THE IMPACT OF TRADE INTEGRATION ON BUSINESS CYCLE SYNCHRONISATION FOR MERCOSUR COUNTRIES

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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 analysing the viability of a potential Monetary Union for Mercosur. Moreover, there has been a renewed interest in the theory of Optimum Currency Area (OCA), since the creation of the European Monetary Union.

According to the traditional literature by Mundell (1961) and McKinnon (1963), three criteria must hold to form an OCA. The first criteria relates to the degree of trade integration between the members of the currency union. Gains from monetary unification stem from lower transaction costs and from the elimination of exchange rate volatility. The more a pair of countries trade, the more that pair will benefit from the reduction in the transaction costs. The second criteria is the high degree of business cycle synchronisation. Losses come from the inability to pursue independent adjustment policies. The extent of losses 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 criteria relates to the degree of labour mobility and wage flexibility in the economies. If I consider the case of asymmetric shocks, as the possibility of independent monetary policy is foregone, labour mobility and wage flexibility would allow for a faster and less costly adjustment.

The aforementioned traditional literature on this subject treats these criteria as exogenous. However, more recent literature has investigated the issue. Frankel and Rose (1998) reassessed the Mundellian criteria and considered their application to be untenable, since they are jointly

endogenous. In particular, they focused on the endogeneity of trade integration and cycle synchronisation. Their hypothesis is that more integration can be expected to lead to more trade; and more international trade will result in more highly correlated business cycles.

In that sense, this research aims at testing this hypothesis for Argentina, Brazil and Uruguay. It intends to analyse empirically the impact of reduced trade barriers, and then, increased trade on the synchronisation of the business cycles using a panel of bilateral trade and business cycle data spanning the three Mercosur countries over sixty-four quarters, with three different time spans. My empirical findings indicate that closer international trade links result in more closely correlated business cycles across the three countries.

The paper proceeds as follows. Section 2 introduces the theoretical framework going through the history of Mercosur, the motives for which the Monetary Union is desirable, the OCA criteria and its criticism, a formal analysis of the framework itself, and a literature review. Section 3 discusses in detail the empirical methodology and the data collection and elaboration process. I next show the obtained results on the impact evaluation of trade integration on business cycle synchronisation in section 4. In the same section a comparison with other exercises and a personal comment are provided. Section 5 ends the paper reporting the conclusions.

2. Theoretical framework

The current section introduces the theoretical framework starting from a brief summary of the history of Mercosur and explaining the reasons why the Monetary Union is a desirable event. Then, an overview on the OCAs criteria and its criticism is provided, as well as the formal analysis of the framework itself. The literature review concludes the section.

2.1. History of Mercosur

Economic integration among the members of the Mercosur started long before its conception in 1991. Originally Argentina and Brazil, by far the largest two Mercosur members (in terms of geographic size, population and output) discussed regional integration in the 1960s during the Cartagena Consensus. However, the process of integration was interrupted by the economic and political turmoil of the 1970s. Links between Paraguay and Uruguay, the smaller members of Mercosur, grew steadily over time; they initiated under the *Asociación Latinoamericana de Integración* (ALADI) with the Least Favoured Nation (LFN) clause between Uruguay and Paraguay. By the 1970s bilateral trade between Uruguay and its neighbours, Brazil and Argentina, had increased significantly. This was due to two treaties of integration, the *Convenio*

Argentino-Uruguayo de Cooperación Económica (CAUCE) Treaty (between Argentina and Uruguay) and the *Protocolo de Expansión Comercial* (PEC) Treaty (between Brazil and Uruguay). Brazil and Argentina traded significantly more with one another during the 1980s, mostly attributable to the exchange rate and inflation stabilisation policies that were implemented at that time.

The first official stage of integration, between Argentina and Brazil, was the Argentine-Brazilian Cooperation and Integration Act signed in July 1986. This removed some sector trade barriers between the two countries. It corresponds to the European economic integration of 1951, which created a free trade zone in specific sectors (namely coal and steel). Due to the concern over stability issues in 1987, the two governments signed the Gaucho Protocol (one of several signed under the Argentine-Brazilian Cooperation and Integration Act), which initiated research into the possibility of 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 free trade area created by the 1986 Act.

By July1990, the Argentine-Brazilian Cooperation and Integration Act had set the date for the creation of a free trade area between the two countries for late 1994, but was extended to include Paraguay and Uruguay after diplomatic requests. Thus in 1991, the Treaty of Asunción was signed by Argentina, Brazil, Paraguay and Uruguay, which established the objective of a common market among these member countries, to be effective on January 1st 1995. The 1991 Treaty demanded that by June 1991, 40% of the tariffs among the member countries would be removed. After this, there would be six monthly reductions in tariffs until they were eliminated and a 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 the implementation of a common market. This customs union became operational on January 1st 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 note complete immediately[2]. To ease the transition 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. As stated by Paglieri and Sanguinetti (1998), Argentina continued to protect 223 categories, Brazil protected 29 categories, Paraguay protected 272 categories, while Uruguay protected 1018 products[3].

In 1995, Mercosur members agreed to end this transition period by 2001, phasing temporary protectionary tariffs out in order to ensure totally free trade between members by 2000. By 1996, tariffs were reduced by 25%, 50% by 1997, 75% by 1998, and eliminated by 1999 for the case of 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 in 2006[4]. The founding of the Mercosur Parliament was agreed at the December 2004 presidential summit. It should have 18 representatives from each country by 2010.

Bolivia, Chile, Colombia, Ecuador and Peru currently have associate member status. Venezuela signed a membership agreement on 17th June 2006, but before becoming a full member its entry has to be ratified by the Paraguyan and Brazilian parliaments. In May 2007, the Brazilian Senate asked Venezuela to reconsider the non-renewal of *Radio Caracas Televisión Internacional* (RCTV) license, an oppositionist television network. President Hugo Chávez responded accusing the Brazilian Congress of being subservient to interests of the US. The leader of the Brazilian Social Democracy Party in the Senate, Senator Arthur Virgílio, stated that the party will try to prevent Venezuela's entry in Mercosur.

2.2. Motives for the creation of Monetary Union in Mercosur

Motives for the monetary unification between the members of Mercosur are numerous. Recent history has proven that due to policy mismanagement and failed stabilisation policies, no full member of Mercosur has the ability to implement credible, effective monetary policy. In 1991, Argentina implemented a currency board, under the Convertibility Plan[5] which collapsed on 10th January 2002. Uruguay had a target zone until June 2002 (when it allowed the Peso to float freely) which operated like a crawling peg, since the exchange rate was nearly always on the bottom of the set band. Brazil also had a target zone based on Real Plan[6] which collapsed on January 14th 1999, after which point, the Brazilian Central Bank allowed the currency to float.

The ultimate aim of monetary union would therefore be to create a credible and effective monetary policy in order to help provide economic stability for the region. Inflation stabilisation policies have been implemented in Mercosur to reduce the high and in some cases hyper-inflation experienced by their economies[7]. The need to reduce inflation and control prices with a

credible monetary policy is therefore of primary importance. Inflation rates experienced by the full members of Mercosur (except Paraguay) have been highly volatile in the period 1975-1998, during which Argentina and Brazil experienced ranges of between near 0% to 3057%, and 3.5% to 2059%, respectively. The inability to manage prices generated high volatility of the Argentine and Brazilian exchange rates with disruptive consequences. This is why the need for credible and effective monetary policy is one of the primary motives of monetary union.

Today the inflation is still one of the most scaring problems not only for Mercosur members, but for all Latin America. The upward pressures are mostly due to the saturation of the productive capacity and to the international context of rising prices of the commodities. Figure 2.1 shows the evolution of the average quarterly inflation rate for the region from June 2003 to June 2008.

Figure 2.2 presents the average inflation rate projections for 11 Latin American countries for 2008 and 2009. It is observable that the Mercosur countries with a faint exception of Brazil are going to manage one of the highest rates of the region.

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, the one size fits all monetary policy could still be more effective than national monetary policies that would have been implemented if monetary union had not been pursued. This may lead to a more stable economic environment, promoting investment, stable capital flows, and economic growth. If this concept were to be taken further, it is even possible that in the long run a stable currency, widely used by the fourth of fifth largest trading bloc in the world, could become a possible currency to be included in the portfolio of reserves in foreign central banks, which in turn could cause an appreciation of its value.

In a certain sense the so-called 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 old legacies of political corruption and monetary mismanagement that plagued the central banks and governments of past political and military movements that governed these countries.

Due to the poor macroeconomic management of member economies, credit rating of their international debt has lowered, and therefore the cost of such debt is still quite high. Monetary union, with a credible regional central bank, could reduce the cost of debt in international markets, reducing the huge spreads with US Treasury bills, by improving government credit ranking. Better credit ratings would also reduce the cost of creating debt by the regional body, making it cheaper for the member governments to finance possible infrastructure projects in an attempt to encourage foreign direct investment. Those members most likely to benefit from the

potential savings in debt payments are those economies who direct public debt towards international markets, namely Argentina and Brazil.

Beetsma and Bovenberg (1997) propose that the focus of credit ratings on inflation and excessive public spending may dissipate if monetary union occurs with the coordination of fiscal policy between member countries, as was the case in Europe under the Maastricht Treaty. Member countries' central banks would be unable to benefit from a lack of fiscal discipline, because fiscal policy would be common to all the members.

Monetary union may also free up reserves that could be used to create investment opportunities. If a single regional central bank were to hold 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 the possibility of speculative attacks, while the regional bank could keep the optimum level of reserves. Monetary union could therefore lower the cost to the regional central bank of holding international reserves.

Another motive for 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[8], they would increase their presence in the international arena, possibly resulting in better trading arrangements with the US, EU, and the rest of the world.

To summarise, there are a number of motives for Mercosur to form a monetary union. Firstly, the monetary policy of each country in Mercosur is relatively ineffective because the policies have little credibility. Instead of losing sovereignty over monetary policy, a regional central bank may actually create credible monetary policy that could react to external shocks effectively. 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, monetary union provides the possibility of a reduction in the cost of central bank reserves and may create a currency that could even be used by other foreign central banks as a reserve currency. Finally, bargaining as a regional bloc could be an advantage in international negotiations.

2.3. The theory of OCAs and its criticism

In 1961 Mundell published a pioneering paper, in which he first developed the concept of OCA. Important contributions have been brought about by McKinnon (1963) and Kenen (1969). These articles constitute the traditional literature on the topic. More recently others have

written about OCAs, there are some relevant surveys by Tavlas (1993), Bayoumi and Eichengreen (1996b).

The so called traditional literature focuses on three crucial relationships mentioned in the introduction. These are the extent of trade, the similarity of shocks and cycles, and labour mobility and wage flexibility. The more intense any of the three relations among the countries, the more appropriate a common currency. Some authors added a fourth criteria: the analysis of the risk sharing system, mainly through fiscal transfers.

The extent of trade was originally suggested by McKinnon 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. Empirical studies by Frankel and Wei (1995) have supported this argument, finding that there appears to be a relatively small but statistically significant negative impact of exchange rate variability on trade.

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 minimised 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 policy 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 monetary union, since it is only present and future shocks and their behaviour that are relevant. Without being able to predict future business cycles accurately, Kenen's argument is of little use in empirically analysing the feasibility of 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. Labour 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 decrease and increase in supply of labour respectively. This process would continue until real wage parity is achieved between the two regions, maximising efficiency since all workers are employed in the area in which they are most productive, allowing the adverse shock to one sub-region to be spread amongst 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 neighbours. This is because when the whole region is in recession, the regional central bank could implement a monetary expansion, eliminating the need for monetary independence between the smaller regions.

For an area to be an OCA, it must also have real wage and price flexibility in 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 utilisation 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 inflexible.

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. European Monetary Union (EMU) recognised the need for coordination of fiscal policy, and made provision for it in the Maastricht Treaty.

The OCA framework has been extensively adopted by researchers, but Frankel and Rose (1998) put it under criticism, considering this procedure invalid, because they suspect joint endogeneity between the first two criteria. Therefore they state that the degree of integration among potential members of a common currency area cannot be considered independently of income correlation, because one depends on the other. They hypothesised that more integration can be expected to lead to more trade, and more international trade will result in more highly correlated business cycles.

2.4. More formally

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

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

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; α_i is the weight of sector i in total output $(\sum_i \alpha_i = 1)$; and g is the trend rate of output growth for the country. The analogue for the foreign country is:

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

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 of each other, 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:

$$cov(\Delta y_t, \Delta y_t^*) = cov\left(\sum_i \alpha_i u_{i,t}, \sum_i \alpha_i^* u_{i,t}\right) + cov(v_t, v_t^*) =$$

$$\sum_i \alpha_i u_{i,t} \alpha_i^* \sigma_i^2 + \sigma_{v,v^*} \quad (3)$$

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 this covariance changes with increased integration. Increased trade results in greater specialisation if most trade is inter-industry. As countries tend to produce and export goods in which they have a comparative advantage, a negative cross-industry correlation between α_i and α_i^* tends to develop; the covariance falls accordingly. If much trade is within rather than between industries, intra-industry, these specialisation effects may be small. The covariance may also be affected by the spill-over 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 specialisation, leading to more asynchronous business cycles. Since the effect of trade integration on business cycles is theoretically ambiguous, it can only be explained empirically.

2.5. Literature review

According to the view of the European Commission[9], differential shocks in demand will occur less frequently in a monetary union. The reason is that trade between the industrial European nations is to a large degree 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 Paul Krugman (1991). According to him, 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, this has two opposing effects on the localisation 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 more concentration of regional activities rather than less. This way sector-specific shocks may then become country specific shocks, because countries turn out to be more specialised so that they will be subjected to more rather than fewer 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.

I could look at the issue also in these terms: if it is aggregate demand shocks that are dominant in driving business cycles, it is expected that an increase in trade integration will increase synchronicity. Instead, 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 characterises 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 Figures 2.3 and 2.4.

De Grauwe (2005) states that both effects exist, but the concentration and agglomeration effect will be blind of the existence of national borders. This creates the possibility that the 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.

At this point the issue remains an empirical one. Canova and Dellas (1993) 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 find that the relationship is generally positive, but dependent on the de-trending method.

Rose (2000), Rose and Van Wincoop (2001) and Rose (2004) applied panel data analysis covering almost all countries in the world to analyse the effect of the currency unions on the

trade flows between the members of the union. They found that on average the mere fact of belonging to the same monetary union doubles the size of trade flows. Studies by Persson (2001) and Nitsch (2001) have criticised Rose's results on econometric grounds. Other analysis, such as the ones by Bun and Klaasen (2002), Micco *et al.(* 2003), and De Nardis and Viccarelli (2003) have focused on trade effects of the monetary integration in Europe. The concluding remark of these studies is that the trade effect of monetary union in Europe is likely to be much smaller from the one calculated by Rose, but remains a sizeable effect.

Frankel and Rose (1998) tried to understand if increased integration affects the asymmetry of shocks. Their conclusion was that a closer trade linkage between two countries is strongly and consistently associated with more tightly correlated economic activity between the two countries. This is also confirmed in the studies of Rose and Engel (2001) and Rose (2002). Similar evidence is presented by Artis and Shang (1995), who find that as the European countries have become more integrated during the 1980s and 1990s, the business cycles of these countries have become more correlated.

3. Empirical methodology

This section presents the empirical methodology by which the investigation aims to answer the following question: what is the impact of trade integration on business cycle synchronicity for Mercosur countries from 1991 to 2006?

3.1. The model

In order to deal with the first question I proceed by means of the Frankel and Rose (1998) guidelines. The regressions to be estimated are:

$$corr(y_i^c, y_j^c)_\tau = \alpha + \beta lnwt_{ij\tau} + \varepsilon_{ij\tau} \quad (4)$$

$$corr(y_i^c, y_j^c)_\tau = \alpha + \beta lnwy_{ij\tau} + \varepsilon_{ij\tau} \quad (5)$$

where y_i^c is the cyclical component of output y for country i and τ is the time span. Higher correlations imply a higher degree of synchronisation. I compute the correlations for each pair i and j of Mercosur countries output as:

$$corr(y_i^c, y_j^c)_\tau = \frac{cov(y_i^c, y_j^c)_\tau}{var(y_i^c)_\tau^{\frac{1}{2}} var(y_j^c)_\tau^{\frac{1}{2}}} \quad (6)$$

I calculated the average values of the trade ratios normalised by international trade and by nominal Growth Domestic Product (GDP) over the mentioned time spans. Thus, $wt_{ij\tau}$ and $wy_{ij\tau}$ are measures of trade intensity computed as follow:

$$wt_{ij\tau} = (X_{ij\tau} + M_{ij\tau})/(X_{i\tau} + X_{j\tau} + M_{i\tau} + M_{j\tau}) \quad (7)$$

$$wy_{ij\tau} = (X_{ij\tau} + M_{ij\tau})/(Y_{i\tau} + Y_{j\tau}) \quad (8)$$

where $X_{ij\tau}$ denotes total nominal exports from country i to country j during period τ; $X_{i\tau}$ denotes total global exports from country i; iM denotes imports; and $Y_{i\tau}$ is the level of nominal GDP in country i at period τ. The first measure normalises total bilateral trade by international trade data, whereas the second one by nominal GDP in the two countries. I use both $wt_{ij\tau}$ or $wy_{ij\tau}$ as independent variables. $\varepsilon_{ij\tau}$ represents the numerous influences on bilateral activity correlations above and beyond the influences of international trade.

My interest falls on the sign and the size of the slope coefficient β. The sign explains if the specialisation effect prevails, in which case I would obtain a negative β, or if the hypothesised effect dominates, in which case the sign on β would be positive. The size of the coefficient allows us to quantify the relevance of the effects.

I start estimating the regression by Ordinary Least Squares (OLS). The estimated model, however, is in some cases characterised by heteroscedasticity. For the latters the variance-covariance matrix is thus adjusted using the Huber procedure to account for the presence of heteroscedasticity of unknown form.

The first regression I estimate is the one that presents trade ratios normalised by international trade as independent variable, and correlations computed on data de-trended by differencing as dependent variable. For the second one, I estimate the equation that depicts trade ratios normalised by nominal output as independent variable and again correlations obtained through differencing as dependent variable. Thirdly, I substitute the dependent variable with the correlations derived from data de-trended by Hodrick-Prescott (HP) filter, keeping trade ratios normalised by international trade as independent variable. Finally, I maintain the correlations derived from data de-trended by HP filter as dependent variable, using trade ratios normalised by nominal output as independent variable.

The OLS estimation could yield inconsistent estimates for β. The trade intensity variable may result to be endogenous. Usually countries are likely to peg their currencies intentionally 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.

Finally, 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.

It follows that I need to instrument the trade intensity term with exogenous instrumental variables (IV). These are also applied for error in measurement of the regressor. Frankel and Rose (1998) suggest to use three IV 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 share a common language, and a dummy variable that shows if the countries are adjacent. Since the common language variable is not so appropriate to the context, and the adjacency variable is irrelevant for the considered Mercosur countries, other variables could replace them. The literature sometimes uses the natural logarithm of the product of the countries' population to have an exogenous variable measuring the mass effect on bilateral trade intensities, thus I put it in the equation. Then, I added the natural logarithm of the product of real GDP of the country pairs, the natural logarithm of the product of the countries' dimension, and the natural logarithm of real exchange rate between the pair of countries.

I run a first stage regression of the natural logarithm of bilateral period-average trade intensity (normalised by international trade and nominal output) on the above mentioned IV.

$$\ln wt_{ij\tau} = \gamma_0 + \gamma_1 \ln dist_{ij} + \gamma_2 ln(pop_i pop_j)_\tau + \gamma_3 ln(GDP_i GDP_j)_\tau + \gamma_4 ln(size_i size_j)_\tau + \gamma_5 \ln(exrate)_{ij\tau} + v_{ij\tau} \quad (9)$$

$$\ln wy_{ij\tau} = \gamma_0 + \gamma_1 \ln dist_{ij} + \gamma_2 ln(pop_i pop_j)_\tau + \gamma_3 ln(GDP_i GDP_j)_\tau + \gamma_4 ln(size_i size_j)_\tau + \gamma_5 \ln(exrate)_{ij\tau} + v_{ij\tau} \quad (10)$$

It is worthwhile noting that the average values were calculated over the time span for the following IV: $ln(pop_i pop_j)_\tau$, $ln(GDP_i GDP_j)_\tau$, and $\ln(exrate)_{ij\tau}$.

Finally, the equations are estimated using the within estimator for the group fixed effects, and using the random effects estimator.

3.2. Data

The chosen period goes from the first quarter of 1991 to the last quarter of 2006 for both the research questions. The starting year is corresponding to the sign of the Asuncion Treaty, the official date in which Mercosur was formed.

The analysis focuses on the Mercosur members: Argentina, Brazil, and Uruguay. Given the poor availability of data on Paraguay and its modest impact in percentage terms of GDP on the Mercosur aggregate, it has been neglected.

In order to answer the question I downloaded quarterly bilateral trade data from International Monetary Fund (IMF)-Direction of Trade Statistics (DTS), and total imports and total exports from International Finance Statistics (IFS) for the above mentioned countries. I used Cost Insurance and Freight (CIF) imports data and Free On Board (FOB) exports data for all the calculations of the two trade intensity measures (independent variables in the regressions to be estimated).

Frankel and Rose (1998) assert that the measure of the country output (which correlations represent the dependent variable in the regression to be estimated) could be one of the following: natural logarithm of real GDP, natural logarithm of industrial production, natural logarithm of employment or unemployment rate. Given the data availability for Mercosur countries I have decided to use the natural logarithm of GDP at 2000 constant prices.

I obtained the yearly current and constant 1993 prices GDP data in Pesos for Argentina from IMF-IFS database. I filled two missing observations taking data from *Ministerio de Economía y Producción - República* Argentina (MECON). The current and constant 2000 prices yearly data in US Dollars have been downloaded from World Bank (WB)-World Development Indicators (WDI). I got quarterly current GDP data in Pesos and quarterly real exchange rate from IFS. Thus, I firstly calculated the quarterly current GDP data in US Dollars. Then, I calculated the yearly GDP deflator for Pesos and US Dollars as follows:

$$yearly\ GDP\ deflator_{2000}^{i,j} = \frac{yearly\ current\ GDP^{i,j}}{yearly\ constant\ GDP_{2000}^{i,j}} \qquad (11)$$

where i is the country and j is the currency. Finally, I computed both constant 2000 prices GDP quarterly data in US Dollars and Pesos using the yearly GDP deflator.

$$quarterly\ constant\ GDP_{2000}^{i,j} = \frac{quarterly\ current\ GDP^{i}}{yearly\ GDP\ deflator_{2000}^{i,j}} \qquad (12)$$

Brazilian yearly current prices GDP data in Reales have been downloaded from IFS, as well as yearly GDP deflator data for year 2000, through which I calculated GDP constant 2000 prices in Reales, using the inverse of (11). Current and constant 2000 prices yearly data in US Dollars are coming from WDI. I got quarterly current GDP data in Reales and the quarterly real exchange rate from IFS. As for Argentina, I calculated both constant 2000 prices GDP quarterly data in US Dollars and Reales by (12).

Uruguayan yearly current and constant 1983 prices GDP data in Pesos have been downloaded from IFS. Hence, I calculated the yearly GDP deflator for the year 1983 by (11), and I converted its base in 2000. Current and constant 2000 prices GDP yearly data in US Dollars are coming from WDI. As previously, I calculated the yearly GDP deflator by (12). I got quarterly constant 1983 prices GDP data in Pesos from Economic Commission for Latin America and the Caribbean (ECLAC) website. Once I calculated quarterly current GDP data through the inverse of (12), I got quarterly constant 2000 prices GDP data in Pesos applying the same formula. In order to compute quarterly current GDP data in US Dollars I downloaded quarterly real exchange rate from IFS. Finally I calculated quarterly constant 2000 prices GDP data in US Dollars by (12).

With respect to the IV, instead of taking the distance between the capitals of the three Mercosur countries as usually suggested by the gravity equation theory, I took data on distance between their business centres. So for the Brazilian case, Brasilia has been substituted with San Paulo. Data have been retrieved from the Argentinean Central Bank website. Population and country size data have been obtained from the respective countries' Central Bank website.

Once I got all the nominal and real GDP, trade, population and country size data, I calculated the natural logarithm.

3.3. Seasonality adjustment and de-trending

I removed the seasonality from the GDP and trade ratios time series using TSW (TRAMO/SEATS)[11].

First differencing at fourth lag has been applied to de-trend real GDP, trade ratios, population and real exchange rate time series. HP filter has been used as an alternative method to obtain real GDP cycle components. This removes a smooth trend ψ_t from a time series x_t by solving the minimisation problem

$$min \sum_{t=1}^{T}[(x_t - \psi_t)^2 + \lambda((\psi_{t+1} - \psi_t) - (\psi_t - \psi_{t-1}))^2] \qquad (13)$$

with respect to ψ_t. The residual, or deviation from trend $c_t = x_t - \psi_t$ is commonly referred to as the business cycle component. In this sense the HP filter is a highpass filter, removing the trend and returning high-frequency components in c_t. The parameter λ penalises fluctuations in the second differences of x_t, and must be specified by the user of the HP filter. Common practice has been to use $\lambda = 1600$ as smoothing parameter when applying the HP filter to quarterly economic data. The first differencing at fourth lag implies the loss of the first five observations, so for the panel data and in particular for the time span τ=16 I get 43 values for each time series of each country, while using the HP filter I end up with 48 values. I did the

same using a time span τ =28[12]. This time I got 32 observations for the differencing method, and 37 for the data de-trended by HP filter. Finally, I used a time span τ =40, or 10 years. I remained with 19 correlations values for the differencing method, and 24 for the HP filtered data.

With respect to the differencing methodology, I perform an Augmented Dickey-Fuller (ADF) test in order to test for stationarity of the seasonally adjusted time series. I set the test with an augmentation equal to five, as the literature suggests for quarterly data. Then I evaluated the augmentation order choice looking at the significance of the highest lag coefficient. If the fifth lag corresponds a t-Student (not standard) lower that 1.645, then I redo the test choosing the number of lags for which the highest is significant. Thus, I did the same for the first difference of the non stationary time series).

Table 3.1 is resuming the ADF test results.

4. Empirical findings

Firstly, this section presents the estimates for the impact of trade integration on business cycle correlations. I use a panel data across three cross-sections (the country pairs) and through 64 quarters (from 1991 to 2006). The results are presented for four different methods of estimation OLS, IV, Fixed Effects (FE), and Random Effects (RE), two different de-trending alternatives (differencing and HP filter) for the dependent variable, two definitions of trade integration (trade ratios normalised by international trade or nominal output), and three time spans (16, 28, and 40 quarters).

Secondly, the results are compared with other exercises, and a personal comment on their plausibility is provided.

4.1. Impact of trade integration on business cycle synchronicity

The discussion is organised as follows: once the table is presented I start pointing out the sign and the magnitude of the coefficients obtained for τ =16 without group effects (by OLS and IV) and introducing group effect (by FE and RE). Then I do the same for τ =28 and τ =40. An overall comment concludes the subsection. For the IV estimation, the R^2 measure of the first stage regression is presented before any comment on the significance of the coefficients. Once I introduce the group effect it is worthwhile citing the results of the F test about the fixed effects influences, and Wald test for overall significance. Each time span paragraph ends up with a notice about the preferability of the FE or the RE model when both estimations prove to be significant for the same equation.

Table 4.1 presents the above mentioned estimates. On the rows there are the estimated coefficients ordered per techniques that allow or not for group effect, whilst on the columns the estimations are shown for dependent variable de-trending technique, and subsequently for independent variable normalisation technique. The same scheme is repeated for the considered time spans. The figures in bold are the significant estimations at 5% significance level, while the ones in italic are generated by regressions with missing R^2 measure. Absolute value for t statistics (z for RE) for β=0 are recorded in parenthesis. For what concerns the OLS and IV estimations I performed a Breusch-Pagan, Godfrey, Cook-Weisberg, Pagan and Hall, White and Koenker test for heteroskedasticity. With respect to FE estimations a modified Wald statistic for groupwise heteroskedasticity in the residuals has been calculated. Thus, if the null hypothesis of constant variance is rejected a "robust" adjustment is implemented and it is signalled by *. Finally, with respect to the IV estimations the R^2 measure of the first stage regressions is always shown.

With respect to the first column, only in one case a significant value is produced. However, it should not be taken into consideration because it is generated by a regression with missing R^2 measure. Thus, I will comment only the last three columns.

For τ =16 the OLS estimates are significant at the conventional 5% significance level. I cannot find any evidence of a dominant specialisation effect, on the contrary a positive effect of trade on business cycle synchronisation seems to prevail for Mercosur countries. The magnitude varies broadly among the significant estimates. Coming to the IV estimation, the set of instruments explain respectively 18.9% and 99.9% of the variation of $\ln wt_{ij\tau}$ and $\ln wy_{ij\tau}$. The significant IV coefficients at 5% significance level come again from the same significant OLS regressions. The sign of the coefficient confirms that the dominance of a specialisation effect is rejected. The IV coefficient from the regression of output correlations de-trended by HP filter on trade ratios normalised by international trade shows a magnitude strongly bigger than the other IV estimates and the OLS ones. However this result should not be considered because the R^2 measure is not provided. In other words this strong change in the magnitude could be a distortion due to the low R^2 measure of the first stage regressions.

Through the within estimator the only significant coefficients at 5% significance level are coming from the regressions of the output correlations de-trended by HP filter on the trade ratio normalised by international trade and nominal output. Looking at the F test, the null hypothesis that the fixed effects exert no influence on the dependent variable is decisively rejected in the

mentioned equations. The within R^2 measure, the appropriate one for this model, suggests that respectively 11.9% and 24.8% of the variation in the data is explained by the included regressor. It is worthwhile noting that the magnitudes are quite different, signifying that the normalisation method turns out to be relevant. Adopting the random effects model the significant estimates come from the same regressions mentioned for the fixed effects model. The overall significance of the relationship can be inferred performing a Wald test, and it is confirmed for the significant β . The between R^2 measure is very high in the case of the independent variable normalised by international trade, indicating that the variation of the data is mostly between sections. Breusch-Pagan test for the random variation across the pair of countries reveals that the null hypothesis of no random effects is decisively rejected for the interesting application at 5% significance level. For the regression in which the independent variable is normalised by international trade, Hausman test for fixed and random effects fails because the model fitted on these data fails to meet the asymptotic assumptions. At 5% significance level the same test proves that the null hypothesis of the random effects is rejected in the case where the trade ratios are normalised by nominal output, implying the superiority of fixed effects.

For τ =28 the OLS coefficients are still significant. In all cases I get positive values, although with different magnitudes. It should be noted that the highest magnitude is coming from the equation with the lower R^2 measure, casting doubts on its reliability. This time the set of IV explain respectively 26.3% and 99.9% of the variation of $\ln wt_{ij\tau}$ and $\ln wy_{ij\tau}$. The results confirm basically what is estimated by other techniques and smaller time span, trade integration increases the synchronicity of Mercosur countries business cycles. Once again the estimate from the output correlations de-trended by HP filter on trade ratios normalised by international trade should not be considered because the R^2 measure is not provided.

Applying the within estimator, the F test suggests that the null hypothesis of no influence of the fixed effects on the dependent variable is rejected in all the relevant estimation. The within R^2 measure is quite low, it varies from 4.1% to 24.8%. However, the sign of the significant coefficient is positive in two cases out of three. It should be observed that the negative sign is present on the coefficient that is showing the lowest significant t-value. Neglecting the negative case, the magnitudes are close to the ones obtained through the same technique but with shorter time span. Through the random effects model only one significant estimate is generated. It is still the one from the regression of correlations of output de-trended through HP filter on trade ratios normalised by international trade. Wald test for overall significance rejects the null hypothesis for the significant estimation. The R^2 measures show that the model overall explains 7.9% of the variation of the data. Again a strong between variation is present. The sign and the size of the significant estimate is confirming the positive dependence of output correlations on

trade integration. As before, the Breusch-Pagan test rejects the null hypothesis of no random effects in every application. As previously, the Hausman test for fixed and random effects fails for the significant estimation because the model fitted on these data fails to meet the asymptotic assumptions.

Finally, for τ =40 only the OLS estimates coming from the regressions on the trade ratios normalised by nominal output are significant. The results basically confirm the findings I obtained with shorter time spans. In this last application the set of IV explain respectively 43.6% and 99.9% of the variation of $\ln wt_{ij\tau}$ and $\ln wy_{ij\tau}$. The IV estimates are all significant at the conventional significance value, but I cannot consider the coefficients of the regressions on trade ratios normalised by international trade, because any R^2 measure is provided. The results of the significant regressions, even if with different magnitude, confirm what I got through different techniques and shorter time spans.

Only the coefficient coming from the regression of correlations of output de-trended by nominal output turns out to be significant when applying the fixed effects or random effects models. The within R^2 is 8.1% for the former, while the latter shows an overall R^2 equal to 38.0% and interestingly the between R^2 is only 38.6%. No random effect hypothesis is rejected by Breusch-Pagan test for the significant estimation, and Hausman test is privileging the random effects model.

Generally, there is evidence of a positive impact of trade intensity on income correlation for the Mercosur experience. Looking at the estimates the positive sign is almost always present, using both different time spans and various estimation techniques. A negative sign is seen for only one estimation, but its t-value is very close to the conventional threshold. Thus, the specialisation effect seems not to prevail and it can be inferred that trade among members is prevalently intra-industry. The intensity of such effect is reflected by the magnitude of the coefficients. It is observable how the significant coefficients of the third column present strong differences in magnitude with respect to the values on the other columns. This seems to be due to the normalisation technique. With respect to this point, I brought about the analysis as suggested by Frankel and Rose, although in my opinion the normalisation by nominal output is to be preferred to the one by international trade on theoretical grounds. What really matters is whether partner trade is considerable relative to the output. If we neglect the international trade normalisation column, then the coefficients are quite homogeneous.

There is a trade-off about 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. However, the longer the time span, the higher the significance of the estimates, and the

magnitude seems to converge to similar values using different estimation techniques. Furthermore the R^2 measure is improving.

Two important caveats of the analysis are now presented. The econometric theory affirms that the best panel is the one for which the number of sections tends to infinite. The small number of sections of the one used in this study may affects the results. Moreover, as alluded IV results for shorter time spans should be considered carefully because of the low explanatory power of the instruments.

4.2. Comparison with other studies

Several econometric studies focusing on Latin America have showed little or negative correlations of shocks. Taking two sub-periods (1975-1989 and 1990-1997) Licandro Ferrando (1998) states that the shocks in Mercosur are less symmetric than in Europe. However, the author illustrates that the shocks correlation between Argentina and Brazil has increased over time, suggesting that the deepening of economic integration between Mercosur may be rendering shocks less asymmetric. In the same direction are the results for Mercosur in Carrera et al. (1998), that detect an increase in correlation for the productive cycles. It should be remarked that none of these studies consider the Argentine crisis in 2001 and its effects.

Although with different techniques, Silva et al. (2004) state that the underlying asymmetries between Argentina and Brazil were exacerbated when Brazil switched to a floating regime in 1999, increasing the divergence in the patterns of output fluctuations. Moreover, even external shocks had adverse effects in terms of synchronisation in the Mercosur area. Morandè and Schmidt-Hebbel (2000), and Larrain et al. (2003) indicate that the degree of synchronisation of output movements is low in Latin America, and that the asymmetric shocks are relative large.

It is worthwhile mentioning Frankel's book (1997), in which he estimated one of the OCA criteria I deal with in this paper, namely, trade flow patterns within regional blocs all over the world. Assuming imperfect competition and increasing returns to scale, gravity models of bilateral trade between pairs of countries are estimated for several regional blocs. In the case of Mercosur, the bloc effect of bilateral trade is not significant during 1965-1975, but it becomes higher and statistically significant after 1990. The author asserts that the four Mercosur countries trade among themselves seven times as much as similar countries.

Coming to my analysis, trade integration is increasing for the country pairs Argentina-Brazil and Argentina-Uruguay, but it is fluctuating a lot for Brazil-Uruguay. Figure 4.5 shows the quarterly evolution of the natural logarithm of trade ratios normalised by nominal output from 1991 to 2006.

However the country pair Argentina-Brazil is the one that really affects the final results, because of its weight. With respect to this, it is meaningful to illustrate the yearly Mercosur GDP composition (with the exclusion of Paraguay) in the same period.

As discussed in 2.5, Frankel and Rose (1998) found a strong positive relationship between bilateral trade intensity and the synchronisation of business cycles, using a panel of 30 years and 20 industrial countries. My exercise follows the same model. Additionally, group effects are included in the analysis, and three different time spans are considered. For the examined Mercosur countries the results confirm what Frankel and Rose assert, although with a much smaller size.

With respect to the coefficient magnitude, it must be said that differently from previous works on Mercosur, the period considered for my analysis covers the 2001 Argentine crisis. When the Brazilian economy recovered strongly in 2000, Argentina and Uruguay remained in recession. Since the objective of the analysis is to understand to which 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 a fact that has exogenously affected the results in a distorting way. It has been thought to control for the event adding a dummy variable that takes the value one when the Argentine real GDP observations overcome one standard deviation and zero otherwise. However, the structure of the estimated equation does not allow for this adjustment because the correlation values are calculated on a specific time span that encompasses other observations, beside the distorted ones. This means that if I applied the aforementioned correction, I would rule out a lot of observations, many of them not altered by the crisis. Then, the size of the obtained estimates could be biased downward, and such bias would be stronger the smaller the time span. Intuitively, taking bigger time spans the distorting effect should be smoothed. Overall I consider my outcome plausible.

More generally, I think that the challenge is to think about the endogeneity of OCA in a broader sense. Endogeneity is in fact associated with a large amount of progress under many OCA properties that are indispensable to sustain monetary unification. Such progress does not always seem to follow a linear pattern, and is often the "crowning" of previous stages. Hence, the endogeneity of OCA debate should not be confined to just trade integration and income correlation. For example, several authors including Artis and Zhang (1997), Artis and Zhang (1998), and Buti and Suardi (2000) argue that the European process of economic and monetary integration has had significant "disciplining effect" on participating countries which has gone together with an increasing business cycles synchronisation. The same has happened for inflation in countries with a poor track record in maintaining low inflation after "anchoring" themselves to low inflation countries. Other examples come from Issing (2001) that flags the

endogeneity of political integration, and from Blanchard and Wolfers (2000) that discuss the endogeneity of labour market institutions.

5. Conclusions

In this paper, an empirical analysis was conducted on the relationship between two Mundellian criteria for the determination of an OCA for the 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 synchronisation, so that the effect of the first variable on the second are unclear. On one side 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 side trade integration could generate an increased industrial specialisation by country because of inter-industry trade, with the associated risk of industry specific shock, and thus more asynchronised output fluctuations.

Using a panel of 64 quarters, three different span lengths, and four different estimation techniques for Argentina, Brazil and Uruguay, I found a positive relationship between the two variables, that is higher commercial integration leads to more synchronised cycles. In all but one, the significant estimates present the positive sign. Generally, the coefficients vary in magnitude; the longer the time span, the higher the significance of the estimates, and the magnitude seems to converge to similar values using different estimation techniques. Assessing the viability of a Monetary Union in Mercosur goes beyond the purposes of this paper, but fundamentally this can be considered a positive evidence for the current debate about its applicability. Obviously it is not comprehensive, as I am neglecting other criteria of the classical OCA theory, besides many other factors.

Figures and tables

Figure 2.1 Average quarterly inflation rate for Latin America (Source: ECLAC)

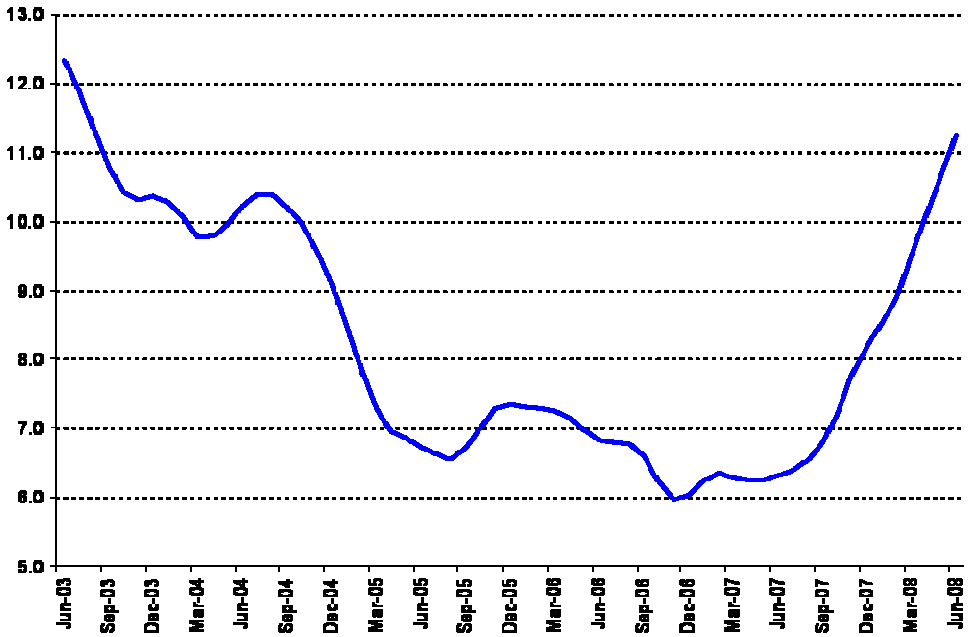


Figure 2.2 Yearly inflation rates projections (Source: ECLAC)

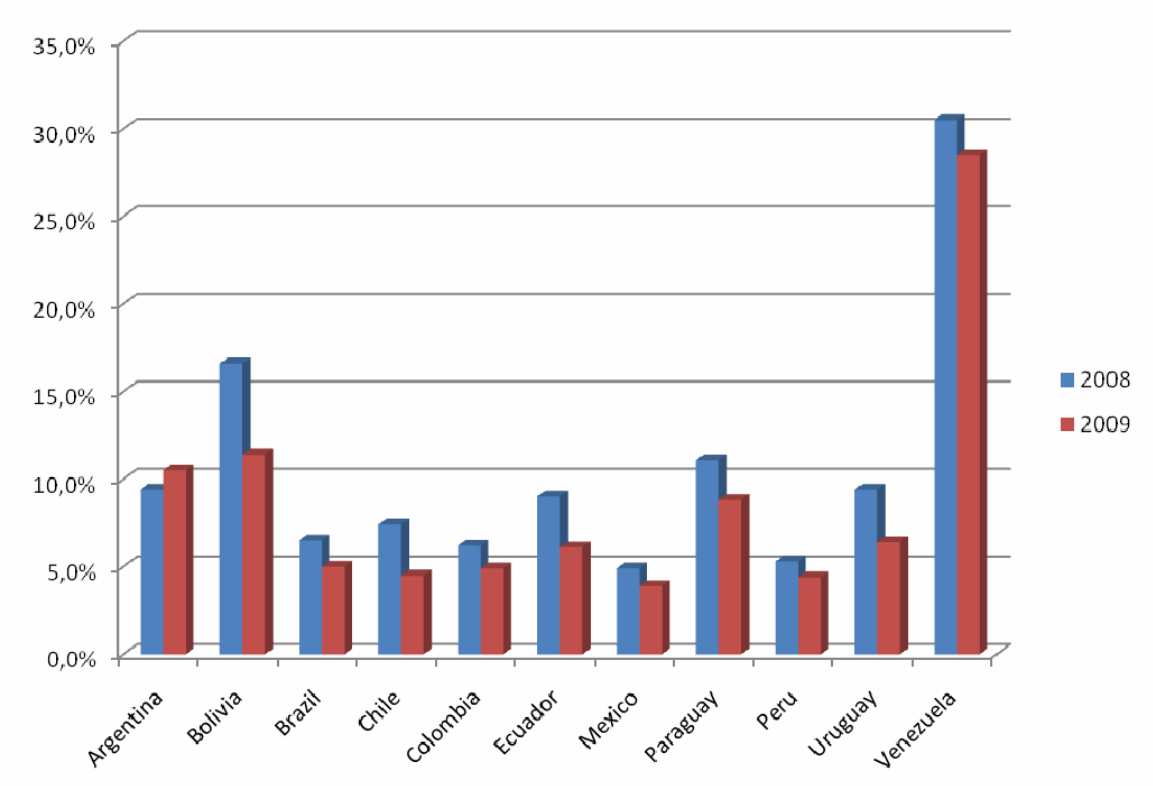


Figure 2.3 The European Commission view

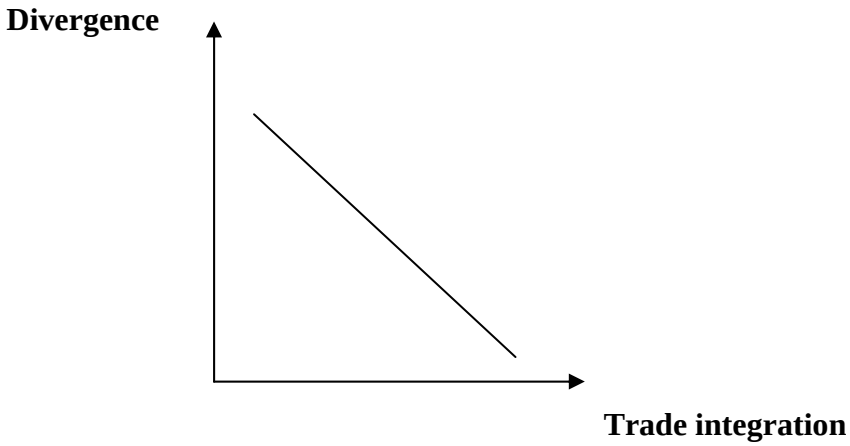


Figure 2.4 The Krugman view

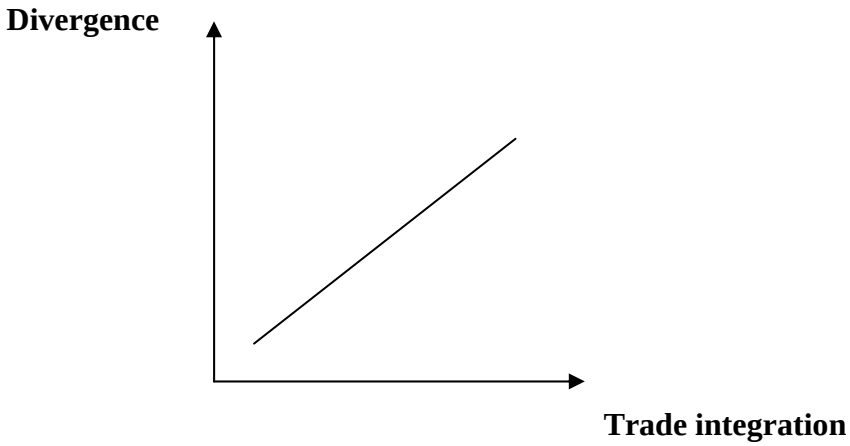


Table 3.1 ADF results

Variable	ADF with augmentation 5	ADF with evaluated augmentation	ADF for the first difference with augmentation 5	ADF for the first difference with evaluated augmentation
Argentine constant 2000 prices GDP in US Dollars	*Nonstationary*	*Non stationary*	*Stationary*	*Stationary*
Dollars Argentine constant 2000 prices GDP in Pesos	*Non stationary*	*Non stationary*	*Non stationary*	*Stationary*
Brazilian constant 2000 prices GDP in US Dollars	*Non stationary*	*Stationary*	-	-
Brazilian constant 2000 prices GDP in Reales	*Non stationary*	*Non stationary*	*Stationary*	*Stationary*
Uruguayan constant 2000 prices GDP in US Dollars	*Non stationary*	*Non stationary*	*Stationary*	*Stationary*
Uruguayan constant 2000 prices GDP in Pesos	*Non stationary*	*Non stationary*	*Stationary*	*Stationary*
Bilateral trade ratios normalised by international trade between Argentina and Brazil	*Non stationary*	*Non stationary*	*Stationary*	*Stationary*
Bilateral trade ratios normalised by international trade between Argentina and Uruguay	*Non stationary*	*Non stationary*	*Non stationary*	*Stationary*
Bilateral trade ratios normalised by international trade between Brazil and Uruguay	*Non stationary*	*Non stationary*	*Stationary*	*Stationary*
Bilateral trade ratios normalised by nominal output between Argentina and Brazil	*Non stationary*	*Non stationary*	*Stationary*	*Stationary*
Bilateral trade ratios normalised by nominal output between Argentina and Uruguay	*Non stationary*	*Non stationary*	*Stationary*	*Stationary*
Bilateral trade ratios normalised by nominal output between Brazil and Uruguay	*Non stationary*	*Non stationary*	*Stationary*	*Stationary*
Logarithm of the product of the Argentine and Brazilian population	*Non stationary*	*Non stationary*	*Stationary*	*Stationary*
Logarithm of the product of the Argentine and Brazilian population	*Non stationary*	*Non stationary*	*Non stationary*	*Stationary*
Logarithm of the product of the Argentine and Brazilian population	*Non stationary*	*Non stationary*	*Non stationary*	*Stationary*
Real Exchange rate between Argentina and Brazil	*Stationary*	*Stationary*	-	-
Real Exchange rate between Argentina and Uruguay	*Non stationary*	*Non stationary*	*Stationary*	*Stationary*
Real Exchange rate between Brazil and Uruguay	*Stationary*	*Stationary*	-	-

Table 4.1 Estimates of β for the impact of trade integration on business cycle correlations

τ =16		Differencing		HP filter	
		Trade Ratio normalised by International Trade	**Trade Ratio normalised by Nominal Output**	**Trade Ratio normalised by International Trade**	**Trade Ratio normalised by Nominal Output**
Without group effect	**OLS**	-1.291349 (-1.17)	**.0307488 (3.03)***	**8.644994 (4.06)***	**.0931353 (4.61)**
	IV	-2.045933 (-0.76)*	.0311828 (3.05)*	*35.98425 (4.61)*	.092896 (4.60)
		R^2=18.9%	R^2=99.9%	R^2=18.9%	R^2=99.9%
With group effect	**FE**	-1.548131 (-1.84)*	-.3144162 (-1.40)*	7.723101 (4.70)*	2.059591 (7.65)*
	RE	-1.329502 (-1.22)	.0247192 (0.85)	8.644994 (3.59)	.3042034 (2.31)
τ =28					
Without group effect	**OLS**	1.231773 (0.69)	.0472256 (9.69)*	14.92254 (3.41)*	.1218722 (7.79)*
	IV	3.158217 (0.91)*	.0473158 (9.68)*	*50.35837 (4.04)*	.1217826 (7.83)*
		R^2=26.3%	R^2=99.9%	R^2=26.3%	R^2=99.9%
With group effect	**FE**	-.8246468 (-0.82)*	-.3113135 (-2.10)*	7.897439 (3.51)*	1.661248 (6.10)*
	RE	-.5888849 (-0.50)	1.343763 (1.88)	11.02227 (2.83)	3.775199 (1.28)
τ =40					
Without group effect	**OLS**	3.812256 (1.71)	.0538088 (11.68)*	9.037274 (1.51)	.1173794 (8.30)*
	IV	*9.103058 (4.10)**	.0538403 (11.64)*	*24.08604 (4.09)**	.117366 (8.30)*
		R^2=43.6%	R^2=99.9%	R^2=43.6%	R^2=99.9%
With group effect	**FE**	.6860237 (1.04)*	.0013749 (0.01)*	.0560187 (0.10)*	.3713941 (2.22)
	RE	1.513661 (1.09)	.0517005 (1.43)	.1552874 (0.14)	.2286623 (2.06)

Figure 4.1 Trade Integration for country pairs

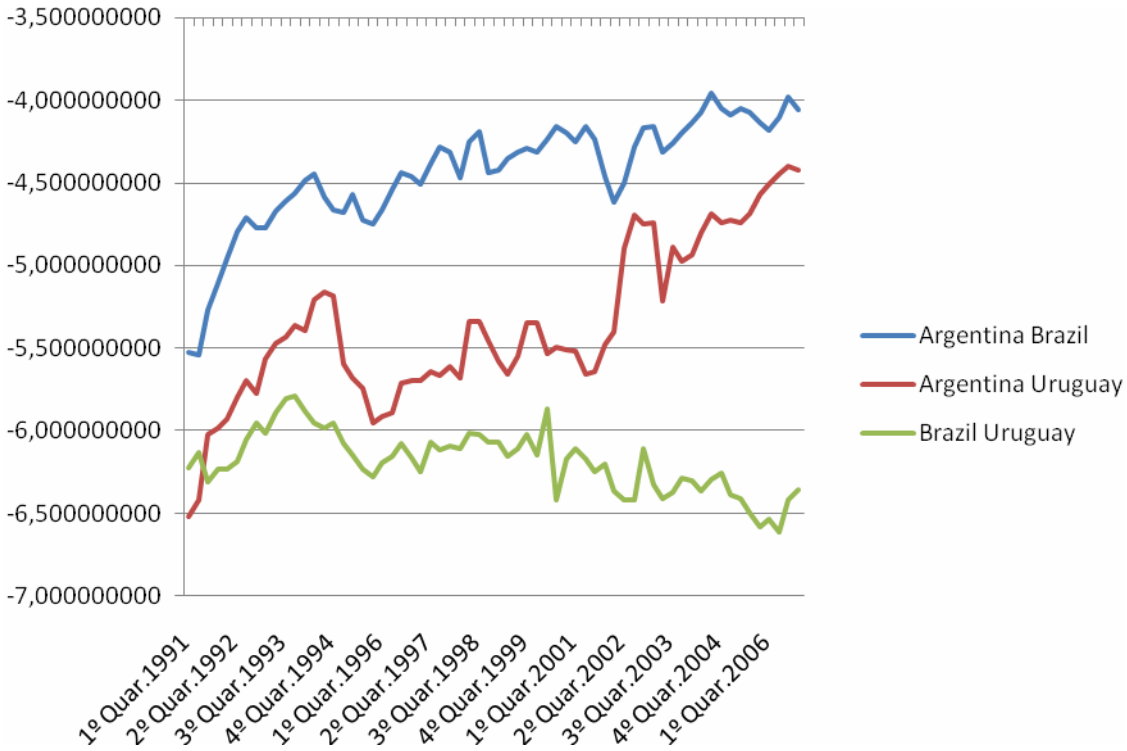
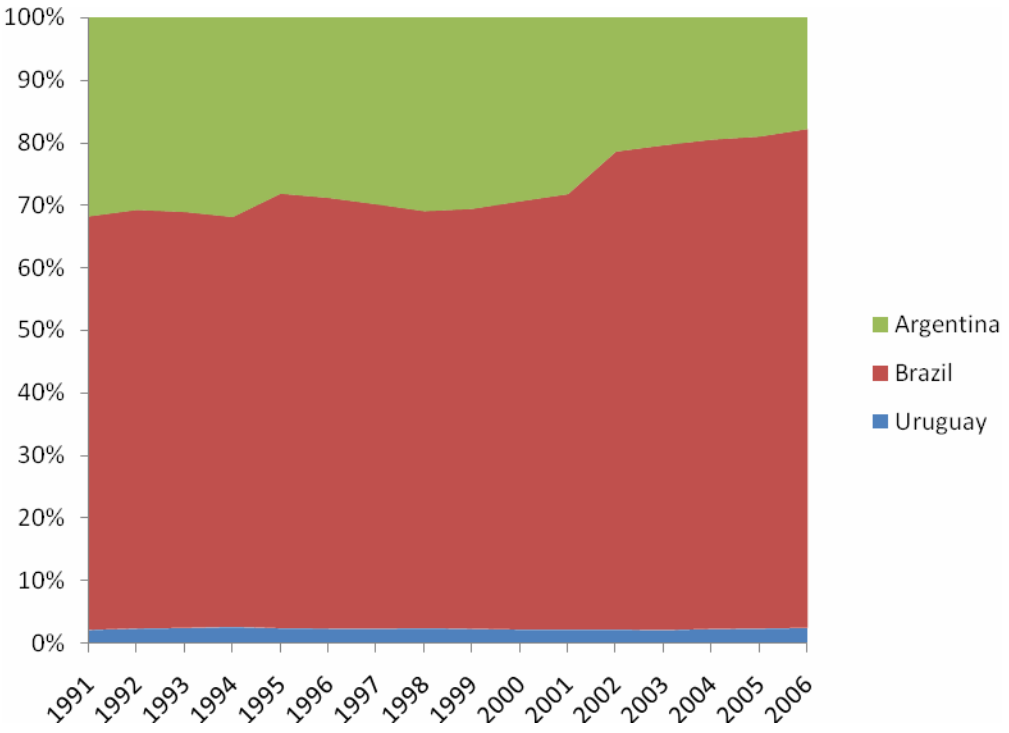


Figure 4.2 Mercosur GDP composition at constant prices (2000)



References

Artis, M. J., Zhang W. (1998) The Linkage of Interest Rates within the EMS, *Weltwirtschaftlilche Archiv*, **132(1)**, 117-132

Artis, M. J., Zhang W. (1997) International Business Cycles and the ERM: Is There a European Business Cycle?, *International Journal of Finance and Economics*, **2**, 1-16

Barrios, S., Lucio J. J. (2003) Economic integration and regional business cycles: Evidence from the iberian regions, *Oxford Bulletin of Economics and Statistics* **65 (4)**, 497–515, TY – JOUR

Bayoumi, T., Eichengreen, B., (1996) Operationalizing the Theory of Optimum Currency Areas, CEPR Discussion Paper, 1484

Bun, M., Klaassen, F. (2002) Has the Euro Increased Trade?, Tinbergen Institute Discussion Paper, 02-108/2

Buti, M., Suardi M. (2000) Cyclical Convergence or Differentiation?, Revue de la Banque/Bank- en Financiewezen, March

Canova, F., Dellas, H. (1993) Trade interdependence and the international business cycle, *Journal of International Economics*,**34**, 23-47

Carrera J.E., Perez P.E., Antonow M., Bellingi, Panigo D. (1998) Integral Analysis of the Macroeconomic Fluctuations in Argentina and Brazil, CACES, mimeo

Coe, D. T., Helpman, E. (1995) International R&D spillovers, *European Economic Review*, **39(5)**, 859-87

De Grauwe, P. (2005) Economics of Monetary Union, Oxford University Press.

De Nardis, S., Viccarelli, C. (2003) The Impact of the Euro on Trade. The (Early) Effect Is Not So Large, European Network of Economic Policy Research Institutes

EC Commission (1990) One Market, One Money, *European Economy*, **44**

Eichengreen, B. (1992) Should the Maastricht treaty be saved?, Princeton Studies in International Finance, 74, International Finance Section, Princeton University, December

Frankel, J. A. (1997) Open Versus Closed Regional Trade Blocs, Regionalism versus Multilateral Trade Arrangements, NBER East Asia Seminar on Economics, 6, Takatoshi Ito and Anne Krueger, editors, University of Chicago Press

Frankel, J. A.,Rose, A. K., (1998) The Endogeneity of the Optimum Currency Area Criteria, *Economic Journal*, Royal Economic Society, **108 (449)**, 1009-25

Frankel, J. A., Wei, S., (1995) European Integration and the Regionalization of World Trade and Currencies: The Economics and the Politics, Center for International and Development Economics Research (CIDER) Working Papers C95-053, University of California at Berkeley

Gros, G., Thygesen, N., (1988) The EMS: Achievements, Current Issues and Directions for the Future, CEPS Working Document, 35

Issing, O. (2001) Economic and Monetary Union in Europe: political priority versus economic integration?, Paper for the Conference 2001 of the European Society for the History of Economic Thought

Kaldor, N. (1966) The Causes of the Slow Growth of the United Kingdom, Cambridge: Cambridge University Press

Kenen, Peter (1969) The theory of optimum currency areas: an eclectic view, in R. Mundell and A. Swoboda, eds., Monetary Problems in the International Economy, Chicago: University of Chicago Press

Kenen P.B. (1995) Economic and Monetary Union in Europe. Moving Beyond Maastricht, Cambridge, U.K., Cambridge University Press

Krugman, P. (1991) Geography and Trade, Cambridge, Mass.: MIT Press

Licandro Ferrando, G. (1998) Coordinar para estabilizar, *Revista de Economia,* **2**, 51–94

McKinnon, R. (1963) Optimum Currency Areas, *American Economic Review,* **53**, 717–25

Micco, A., Ordoñez, G., Stein, E. (2003) The currency Union effect on Trade: Early Evidence on Trade, *Economic Policy*, London: CEPR

Mundell, R. (1961) A Theory of Optimum Currency Area, *American Economic Review*, **51**, 509-517

Myrdal, G. (1957) Economic Theory and Underdeveloped Regions, New York: Duckworth

Nitsch, V. (2001) Honey, I Shrunk the Currency Union Effect on Trade, *World Economy,* **25 (4)**, 457-74

Paglieri, B., Sanguinetti, P. (1998) Institutional Issues and the Results of the Tariff and Non-Tariff Liberalization in Mercosur, Mimeo, Universidad Torcuato Di Tella

Persson, T. (2001) Currency Union and Trade: How Large is the Treatment Effect, *Economic Policy,* **33**, 335-48

Rose, A. K., (2000) One Money, One Market: Estimating the Effect of Common Currency on Trade, *Economic Policy*, **30**, 9-45.

Rose, A. K., Van Wincoop, E. (2001) National Money as a Barrier to Trade: The Real Case for Monetary Union, *American Economic Review*, **91 (2)**, 386-90

Rose, A. K., (2004) Do We Really Know That the WTO Increases Trade?, *American Economic Review*, **94 (1)**, 98-114, March

Tavlas, G. (1993) The 'New' Theory of Optimum Currency Areas, *World Economy*, **33**, 663-82

Notes

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[2] On Janutary 1st 1995 Mercosur enacted a common external tariff for almost 85% of tariff items of the four countries.

[3] 57% of Argentina's protected products were steel related, 19% textile related, 11% paper sector, and 6% shoe sector, while Brazil protected industries ranging from wood and wine to petroleum, Paraguay primarily protected textiles, agricultural products, wood and steel, while Uruguay protected textiles, chemical and pharmaceutical products, electrical machinery, and metallurgic products.

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

[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 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] These plans included the 1970 Plan and the Tablita Plan in Uruguay, implemented in 1967 and 1990 respectively, the Tablita, Austral, Spring and Bonex plans in Argentina, and the Cruzad, Bresser, Summer, and the Collor I and II Plans for Brazil.

[8] European Commission has power to impose sanctions internationally for breaches of its legislation, such as in the area of competition.

[9] See EC Commission (1990), and Gros and Thsegen (1992).

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

[11] It estimates the unobserved components in time series following the Autoregressive Integrated Moving Average (ARIMA) model-based method. The trend, seasonal, irregular and transitory components are estimated and forecasted with signal extraction techniques applied to ARIMA models.

[12] Such a time span, corresponding to 7 years, is considered the conventional length of a business cycle