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The Impact of Trade Integration on Business Cycle Synchronization for Mercosur Countries

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Abstract

This paper intends to evaluate empirically the impact of reduced trade barriers and increased trade on the synchronization of business cycles. It draws on Frankel and Rose (1998) who reassessed the Mundellian criteria on Optimum Currency Areas (OCAs) and considered their application to be untenable given that trade integration and cycle synchronization may be endogenous. This research aims to test this hypothesis for Mercosur countries. Using a quarterly panel dataset spanning the members since the establishment of the free trade area (FTA) in 1991 until 2008, the empirical findings indicate a positive effect, implying intra-industry trade.

JEL Classification: E32, F15

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1. Introduction

In the past few decades there has been a progressive movement towards regionally-based free trade areas (FTAs) in North America, such as the North American Free Trade Agreement (NAFTA), Common Market for Eastern and Southern Africa (COMESA) in Africa, Asean Free Trade Area (AFTA) and South Asia Free Trade Agreement (SAFTA) in Asia, and *Mercado Común del Sur* (Mercosur) in South America, among others. The possibility that Mercosur may eventually lead to a more ambitious integration project suggests the usefulness of analyzing the viability of a potential monetary union. Moreover, there has been renewed interest in the theory of Optimum Currency Areas (OCAs), since the creation of the European Monetary Union.

There are a number of motives for Mercosur to form a monetary union. Firstly, the monetary policy of each country in Mercosur (Argentina, Brazil, Uruguay and Paraguay) has been relatively ineffective because of its little credibility. Instead of losing sovereignty over monetary policy, a regional central bank may actually adopt credible monetary policy that could react effectively to external shocks. Secondly, due to the poor macroeconomic management of member economies, their credit ratings for international debt are poor, and therefore the cost of such debt is very high. Thirdly, a monetary union provides the possibility of a reduction in the cost of central bank reserves and may create a

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currency that could be used by other foreign central banks as a reserve currency. Finally, bargaining as a regional bloc could be an advantage in international negotiations.

According to the traditional literature by Mundell (1961) and McKinnon (1963), three criteria must hold to form an OCA. The first criterion relates to the degree of trade integration between the members of the currency union. Gains from monetary unification stem from lower transaction costs and the elimination of exchange rate volatility. Thus, the more a pair of countries trade, the more that pair will benefit from the reduction in the transaction costs. The second criterion is the high degree of business cycle synchronization. Losses come from the inability to pursue independent adjustment policies and their extent depends on the size and incidence of shocks. If these are symmetrically distributed across countries, symmetrical policy responses will be enough, eliminating the need for policy autonomy. Finally, the third criterion relates to the degree of labor mobility and wage flexibility in the economies. If the case of asymmetric shocks is considered and the possibility of independent monetary policy is foregone, labor mobility and wage flexibility would allow for a faster and less costly adjustment.

The aforementioned literature on this subject treats these criteria as exogenous. However, more recent literature has further investigated this issue since many have asserted that trade linkages could affect business cycle comovements. Krugman (1991) pointed out that as trade linkages among countries increase *a là* Ricardian comparative advantage, the specialization effect prevails, generating less synchronized business cycles. On the contrary, the European Commission (1990) states that more trade is occurring within the same industries. Hence, the effect of an increase of trade integration should result in more synchronized shocks among the economies.

Frankel and Rose (1998) analyzed the issue empirically. In particular they tested the hypothesis that more integration can be expected to lead to more highly correlated business cycles. They found evidence of a positive impact of increased regional trade on business cycle synchronization for 21 industrialized countries.

This research aims at testing this hypothesis for the Mercosur countries (with the exclusion of Paraguay). More specifically, it analyzes empirically the impact of reduced trade barriers and increased trade on the synchronization of the business cycles. It uses a panel of bilateral trade and business cycles data spanning the three Mercosur countries over 72 quarters and controlling for macroeconomic policy coordination. The empirical findings indicate that closer international trade links result in more closely correlated business cycles across the countries.

The paper structure is as follows. Section 2 introduces the history of economic integration in Mercosur and the motives for which a monetary union is desirable. The OCA theoretical framework and its criticism are presented in

Section 3. Section 4 explores some of the main contributions in the literature studying the effect of trade integration on business cycle synchronization. Section 5 explains the methodology that is used to analyze the mentioned relationship, describes the data, and presents some descriptive statistics along with the results of the empirical estimations. Section 6 reports the paper's conclusions.

2. Economic Integration in Mercosur

This section presents the steps that Mercosur has taken since it was created in 1991. It then analyzes why the area would benefit from further integration and thus a monetary union.

2.1 A Historical Perspective

Economic integration among the members of the Mercosur started long before its conception in 1991. The first official stage of integration was the Argentinean-Brazilian Cooperation and Integration Act signed in July 1986. This removed some sector trade barriers between the two countries. Due to concern over stability issues in 1987, the two governments signed the *Gaucho* Protocol (one of several signed under the Argentinean-Brazilian Cooperation and Integration Act), which initiated research into the possibility of a currency union between Argentina and Brazil. However, shortly after the signing of this Protocol, exchange rate crises in both countries dampened currency union integration efforts. In November 1988, the Integration Cooperation and Development Treaty was signed by Argentina and Brazil, which expanded the FTA created by the 1986 Act.

By July 1990, the Argentinean-Brazilian Cooperation and Integration Act had set the date for the creation of an FTA between the two countries for late 1994. After diplomatic requests, the FTA was extended to include Paraguay and Uruguay. Thus, the Treaty of Asunción was signed in 1991 by Argentina, Brazil, Paraguay and Uruguay and established a common market among these member countries effective on January 1, 1995. The 1991 Treaty demanded that by June 1991, 40 percent of the tariffs among the member countries would be removed. There then would be six monthly reductions in tariffs until they were completely eliminated and free trade was established. Mercosur aimed to establish the free movement of goods, services and factors of production among member countries, the setting of a common external tariff, the adoption of a common trade policy regarding the rest of the world and the ambitious coordination of macroeconomic and sector policies.

In December 1994, the *Ouro Preto* summit modified the schedule set out in the Treaty of Asunción and created the *Ouro Preto* Protocol, laying down the institutional structure of Mercosur. At this summit, member countries agreed to implement a customs union before implementing a common market. This customs union became operational on January 1, 1995, with the elimination of tariff and non-tariff barriers among the member countries and the setting of a

common external tariff although its application was not immediately completed.[2] To ease the shift of Mercosur into a common market, a transitory schedule was established at the *Ouro Preto* summit, in which it was agreed that certain products traded within Mercosur were allowed to remain protected by member tariffs.

In 1995, Mercosur members agreed to end this transition period by 2001, phasing temporary protectionary tariffs out in order to ensure entirely free trade between members by 2000. By 1996, tariffs were reduced by 25 percent, 50 percent by 1997, 75 percent by 1998, and eliminated by 1999 for Argentina and Brazil, while Paraguay and Uruguay were required to eliminate tariffs by 2000. In addition, permission was granted to allow 300 products per member to remain exempt from the common external tariff until 2001 for Argentina, Brazil and Uruguay, and 2006 for Paraguay. Hence, the Mercosur customs union became fully operational only in 2006.[3]

Overall, the process of integration yielded some results. As estimated in Frankel (1997), the Mercosur bloc effect of bilateral trade is not significant during 1965-1975, but it becomes higher and statistically significant after 1990.[4]

2.2 Motives for the Creation of a Monetary Union in Mercosur

There are several motives for the monetary unification between the members of Mercosur. Recent history has proven that due to policy mismanagement and failed stabilization policies, no full member of Mercosur had the ability to implement a credible and effective monetary policy. In 1991, Argentina implemented a currency board, under the Convertibility Plan[5], which collapsed on January 10, 2002. Uruguay had a target zone until June 2002 that operated like a crawling peg as the exchange rate was frequently on the bottom of the set band. After that, it allowed the Peso to float freely. Brazil also had a target zone based on the Real Plan[6] that collapsed on January 14, 1999, after which the Brazilian central bank allowed the currency to float.[7] Overall, the improvement of

[2] On January 1, 1995 Mercosur enacted a common external tariff for almost 85 percent of tariff items of the four countries.

[3] Due to the differences in national policies, the sugar and automobile sectors of each member country were excluded from the restrictions imposed by the FTA.

[4] The author also asserts that the four Mercosur countries trade among themselves seven times as much as similar countries.

[5] The Convertibility Plan, besides fixing the Peso to the US Dollar one for one, counted that the monetary authority covered the entire monetary base by international reserves and to convert in whatever moment Pesos in US Dollars at the fixed exchange rate.

[6] The Real Plan intended to stabilise the domestic currency in nominal terms after a string of failed plans to control inflation. It created the Real Unit of Value, which served as key step to the implementation of the current currency, the Real.

[7] Differences in monetary and exchange rate regimes among Mercosur countries have been an important determinant of trade integration. However, the analysis of the relationship goes beyond the scope of this paper.

the monetary stability and credibility of the monetary frameworks since the end of the 1990s renewed the countries' interest for a monetary union.

Inflation stabilization policies have been implemented in Mercosur to reduce the notoriously high inflation (and in some cases hyperinflation) experienced by its economies.[8] Nonetheless, the inability to manage prices generated high volatility of the Argentinean and Brazilian real exchange rates with disruptive consequences. During recent years, inflation has still been one of the biggest concerns not only for Mercosur members but also for Latin American countries in general. The upward pressures were mostly due to the saturation of the productive capacity and to the international context of rising prices of commodities, and to capital inflows. Therefore, the need to reduce inflation and control prices through credible monetary policy is of critical importance.

If a regional bank is committed to controlling inflation, and has a credible reputation, it could respond effectively to external shocks. Even if these shocks are asymmetric to the regional members, a "one size fits all" monetary policy could still be more effective than national monetary policies that would be implemented if a monetary union was not pursued (see De Grauwe, 2005). This may lead to a more stable economic environment as well as promote investment, stable capital flows, and economic growth. If this concept were taken a step further, it is also possible that in the long-run a stable currency, widely used by the fourth or fifth largest trading bloc in the world, could become a currency included in the portfolio of reserves in foreign central banks. This, in turn, could cause an appreciation of the currency's value.

In a certain sense, the cost of relinquishing national monetary policy to a regional body is also low in the case of Mercosur since there is little credible monetary policy for the full members of Mercosur to relinquish. A new regional central bank could abandon the legacies of political corruption and monetary mismanagement that plagued the central banks and the political and military movements that governed these countries in the past.

Due to the poor macroeconomic management of member economies, the credit rating of their international debt has lowered. Therefore, the cost of their debt is still quite high. A monetary union with a credible regional central bank could reduce the cost of debt in international markets, consequently reducing the spreads with the United States Treasury bills by improving government credit ranking. Better credit ratings would also diminish the cost of creating debt by the regional body, making it cheaper for the member governments to finance infrastructure projects in order to encourage foreign direct investment. Those members most likely to benefit from the potential savings in debt payments are

[8] These plans included the 1970 Plan and the Tablita Plan in Uruguay, respectively; the Tablita, Austral, Spring and Bonex plans in Argentina; and the Cruzad, Bresser, Summer, and the Collor I and II Plans for Brazil.

those economies that direct public debt towards international markets, namely Argentina and Brazil.

Beetsma and Bovenberg (1997) point out that the focus of credit ratings on inflation and excessive public spending may dissipate if a monetary union occurs with the coordination of fiscal policy between member countries, as was the case in Europe under the Maastricht Treaty. However, recent crises in the Euro area contradict what the authors argue.

A monetary union may also free up reserves that could be used to create investment opportunities. In fact, if a single regional central bank held reserves, the level of reserves held by this bank could be less than the sum of each member's central bank reserves, since the national central banks may over stock due to possible speculative attacks. On the contrary, a regional bank could keep the optimum level of reserves. A monetary union could therefore lower the cost to the regional central bank of holding international reserves.

Another motive of a monetary union is to gain a stronger bargaining position internationally. The formation of Mercosur has allowed the member countries to negotiate in international forums as a regional bloc. If the members were to form a monetary union and create regional institutions, similar to the European Commission, they would increase their presence in the international arena. This would possibly result in better trading arrangements with the United States, European Union and the rest of the world.

3. The Theory of OCAs and its Criticism

In 1961 Mundell published a pioneering paper, in which he first developed the concept of OCA. McKinnon (1963) and Kenen (1969) also made important contributions to the literature. These articles constitute the traditional literature on the topic. More recently, others have written about OCAs and there are some relevant surveys conducted by Tavlas (1993), and Bayoumi and Eichengreen (1996).

The traditional literature focuses on the three crucial relationships mentioned in the introduction. These are based on the extent of trade, the similarity of shocks and cycles, and labor mobility with wage flexibility. The higher the value of any of the three variables among the countries, the more appropriate a common currency is. Some authors added a fourth criterion: the analysis of the risk sharing system, mainly through fiscal transfers may reduce the need for an independent monetary policy.

The extent of trade was originally suggested by McKinnon (1963) as an important factor and is one of the main determinants of whether or not to pursue a monetary union. In the case of two countries, the higher the level of bilateral trade, the more valuable exchange rate stability is between these economies. Exchange rate variability is thought to disrupt trade flows and market

integration by complicating price comparisons, and creating the requirement of importers and exporters to hedge, adding to their costs and reducing the volume of intra-regional trade. This was the primary motive given by the European Commission when pressed on the requirement of the Single European Market to form a single currency. This argument is supported by most empirical studies, which assert that there appears to be a relatively small but statistically significant negative impact of exchange rate variability on trade.[9]

The degree of symmetry between real business cycles of economies choosing to form a monetary union is an important part of the OCA theory. The theory states that the cost of relinquishing monetary policy is minimized when the exchange rate is least required to change relative prices. If underlying shocks to the member economies are symmetric, it is likely that the real business cycles between them will also be symmetric, and therefore monetary policies required to react to such shocks should be symmetric. However, Kenen (1995) argues that past business cycle asymmetries are of no significance to the analysis of a monetary union since only present and future shocks and are relevant. Without being able to predict future business cycles accurately, Kenen's argument is of little use in empirically analyzing the feasibility of a monetary union, but should be kept in mind when drawing final conclusions.

The theory of OCAs also suggests that factors within the area must be mobile in order for the area to sustain a monetary union. Labor markets must be integrated so that they can react to shocks affecting members within the region. Assume a region is in equilibrium and a sub-region is hit by an adverse productivity or terms of trade shock. This sub-region will experience a fall in output and real wage, while the rest of the region remains in equilibrium. Theory states that workers from the adversely affected sub-region would migrate to the unaffected region in order to enjoy higher wages and employment opportunities. This would cause the real wage to rise in the adversely affected sub-region, while the real wage would fall in the rest of the region due to the labor supply's decrease and increase, respectively. This process would continue until real wage parity is achieved between the two regions. It would thus maximize efficiency since all workers are employed in the area in which they are most productive, allowing the adverse shock in one sub-region to be spread among the rest of the region.

Therefore, the benefits of an economy pursuing its own independent monetary policy under a floating exchange rate regime are reduced when it is highly integrated with its neighbors. This is due to the fact that when the whole region is in recession, for example, the regional central bank could implement a monetary expansion, eliminating the need for monetary independence between the smaller regions.

[9] See Frankel and Wei (1995), Rose (1999), De Grauwe and Skudelny (2000) and Anderton and Skudelny (2001).

For an area to be an OCA, it must also have real wage and price flexibility to allow order for sub-regions within it to react to adverse shocks efficiently. If factor mobility was limited between the members of such a monetary union, an adverse shock to one sub-region would require independent sovereign monetary policy to prevent under-capacity utilization and/or higher unemployment. Independent monetary policy could devalue the nominal exchange rate so as to reduce the sub-region's price level. However, it must be noted that this would be ineffective if prices and/or wages are sticky.

The coordination of fiscal policy in a monetary union also reduces the need for independent monetary policy. This is because the creation of a federal fiscal system would allow the transfer of funds from the regions not affected by an adverse shock to those sub-regions suffering from such a shock. The European Monetary Union recognized the need for coordination of fiscal policy and made provision for it in the Maastricht Treaty.

Researchers have extensively adopted the OCA framework, but Frankel and Rose (1998) criticized it, considering the procedure invalid because they suspected joint endogeneity between the first two criteria. More specifically, they state that the degree of integration among potential members of a common currency area cannot be considered independent of income correlation, because one depends on the other. They hypothesized that more integration can be expected to lead to more trade, and more international trade will result in more highly correlated business cycles.

From the formal point of view, Frankel and Rose (1998) suggest expressing output as:

$$\Delta y_t = \quad {}_i \alpha_i \, u_{i,t} + v_t + g \qquad (1)$$

where ΔY_t is the growth rate of real output for the domestic country at time t; $u_{i,t}$ is the sector-specific deviation of the growth rate of output in sector i at time t from the country's average growth rate at time t, v_t; $\alpha_i$is the weight of sector i in total output (${}_i \alpha_i = 1$); and g is the trend rate of output growth for the country. The analogue for the foreign country is:

$$\Delta y_t^* = \quad {}_i \alpha_i^* \, u_{i,t} + v_t^* + g^* \qquad (2)$$

where an asterisk denotes a foreign value, and assumes that the sector-specific shocks (but not the sector-specific output shares) are common across countries.

It is assumed that $u_{i,t}$ are distributed independently across both sector and time, with sector-specific variance σ_i^2. Moreover it is assumed that v_t are distributed independently over time and independently of the sector-specific shocks.

The cross-country covariance is:

$$cov\ \Delta y_t, \Delta y_t^* = cov\ \ {}_i\alpha_i u_{i,t},\ \ {}_i\alpha_i^* u_{i,t} + cov\ v_t, v_t^* = {}_i\alpha_i u_{i,t}\alpha_i^*\sigma_i^2 + \sigma_{v,v^*} \qquad (3)$$

where σ_{v,v^*} is the covariance between the country-specific aggregate shocks.

The degree to which business cycles are correlated internationally rises or falls depending on how the covariance changes with increased integration. Increased trade results in greater specialization if most trade is inter-industry. If countries produce and export goods in which they have a Ricardian comparative advantage, a negative cross-industry correlation between α_i and α_i^* tends to develop and the covariance falls accordingly. If a great deal of trade is intra-industry, i.e. within rather than between industries, the specialization effects may be small and the covariance would increase. The covariance may also be affected by the spillover of aggregate demand shocks, or by the productivity shocks induced by trade integration, as explained by Coe and Helpman (1995).

Therefore, stronger international integration tends to raise the covariance of country-specific demand shocks and aggregate productivity shocks, thus increasing the international coherence of business cycles. On the other hand, integration may tend to raise the degree of industrial specialization, leading to more asynchronous business cycles. Since the effect of trade integration on business cycles is theoretically ambiguous, it can only be investigated empirically.

4. Literature Review

According to the view expressed by the European Commission (1990), differential shocks in demand will occur less frequently in a monetary union. The reason is that trade between the industrial European nations is largely intra-industry trade. The trade is based on the existence of economies of scale and imperfect competition (product differentiation). It leads to a structure of trade in which countries buy and sell the same categories of products to each other. Thus, such countries' aggregate demand will be affected in similar ways.

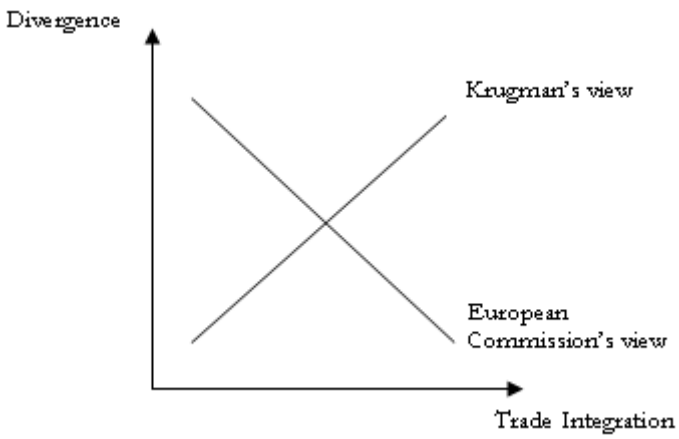
The other and opposite view has been defended by Krugman (1991). According to his study, one cannot discard Mundell's analysis because there is another feature of the dynamics of trade with economies of scale that may make it still relevant. Trade integration that occurs as a result of economies of scale also leads to regional concentration of industrial activities.[10] The idea is that when barriers to trade decline, it has two opposing effects on the localization of industries. It makes it possible to produce closer to the final markets, but it also makes it possible to concentrate production so as to profit from economies of scale. This explains why trade integration may in fact lead to greater concentration of regional activities rather than less. In this sense, sector-specific

[10] This concept was firstly developed by Myrdal (1957) and Kaldor (1966).

shocks may then become country-specific shocks, because countries are more specialized so that they will be subjected to more rather than less asymmetric shocks. Countries faced with these shocks may then prefer to use the exchange rate as an instrument of economic policy to correct for these disturbances.

In other words, if aggregate demand shocks are dominant in driving business cycles, it is expected that an increase in trade integration will increase synchronicity. But, if it is either supply or demand industry-specific shocks that are the dominant force behind business cycles, then the relation between trade integration and synchronicity would depend on the pattern of trade that characterizes the economies. The relation would be negative if trade is mainly inter-industry. If instead trade is mainly intra-industry, supply or demand industry-specific shocks will not necessarily lead to asymmetric effects. The two views are represented in figure 1.

Figure 1 Different views on the effects of Trade Integration on Divergence of Business Cycles



Source: Author's elaboration.

De Grauwe (2005) states that both effects exist, but the concentration and agglomeration effect will be blind to the existence of national borders. This creates the possibility that clusters of economic activity will encompass borders. Then, it would be correct to say that regions where the activity is concentrated may still be very much affected by asymmetric shocks.

The issue has been studied at the empirical level by Canova and Dellas (1993). They studied the relationship between bilateral trade linkages and cyclical fluctuations using a set of time-series techniques on data for ten large industrial countries from 1960 through 1986. However, the focus of their investigation is on the transmission of shocks across countries that are linked by trade rather than on the effects of changing trade integration on business cycle coherency.

They found that the relationship is generally positive, but dependent on the de-trending method.

Bayoumi and Eichengreen (1992) explained how Europe is characterized by one core group of countries sharing similar shocks and a periphery facing asymmetric shocks relative to the core. The core had the more diversified economic structure and experienced the highest ratios of intra-industry trade in total European Union trade, whereas the periphery countries tended to be more specialized in inter-industry trade.

Frankel and Rose (1998) tried to understand if increased integration affects the asymmetry of shocks using a panel of 30 years and 21 industrialized countries. Their conclusion was that a closer trade linkage between two countries is strongly and consistently associated with more tightly correlated economic activity. This finding has been confirmed in almost all subsequent studies on the determinants of business cycle synchronization. For instance, Babetskii (2005) provides support for the Frankel and Rose's hypothesis from a sample of ten Central and Eastern European countries.

Along the same line, Baxter and Kouparitsas (2005) found that bilateral trade intensity is robustly related to business cycle synchronization based on a dataset that includes over 100 developed and developing countries. Calderón et al. (2007) studied the effects of trade integration on business cycles convergence comparing industrial and developing countries. Using annual information for 147 countries for the period 1960–99 they found that the impact of trade intensity on business cycle correlation among developing countries is positive and significant but substantially smaller than that among industrial countries. They came to the conclusion that differences in the responsiveness of cycle synchronization to trade integration between industrial and developing countries are due to differences in the patterns of specialization and bilateral trade.

More specifically, studies on Mercosur proved that shocks in the area are less symmetric than in either the European Union or Nafta and their sizes are substantially larger. Morandé and Schmidt-Hebbel (2000) and Larrain and Tavares (2003) indicate that the degree of synchronization of output movements is low in Latin America, and that the asymmetric shocks are relatively large.

Licandro Ferrando (1998) showed that Mercosur faced a mixture of symmetric and asymmetric shocks over the period 1975-1996, with neither prevailing over the other. The shock correlation of real GDP between the pairs Argentina and Brazil, Argentina and Uruguay, and Brazil and Uruguay were statistically not different from zero. On the other hand, when the estimates were conditioned on countries simultaneously undertaking exchange rate stabilization programs, supply shock correlations identified by regional Vector Autoregression (VAR) equations became positive and statistically significant. Conversely, shock correlations turned negative when stabilization programs were not synchronized

across member countries. Overall, these results highlight the importance of monetary policy coordination in dampening asymmetric shocks.

Moreover, Licandro Ferrando (1998) found a rise in the estimated values of shock correlations between Brazil and Uruguay and between Argentina and Uruguay after 1990, with only the latter pair being statistically different from zero. These results were accompanied by an increase in the ratio of intra-industry to total trade in Mercosur. The results for Mercosur in Carrera et al. (1998) are in the same direction and detect an increase in correlation for the cycles. Notably, none of these studies encompass the Argentinean crisis in 2001 and its repercussions. Overall, the evidence from Mercosur is very limited compared to that available for the European Union.

5. Empirical Analysis

This section first presents the model. Second, data employed are described and some descriptive statistics are shown. Finally, the results from the estimations are discussed.

5.1 The Model

In order to deal with the research question, Frankel and Rose (1998) guidelines are followed. In addition, group effects are included in the analysis and macroeconomic policy coordination effects are taken into account.

The equation to be estimated is:

$$\begin{aligned} &corr(y_i^c, y_j^c)_\tau = \\ &\alpha + \beta_0 TradeIntegration_{ij\tau} + \beta_1 corr\ money_i; money_j\ _\tau + \\ &\beta_2 corr(pubspending_i; pubspending_j)_\tau + v_i + \varepsilon_{ij\tau} \end{aligned} \tag{4}$$

where y_i^c is the cyclical component of real output y for country i and τ is the time span.

The measure of the cycle has been obtained both by first differencing and by Hodrick-Prescott (HP) filtering[11] of real output data. The values for each variable have been computed over the time span τ=28 quarters, corresponding to 7 years, that is considered the conventional length of a business cycle. Finally, the output correlations for each pair i and j of Mercosur countries output are computed as:

[11] For the HP filter the smoothing parameter, λ, has been set to 1600.

$$corr(y_i^c, y_j^c)_\tau = \frac{cov(y_i^c, y_j^c)_\tau}{var(y_i^c)_\tau^{\frac{1}{2}} \, var(y_j^c)_\tau^{\frac{1}{2}}} \tag{5}$$

where higher correlations imply a higher degree of synchronization.

Regarding the independent variables, two measures of trade integration are computed as follows:

$$TRY_{ij\tau} = (X_{ij\tau} + M_{ij\tau})/(Y_{it} + Y_{jt}) \tag{6}$$

$$TRT_{ij\tau} = (X_{ij\tau} + M_{ij\tau})/(X_{it} + X_{jt} + M_{it} + M_{jt}) \tag{7}$$

where $X_{ij\tau}$ ($M_{ij\tau}$) denotes total nominal exports (imports) from country i to country j during period t, X_{it} (M_{it}) denotes total global exports from country i, and Y_{it} is the level of nominal output in country i at period t. The measure described in equation (6) normalizes total bilateral trade by international trade, whereas the measure in equation (7) by nominal output in the two countries.

In the context of a panel regression, unobserved components of each country's time-invariable characteristics country are controlled for by introducing group fixed effects, v_i. However, as pointed out by Shin and Wang (2005), if policy shocks are time-varying the within estimator cannot entirely solve the problem. Therefore, in equation (4) two types of policy coordination are explicitly considered.

The first measure of policy coordination, $corr\ money_i; money_j$, is calculated as the correlation between the monetary base of country i and country j and should proxy the coordination of monetary policy in the countries. Along the same line, the correlation between general government public spending, $corr(pubspending_i; pubspending_j)$, is included as a measure of fiscal policy coordination.

As noted by Shin and Wang (2005), another important time varying variable is the degree of financial integration. However, many papers in the literature do not consider this effect because of the lack of data. Some proxies as bilateral consumption correlation and bilateral spreads in asset returns have been proposed, but these measures suffer from a several shortcomings.[12] Hence, the role of financial flows has been excluded in the analysis. This choice could lead to biased coefficients due to omitted variables, but given the low degree of financial integration in Mercosur it should not represent a large source of distortion of the estimates.

[12] The most serious problem is that there might be a third country that has influences on the two countries concerned.

The exchange rate regime is not introduced in the analysis. A fixed exchange rate would help synchronize the cycles of the Mercosur countries, but this would occur only if they peg to the same currency, i.e. the US dollar. In particular, the pegged countries' cycles would become more similar to the US cycle and therefore more synchronized among each other. However, this is not the case for the countries under analysis.[13]

Finally, the error term $\varepsilon_{ij\tau}$ represents the numerous influences on bilateral activity correlations above and beyond those of the regressors.

The interest falls on the sign and the size of the coefficient β_0. The sign explains if the specialization effect prevails, in which case a negative sign would be obtained, or if the hypothesized effect dominates, thus the sign would be positive. The size of the coefficient allows the author to quantify the relevance of the effects.

Frankel and Rose (1998) also estimated an equation similar to equation (4), including only the first term in their regression. They note that such specification could suffer from reverse causality. Countries are likely to peg their currency to those of their most important trading partners in order to capture gains associated with greater exchange rate stability. This could cause both high trade and coordinated business cycles. Therefore, the association could be the result of countries' application of the OCA criterion rather than an aspect of economic structure that is invariant to exchange rate regimes. Thus, the Ordinary Least Squares (OLS) estimation could yield inconsistent estimates for β_0.

It follows that the trade intensity term needs to be instrumented with exogenous instrumental variables. Frankel and Rose (1998) suggest using three instrumental variables that are devised from the gravity model of bilateral trade: the natural logarithm of the distance between the capitals of the relevant pair of countries, a dummy variable that indicates if the pair of countries shares a common language, and a dummy variable that shows if the countries are adjacent. In addition to the fact that common language is not appropriate to the context, and the adjacency variable is irrelevant for the considered Mercosur countries, these instrumental variables do not change over time and are not useful in a panel framework.

The literature on gravity models uses the natural logarithm of the product of the countries' populations in order to have an exogenous variable measuring the mass effect on bilateral trade intensities. Thus, this has been used as a regressor in the equation. Moreover, the natural logarithm of the product of the

[13] Argentina is the only country of Mercosur that pegged its currency to the US Dollar from the second quarter of 1991 to the last quarter of 2001. Since 1990, Brazil adopted a floating exchange rate regime with minor interventions. From 1995 to 1999 the exchange rate was subject to an adjustable band from 1995-1999 in a program to control the money creation and thus inflation. Uruguay never had a fixed exchange rate regime, just bands from January 1992 to June 2001.

countries' GDP has been included. Since the volatility of the Real Bilateral Exchange Rate (RBER) is believed to inhibit trade activities (see Arize et al., 2008, for a recent analysis of Latin American countries) and thus trade integration, rolling standard deviation[14] of the first difference of the natural logarithm of RBER has been added to the first stage equation. This serves as a proxy of the uncertainty effect that volatility exerts on the companies' willingness to trade.

As robustness tests for the results, apart from adopting two different de-trending alternatives for the dependent variable and two definitions of trade integration, estimations were carried out with random effects models (with and without instrumental variables) by using the Generalized Least Squares (GLS) estimator (producing a matrix-weighted average of the between and within results) and using two other time spans τ=16 and τ=40.[15]

5.2 Data and Descriptive Statistics

The chosen period starts with the first quarter of 1991 and ends with the last quarter of 2008. The starting year corresponds to the sign of the Asuncion Treaty, the official date when Mercosur was formed. The analysis focuses on three of the four Mercosur members: Argentina, Brazil, and Uruguay. Given the poor availability of data for Paraguay and its modest incidence on the Mercosur aggregate GDP[16], it has been neglected.

Frankel and Rose (1998) assert that the measure of country output could be one of the following: real GDP, industrial production, employment or unemployment rate. Given the quarterly data availability for Mercosur countries, real GDP in US Dollars (1993 prices) has been adopted and obtained from the national central banks' website (figure 3).

Quarterly bilateral and total trade data have been taken from the Direction of Trade Statistics database for the above-mentioned countries. Cost Insurance and Freight imports data and Free On Board exports data have been used for all the calculations of the two trade intensity measures.

Looking at figure 2, it is evident that the normalization method affects the patterns of trade integration between countries. The upper panel shows the quarterly evolution of trade integration indexes calculated as in equation (6) for the period under analysis (data for the country pairs Argentina-Brazil and

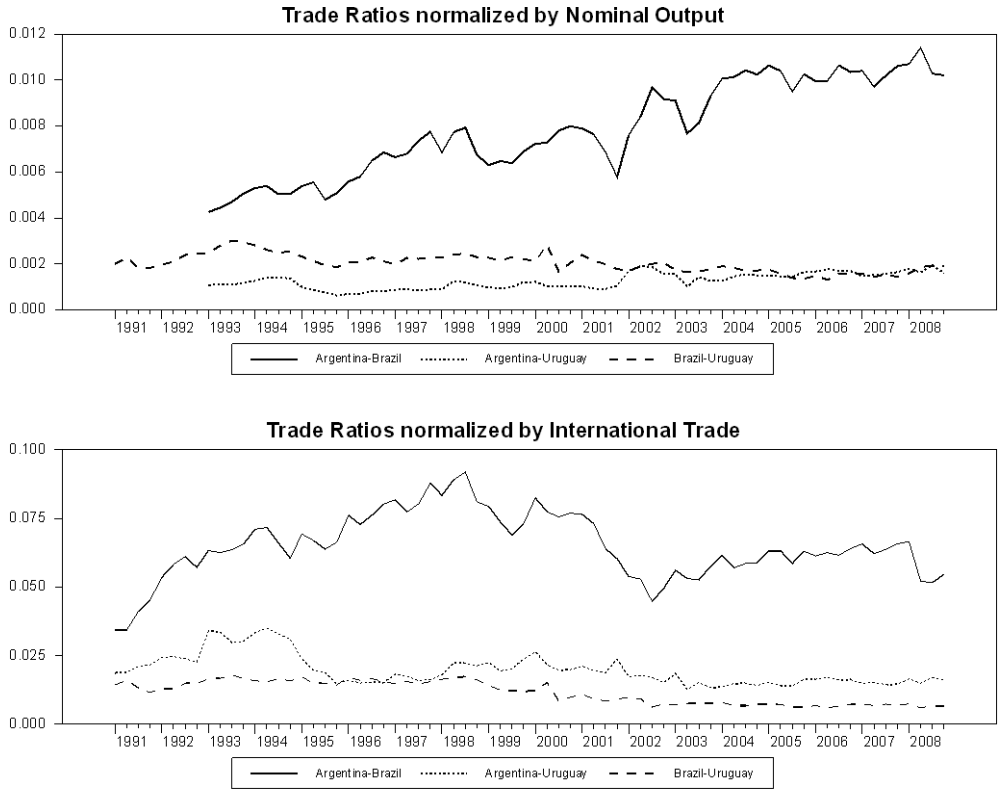
[14] Rolling standard deviation is computed using monthly data over a six months window. Thus, the RBER volatility of the quarter is the average of the rolling Standard Deviation measures recorded for the three months composing the quarter. By using this measure, it is assumed that agents have a six months memory when they decide whether to trade (as robustness check a 12 months window has also been used).

[15] Note that there is a trade-off when increasing the length of the time span, because the correlations output figures are better defined, but the number of observations for the estimations is reduced.

[16] The average of the Paraguayan contribution to the Mercosur GDP from 1991 to 2008 is 0.7 percent.

Argentina-Uruguay are available from the first quarter of 1993 because of the lack of Argentinean output data for the preceding quarters). Since the signature of the Treaty of Asunción in 1991, trade integration has been strongly increasing for the country pair Argentina-Brazil, whereas it rose only slightly for Argentina-Uruguay. In contrast, it has been slightly declining for Brazil-Uruguay. However, the country pair Argentina-Brazil experiences the largest variation and is the pair that really affects the total trade volumes of the area. The lower panel presents the trade integration indexes calculated as in equation (7). Here evidence is mixed. Trade integration steadily increased until the end of 1998 for the Argentina-Brazil pair, then it decreased up to the end of 2002 and it started to rise again from 2003. The variations are less pronounced for the remaining country pairs. Trade integration between Argentina and Uruguay rose until the first quarter of 1995, when it dramatically fell. From there, a more stable path is observed. Between Brazil and Uruguay a negative trend is confirmed.

Figure 2 Graphs of Trade Integration Indexes



Source: DOT and National Central Banks

Regarding monetary and fiscal policy, the choice of the measures has been seriously reduced by the limited quarterly data availability over the considered

time period and by changes in the definitions across the countries observed. Monetary base and general government public spending have been selected and data have been obtained from the national central banks' websites. Although public spending is the indicator with the highest quarterly coverage, the time series do not cover the entire period under analysis, as data for Argentina and Brazil are available from the first quarter of 1993 and data for Uruguay are available only from the first quarter of 1999. Population data was obtained from respective national central bank websites.

Finally, seasonality has been removed from the data using the X-12-ARIMA methodology. All the variables are taken as first differences of its natural logarithms.

Data sources and variable definitions are further discussed in the appendix. Basic descriptive statistics for the differenced and HP filtered data used in the regression estimations are reported in table 1.

Table 1: Summary Statistics of all the Variables

	Obs	**Mean**	**SD**	**Min**	**Max**
Cycle Synchronization (first difference)	116	0.232	0.256	-0.124	0.735
Cycle Synchronization (HP)	119	0.018	0.629	-0.823	0.904
TRY	116	0.006	0.013	-0.024	0.033
TRT	116	-0.011	0.01	-0.035	0.012
Monetary Policy Coordination	132	0.214	0.249	-0.272	0.635
Fiscal Policy Coordination	55	0.205	0.299	-0.452	0.657

Source: IMF-Direction of Trade Statistics (DOT) and National Central Banks.

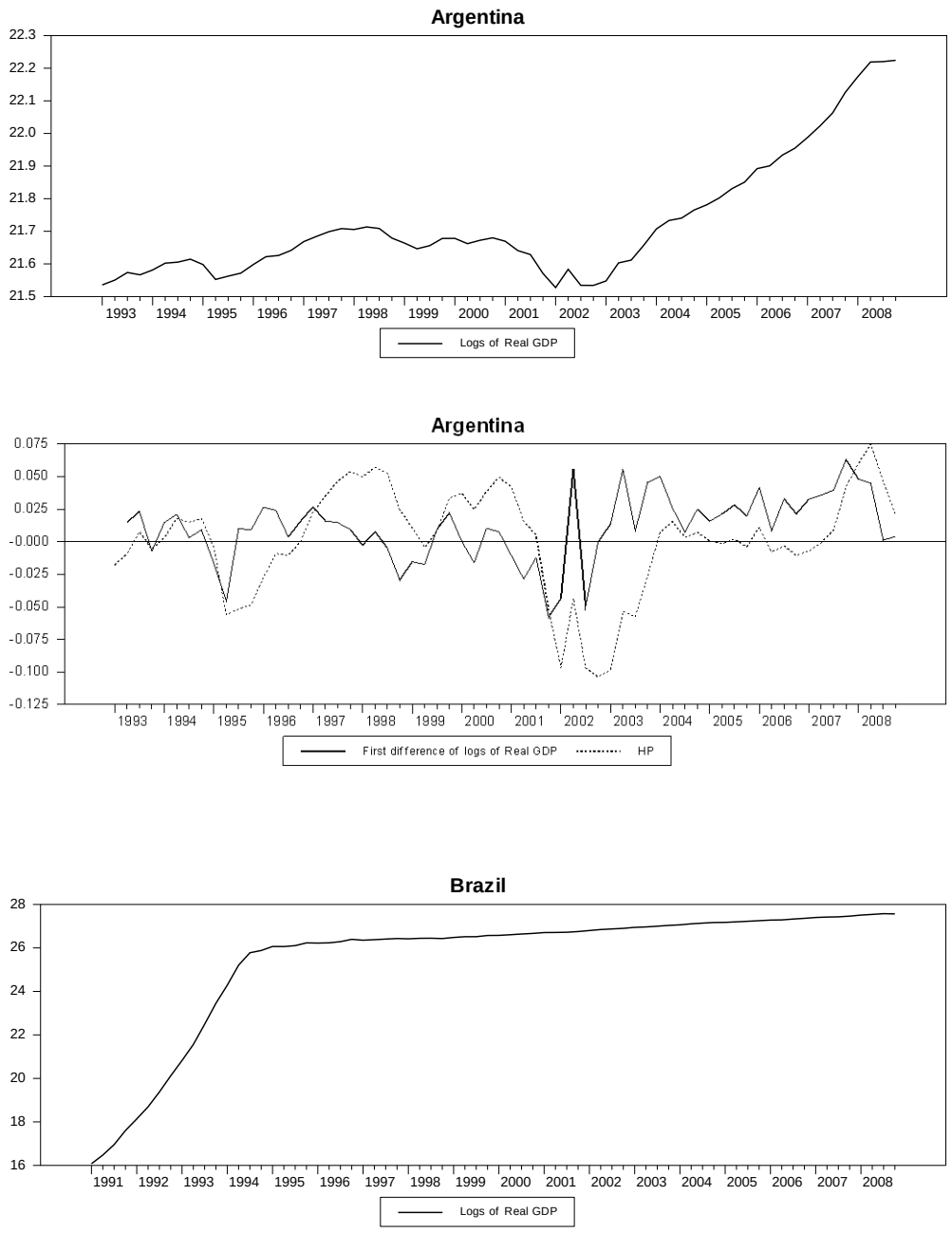
Table 2 illustrates the average growth rate of real GDP, trade openness (sum of exports plus imports to GDP) and regional trade to total trade for the full period and two subperiods and for each country, from 1991 to 1999 (period 1) and from 2000 to 2008 (period 2).

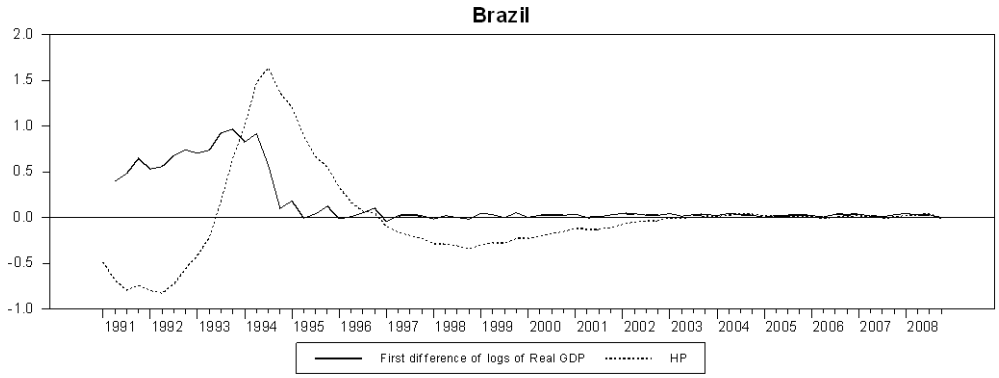
Over the full period, it is evident that the region is not homogeneous in terms of growth. More specifically, Brazil shows a much higher average growth rate. However, this is particularly true for period 1. After 2000, the growth rates seem to converge. This is also observable from figure 3.

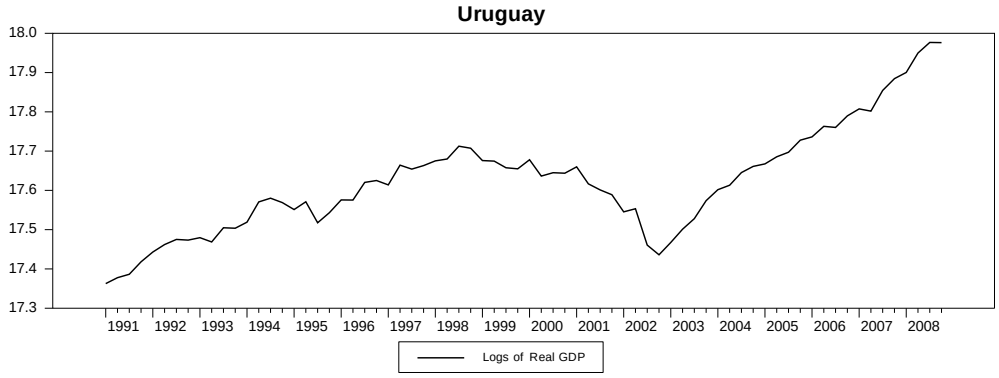
Argentina and Uruguay show the highest trade openness. Nonetheless, all the countries increase the weight of trade on GDP from period 1 to period 2, with Argentina showing the biggest increase.

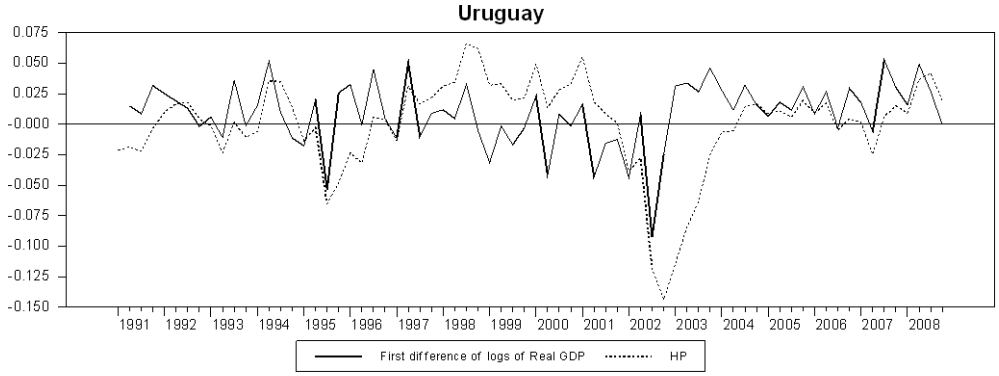
Interestingly, regional trade decreases for Brazil and especially for Uruguay (from 44.015 to 35.405 percent), who both seem to having progressively reoriented their trade towards countries different than Mercosur ones.

Figure 3: Graphs of the Real GDP in USD









Source: National Central Banks

Table 2: GDP Growth, Trade/GDP Ratio, and Regional/World Trade Ratio

	GDP growth		
	Period 1	**Period 2**	**Full**
Argentina	0.528	1.517	1.093
Brazil	29.991	2.755	16.181
Uruguay	0.835	0.893	0.864
	Openness		
	Period 1	**Period 2**	**Full**
Argentina	16.653	32.982	25.838
Brazil	14.792	22.571	18.681
Uruguay	23.771	33.35	28.561
	Regional Trade		
	Period 1	**Period 2**	**Full**
Argentina	24.522	25.751	25.137
Brazil	12.073	9.494	10.784
Uruguay	44.015	35.405	39.81

Notes: Period 1 goes from the first quarter of 1991 to the last quarter of 1999 and period 2 goes from the first quarter of 2000 to the last quarter of 2008. Openness is measured as the sum of imports of country i from the world and exports from country i to the world divided by GDP of country i. Regional Trade is calculated as the sum of imports of country i from Mercosur and exports of country i to Mercosur divided by the sum of imports of country i from the world and exports of country i to the world.

Source: Author's elaboration.

In table 3, the average measure of output correlation and trade intensity are calculated for the full period and the two mentioned subperiods. For example, the correlation measures are calculated for Argentina with Brazil and Uruguay and the average is used as the measure for Argentina. The mean correlation reported in table 3 is based on a simple arithmetic mean of the average correlation measures across the three countries. Maximum and minimum of the average measure are also reported and the corresponding countries in parentheses.

What emerges from table 3 is that the detrending procedure is critical when analyzing the evolution of correlations of countries' real output. The average correlation is positive using either first differences or HP filter. However, by the former method higher and increasing correlations are obtained meaning that co-movements increased, whereas by the latter the average negative correlation of

Brazil lowers the average correlation for the area and it seems that recent co-movements have decreased.

Likewise, the normalization of the trade integration measures is relevant, as already observed in figure 2. When normalizing by nominal output, the ratios remain roughly the same on average, whereas when normalizing by international trade ratios decrease over time albeit are higher than the former.

The poor robustness due to the employment of different detrending procedures is not new in the literature. As pointed out by Canova and Dellas (1993), different detrending methods make different assumptions about the underlying economic structure which may result in different distributional properties for the derived cyclical components and possibly conflicting descriptions of the empirical evidence. At the same time, discrepancies in the trade ratios are due to the fact that GDP and total trade may easily follow different paths.

Table 3: Subsample Averages of the Variables

		Period 1	**Period 2**	**Full**
Cycle Synchronization	Mean	0.181	0.236	0.242
(first difference)	Min	.172 (Uru)	.007 (Bra)	.087 (Bra)
	Max	.193 (Bra)	.326 (Arg)	.322 (Arg)
Cycle Synchronization	Mean	0.066	0.029	0.044
(HP)	Min	-.275 (Bra)	-.382 (Bra)	-.356 (Bra)
	Max	.293 (Uru)	.246 (Arg)	.246 (Arg)
TRY	Mean	0.003	0.004	0.004
	Min	.001 (Uru)	.002 (Uru)	.002 (Uru)
	Max	.004 (Bra)	.005 (Bra)	.005 (Bra)
TRT	Mean	0.037	0.028	0.033
	Min	.019 (Uru)	.001 (Uru)	.015 (Uru)
	Max	.048 (Arg)	.039 (Arg)	.043 (Arg)

Notes: Period 1 goes from the first quarter of 1991 to the last quarter of 1999 and period 2 goes from the first quarter of 2000 to the last quarter of 2008.

Source: Author's elaboration.

5.3 Empirical Findings

To analyze the relationship between cycles' synchronization and trade integration, equation (4) is estimated. Results for τ=28 are reported in table 4. In the upper panel, the first estimated regression presents only trade ratios

normalized by nominal output as an independent variable, and correlations computed on data, detrended by differencing, as the dependent variable. From here, different specifications have been attempted, adding one regressor at a time. In particular, the specification in column (2) includes the monetary policy coordination, whereas column (3) includes both monetary and fiscal policy coordination. The poor data availability for public spending generates a drop of observations for the third regression.

The same procedure is followed in columns (4), (5) and (6), but starting from the regression showing trade ratios normalized by international trade as an independent variable. Columns (7) to (12) present the same specifications as from (1) to (6), but they are now estimated through the instrumental variables fixed effects model.

The lower panel of table 4 shows the results of the same specifications as in the upper panel, but obtained by previously HP filtering real output data. For all estimations, the variance-covariance matrix is adjusted using the White (1980) procedure to account for the presence of heteroskedasticity of unknown form.

Table 4: Regression Results with τ=28

	First difference												
	FE (1)	**FE (2)**	**FE (3)**	**FE (4)**	**FE (5)**	**FE (6)**		**IV FE (7)**	**IV FE (8)**	**IV FE (9)**	**IV FE (10)**	**IV FE (11)**	**IV FE (12)**
TRY	7.178	6.940*	-3.414					25.501***	13.352***	6.609			
	(1.95)	(3.32)	(-1.48)					(5.38)	(5.60)	(0.84)			
TRT				4.291*	6.515	1.674					4.461**	7.886***	1.227
				(3.31)	(2.15)	(0.69)					(2.52)	(4.24)	(0.56)
Monetary Policy		0.093	-0.363***		0.240	-0.410*			0.063	-.421**		.263***	-.402***
Coordination		(0.39)	(-15.60)		(0.69)	(-3.13)			(1.01)	(-2.11)		(4.00)	(-2.56)
Fiscal Policy			.230***			.243*				.313*			.246**
Coordination			(27.64)			(3.43)				(1.94)			(2.09)
Constant	.191**	0.169	.256***	.281***	.246**	.223***		.099***	.140***	.171**	.283***	.255***	.224***
	(9.26)	(2.35)	(14.16)	(18.83)	(4.59)	(60.54)		(5.38)	(6.22)	(2.19)	(11.86)	(11.17)	(7.27)
Observations	116	116	55	116	116	55		116	116	55	116	116	55
R2	0.229	0.194	0.274	0.061	0.001	0.751		0.229	0.219	0.497	0.061	0.011	0.758
	HP												
	FE (1)	**FE (2)**	**FE (3)**	**FE (4)**	**FE (5)**	**FE (6)**		**IV FE (7)**	**IV FE (8)**	**IV FE (9)**	**IV FE (10)**	**IV FE (11)**	**IV FE (12)**
TRY	5.527	4.895	21.541*					18.749***	15.342***	19.368**			
	(1.97)	(0.88)	(3.41)					(2.61)	(2.87)	(2.09)			
TRT				11.401*	16.597	31.369**					16.473***	27.572***	58.163***
				(3.02)	(1.75)	(5.10)					(4.42)	(6.89)	(5.57)
Monetary Policy		0.247	1.032		0.561	1.662			0.198	0.467		.753***	2.095***
Coordination		(0.97)	(1.25)		(1.31)	(1.82)			(1.42)	(0.32)		(5.3)	(2.81)
Fiscal Policy			0.201			0.316				1.006			0.566
Coordination			(0.28)			(0.35)				(0.86)			(1.01)
Constant	-0.017	-0.076	-.694**	.146*	0.063	-.438*		-.091*	-.122**	-1.546**	.204***	.140***	-.379**
	(-1.06)	(-1.14)	(-4.50)	(3.35)	(0.94)	(-3.14)		(-1.83)	(-2.42)	(-2.70)	(4.07)	(2.86)	(-2.60)
Observations	116	116	55	116	116	55		116	116	55	116	116	55
R2	0.142	0.024	0.218	0.067	0.001	0.12		0.142	0.111	0.047	0.067	0.018	0.124

Notes: The numbers in parenthesis report robust t-statistics. Estimations performed using ordinary least squares and two stage least squares including fixed effects. ***, **, and * denote significance at 1 percent, 5 percent, and 10 percent, respectively.

Source: Author's elaboration.

Overall, the regression results in table 4 show a positive contribution of trade integration on business cycles' synchronization. Only in one case is there a negative but not significant coefficient obtained.

Such empirical finding does not seem sensitive to the introduction of new regressors. Even when the fiscal policy coordination variable is introduced and consequently the number of observations falls, in some of the employed specifications the effect of trade integration is still positive and significant.

Better results in terms of significance are obtained when real output is detrended by HP filter, on the contrary the normalization of the trade measures does not seem to matter. The estimation technique turns out to be relevant when looking at the magnitudes of the estimated coefficients. In fact, the estimated effect is much larger when instrumental variables are used.[17]

Monetary policy coordination is found to be less important for the cycles' synchronization and the results show mixed evidence. In the upper panel, the coefficients show a negative and significant sign when the fiscal policy coordination variable is added to the specification. However, in the lower panel, the significant coefficients on the monetary policy coordination variable are positive, implying a positive impact on the cycle's synchronization. As for the fiscal policy coordination variable, when significant, it shows a modest but always positive impact on the synchronicity of the business cycles.

Results are robust at setting τ =16 and τ =40, thus confirming what was obtained with τ =28. As mentioned above, the same equations have been estimated employing the random effects model. In general, the Hausman test for fixed and random effects proves that the null hypothesis of the random effects is rejected, implying the superiority of fixed effects. However, the empirical findings confirm the positive impact of trade integration on business cycle synchronicity.[18]

Generally, there is clear evidence of a positive impact of trade intensity on income correlation for the Mercosur experience. Thus, as observed by Frankel and Rose (1998) for OECD countries, the specialization effect seems not to prevail, and the cause may be the prevalence of intra-industry trade. These findings are consistent with those of the literature on developing countries (Baxter and Kouparitsas, 2005 and Calderón et al., 2007).

Two important caveats of the analysis are presented. Firstly, econometric theory affirms that the best panel is the one for which the number of sections is large. The small number of sections used in this study may affect the results.

[17]Changes in magnitude due to the employed estimation methodologies have been highlighted also in Shin and Wang (2005) and Abbott et al. (2008).

[18]Fixed effects estimation circumvents constant unobservable heterogeneity of countries, but there could still be a problem if such heterogeneity is time varying and goes beyond the effect of macroeconomic policy coordination. The random effects model application should provide a robustness test for that.

Second, it must be said that contrary to previous works on Mercosur, the period considered for this analysis covers the 2001 Argentinean crisis. When the Brazilian economy recovered in 2000, Argentina and Uruguay remained in recession. Since the objective of the analysis is to understand to what extent trade integration affects business cycle synchronicity, what occurred in Argentina plays an important role in determining its degree. In other words, the crisis can be considered an exogenous fact that affects the results in a distorting way. However, the structure of the estimated equation does not allow controlling for such event through the introduction of a dummy variable because the correlation values are calculated on a specific time span that encompasses other observations, beyond the distorted ones. Thus, the size of the obtained estimates can be considered as a lower bound. Moreover, the bias would be stronger when the time span is smaller. Intuitively, using long time spans smoothes the distorting effect.

6. Conclusions

In this paper, an empirical analysis was conducted on the relationship between two Mundellian criteria for the determination of an OCA for Mercosur countries. The investigation is an extension of the analysis carried out by Frankel and Rose (1998) on industrial countries.

From the theoretical point of view there could be endogeneity between trade integration and business cycle synchronization so the effect of the first variable on the second is unclear. On one hand, the reduction of the trade barriers may bring about more correlated business cycles because of common demand shocks or intra-industry trade. On the other hand, trade integration could generate an increased industrial specialization by country because of inter-industry trade, with the associated risk of industry specific shock, and thus more asynchronized output fluctuations.

At a descriptive level, it is evident that GDP growth rates are not homogeneous at the beginning of the sample, but afterwards, tend to converge. Furthermore, members of Mercosur increase their trade openness, but regional trade decreases, implying a reorientation of the trade activities to countries other than the Mercosur ones. Both business cycles comovements and trade integration indexes seem to be sensitive to the detrending and the normalization technique respectively. Therefore, the empirical analysis is carried out using the series computed in different ways.

Using a panel of 72 quarters, three different span lengths, and different estimation techniques for Argentina, Brazil and Uruguay, the issue is empirically studied. The main finding of the analysis is that trade intensity seems to have a positive effect on the business cycle co-movement. Thus, evidence is found that higher commercial integration leads to more synchronized cycles. Moreover, results are fairly robust to changes in the time span length and estimation technique.

Assessing the full viability of a monetary union in Mercosur goes beyond the purposes of this paper, yet it can be considered positive evidence for the current debate about its applicability. In particular, the result has important implications when considering the adoption of a common currency since the costs of joining the currency union would be reduced if intra-industry trade becomes predominant in the region, as it seems to be for Mercosur.

Appendix: Variable Definitions and Data Sources

Variable	**Source**	**Definition**
Cycle synchronization first difference	National Central Banks	Bilateral correlation of first differenced natural logarithms of output calculated from real GDP data
Cycle synchronization HP	National Central Banks	Bilateral correlation of HP filtered natural logarithms of output calculated from real GDP data
TRY	IMF-Direction of Trade Statistics (DOT) and National Central Banks	Average of the first differenced natural logarithm of the sum of bilateral imports and bilateral exports normalized by the sum of countries' GDP
TRT	Direction of Trade Statistics (DOT)	Average of the first differenced natural logarithm of the sum of bilateral imports and bilateral exports normalized by international trade
Monetary Policy Coordination	National Central Banks	Bilateral correlation of first differenced natural logarithms of monetary base
Fiscal Policy Coordination	National Central Banks	Bilateral correlation of first differenced natural logarithms of general government public spending

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