions in different countries is 3,086.7 km. The difference between these two average distances is significant at the 1% level. In particular, we can observe higher correlation for adjacent regions. Furthermore, business cycles can be more synchronized among larger regions than smaller regions.

Figures 4-5 are scatterplots of business cycle correlations as a function of bilateral distance and combined size for the sub-period 1985-2000. As expected, we observe a clear negative association between business cycle synchronization and distance. However, we do not find a clear pattern for size.

We turn now to a formal econometric analysis. We first estimate Equation (2) above by OLS. Estimation results are reported in the first and third column of Table 2. The coefficient on distance is significantly different from zero and, as expected, negative, thus confirming our preliminary visual inspection. The coefficient on size is not significant when we consider the whole period, but becomes significantly negative over the period 1985-2000. After controlling for size and distance, the border effect is substantially lower than the *raw* border effect reported in Table 1 (0.125 and 0.100 lower based on the BK de-trending), respectively, but it is still positive and significant.

Therefore, bilateral distance plays an important role in explaining observed differences between within and cross-country correlations, suggesting that trade would be relevant to understand regional co-movement of economic activity. Moreover, a significant difference still remains unexplained, leaving open the question whether additional factors suggested by economic theory, such as sectoral specialization and economic policy coordination are also important. We will address this question in the next sub-section.

3.3 *Production Structures and Fiscal Policy*

Fatás (1997) argues that two of the main factors determining the size and the shape of regional business cycles are the degree of regional specialization and the degree of coordination of economic policy. If production structures are more similar among regions within a country than across countries and if fiscal policies are more coordinated among the formers, we would expect that sectoral specialization and fiscal policy differentials could help to explain the remaining border effect. In this section we sequentially assess the influence of these two factors on the degree of regional business cycle synchronization.

Table 2 also shows estimates of Equation (3), i.e. estimates of the border effect when we additionally control for dissimilarity in production structures. We report results for the whole sample period, 1961-2000, based on the index defined in Equation (4) (column two) and covering five sectors and for the sub-period 1985-2000 with the same measure and one that covers nine sectors (columns four and five, respectively). Three main points deserve being stressed. First, as expected from the theory, regions with less similar production structures have more asymmetric business cycles. Second, the impact of sectoral specialization is larger in the sub-period 1985-2000, as we would expect, given the trade liberalization initiatives implemented since the mid-1980s. Third, even though significant in explaining business cycles synchronization, sectoral specialization accounts for only a minor fraction of the border effect. This can be clearly seen if comparing estimates of this effect reported in columns one and three with those reported in Columns one and four-five, respectively: for the sub-period 1985-2000 the border effect is 0.005 lower when data de-trended by the band-pass filter are considered.

Is the coordination of fiscal policy relevant to explain the border effect? Raw data indicate that there is a slightly higher coordination among regions within the same country: the average standard deviation of primary budget deficit for regions within a country is 2.515, while that of regions in different countries is 2.653. To formally answer this question we estimate Equation (5) by OLS and GMM, where we use the absolute difference of average government size and an adjacency dummy as instruments. We resort to GMM estimation, because we expect a lower business cycle correlation to increase the standard deviation of primary deficit, which would lead to a downward bias in the OLS coefficient. Results are shown in columns six and seven of Table 2.[13] These results show indeed the downward bias: while the estimated coefficient on the fiscal policy variable is negative (although insignificant), there is certain evidence in favor of a positive relationship between fiscal policy differentials and business cycles synchronization when accounting for endogeneity. Hence, a higher degree of fiscal policy coordination would be associated with larger business cycle asymmetries. This would be the case if economic policy would act a stabilizer of business cycle (see Clark and van Wincoop, 2001). However, this variable does not seem to explain the observed border effect.

3.4 *The Role of Trade: A Direct Assessment*

We can perform a direct assessment of the importance of trade relationships in explaining the border effect using a reduced sample comprising the Brazilian states and Argentina as a whole. This analysis

[13] This table presents estimation results based on the specialization measure that covers nine sectors. Results based on a similar measure covering five sectors convey the same message, and are available from the authors upon request.

therefore aims at uncovering the determinants of the border effect for Brazil as reported in Table 1. In fact, re-estimating Equation (1) on this restricted sample, we find a border effect of 0.128, which is significant at the 5% level (based on HP-detrended data). Inspecting the data we observe that the average level of trade among Brazilian states is higher than that with Argentina. In particular, the average trade index is 0.012 in the first case and 0.005 in the second case. The difference between these average trade levels is significant at the 10% level.

Figure 6 suggests that the intensity of bilateral trade relationships seems to be positively related to the extent of business cycle correlations. Table 3 shows OLS and GMM estimations of the impact of trade on business cycle correlations. In GMM estimations trade intensity is instrumented by distance and combined size.[14] Distance is highly negatively correlated with trade intensity, being the absolute correlation almost 0.60.[15] As pointed out by Clark and van Wincoop (2001), the effect of distance on business cycle correlations takes place mostly through its effect on trade. Size has also a high correlation with trade. Note that the Hansen J statistic suggests that the orthogonality conditions are satisfied. The main message is robust across different specifications including those controlling for dissimilarity in production structures: more intense bilateral trade relationships are associated with a higher degree of business cycles synchronization and, once controlled for these relationships, the border effect becomes insignificant. In particular, it is noteworthy that instrumenting trade results in a higher point estimate. The reason is that this controls for the attenuating endogeneity bias originated in the fact that non-synchronized economies tend to trade more (see Imbs, 2004b).

As already discussed, trade may influence business cycle synchronization both directly and indirectly through changes in specialization patterns across regions. To identify these direct and indirect channels of influence we estimate the System of Equations (9)-(11) both by 3SLS and GMM. Table 4 reports the estimation results and the Hansen J statistics, which indicate that the orthogonality conditions are satisfied.[16] These estimates suggest that trade is a key factor for understanding the border effect. Trade intensity favors business cycle synchronization directly and is also associated with less dissimilar production structures. On the other hand, there is no direct impact of sectoral specialization on trade.

To control for a possible omitted variable bias, we reintroduce the fiscal policy differentials as additional explanatory variable. In particular, we estimate Equation (12) by OLS and GMM and, to disentangle the direct and indirect effects of the endogenous variables, the System of Equations (13)-(16) by 3SLS and GMM. Estimates are presented in Tables 5 and 6, respectively. Our previous results are confirmed: higher bilateral trade intensity is associated with higher business cycle synchronization. Again, the degree of fiscal policy coordination, as measured by the standard deviation of regional fiscal deficit differentials, does not have any significant impact on output correlations.

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[14] We have also used subsets of these variables as instruments (i.e., distance and adjacency and only distance), finding similar results, which are available from the authors upon request.

[15] Our measure of trade intensity does not have a high correlation with the border dummy.

[16] Table 4 presents estimation results using the specialization measure that covers nine sectors. We find similar results when using the measure covering five sectors. These results are available from the authors upon request.

Do these results also apply for Argentina? Unfortunately, the data we require to perform the same econometric analysis as before are not available for Argentinean provinces. It is however possible to carry out a slightly modified exercise to get indicative evidence. The main idea is to drop those Argentinean provinces whose exports to Brazil as a share of total provincial exports are lower than the national average and to re-estimate Equations (1), (2), and (3).[17] Compared to the estimates based on BK de-trending (reported in Tables 1 and 2), the average cross-country correlation is now higher and the estimated border effect is substantially lower. The raw measure of this effect is 0.165, the net measure is 0.071, and the magnitude once controlling for dissimilarity in production structures is 0.065.[18] However, Argentina's specific estimated border effect is, although lower, still large and significant. This suggests that a higher level of trade among Argentinean provinces can (only) partially account for the observed border effect, and that other factors also seem to play an important role in explaining its level and its evolution over time. These factors are mainly related to monetary policies as well as large country-specific shocks.

Figure 3 provides some insights about these additional factors. As noted before, the border effect has steadily increased since the mid-1980s. The second half of the 1980s was a period characterized by high macroeconomic instability in Argentina, reaching its peak with the hyperinflation episodes in 1989 and 1990. After this country adopted a currency board in 1991 with the exchange rate fixed to the U.S. Dollar, inflation fell substantially and the economy started to grow at an average rate of 8% between 1991 and 1994, i.e. expansion with exchange rate based-stabilization (see Kiguel and Liviatan, 1992). In sum, Argentina has been exposed to substantial macroeconomic shocks during the period under examination. Idiosyncratic reform processes and a specific strategy to recover from major macroeconomic crises also pushed towards higher within-country correlations and divergence with neighbor countries. We thus observe that average cross-country correlation has decreased between 1991 and 1994. The first half of the 1990s witnessed divergent macroeconomic situations in Argentina and Brazil. Brazil faced severe macroeconomic problems with high inflation and low growth, which dramatically changed with the Plan Reai, a stabilization plan implemented in the second half of 1994. Thus, between 1995 and 1998 monetary and fiscal policies in Argentina and Brazil tended to be more linked through the convergence in exchange rate policies. Interestingly, during this period both the level of trade between these countries (see Figure 1) *and* the average cross-country business cycle synchronization were growing (see Figure 3).

A further piece of evidence which amounts to the importance of macroeconomic policies can be obtained by filtering out the impact of national inflation rates on business cycle correlations. Given

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[17] We use total export data for the period 1995-1996 from INDEC and adopt the exclusion criterion based on exports to MERCOSUR instead of exports to Brazil, because we do not have geographically disaggregated data. In those years, the share of exports to MERCOSUR over total exports averaged 35%. Note that this exercise implies assuming that other factors beyond distance and size play a significant role in shaping regional patterns of trade with Brazil. Some particular cases confirm this presumption. For example, Misiones, one of the Argentinean provinces closest to Brazil, did not have an export structure concentrated on Brazil, while Tierra del Fuego, one the smallest and most distant province to Brazil, had a share of exports to MERCOSUR exceeding the national average.

[18] The exclusion criterion that we use implies to dropping 11 provinces. Since the re-sampling is important, we check the robustness of the direction of changes by dropping out only the three (and five) provinces with the lowest export intensity with MERCOSUR. Even though changes are less pronounced, estimation results confirm our findings.

the dynamics it displayed in the countries under examination, this variable allows us to capture monetary shocks and, in particular, macroeconomic stabilization programs. Specifically, we regress the regional business cycle components on national inflation rates and compute the residuals. Given that serial correlation, cross-sectional correlation as well as groupwise heterokedasticity are likely to prevail, we first transform the data as propose by Prais and Winsten (1954) to remove autocorrelation. We then perform an OLS estimation with panel corrected standard errors as proposed by Beck and Katz (1996). Residuals derived according to this procedure are then used to calculate the pairwise correlations measuring the business cycle synchronization.[19] Finally, we re-estimate Equation (3) for the whole cross-sectional sample, this time with these "filtered" correlations as dependent variables. Results are presented in Table 7. It is worth noting that, for the whole period, the border effect ceases to be significant, while for the sub-period 1985-2000, it is still significant but substantially lower than before (0.101 vs. 0.182, as reported in a comparable regression in Table 2). In sum, this econometric evidence confirms that monetary policies and large country-specific macroeconomic shocks are also relevant factors to explain cross-regional patterns of co-movements of economic activity.

4 Literature Comparison: Developed vs. Developing Countries

We find that average within-country business cycle correlations are substantially higher than cross-country correlations, suggesting that there is a significant border effect between countries. In particular, business cycles are more synchronized among Argentinean provinces than among Brazilian states. Furthermore, the magnitude of the border effect has increased over time, especially due to developments in Argentina. This increase has taken place during a period characterized by unilateral and concerted trade liberalization initiatives in both countries. Bilateral distance has a significant negative effect on business cycle correlations and accounts for a significant part of this border effect. As shown by estimations considering Brazilian states and Argentina as a whole, the impact of this variable (indirectly) materializes through trade relationships. Lower bilateral distances are associated with more intense trade links, and thus with a higher degree of business cycles synchronization. In particular, multiple-equation estimations based on this reduced sample suggest that trade is a relevant factor explaining the border effect. Furthermore, according to results from single-equation approach, relative sectoral specialization also helps to explain this degree of synchronization. As expected from the theory, we find that regions with more similar production structures tend to have more symmetric co-fluctuations. Production similarity does not, however, explain a significant part of the border effect. Moreover, when we explicitly account for the interplay

[19] In a similar exercise we filtered out external common shocks as proxied by world output (i.e. a weighted average of the cyclical components of France, Germany, Italy, Spain, the U.K., and the U.S., where the weights are the shares of these countries in countries' total exports) and a measure of world interest rate (i.e. the yield of a short term U.S. treasury bond). The results are similar to those reported before and are available from the authors upon request. This procedure allows us to address an additional concern: the business cycles of two regions may be highly synchronized because both are highly synchronized with a third region or country. Furthermore, there may be particular spatial patterns. Indeed, the Moran and Geary tests suggest that the cyclical components exhibit spatial autocorrelation in most years. We have therefore estimated a spatial lag and a spatial error model by maximum likelihood (see Elhorst, 2003). The econometric evidence favors the latter. By accounting for cross-sectional correlation, our estimation strategy is able to account for the implied interdependencies.

between output correlations, trade, and production structures within the framework of our system of equations, sectoral specialization does not have a direct significant impact on business cycle synchronization. The same also holds for fiscal policy coordination. The experience of Argentina suggests that macroeconomic policies and large country-specific shocks have played an important role in shaping the regional patterns of economic fluctuations.

Are these results in line with the findings of previous studies on developed countries? In general, the answer is yes, as most empirical studies detect a significant border effect. There are, however, different conclusions regarding the time profile of this effect. Bayoumi and Eichengreen (1993), Wynne and Koo (2000), and Clark and van Wincoop (2001) show that the business cycles of U.S.' census regions are substantially more synchronized than those between European countries. Furthermore, Clark and van Wincoop (2001) find a significant border effect between Germany and France when considering regional data for these countries. In both cases, the border effect has slightly declined over time, but this change is small and not statistically significant.

Fatás (1997) uses annual employment growth rates for regions within Germany, France, Italy, and the U.K. to examine business cycle correlation patterns. Consistently with previous results, he finds that regional business cycles are more synchronized with their respective national cycles than with that of the EU as a whole. He concludes, however, that the correlation of these regional cycles across national borders has increased between the periods 1966-1979 and 1979-1992, while the cross-regional correlations within countries has decreased over the same period. Similarly, Barrios and de Lucio (2003) analyze co-movements of economic fluctuations between Spanish and Portuguese regions and also find that there is a significant border effect. The magnitude of this effect has, however, significantly decreased as these two countries accessed the European Union. Barrios et al. (2003) report that U.K. national and regional economic fluctuations are less correlated with the euro-zone than those of other main E.U. economies and that there is a trend towards further cyclical divergence.

In general, distance and size contribute to explain within- and cross-country business cycle correlations. Distance has a negative impact on business cycle synchronization (see Clark and van Wincoop, 2001, and Barrios et al., 2003), whereas size has a positive one (see Clark and van Wincoop, 2001, Barrios and de Lucio, 2003, and Barrios et al., 2003). There are, of course, differences regarding the magnitude and the significance of these effects across studies. For example, size does not have a significant influence on business cycle correlation between German and French regions over the period 1982-1992 when GDP data is used (see Clark and van Wincoop, 2001). Similarly, distance is found to be an irrelevant factor in Spanish and Portuguese co-fluctuation (see Barrios and de Lucio, 2003). There are also differences regarding the portion of the raw border effect that these two variables account for.

Production structure dissimilarities have a negative impact on the degree of business cycles synchronization. This is a robust finding across empirical analyses using both regional (see Clark and van Wincoop, 2001, Barrios and de Lucio, 2003, and Barrios et al., 2003) and national data (see Imbs, 2003, and Calderón et al., 2003), as well as in single and multiple equation settings (see Imbs, 2004b, and Guerrero and Ruiz, 2004).[20] Due to obvious data limitations, direct evidence of the impact of trade using regional data is scarce (see, e.g., Clark and van Wincoop, 2001, and Chen, 2004). Results using national data are coincident: trade promotes business cycle synchronization (see Frankel and Rose, 1998, Clark and van Wincoop, 2001, and Calderón et al., 2003). More importantly, Clark and van Wincoop (2001) show that incorporating trade into the regression equations turns the border effect insignificant. This means that higher levels of within-country trade can explain most of the observed differences between within- and cross-country business cycle correlations.

Are there any significant differences between results for developing countries and those for developed countries? The answer is also yes. First, these differences are related to the magnitudes of the effects. Table 8 summarizes findings of comparable studies. The message is clear: the border effect is not significantly different from that found among developed countries, but the average cross-country business cycle correlation is substantially lower in our two developing countries. This also implies that business cycles are less synchronized among regions within these countries than those in developed countries. Second, macroeconomic policies seem to be more relevant in explaining the patterns of fluctuations in developing countries. Clark and van Wincoop (2001) assess their role only for a sample of European countries. Their estimation results suggest that the variables that measure monetary and fiscal policy similarity and exchange rate volatility are mostly not significant. Third, trade linkages are more important than economic structure in determining business cycle synchronization. Contrary to Imbs (2004b) and Guerrero and Ruiz (2004), once the interaction of the main endogenous variables is addressed through a simultaneous equation methodology, we find that the degree of production structures similarity does not have a significant direct effect on output correlations. The reason for this prevalence of demand-driven factors may be that, even though there are substantial differences in sectoral specialization across regions, the two countries we examined have a similar relative specializations vis-à-vis the rest of the world.

5 Concluding Remarks

How high is the degree regional business cycles synchronization in developing countries? How important is the border effect in these countries? What are its main determinants? Does trade play an important role?

This paper aimed at answering these questions using –at least to our knowledge- for the first time regional data from Argentina and Brazil. We therefore contribute to the existent empirical literature by presenting evidence on two medium-size developing countries. We also add some insights to the policy debate on the desirability of macroeconomic coordination for MERCOSUR by

[20] Calderón et al. (2003) find that the impact of trade intensity on cycle correlation is larger when countries have more similar production structures using the Krugman (1991) index as interacting term, whereas Imbs (2003) shows that countries with similar sectoral production patterns tend to have more synchronized business cycles using the Shea (1996) index as independent explanatory variable.

providing measures of co-fluctuation among regions within and between two already existing monetary unions.

We find that business cycle correlations among regions within the same country are significantly higher than among regions in different countries, suggesting the existence of a significant border effect. Second, this effect seems to have increased over time, especially during a period characterized by deepened trade liberalization. Third, although size, production structures similarity, and mainly bilateral distance between regions can partially explain the observed border effect, this border is still relatively large and significant after controlling for those factors. Fourth, trade linkages favor business cycle synchronization. In particular, the higher level of trade among Brazilian states accounts for a substantial part of the difference between their business cycle correlations and those with Argentina as a whole. Finally, the degree of disparity in regional fiscal policies explains neither the regional pattern of co-fluctuations nor the border effect. Monetary policies and large country-specific shocks play an important role in explaining the observed border effect and its evolution over time. This is especially true in the case of Argentina.

Our findings based on the Brazilian states sample plus Argentina as a whole suggest that trade integration may foster business cycle symmetry. However, the increased level of trade between these two countries does not seem to have been translated into a significant increase in average cross-country regional business cycles synchronization. As stated by Clark and Shin (2000), merely reducing trade barriers is likely to have only modest effects on the features of fluctuations if there is no concomitant attempt to coordinate monetary and fiscal policies or to increase labor mobility between the partners. This seems to be the case of Argentina and Brazil, with a rising but still relatively low level of bilateral trade. Furthermore, the evidence indicates that macroeconomic policies have not very coordinated across countries.

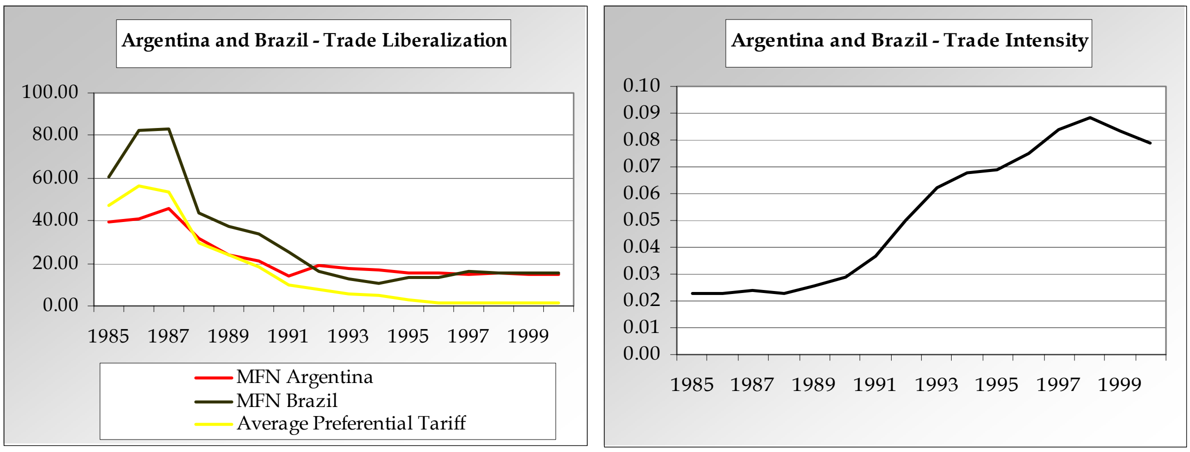
In sum, trade induces business cycle synchronization but not as much as it could do under more regionally stable macroeconomic conditions. A minimum level of coordination is required to allow the Frankel and Rose (1998) effect to fully operate. Therefore, MERCOSUR members will have to further explore mechanisms of macroeconomic coordination if they aim at attaining a higher level of economic integration.

Table 1

Border Effect and Cross-Regional Business Cycle Correlations (Whole Cross-Sectional Sample)	Whole Period 1961-2000	Symmetric Sub-periods 1961-1980	1981-2000	Change	Sub-period 1985-2000
	BK				
Border	0.160***	0.084***	0.236***	0.153***	0.287***
	(0.014)	(0.019)	(0.017)	(0.025)	(0.020)
Average Within-Country Correlation	0.197***	0.127***	0.254***	0.128***	0.338***
	(0.011)	(0.014)	(0.013)	(0.019)	(0.015)
Argentina	0.262***	0.131***	0.355***	0.224***	0.415***
	(0.013)	(0.017)	(0.015)	(0.023)	(0.021)
Brazil	0.111***	0.120***	0.122***	0.002	0.119***
	(0.018)	(0.024)	(0.020)	(0.032)	(0.026)
Cross-Country Correlation	0.037***	0.043***	0.018	-0.025	0.051***
	(0.008)	(0.012)	(0.011)	(0.016)	(0.013)
	HP(10)				
Border	0.179***	0.097***	0.257***	0.160***	0.314***
	(0.013)	(0.018)	(0.017)	(0.025)	(0.019)
Average Within-Country Correlation	0.214***	0.125***	0.290***	0.165***	0.367***
	(0.011)	(0.014)	(0.013)	(0.019)	(0.014)
Argentina	0.278***	0.134***	0.388***	0.254***	0.441***
	(0.013)	(0.017)	(0.014)	(0.023)	(0.020)
Brazil	0.129***	0.113***	0.160***	0.048	0.147***
	(0.017)	(0.022)	(0.020)	(0.030)	(0.024)
Cross-Country Correlation	0.034***	0.028**	0.033***	0.005	0.053***
	(0.008)	(0.011)	(0.011)	(0.016)	(0.012)

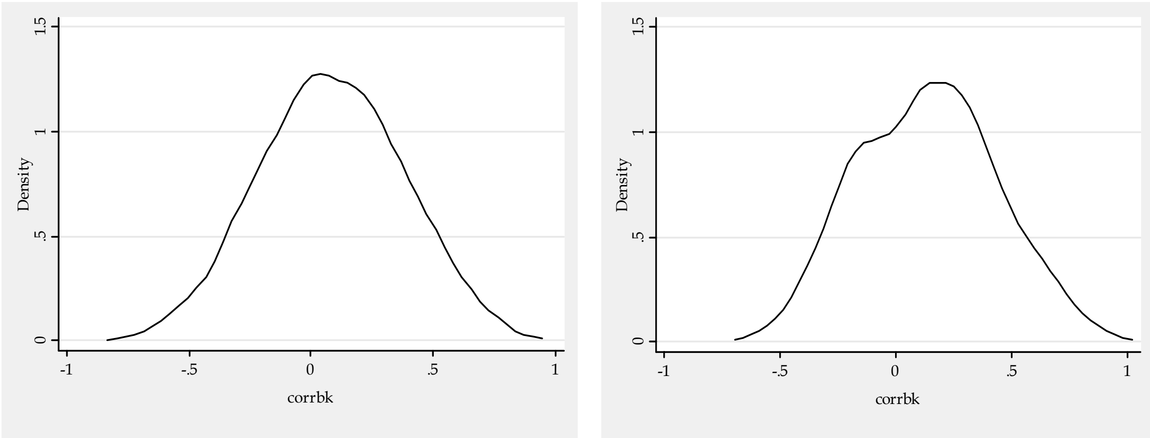
The table reports average within-country and cross-country correlations over the whole sample period and for selected sub-periods
Border dummy is equal to the average within-country correlation less the average cross-country correlation
BK: Data detrended with the Band-Pass Filter as suggested in Baxter and King (1999)
HP(10): Data detrended with the Hodrick-Prescott Filter with lambda equal to 10
The dates correspond to the sample period over which the raw data are available
The number of observations is 990
Robust standard errors in parentheses
* significant at 10% level; ** significant at 5% level; *** significant at 1% level

Figure 1: Trade Liberalization and Intensity of Trade between Argentina and Brazil (two-years moving average)



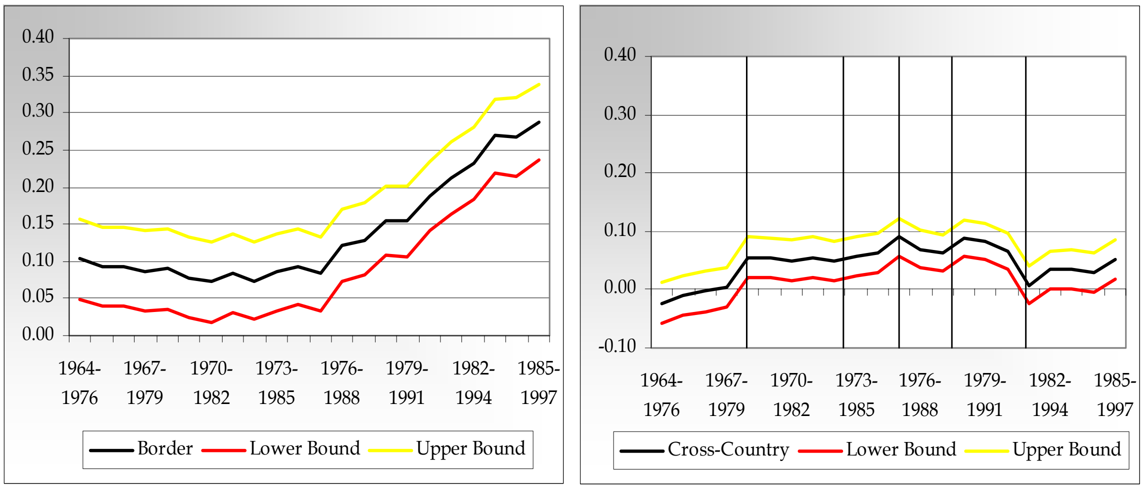
Trade intensity measured by the index defined in Equation (7). MFN and preferential tariff data were provided by Antoni Estevadeordal.

Figure 2: Kernel Density Estimate of Correlations (1961-1980 and 1981-2000)



Business cycle correlations calculated on data detrended using the
Band-Pass Filter as suggested in Baxter and King (1999)

Figure 3: Evolution of Border Effect and Average Cross-Country Correlation over Time

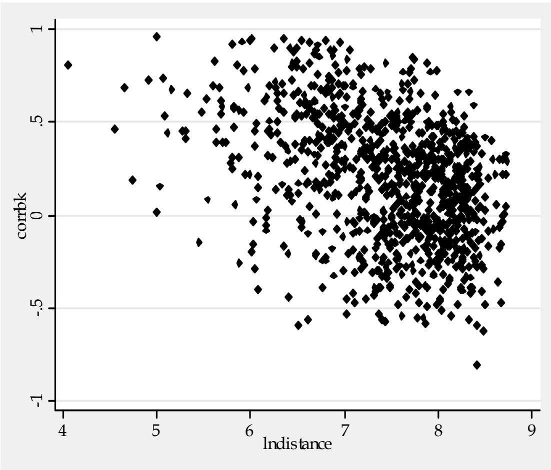


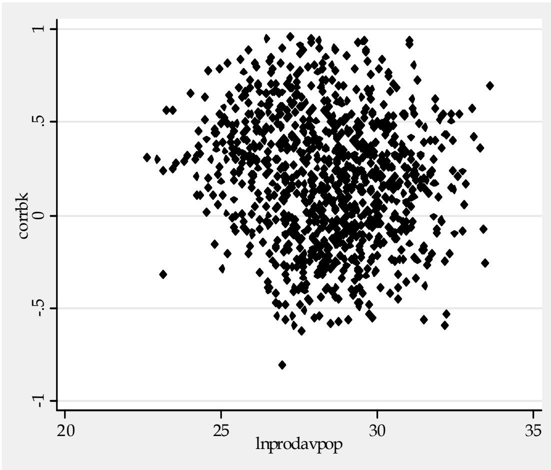
Panel A Panel B

The figures show the border effect estimates (Panel A) and the cross-country correlations (Panel B) resulting from a regression of correlation of business cycle measures obtained with the Band-Pass Filter as indicated in Baxter and King (1999) on a constant and a border dummy which is equal to one if both regions are within the same country. Moving time periods of 13 years are considered. The upper and the lower bound correspond to the limits of a 99% confidence interval.

Figure 4: Business Cycle Correlation and Distance (1985-2000)

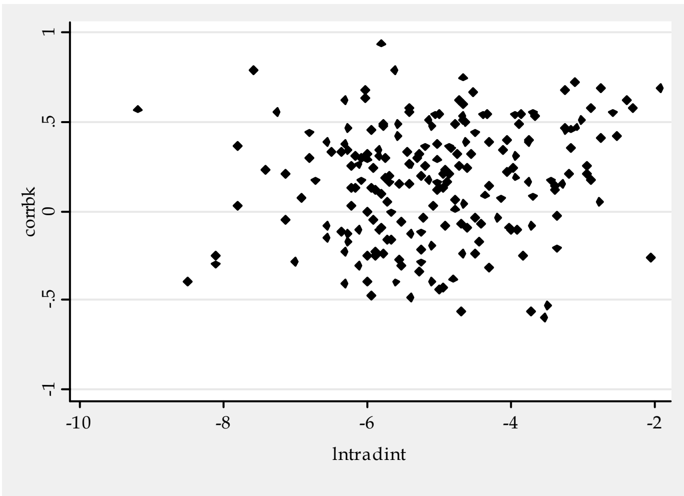
Figure 5: Business Cycle Correlation and Size (1985-2000)





Business cycle correlations calculated on data detrended using the Band-Pass Filter as suggested in Baxter and King (1999)

Figure 6: Business Cycle Correlation and Trade Relationship in Brazil (1985-2000)



Business cycle correlations calculated on data detrended using the Band-Pass Filter as suggested in Baxter and King (1999). Trade intensity measured by the index defined in Equation (7).

Table 2

Border Effect After Controlling for Distance, Size, and Specialization (Whole Cross-Sectional Sample: Argentinean Provinces and Brazilian States)							
	OLS						**GMM**
	Whole Period 1961-2000		**Sub-period 1985-2000**				
	BK						
Border	0.035**	0.034**	0.187***	0.182***	0.184***	0.183***	0.188***
	(0.017)	(0.017)	(0.025)	(0.025)	(0.025)	(0.025)	(0.026)
Distance	-0.126***	-0.124***	-0.097***	-0.097***	-0.094***	-0.094***	-0.100***
	(0.012)	(0.012)	(0.016)	(0.016)	(0.016)	(0.016)	(0.017)
Size	-0.001	-0.002	-0.018***	-0.022***	-0.024***	-0.024***	-0.020***
	(0.003)	(0.003)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)
Dissimilarity5		-0.060*		-0.154***			
		(0.033)		(0.045)			
Dissimilarity9					-0.132***	-0.136***	-0.091*
					(0.043)	(0.044)	(0.050)
Fiscal Policy Differentials						-0.004	0.050*
						(0.009)	(0.028)
Hansen J Statistic, $X^2(1)$							0.014
[p-value]							[0.905]
	HP(10)						
Border	0.078***	0.078***	0.225***	0.222***	0.223***	0.222***	0.226***
	(0.017)	(0.017)	(0.023)	(0.023)	(0.023)	(0.023)	(0.024)
Distance	-0.102***	-0.102***	-0.085***	-0.085***	-0.083***	-0.082***	-0.087***
	(0.012)	(0.012)	(0.015)	(0.015)	(0.015)	(0.015)	(0.016)
Size	-0.002	-0.003	-0.022***	-0.024***	-0.025***	-0.026***	-0.022***
	(0.003)	(0.003)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
Dissimilarity5		-0.002		-0.094**			
		(0.032)		(0.042)			
Dissimilarity9					-0.089**	-0.097**	-0.057
					(0.047)	(0.042)	(0.046)
Fiscal Policy Differentials						-0.009	0.038
						(0.008)	(0.026)
Hansen J Statistic, $X^2(1)$							0.194
[p-value]							[0.660]

The table reports the results of three sets of regressions:
1. Regressions of the correlation between two regions on a constant, a border
dummy with value 1 if both regions are within the same country, the log of the distance between the regions,
and the log of combined size as measure by population
2. Regressions of the correlation between two regions on a constant, a border
dummy with value 1 if both regions are within the same country, the log of the distance between the regions,
the log of combined size as measure by population, and the Krugman's index of production dissimilarity
3. Regressions of the correlation between two regions on a constant, a border
dummy with value 1 if both regions are within the same country, the log of the distance between the regions,
the log of combined size as measure by population, the Krugman's index of production dissimilarity,
the fiscal policy differentials as measured by the standard deviation of regional primary deficits
For GMM, fiscal policy differentials are instrumented by the absolute difference of current public expenditure
averaged over time and a dummy variable identifying adjacency
BK: Data detrended with the Band-Pass Filter as suggested in Baxter and King (1999)
HP(10): Data detrended with the Hodrick-Prescott Filter with lambda equal to 10
Dissimilarity5 (9): Specialization index defined in Equation (4) estimated using data on 5 (9) economic sectors
(see Appendix A1)
The dates correspond to the sample period over which the raw data are available
The number of observations is 990
Robust standard errors in parentheses
* significant at 10% level; ** significant at 5% level; *** significant at 1% level

Table 3

Border Effect After Controlling for Trade and Specialization (Reduced Cross-Sectional Sample: Argentina and Brazilian States)						
	OLS 1985-2000				GMM 1985-2000	
	BK					
Border	0.027	0.058	0.046	0.087	0.035	0.053
	(0.065)	(0.069)	(0.066)	(0.070)	(0.074)	(0.074)
Distance	-0.084***		-0.068**			
	(0.029)		(0.031)			
Size	0.018		0.006			
	(0.020)		(0.021)			
Trade		0.031*		0.020	0.059***	0.043*
		(0.018)		(0.018)	(0.020)	(0.022)
Dissimilarity9			-0.242**	-0.202*		-0.241**
			(0.101)	(0.104)		(0.108)
Hansen J Statistic, $X^2(1)$					1.319	1.411
[p-value]					[0.251]	[0.235]
	HP(10)					
Border	0.071	0.073	0.088	0.095	0.056	0.073
	(0.059)	(0.062)	(0.061)	(0.063)	(0.065)	(0.066)
Distance	-0.068**		-0.053*			
	(0.028)		(0.030)			
Size	0.032*		0.022			
	(0.020)		(0.020)			
Trade		0.041**		0.033*	0.058***	0.045**
		(0.017)		(0.017)	(0.020)	(0.022)
Dissimilarity9			-0.229**	-0.151		-0.218**
			(0.092)	(0.095)		(0.099)
Hansen J Statistic, $X^2(1)$					0.058	0.094
[p-value]					[0.810]	[0.759]

The table reports the results of four sets of regressions estimated by OLS.
The last two are also estimated by GMM to address potential endogeneity.
1. Regressions of the correlation between two regions on a constant, a border dummy with value 1 if both regions are within Brazil, the log of the distance between the regions, and the log of combined size as measure by population
2. Regressions of the correlation between two regions on a constant, a border dummy with value 1 if both regions are within the same country, the log of the distance between the regions, the log of combined size as measure by population, and the Krugman's index of production dissimilarity
3. Regressions of the correlation between two regions on a constant, a border dummy, and the intensity of trade relationships
4. Regressions of the correlation between two regions on a constant, a border dummy, the Krugman's index of production dissimilarity, and the intensity of trade relationships

Trade intensity measured as indicated by Equation (7) and is instrumented by distance and size as measured by population
BK: Data detrended with the Band-Pass Filter as suggested in Baxter and King (1999)
HP(10): Data detrended with the Hodrick-Prescott Filter with lambda equal to 10
Dissimilarity9: Specialization index defined in Equation (4) estimated using data on 9 economic sectors (see Appendix A1)
The dates correspond to the sample period over which the raw data are available
The number of observations is 231
Robust standard errors in parentheses
* significant at 10% level; ** significant at 5% level; *** significant at 1% level

Table 4

Border Effect After Controlling for Trade and Specialization: System Estimation (Reduced Cross-Sectional Sample: Argentina and Brazilian States)	3SLS 1985-2000		GMM 1985-2000	
	BK	**HP(10)**	**BK**	**HP(10)**
Correlation				
Border	0.055	0.074	0.061	0.077
	(0.078)	(0.073)	(0.061)	(0.059)
Trade Intensity	0.042	0.047*	0.043*	0.047**
	(0.027)	(0.025)	(0.026)	(0.024)
Dissimilarity9	-0.275	-0.242	-0.197	-0.141
	(0.287)	(0.267)	(0.284)	(0.265)
R^2	0.046	0.069	0.046	0.067
Dissimilarity9				
Trade Intensity	-0.072***	-0.072***	-0.084***	-0.083***
	(0.013)	(0.013)	(0.016)	(0.016)
Size Differentials	0.099***	0.099***	0.110***	0.109***
	(0.021)	(0.021)	(0.023)	(0.023)
R^2	0.169	0.169	0.156	0.158
Trade Intensity				
Distance	-0.104***	-1.035***	-1.081***	-1.081***
	(0.077)	(0.077)	(0.064)	(0.064)
Size	0.622***	0.628***	0.642***	0.645***
	(0.051)	(0.051)	(0.055)	(0.055)
Dissimilarity9	-0.949	-0.933	-0.360	-0.409
	(0.625)	(0.625)	(0.625)	(0.624)
R^2	0.688	0.694	0.693	0.694
Hansen J Statistic, $X^2(3)$			2.510	1.219
[p-value]			[0.474]	[0.749]

The table reports 3SLS and GMM estimations of the System of Equations (9)-(11)
In addition to the exogenous variables in each equation:
The equation for correlation uses as instruments the log of distance, the log the product of populations, the log of the ratio of populations
The equation for dissimilarity uses as instruments a dummy variable identifying adjacency and the log the product of populations
The equation for trade intensity uses as instruments the border dummy and the log of the ratio of the populations
3SLS uses the same set of instruments for all equations (all exogenous variables)
BK: Data detrended with the Band-Pass Filter as suggested in Baxter and King (1999)
HP(10): Data detrended with the Hodrick-Prescott Filter with lambda equal to 10
Dissimilarity9: Specialization index defined in Equation (4) estimated using data on 9 economic sectors (see Appendix A1)
Trade intensity is measured as indicated in Equation (7)
The dates correspond to the sample period over which the raw data are available
The number of observations is 231
(Robust) standard errors in parentheses
* significant at 10% level; ** significant at 5% level; *** significant at 1% level

Table 5

Border Effect After Controlling for Trade, Specialization, and Fiscal Policy Differentials (Reduced Cross-Sectional Sample: Argentina and Brazilian States)				
	OLS 1985-2000		**GMM 1985-2000**	
	BK			
Border	0.044	0.078	0.045	0.026
	(0.069)	(0.073)	(0.072)	(0.080)
Distance	-0.069**		-0.068**	
	(0.031)		(0.030)	
Size	0.007		0.006	
	(0.022)		(0.028)	
Trade		0.016		0.053**
		(0.019)		(0.025)
Dissimilarity9	-0.240**	-0.269**	-0.243**	-0.214*
	(0.103)	(0.105)	(0.101)	(0.111)
Fiscal Policy Differentials	0.002	-0.000	0.001	0.027
	(0.016)	(0.015)	(0.040)	(0.035)
Hansen J Statistic, $X^2(1,2)$			0.010	0.864
[p-value]			[0.921]	[0.649]
	HP(10)			
Border	0.089	0.094	0.076	0.057
	(0.063)	(0.065)	(0.063)	(0.070)
Distance	-0.053*		-0.055*	
	(0.031)		(0.029)	
Size	0.021		0.029	
	(0.022)		(0.025)	
Trade		0.026		0.051**
		(0.019)		(0.023)
Dissimilarity9	-0.230**	-0.247**	-0.213**	-0.195*
	(0.095)	(0.096)	(0.094)	(0.102)
Fiscal Policy Differentials	-0.001	-0.004	0.015	0.016
	(0.015)	(0.014)	(0.037)	(0.031)
Hansen J Statistic, $X^2(1,2)$			0.000	0.006
[p-value]			[0.994]	[0.997]

The table reports the results of two sets of regressions estimated by OLS and GMM.
1. Regressions of the correlation between two regions on a constant, a border
dummy with value 1 if both regions are within Brazil, the log of the distance between the regions,
the log of combined size as measure by population, the Krugman's index of production dissimilarity, and
the fiscal policy differentials as measured by the standard deviation of regional primary deficits
2. Regressions of the correlation between two regions on a constant, a border
dummy with value 1 if both regions are within Brazil, the intensity of trade relationships,
the Krugman's index of production dissimilarity, and
the fiscal policy differentials as measured by the standard deviation of regional primary deficits
Trade intensity measured as indicated by Equation (7) and is instrumented by distance
and size as measured by population
Fiscal policy differentials are instrumented by the absolute difference of current public expenditure
averaged over time and the size difference as measured by the log of the ratio of populations
BK: Data detrended with the Band-Pass Filter as suggested in Baxter and King (1999)
HP(10): Data detrended with the Hodrick-Prescott Filter with lambda equal to 10
Dissimilarity9: Specialization index defined in Equation (4) estimated using data on 9 economic sectors
(see Appendix A1)
Fiscal policy differentials are captured by the standard deviation of the regional primary balances
The dates correspond to the sample period over which the raw data are available
The number of observations is 231
Robust standard errors in parentheses
* significant at 10% level; ** significant at 5% level; *** significant at 1% level

Table 6

Border Effect After Controlling for Trade, Specialization, and Fiscal Policy Differentials: System Estimation (Reduced Cross-Sectional Sample: Argentina and Brazilian States)				
	3SLS 1985-2000		**GMM 1985-2000**	
	BK	**HP(10)**	**BK**	**HP(10)**
Correlation				
Border	0.047	0.061	0.032	0.061
	(0.084)	(0.079)	(0.081)	(0.070)
Trade Intensity	0.051*	0.055**	0.051*	0.051**
	(0.029)	(0.027)	(0.027)	(0.025)
Dissimilarity9	-0.285	-0.259	-0.227	-0.154
	(0.286)	(0.266)	(0.284)	(0.266)
Fiscal Policy Differentials	0.050	0.034	0.021	0.009
	(0.036)	(0.034)	(0.035)	(0.032)
R^2	0.002	0.040	0.038	0.065
Dissimilarity9				
Trade Intensity	-0.078***	-0.077***	-0.087***	-0.087***
	(0.013)	(0.013)	(0.016)	(0.016)
Size Differentials	0.100***	0.100***	0.110***	0.110***
	(0.021)	(0.021)	(0.023)	(0.023)
R^2	0.165	0.165	0.152	0.153
Trade Intensity				
Distance	-1.045***	-1.038***	-1.076***	-1.081***
	(0.077)	(0.077)	(0.066)	(0.066)
Size	0.617***	0.621***	0.645***	0.652***
	(0.050)	(0.051)	(0.055)	(0.055)
Dissimilarity9	-0.840		-0.567	-0.555
	(0.617)		(0.635)	(0.635)
R^2	0.690	0.691	0.693	0.693
Fiscal Policy Differentials				
Correlation	0.230	-0.177	-0.686	-0.780
	(1.100)	(1.033)	(1.083)	(1.108)
Government Size Differentials	0.107***	0.106***	0.111***	0.109***
	(0.026)	(0.026)	(0.029)	(0.029)
R^2	0.081	0.080	0.046	0.050
Hansen J Statistic, $X^2(4)$			4.946	3.569
[p-value]			[0.293]	[0.467]

The table reports 3SLS and GMM estimations of the System of Equations (13)-(16)
In addition to the exogenous variables in each equation:
The equation for correlation uses as instruments the log of distance, the log the product of populations, the log of the ratio of populations
The equation for dissimilarity uses as instruments a dummy variable identifying adjacency and the log of the product of populations
The equation for trade intensity uses as instruments the border dummy and the log of the ratio of the populations
The equation for fiscal policy differentials uses as instruments a dummy variable identifying adjacency and size differential as measured by the log of the ratio of populations
3SLS uses the same set of instruments for all equations (all exogenous variables)
BK: Data detrended with the Band-Pass Filter as suggested in Baxter and King (1999)
HP(10): Data detrended with the Hodrick-Prescott Filter with lambda equal to 10
Dissimilarity9: Specialization index defined in Equation (4) estimated using data on 9 economic sectors (see Appendix A1)
Trade intensity is measured as indicated in Equation (7)
Fiscal policy differentials are captured by the standard deviation of the regional primary balances
The dates correspond to the sample period over which the raw data are available
The number of observations is 231
(Robust) standard errors in parentheses
* significant at 10% level; ** significant at 5% level; *** significant at 1% level

Table 7

Border Effect After Controlling for Distance, Size, Specialization, and Country Specific Shocks (Whole Cross-Sectional Sample: Argentinean Provinces and Brazilian States)		
	Whole Period 1961-2000	**Sub-period 1985-2000**
	BK	
Border	0.010	0.101***
	(0.017)	(0.026)
Distance	-0.116***	-0.098***
	(0.012)	(0.017)
Size	0.002	-0.016***
	(0.003)	(0.005)
Dissimilarity5	-0.073**	-0.159***
	(0.033)	(0.047)

The table reports the results of OLS regressions of the correlation between two regions on a constant, a border dummy with value 1 if both regions are within the same country, the log of the distance between the regions, the log of combined size as measure by population, and the Krugman's index of production dissimilarity

Correlations are calculated after filtering out the impact of national inflation rates on regional cyclical components by performing a Prais Winsten regression with panel corrected standard errors of these components on inflation rates (these rates allow us to capture country specific shocks as well as stabilization programs).

BK: Data detrended with the Band-Pass Filter as suggested in Baxter and King (1999)

HP(10): Data detrended with the Hodrick-Prescott Filter with lambda equal to 10

Dissimilarity5: Specialization index defined in Equation (4) estimated using data on 5 economic sectors (see Appendix A1)

The dates correspond to the sample period over which the raw data are available

The number of observations is 990

Robust standard errors in parentheses

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

Table 8

Business Cycles Correlations and Border Effects in Developed and Developing Countries				
Pairs of Countries	**Period**	**Raw Border Effect**	**Average cross-country correlation**	**"Net" Border Effect**
Germany and France (1)	1983-1996	0.31	0.43	0.23
		(0.11)	(0.12)	(0.12)
Spain and Portugal (2)	1988-1998	0.28	0.34	-
		(0.06)	(0.07)	-
U.S. and Canada (3)	1981-1999	-	0.65	-
		-	-	-
Argentina and Brazil	1985-2000	0.31	0.05	0.23
		(0.02)	(0.01)	(0.02)

The table reports estimates of the border effect and average cross-country correlations among regions in selected pairs of countries. All estimated correlations are based on data detrended with the Hodrick and Prescott (1997) filter.

"Net" Border Effect: Remaining border effect after controlling for distance and size

Standard errors are reported in parentheses

(1) Taken from Clark and van Wincoop (2001), Table 1

(2) Taken from Barrios and de Lucio (2003), Table 7

(3) Taken from Chen (2004), Table 2

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Appendix A: Dataset

Regional economic activity in Argentina and Brazil is described, respectively, by (the natural logarithm of) annual province and state GDP over the period 1961 to 2000.[22] Argentinean data, which were kindly provided by Luciano Di Gresia, come from the Federal Council of Investments (CFI) and are expressed in thousands of 1986 Pesos.[23] These data cover the 24 provinces of Argentina: City of Buenos Aires, Buenos Aires, Catamarca, Chaco, Chubut, Córdoba, Corrientes, Entre Ríos, Formosa, Jujuy, La Pampa, La Rioja, Mendoza, Misiones, Neuquén, Río Negro, Salta, San Luis, San Juan, Santa Cruz, Santa Fe, Santiago del Estero, Tucumán, and Tierra del Fuego. The data for Brazil were obtained applying states' shares on Brazil's GDP expressed in thousands of 2002 Reais. The series of states' shares were kindly provided by Carlos Azzoni, while that of national GDP was taken from the database IPEADATA of the Institute for Applied Economic Research (IPEA). These data cover 21 out of the 27 Brazilian states: Alagoas, Amazonas, Bahía, Ceará, Distrito Federal, Espirito Santo, Goiás, Maranhao, Mato Grosso, Mina Gerais, Pará, Paraíba, Paraná, Pernambuco, Piauí, Rio de Janeiro, Rio Grande do Norte, Rio Grande do Sul, Santa Catarina, Sao Paulo, and Sergipe.

We measure distance as the (natural logarithm of) geographic distance between regions' capital cities. More precisely, distances are calculated using the formula proposed by the Centre for Prospective Studies and International Information (CEPII), which takes into account the curvature of the earth. Formally, the geodesic distance between two points *i* and *j* is given by:

$$d_{ij} = 6370 * ar\cos\begin{bmatrix}\cos\left(lat_j/57.2958\right) * \cos\left(lat_i/57.2958\right) * \cos\left(\min\left(360 - abs(long_j - long_i\right), abs\left(long_j - long_i\right)/57.2958\right)\\ + \sin\left(lat_j/57.2958\right) * \sin\left(lat_i/57.2958\right)\end{bmatrix}$$

where *lat* is latitude and *long* means longitude. Coordinates data have been provided by the Argentina's Geographical Military Institute (IGM) and from the Brazilian Statistical Office (IBGE).

Size is measured as the sum of the (natural logarithm of) populations of two regions averaged over the relevant estimation period. The data are taken from Argentina's Statistical Office (INDEC) and Brazil's Statistical Office (IBGE). Over the period 1960-2000, four national population censuses were carried out in Argentina and Brazil: 1960, 1970, 1980, and 1991. Therefore, for the overall period we use the averages of the figures corresponding to these four surveys, while for the first sub-period, 1961-1980, we calculate averages from 1960 and 1970 censuses and for the second sub-period, 1981-2000 (and also for 1985-2000), we calculate averages from 1980 and 1991 censuses.

Sectoral GDP data at the regional level are available for the period 1970-1995 in the case of Argentina and come from the CFI. They are expressed in thousands of 1986 Pesos and reported on the basis of a classification covering nine sectors. In the case of Brazil data for the years 1960-1969, 1970, 1975, and 1980 are available in terms of five sectors, while data for the period 1985-2000 in terms of fifteen sectors. These data are expressed in current Reais and their sources are IPEADATA and IBGE, respectively. To have comparable figures, we map the raw data from the most disaggregated into the less disaggregated classification. Hence, for the whole sample period, 1961-2000, we use regional GDP data disaggregated in five sectors, whereas for the period 1985-2000 we use data disaggregated in nine sectors (see Table A1 below for more details). We then average these data over time for the relevant estimation period.

The degree of fiscal policy coordination between pairs of regions is captured by the standard deviation of the fiscal deficit differentials over the estimation period. In particular, we first calculated for each region the primary budget deficit as a percentage of regional GDP. To perform these calculations we used data for the period 1985-1999 provided by Argentina's Ministry of Economics and Fernando Blanco Cossio. We deflated Argentina's original data in current Pesos by the national GDP deflator to ensure homogeneity with our provincial GDP series. Second, we calculate all possible bilateral differences of primary deficit ratios. Third, we estimated the standard deviation over the period 1985-1999. Previously described data sources and construction procedures are also used to obtain the instrument for this variable in our GMM estimations, i.e., the absolute difference in average government size as measured by current public spending as a percentage of GDP.

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[22] We use GDP data deflated with national deflators (see, e.g., Clark and Wincoop, 2001, and Kalemli-Ozcan et al., 2001). Some other studies use employment data (see, e.g., Fatás, 1997, Clark and van Wincoop, 2001, and Barrios and de Lucio, 2003), to avoid the problems related to the deflation of regional series. However, data on overall employment at provincial level in Argentina are not available, while for Brazil these data are only available for the period 1985-2000.

[23] Data from the CFI correspond to the period 1961-1997. For the remainder of the period, 1998-2000, we apply annual rates of variation in raw data expressed in 1993 pesos (provided by Argentina's Ministry of Economics).

As said before, data on Argentinean inter-provincial trade flows and between Argentinean provinces and Brazilian states are not available. We can, however, measure the average level of trade among Brazilian states using the data on shipments of goods and services estimated by Vasconcelos (2001) for 1998 and state exports and imports for the same year using data provided by the Brazilian Foundation for Foreign Trade (FUNCEX). These data are expressed in thousands of 1998 Reais and millions of U.S. Dollars, respectively. To get comparable figures, we convert dollar values into 1998 Reais using the average monthly nominal exchange rate Reais/U.S. Dollars for 1998 as reported in IPEADATA.

To filter the cyclical components (Sub-section 3.4.) we use national inflation rates. Data on annual inflation rates for Argentina correspond to the annual rate of change of CPI as presented in the International Financial Statistics (IFS) published by the IMF, while for Brazil refer to the annual rate of change of the FIPE price index disclosed in IPEADATA. Finally, data on constant prices GDP for France, Germany, Italy, Spain, the U.K. and the U.S. were provided by Todd Clark, while those on U.S. Treasury bond yields were taken from the IFS of the IMF.

Table A1: Sectoral Regional GDP Data - Disaggregation and Time Coverage

<table>
<tr><th>Argentina</th><th colspan="2">Brazil</th><th colspan="3">Argentina and Brazil</th></tr>
<tr><th>1970-1995</th><th>1960-1969,
1970, 1980</th><th>1985-2000</th><th>1961-2000</th><th>1961-1980
1981-2000</th><th>1985-2000</th></tr>
<tr><td>Agriculture, forestry, and fishing</td><td>Agriculture, forestry, and fishing</td><td>Agriculture, forestry, and fishing</td><td>Agriculture, forestry, and fishing</td><td>Agriculture, forestry, and fishing</td><td>Agriculture, forestry, and fishing</td></tr>
<tr><td>Mining</td><td rowspan="4">Mining, manufacturing industries, electric, gas, sanitary, and construction</td><td>Mining</td><td rowspan="4">Mining, manufacturing industries, electric, gas, sanitary, and construction</td><td rowspan="4">Mining, manufacturing industries, electric, gas, sanitary, and construction</td><td>Mining</td></tr>
<tr><td>Manufacturing industries</td><td>Manufacturing industries</td><td>Manufacturing industries</td></tr>
<tr><td>Electric, gas, and sanitary</td><td>Electric, gas, and sanitary</td><td>Electric, gas, and sanitary</td></tr>
<tr><td>Construction</td><td>Construction</td><td>Construction</td></tr>
<tr><td rowspan="2">Wholesale and retail trade, and restaurants and hotels</td><td rowspan="4">Wholesale and retail trade, restaurants and hotels, transportation, storage, and communication</td><td>Wholesale and retail trade</td><td rowspan="4">Wholesale and retail trade, restaurants and hotels, transportation, storage, and communication</td><td rowspan="4">Wholesale and retail trade, restaurants and hotels, transportation, storage, and communication</td><td rowspan="2">Wholesale and retail trade, and restaurants and hotels</td></tr>
<tr><td>Restaurants and hotels</td></tr>
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<tr><td>Communication</td></tr>
<tr><td rowspan="2">Finance, insurance, real estate, and business and legal services</td><td rowspan="2">Finance, insurance, real estate, and business and legal services</td><td>Finance services</td><td rowspan="2">Finance, insurance, real estate, and business and legal services</td><td rowspan="2">Finance, insurance, real estate, and business and legal services</td><td rowspan="2">Finance, insurance, real estate, and business and legal services</td></tr>
<tr><td>Insurance, real estate, and business and legal services</td></tr>
<tr><td rowspan="4">Community, personal, and other services and government</td><td rowspan="4">Community, personal, and other services and government</td><td>Government (Public Administration)</td><td rowspan="4">Community, personal, and other services and government</td><td rowspan="4">Community, personal, and other services and government</td><td rowspan="4">Community, personal, and other services and government</td></tr>
<tr><td>Health and education services</td></tr>
<tr><td>Other community, personal, and social services</td></tr>
<tr><td>Domestic services</td></tr>
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