Disentangling Business Cycles and Macroeconomic policy in Mercosur: a VAR and an Unobserved Components Models approaches.

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This paper analyses the feasibility of a monetary union within the Mercosur, focusing on cycle synchronicity. Three questions are addressed, concerning respectively the features of shocks hitting each member, the impact of exchange rate regime differences on countries' responses and the share of common and idiosyncratic components in shocks and policy responses. Shocks are identified through identical country-VARs. This paper concludes that there exists a weak cycle synchronization, due to asymmetric shocks and divergences in policy responses. The endogenous approach in OCA theory can advise the adoption of a common nominal anchor, in order to speed up convergence.

Key-words : Business Cycles, OCA, Co-movement, VAR, Unobserved components model, Mercosur.

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1. INTRODUCTION

The Common market of the South (Mercosur) was created in 1991 by the Treaty of Asuncion signed between Argentina, Brazil, Paraguay and Uruguay. At the beginning the formal project was just a free trade agreement. During the 90s, the signatory countries envisaged a more ambitious economic and monetary process of integration. Then, an institutional framework promoting economic policy coordination was gradually set up. In 2000, the Treaty of Ouro Preto established a permanent structure dedicated to this coordination. Targets and procedures intended to allow the convergence of public deficit and the debt ratio were defined. A high-level macroeconomic Group of surveillance equivalent to the Ecofin council in the European Union was created.

During the 90s, Mercosur countries have been hit by successive regional and international shocks such as the Mexican (1994), Asian (1997), Russian (1998), Brazilian (1999) and Argentina (2001-2002) crises. These shocks strongly increased the volatility of macroeconomic variables. Paradoxically, despite the fact that the integration process suggests that policy coordination is the most efficient response to financial mayhem, economies gave priority to national concerns, weakening the economic and institutional links embodied in the Asuncion Treaty.

This evolution raises the question of the feasibility of a regional monetary union between the Mercosur countries[3]. The purpose of this study is to bring some elements of answer. Contrary to the basic optimal currency areas (OCA) literature which proposes a costs-benefit analysis of a monetary union[4], our approach is exclusively based on the business cycles properties of the Mercosur countries.

Our analysis focuses on business cycle synchronicity across countries, on the propagation mechanisms of shocks, and on their common and specific components.

A large body of empirical research focusing on the cyclical properties of Mercosur countries has been published. A first strand of literature uses different specifications to decompose cycles in specific and common components (Loayza, Lopez, and Ubide (1999); Karras (2003)). The main conclusion of this literature is that contrary to East Asian countries, Mercosur is not an OCA. A second strand of literature takes into account a larger macroeconomic framework with VAR or VECM models (Hallwood, Marsh, and Scheibe (2004); Fanelli and González-Rozada (2003); and Ahmed (2003)). The results of these studies exhibit low correlation of shock-disturbances not only inside the Mercosur zone, but also between Mercosur countries and the United States. A monetary union or a common peg to the dollar (dollarization) are not viable solution.

Our paper differs from the previous literature on several points. First, our analysis focuses on the period following the creation of Mercosur. Indeed, not only the quality of data for long periods is low

[3]. For date availability reasons, our study covers only three countries: Argentina, Brazil, and Uruguay.

[4]. See, for instance: Eichengreen (1998), Levy-Yeyati and Sturzenegger (2000), Larrain and Tavares (2003), Eichengreen and Taylor (2004), and Alesina, Barro, and Tenreyro (2003).

in emerging countries, but also, during the 80s, the three economies were very unstable, mainly due to the debt crisis and the bouts of hyperinflation: such disturbances make data processing very complex and unstable. So, our study begins in 1991 by taking into account more stabilized economies. Our approach of currency unions being based on business cycle dynamics, we use quarterly data, only available and comparable since 1990 for the three countries. As a result, the paper uses quarterly frequency for the period 1991-Q1-2006-Q1. Second, we build VAR models for each economy including more macroeconomic variables than previous studies. In comparison with studies decomposing shocks only into their specific and common components, we are able to identify the nature of disturbances hitting these countries. Contrary to bivariate VAR models, we take into account more diverse shocks such as external and domestic disturbances, but also policy shocks. Finally, we propose to break down structural innovations of domestic semi-structural VARs into unobservable common and idiosyncratic components using a state-space model (Harvey, 1990). These models respond to the drawbacks of the previous literature, of which the quasi-totality concentrates on the correlation of shocks without disaggregating the shocks into specific common and components constituent in every country. These results are used to check evidence of economic synchronicity, and convergence of macroeconomic policy.

Three questions linked to the feasibility of a currency union in Mercosur are addressed. First, what kinds of shocks –real or nominal, external or domestic- produce higher fluctuations in the three countries? If major shocks differ between countries, policy responses would probably limit the sustainability of any monetary union. Second, to what extent has the adoption of different exchange rate regimes affected the countries' reactions to disturbances? In other words, is the diversity of exchange rate regimes inside the area an obstacle to macroeconomic policy convergence? Different adjustments to similar external and/or domestic shocks give indications of the degree of convergence between Mercosur countries. Third, what is the respective share of common and specific components of disturbances in the studied countries? Weak common components imply large exchange rate adjustments decreasing the feasibility of a currency union. They result either from the existence of asymmetric shocks across countries or from the absence of macroeconomic policy coordination.

Several interesting facts emerge from our analysis. First, cross-correlations show a weak synchronicity of cycles which can be explained by the presence of asymmetric shocks and/or different economic policy responses to shocks. Such a result is observed not only for the synchronicity of cycles between each country and the United States, but also between the countries themselves. Second, the VARs confirm the weak convergence of the economic policies between these countries identified in other studies. While these countries seem all to be hit essentially by nominal shocks, the adjustments are different. This result rests on the fact Mercosur countries adopted different exchange rate regimes during the 90s: hard peg for Argentina and intermediate regimes for Brazil and Uruguay. Different adjustments to similar shocks suggest that the diversity of the exchange rate regimes inside the area is one of the main impediments to the convergence of economic policy. Third, despite different exchange rate regimes, our three countries share a similar behavior: fear of floating. Indeed, the VARs show that domestic interest rates don't significantly react to external and domestic real shocks. Even in countries with a soft peg, the nominal anchor exerts a constraint on the monetary policy. Fear of floating means here a fear of inflation. Finally, our state-space model shows the weak common component of shocks representing economic policies. It implies not only a weak convergence of economic policies, but also a low degree of coordination within the area. Indeed, we take into account economic policy shocks. Overall, our results converge to indicate that the Mercosur countries are not predisposed to form a monetary union either between them, or with the United States.

The policy implications of the results are the following. The Mercosur area adopted an institutional framework dedicated to the promotion of coordination between member countries. Our results suggest that this initial target is far from reached. The lack of a common anchor is one of the main causes of this fact. Indeed, it appears from our VARs that the nature of shocks is not significantly different between countries. So, to favor an economic policy convergence, it seems important that Mercosur countries adopt a similar anchor. Shock asymmetry between the Mercosur area and the United States implies that the US dollar is not a good candidate. Trade diversity from a geographic point of view suggests that a peg to a common currency basket would be a solution. An alternative solution, suggested for instance by Rose (2006), would be for Mercosur countries to adopt a similar inflation target in the conduct of their monetary policy.

The remainder of this paper is organized in five sections. Section two presents and analyzes business cycles in Mercosur. Cross-correlations are used to bring to light evidence of propagation mechanisms and comovements. Section three presents the outcomes of the estimates of a VAR model for each economy; it identifies the interdependence between domestic macroeconomic variables, and with external ones, and the sources of disturbances. Section four proposes to break down structural innovations of domestic VAR into unobservable common and idiosyncratic components using a state-space model. Section five concludes.

2. CYCLICAL COMOVEMENTS IN MERCOSUR: SOME EVIDENCE ON EMPIRICAL REGULARITIES.

To investigate the issues of business cycle synchronicity and propagation mechanisms of shocks we will begin the study by identifying some stylized facts relative to the three main partners of the Mercosur, and the United States.

Reporting in Table 2.1 the average quarterly *Industrial Production Index* (*IPI*) growth rate of the three countries from 1991Q1 to 2005Q3, we can draw a first conclusion about the dynamic of Mercosur countries for the period.

Table 2.1 Quarterly *IPI* Growth and Volatility (average quarterly growth rate in percentage from 1991:1 to 2005:3)

	Argentina	Brazil	Uruguay
Mean	0.003837	0.005532	0.000687
Median	0.008998	0.008397	-0.004677
Maximum	0.069170	0.078137	0.161532
Minimum	-0.146305	-0.109355	-0.147168
Std. Dev.	0.037041	0.032248	0.062580

Source: author's calculations using the IMF data base.

As a whole, average growth rates are very low. Brazil exhibits the highest growth rate with the lowest volatility; at the opposite, the Uruguayan *IPI* growth rate is both low and volatile. The wide gap between the observed maximum and minimum values of the growth rate reveals a high degree of instability. To conclude, real volatility is fairly high for the three countries (but it is the case of emerging countries in general, and of the Latin American ones in particular).

Stationarity and Cointegration Investigation

We begin by checking - for each country - the stationarity of interest rates, and of the logarithm of all the other variables[5]. Standard Augmented Dickey Fuller tests are largely perturbed by numerous shocks, periods of high inflation, stabilization programs, and changes in monetary, currency, or fiscal regimes. But even after correction of structural breaks (Perron, 1989), all data are I(1), except interest rates, which are apparently I(0). Finally, tests of cointegration (Johansen) failed to find any cointegrating vector[6]. Anyway, given the size of our data set, tests for inflation and cointegration are likely to have low power: we therefore followed economic theory to guide our choices.

To stationarize the I(1) series, we use two detrending methods:

1) The first differentiation of the logarithm of variables;
2) The decomposition trend/cycles by an HP filter. In this latter case, we had to choose values of lambda. Investigating business cycles in developing countries, Agenor, McDermott, and Prasad (2000) assess cycle length to be between two and four years. In another study, Rand and Tarp (2002) confirm that the usual length for industrialized countries -between 24 and 32 quarters– is not relevant for emerging markets: the duration of business cycle is clearly shorter, between 7.7 to 12 quarters. So, we deduce a lambda of 1600 for the United States and 400 for our emerging economies.

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[5]. Our model contains eight variables: *World Oil Price*, *US Industrial Production Index*, *Fed Funds Interest Rate*, and for each Mercosur country: *Industrial Production Index*, *Price Production Index*, *Money Market Interest Rate*, *Monetary Aggregate M2,* and the *Real Exchange Rate*. All the data are quarterly and come from the International Financial Statistics of the IMF. For a detailed analysis of these variables, see our VAR model below.

[6]. All the tests are available upon request to the authors.

In the following section, we just present the conclusions inferred from the times series detrended by the HP filter[7].

Cycles and Synchronicity in the Mercosur Area

We measure the degree of business cycle co-movement of quarterly *IPI* growth by pairs of countries. We will mainly focus on the magnitude of cycle synchronicity in the OCA perspective, looking at the cross-correlation of conjuncture between the three LA countries, and between them and the United States. For each LA country, we also computed the cross-correlation between a set of key macroeconomic variables. We only consider here results from the *IPI* cross-correlations[8].

Following Agenor, McDermott and Prasad (2000), we measure the degree of co-movement between two stationary components y_t and x_t, derived from our series using the same H.P. filter, by the magnitude of the correlation coefficient $\Delta(j), j \in \{0, \pm 1, \pm 2, ...\}$. We will consider the series "y_t" and "x_t" to be procyclic, acyclic, or countercyclic if the contemporaneous correlation $\Delta(0)$ is positive, zero, or negative, respectively. In addition, we deem the series to be strongly correlated if $0,27 \leq |\Delta(j)| \leq 0,27$, weakly correlated if $0,13 \leq |\Delta(j)| \leq 0,13$, and uncorrelated in the other cases[9]. We say that y_t leads the cycle by "j" periods if $|\Delta(j)|$ is a maximum for a positive "j", is synchronous with the cycle if $j=0$, and lags the cycle if $|\Delta(j)|$ is a maximum for negative j.

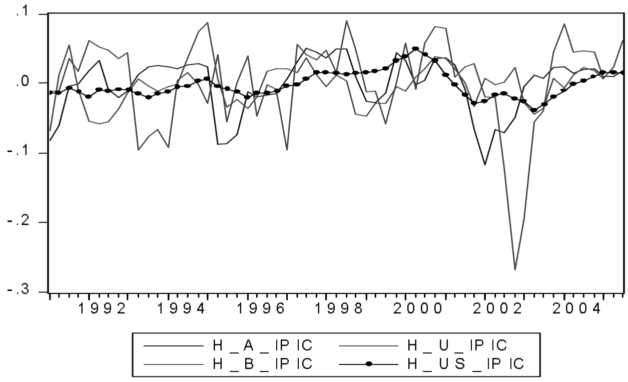
We distinguish the cycles with the United States on one side, and the cycles between the Mercosur countries on the other side.

Cross-correlations Between the United States and the Mercosur Countries

Figure 2.1 exhibits business cycles estimated with the HP filter for the United States and our three emerging countries.

[7] A similar analysis carried out with log differenced data, but not presented here, leads to the same conclusion.
[8]. Results concerning *Price Production Index* and *Real Exchange Rate*s are available from the authors.
[9]. The approximate standard error of these correlation coefficients, computed under the null hypothesis that the true correlation coefficient is zero and given a number of observations per country in the sample, is about 13,5.

Figure 2.1 Cycles in the United States, Argentina, Brazil, and Uruguay



NB: the prefix "*h*" and the suffix "*c*" indicate that the matter is about cycles stemming from the filtered (by HP) *IPI*. Letters *A, B, U, US*, indicate the three countries of Mercosur and the United States respectively.

Source: authors' calculations using the IMF datebase.

The figure confirms country specific periodicities, (not fundamentally modified by the choice of the value of lambda). Peaks and troughs of the Mercosur countries correspond to peaks and troughs of the US, but the difference of frequency involves a higher number of fluctuations in the first group of countries. Indeed, these are subject to numerous shocks increasing their macroeconomic volatility. Thus, the lagged correlations lose a part of their meaning as driving forces. The contemporaneous cross-correlations, presented in appendix 1, show very significant links between the United States on one side, and Argentina and Uruguay on the other side (0.39 in both cases) and a lesser influence of the American cycles on Brazil (0.27). We thus have here a first illustration of the greater autonomy of this economy, as will be confirmed below.

In terms of the relevance of a dollar area with the United States, we can thus conclude that the conditions are not fulfilled. The three Mercosur countries and the United States do not form an optimal currency area.

Cross-correlations Between the Mercosur Countries

As reported in appendix 1, the cross-correlations are sharply less significant than the ones computed for the countries of the European Union and for the various states of the United States. However, the correlation between the cycles of our three countries is not nil. Indeed, the contemporaneous correlations are significant except within Brazil and Uruguay. The lagged correlations confirm a common cycle with a three year periodicity for Argentina and Brazil: so, the figure in appendix 1 exhibits a fairly significant negative cross-correlation for six quarters, and again a strong positive correlation for twelve / thirteen quarters. At least, the Argentina cycle precedes the Uruguayan one.

This set of outcomes could suggest country specific periodicity of cycles. The gap with the U.S. conjuncture is striking, with no hints of any co-movement. In the Mercosur area, our analysis exhibits some evidence of cycle synchronicity. The following experiments will deepen these results.

3. MODELING DOMESTIC CYCLES AND PROPAGATION MECHANISMS

Literature on regional integration and OCAs stresses the identification of common shocks, the degree of similarity in the adjustment process of the candidates and the convergence of policy responses to shocks. This section aims at deepening these points. In the context of strong links of macroeconomic variables with complex feed back linkages, VAR approach constitutes a useful tool: it allows the assessment of the consequences of structural (orthogonal) shocks on endogenous external and policy variables. VARs are “a-theoretical”: the usual way to introduce theory passes through the inclusion of restrictions in the structural VARs (SVARs), leading to specific predictions relative to the time path of endogenous variables as consequences of shocks. It can also pass through the Cholesky ordering used to orthogonalize the impulses (this kind of “half” structural VAR is sometimes called recursive Var or RVAR). In this paper, the choice of a simple VAR in differences is made, due to the lack of cointegration vectors (any other solution would lead to greater forecast errors, as showed Allen, and Fildes, 2004).

Variable selection

Our choice of variables is the traditional one for VARs analyzing external shocks, and macroeconomic packages in open economies (Favero, 2001, Lütkepohl, & Krätzig, 2004). For the external variables, we chose the *World Oil Price* (noted *WOP*), the US Industrial Production Index (*US_IPI*) and the *US Federal Funds Rate* (*US_R*), a way to account for the main real supply and financial shocks. For the domestic variables (for each country *«i”, I= A, B, U*) , we took *Industrial Production Index* (*i_IPI*), *Producer Prices Index* (*i_PPI*), *Money Market Interest Rate* (*i_R*), *Money Aggregate* (*i_M2*), and *Real Exchange Rate* (*i_R*).

One of the first characteristic of this model is to build an identical VAR for each of our three economies, building-in the same elementary three variables US model (including: *World Oil Price*, *US IPI*, and *US Federal Funds Rate)*. We chose this option instead of adding external variables as purely exogenous to underline the interaction between these three variables in each of our national models. Thus, each national VAR is an 8 variables model, with 3 external variables and 5 domestic variables.

As usual in the literature, we suppose that structural (orthogonal) shocks are linear combinations of the residuals in the reduced form VAR models. The identification of the structural shocks of interest is carried out using contemporaneous restrictions based on the Choleski ordering of a recursive economic structure (with the most exogenous variable ordered first, i.e. here the external variables: *International Oil Price*, *US Product Index*, and *Federal Funds Rate*). It means that contrary to numerous similar works, we do not apply the "BQ" decomposition identification procedure (Blanchard, and Quah, 1989). Assuming a long term neutrality of nominal shocks would seem widely arbitrary for a work covering about twelve or so years, even if business cycles are – as shown above - shorter for these countries than for industrialized ones. *In fine,* the ordering follows the following order: *World Oil Price*, *US IPI, US Federal Funds Rate*, *Domestic IPI, Domestic PPI, Domestic Interest Rate, Domestic Money Aggregate,* and *Real Exchange Rate*, with a just identified scheme: contrary to Kim, and Roubini, 1997, we consider here domestic the interest rate as more exogenous than money demand (in their paper, both authors proposed an over-identified model, with a simultaneous feedback between money demand and the central bank rule).

Then, we deduce (orthogonal) structural innovations from the residuals of the reduced form VAR, using an identification restriction scheme (presented above). They are used to perform impulse response experiments and variance decomposition analysis of forecast errors. Finally, a state-space model will carry out a decomposition of structural shocks to extract the eventual common component.

The model

The first step was to estimate our VAR (in first differences of logarithms) for the three countries. The number of lags in each was selected using the common set of criteria and tests (available on the software Eviews). In presence of contradictory results, we followed the parsimony principle and chose the shorter lag (one lag for every country case). For each country "i", the standard (reduced) form of our VAR with constant is the following :

$$\begin{pmatrix} \Delta\ln\_WOP(t) \\ \Delta\ln\_US\_IPI(t) \\ \Delta US\_R(t) \\ \Delta\ln\_i\_IPI(t) \\ \Delta\ln\_i\_PPI(t) \\ \Delta i\_R(t) \\ \Delta\ln\_i\_M2(t) \\ \Delta\ln\_i\_ER(t) \end{pmatrix} = \begin{pmatrix} C_{wop} \\ C_{us\_ipi} \\ C_{us\_r} \\ C_{i\_ipi} \\ C_{i\_ppi} \\ C_{i\_R} \\ C_{i\_M2} \\ C_{i\_ER} \end{pmatrix} + \begin{bmatrix} C_{(1,1)} & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & C_{(1,8)} \\ \cdots & & & & & & & \\ \cdots & & & & & & & \\ \cdots & & & & \cdots & & & \\ \cdots & & & & & & & \\ \cdots & & & & & & & \\ \cdots & & & & & & & \\ C_{(8,1)} & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & C_{(8,8)} \end{bmatrix} \begin{pmatrix} \Delta\ln\_WOP(-1) \\ \Delta\ln\_US\_IPI(-1) \\ \Delta US\_R(-1) \\ \Delta\ln\_i\_IPI(-1) \\ \Delta\ln\_i\_PPI(-1) \\ \Delta i\_R(-1) \\ \Delta\ln\_i\_M2(-1) \\ \Delta\ln\_i\_ER(-1) \end{pmatrix} + \begin{pmatrix} e_{wop} \\ e_{us\_ipi,t} \\ e_{us\_r,t} \\ e_{i\_ipi,t} \\ e_{i\_ppi,t} \\ e_{i\_R,t} \\ e_{i\_M2,t} \\ e_{i\_ER,t} \end{pmatrix}$$

In order to account for specific country shocks during the period, we added dummies:

- for Brazil, from 1990Q1 to 1994Q2, i.e. for the period of accelerated inflation, up to the Real Stabilization Plan,
- for Uruguay, from 2001Q3 to 2003Q1, a period perturbed by Argentinean and Brazilian instability.

Tests for a dummy variable for the Argentinean Currency Board crisis did not reveal a significant effect. Therefore, we did not keep it in our model.

One has to keep in mind that our three economies have adopted different exchange rate regimes. These regimes have subsequently evolved, following independent paths for the period! We sum up this evolution:

- from 1991 to 2001, Argentina adopted a currency board (hard peg), then an independent regime of floating;
- from 1991 to 1997, Brazil adopted a crawling band regime (a kind of *Real Exchange Rate* targeting) more or less “de jure” and more or less narrow, according to the context. After the strong currency crisis, in January 1999, Brazil implemented a flexible exchange rate regime combined with inflation targeting.
- From 1991 to 2001, Uruguay adopted a crawling band, substituted in June 2002 by a flotation regime.

Results

We account for various kinds of shocks:

1) two external real shocks: the *World Oil Price* as an international shock, and the *U.S. Industrial Production Index* as a regional shock;

- one domestic real shock with the *Industrial Production Index* compiled for each Mercosur country;

- four domestic nominal shocks including the production price index, *Money Market Interest Rate*s, the monetary aggregate *M2* and the *Real Exchange Rate*. As the real and nominal exchange rates produce similar effects on countries, we classify the first ones as nominal shocks[10].

In addition, over the studied period, the *Real Exchange Rate* is strongly determined by the evolution of production prices. Nominal interest rates and *Real Exchange Rate*s are our policy variables. As in Eichenbaum and Evans (1995), *M2* represents here the money demand (we do not consider it as a policy instrument). In spite of this assumption, responses of *M2* to shocks remain difficult to interpret for the following reasons:

- in some cases (for instance, Brazil), this aggregate includes liquid public debts. As a result, the behavior of *M2* does not necessarily follow a transactional logic;

- changes in *M2* are partly linked to the dollarization of countries. More exactly, it is advisable to take into account the fact that the degree of dollarization is not the same among the studied countries, and that this monetary aggregate eventually builds deposits in foreign currencies. Let us clarify this point.

[10]. This observation is also valid for industrial countries. See Favero (2000).

Using the classification proposed by Reinhart, Rogoff and Savastano (2003), Argentina and Brazil belong to Type I dollarization –in which domestic and external liability dollarization co-exist- while Uruguay is a dollarized economy of Type II where dollarization is predominantly of a domestic nature. The degree of dollarization is different between these countries: high in Argentina (index 20 on a scale of 0 to 30) and Uruguay (21), but moderate in Brazil (7). By reporting the share of foreign deposits in percentage of total deposits, Table 3.1 confirms these facts.

Table 3.1 Foreign Currency Denominated Deposits (in percent of total deposits)

	1990	2001	2004
Argentina	47.2	71.5	10.7*
Brazil	0.0	6.1	6.5
Uruguay	88.6	83.0	83.0

* the decrease results from the forced "pesification"[11] of the economy after the exchange rate crisis in January 2002.

Source : Rennhack and Nozaki (2006).

Finally, we observe that in Argentina, *M2* includes some deposits in dollars, in opposition with Brazil and Uruguay. In the Brazilian case it is not really important given the moderate degree of dollarization of the economy. But it is not the same for Uruguay; in this country, we observe that the demand for money measured by *M2* does not respond exclusively to the traditional factors in monetary theory: it also depends on (external and domestic) events influencing the confidence in the domestic currency. For instance, during the Argentina crisis, the M3 growth (which includes dollars deposits) balanced the *M2* decrease in Uruguay, as consequence of a greater dollarization of the economy. Indeed, the Argentinean crisis casts doubt on the sustainability of the exchange rate regime in Uruguay[12].

External Real Shocks: Responses of Domestic Variables

The observation of *IPI* responses to *WOP* and *US_IPI* shocks shows a prevailing short term impact (about one-two quarters), with fluctuations of small magnitude. For instance, following a *WOP* shock, we observe an increase in the growth rate of the *IPI* for producers of gas and oil (Argentina and Brazil), and a limited drop in Uruguay. However, in every case, the equilibrium is restored within one year. Variance decomposition confirms these results. Innovations on *WOP* or the *US_IPI* never explain more than 10% of the variance of the *IPI* for our sample of three countries.

[11] adoption of "peso", the Argentinean Currency, as single domestic currency after the Currency Board Regime with official bi-monetarism (and the possibility to own deposit in both pesos and dollars)

[12]. The exchange rate regime of Uruguay collapsed in June 2002. The country adopted a floating regime.

In the three countries, a *WOP* shock leads to a price increase, either on impact, or at the end of the first quarter. The adjustment of production prices is quite fast in the three countries. The shock is indeed absorbed after five – six quarters. The price fluctuations are particularly significant in Argentina. The monetary regime reduces the smooth adjustments of the economy to shocks. As a consequence, either the adjustments are fast, but costly in terms of short-run instability, or on the contrary they are very slow and painful.

The short-term price increase following a shock on *US_IPI* is in accordance with the expected effects. The similarity of the effects with the shock on *WOP* does not mean that transmission mechanisms are identical. Higher oil prices increase production costs, while the supply increase due to the shock on *US_IPI* entails a price increase of raw materials, and possibly wage costs, with an impact on the *PPI*.

We find again differences as far as the size of the fluctuations is concerned. Argentinean prices react very strongly while Uruguayan prices very little. The two main economies of our sample have a significant price decrease after three quarters in Argentina and six in Brazil. Variance decompositions confirm the previous results. The innovations on *US_IPI* explain a significant share of price variance in Argentina and Uruguay, but not in Brazil.

The interest rate reactions to previous shocks are not very significant. The interpretation can be the following: whatever the exchange rate regime, the room for maneuver of monetary policies was weak for the main part of the period. Indeed, in the three countries, the interest rate was used to enforce the nominal anchor (where the exchange rate appears every time) in a context of disinflation policies. The counter-cyclical responses to shocks are thus limited. This analysis seems to be confirmed by the variance decompositions: none of the external real variables exerts any influence on the interest rates, except Uruguay with the *US_IPI*. The innovations on this variable explain 15% of the variance of *U_PPI* after twelve quarters.

For the three countries, the responses of *M2* to real external shocks are either not significant, or of very short term, with the exception of Uruguay. We find the weak influence of the external variables in the analysis of the variance decompositions. The innovations on the American production explain between 10 and 16% of the variance of the Uruguayan monetary aggregate. Neither the innovations on *WOP*, nor those on the *US_IPI*, explain the variance of *M2* in the two other countries.

In the three countries, the effects of real external shocks on the *Real Exchange Rate*s are weak and short.

External Nominal Shock: Response of Domestic Real and Nominal Variables

The US interest rate shocks are interpreted as monetary policy ones. After one quarter, output falls slightly following the monetary contraction in the United States. Prices do not show significant responses. Interest rates increase in Brazil and in Uruguay (which seems in accordance with the traditional financial links), but decrease in Argentina. However, this effect is a very short-lived one (less than one quarter) and according to common knowledge about the functioning of currency boards, interest rates adjust very quickly in Argentina. The responses of the aggregate *M2* are weak or not significant with the exception of the Uruguay: we observe a decline of *M2* on the impact of the shock explained by a monetary substitution process in favour of the dollar deposits not included in *M2*. In the three countries however, the adjustment is fast. And *Real Exchange Rate*s exhibit an over-shooting process, appreciating on the impact of the shock, and depreciating later (as expected). The fluctuations are of short run duration.

Overall, responses of domestic variables are weakly significant and produce only short term effects. This does not imply that Latin American countries are not influenced by US interest rates. However, over the sample period, except 1994-1995 and the period after the second quarter of 2004, the main trend has been a US expansive monetary policy. As a result, the size of interest rate shocks looks relatively weak over the period.

Variance decompositions confirm the weak influence of the US interest rate. The innovations of this variable explain:

- the variance of the Argentinean interest rate (as expected for a currency board country) but without a persistence effect (15% of the contemporaneous variance; 7.4% at quarter four),
- the variance of Uruguayan aggregate *M2* (9.6% of the contemporaneous variance without persistence),
- and the variance of the Uruguayan *Real Exchange Rate* with a strong persistence effect (17.1% of the contemporaneous variance; around 15% after).

Domestic Real Shocks

The responses to domestic supply shocks are of short duration and are weak or not significant, except for Brazil,. Moreover, the variance decompositions of the various domestic variables show that the innovations on the *IPI* explain the other variables only for Brazil (but without any long term effect). For instance, the innovations on *B_IPI* (*Industrial Production Index* of Brazil) explain 15% of the contemporaneous price variance… but just 7.6% after four quarters. Other nominal variables weakly influenced by *B_IPI* are interest rates (11.3% and 7.7%) and *M2* (9.7% and 8.4%) for the contemporaneous and quarter four variances.

Domestic Nominal Shocks

The analysis of variance decompositions allows us to stress the influence of prices in these economies. Innovations on prices do not explain the variance of production, but they exert a significant influence on other nominal variables. The effect on interest rates is important and persistent (around 30% in Argentina after one quarter; between 27 and 38% for Brazil; from 33 to 44% in Uruguay). The reaction of the authorities to any pressure on prices rests on the inflationary history of these countries.

We also find a significant influence on the monetary aggregates *M2* (particularly for Brazil). The impact is less important in both dollarized countries (Uruguay and especially Argentina). Innovations on prices explain around 25% of the variance of the *Real Exchange Rate* in Brazil and Uruguay, suggesting a limited adjustment of the nominal exchange rate linked to fear of floating. The extreme rigidity of the nominal exchange rate under a currency board explains the fact that prices exert a strong influence on the *Real Exchange Rate* in Argentina (more than 55% of its variance).

The innovations on interest rates are monetary policy shocks. The adjustments after an interest rate shock seem rapid in the three countries: the main part of the adjustment for the set of endogenous variable lasts four quarters for Argentina, seven for Brazil and six for Uruguay. Variance decompositions suggest that innovations on interest rates are not relevant explicative variables.

A shock on *M2* is interpreted as a nominal demand shock. The monotonous Argentinean money path converges smoothly in about six quarters. For Brazil and Uruguay, the path exhibits a negative overshooting, and then converges in about three quarters. These schemes can be explained by the differences in nominal anchors, linked to the exchange rate regime: in Argentina, the hard peg stabilizes money demand (which remains unstable in both the other partners of Mercosur). Innovations on *M2* induce a very short duration in macroeconomic fluctuations: two quarters in Uruguay, less that six in Brazil and six quarters in Argentina. The impact in Argentina is stronger. Variance decompositions show that innovations on *M2* explain from 16% to 18% of the variance of *IPI* in Argentina, but they do not exert any influence in the two other countries. Innovations on the monetary aggregate explain 10% of the variance of Argentinean prices after one year. The variance of interest rates in Argentina and Brazil is explained at the level of 12% and 10% respectively after four quarters. The long term influence of the interest rate rests on the monetarist approach of the monetary policy in the three countries. Indeed, a risk of excessive liquidity is synonymous with monetary tensions. Last, innovations on *M2* explain between 12 and 10% of the *Real Exchange Rate* variance in Uruguay.

A shock on *Real Exchange Rate* is a depreciation followed by a slight and short re-appreciation, in the three countries. The effects on other variables have a short duration, between two and three quarters. Variance decompositions confirm this weak influence of the *Real Exchange Rate* over the sample period... But we must remember that during the main part of the period, monetary authorities had smoothed its volatility, either because its adoption as “official” nominal anchor, or to avoid “pass through” effects (even after the adoption of inflation targeting and flotation regimes).

4. IDENTIFICATION OF COMMON AND COUNTRY SPECIFIC COMPONENTS OF STRUCTURAL SHOCKS USING A STATE SPACE MODEL

The main purpose of structural VAR estimation is to obtain non-recursive orthogonalization of the error terms for impulse response analysis and variance decompositions of forecast errors. Whatever the identification restrictions (short or long run), and their theoretical (or “a-theoretical”) foundations (choice of an "ad-hoc" scheme of identification, or decomposition " à la Blanchard and Quah" contrasting demand and supply shocks on the basis of long run neutrality on the supply side), these experiments don't allow the distinction between common and specific components of fluctuations and shocks. However, this distinction, and the overall weight of the common component, are the fundamental criteria of judgment in the choice of economic and monetary integration. Following the OCA theory, a too light weight of the common component implies significant adjustment of exchange rates in case of strong shocks. Such adjustments are difficult to endure in a simple free trade area; it becomes impossible in the case of a common monetary zone. In short, any integration process implies symmetry, i.e. a large common component.

The model

In order to assess the share of the common and idiosyncratic components in the variability of the structural shocks (policy shocks included), we propose a breakdown in two unobservable stochastic components using Kalman filter (Harvey, A.C., 1989, Kim., C.J., Nelson, C.R., 1999). The same method has been used by Bosco N'Goma (2000) for members of CFA Zone, by N.Chamie, A.Desserres, and R.Lalonde, 1994 for a comparison between Europe and USA, or by Lalonde and St-Amand (1993) for ALENA. We report here an adaptation of the explanations proposed by this set of papers.

The state-space models distinguish observed variables (the "signal" or "observation") and unobserved variables ("state" variables). They are composed of two sets of equations:

One or several "signal " (or "measurement") equations relating the observable variables to the unobservable states ;

One or several "state" (or "transition") equations describing how the vector of "states" evolves over time.

In this part, we aim at breaking down shocks affecting jointly the three members of Mercosur - or any pair of them – into two unobservable components: a common component for the three countries – or at least for two of them- and an idiosyncratic component, specific for each country. We note :

the three members by $i = A, B$ and U respectively for Argentina, Brazil and Uruguay ;

$\varepsilon_{i\_j,t}$ the real or nominal shocks, for period « t », with j=*IPI*, *CPI*, *En*, *R* ;

$\{n_{C\_j,t}\}$ the common components ;

$\{n_{i\_j,t}\}$ the idiosyncratic components ;

α_{i_j} and $\left(1-\alpha_{i\_j}\right)$ the respective weight of common and idiosyncratic components in each shock $\varepsilon_{i\_j,t}$;

The decomposition consists of the estimation of the parameters α_{i_j} and the time series $\left\{n_{C\_j,t}\right\}$ and $\left\{n_{i\_j,t}\right\}$.

In our state-space model, the following equations:

$$\begin{pmatrix} \varepsilon_{A\_j,t} \\ \varepsilon_{B\_j,t} \\ \varepsilon_{U\_j,t} \end{pmatrix} = \begin{bmatrix} \alpha_{A\_j} & \left(1-\alpha_{A\_j}\right) & 0 & 0 \\ \alpha_{B\_j} & 0 & \left(1-\alpha_{B\_j}\right) & 0 \\ \alpha_{U\_j} & 0 & 0 & \left(1-\alpha_{U\_j}\right) \end{bmatrix} \begin{bmatrix} n_{C\_j,t} \\ n_{A\_j,t} \\ n_{B\_j,t} \\ n_{U\_j,t} \end{bmatrix}$$

constitute the measurement (or transition) system, with the structural innovations – stemming from the decomposition of our reduced form VAR residuals – as endogenous variables.

To estimate the parameters α_{i_j} and the series $n_{C\_j,t}$ and $n_{i\_j,t}$, we need a set of transition equations, specifying the dynamics of the unobservable components. For identification purposes, we assume that common and specific components are uncorrelated. In a large number of software packages – and in particular Eviews 5 and Rats 6, used here – the identifying restrictions assume normalized structural innovations $\varepsilon_{i\_j,t}$, with unit variance. This normalization facilitates the comparison of structural shocks, stemming from our different country VARs estimated separately! We will also assume unit variance for the unobservable components. While determining the stochastic components path through the definition of their distributions, this assumption defines the transition equations. So, we can write as "state" system:

$$\Omega = \begin{bmatrix} Var(n_{C\_j,t}) & 0 & 0 & 0 \\ 0 & Var(n_{A\_j,t}) & 0 & 0 \\ 0 & 0 & Var(n_{B\_j,t}) & 0 \\ 0 & 0 & 0 & Var(n_{U\_j,t}) \end{bmatrix}$$

$$\begin{cases} Var(n_{C\_j,t}) = 1 \\ Var(n_{A\_j,t}) = 1 \\ Var(n_{B\_j,t}) = 1 \\ Var(n_{U\_j,t}) = 1 \end{cases}$$

Finally, we must choose a reference country shock to which the other shocks will be compared: we will choose Argentina when Argentina is present (and Brazil in the other cases) and start estimation initializing $\alpha_{i\_j} = 1$. The Kalman filter algorithm will be used to decompose the structural shock and idiosyncratic and (if they exist) common components.

We have printed in Appendix 4 the outcomes of our results. Specification tests are derived using a maximum likelihood approach (Harvey, A.C., 1989).

Foreign shocks

In all our results, C(1), C(2), and C(3) point out the weight of common components in the structural shocks for Argentina, Brazil, and Uruguay respectively. Shocks on foreign variables give us an assessment of the pertinence of the method. These variables, are present in the three VAR models (and thus endogenous). In the Choleski matrix allowing the identification of structural shocks, they are ordered as follows (from the least to the most endogenous): *World Oil Price* (*WOP*), *US Industrial Production Index* (*US_IPI*), *US interest on the Fed. Funds* (*US_R*). We can assume that the series of structural shocks for these foreign variables - deduced from the three equations of the three country models - embody a significant common component for the three countries: the origin of these shocks is exogenous and common for the domestic block of the three country models!

In spite of the poor performance of oil price estimation, we can check that the oil price shock common in the three systems… is effectively recognized as common by our program! It is a way to check that the UCM (Unobservable Component Model) identifies common components. To a lesser degree, it is also the case for both the other external variables (*US_IPI* and *US_R*) variables. In tables A.4.1., A.4.2., and A.4.3., the common component represents between 70 and 80% of the variance for oil shock, a little less for both the other shocks.

We can note also that the score for Brazil is always lower (a confirmation of the larger autonomy of the Brazilian economy regarding US conjuncture?)

Domestic shocks

The first shock is represented by the domestic series of structural innovations in the *IPI* in the three VARs. (Table A.4.4). The Argentine cycle is taken as the base (i.e. as the reference for the other countries). The Brazilian real cycle is not significantly linked to any common trend, contrary to the Uruguayan one. But even in this last case, the weight of the common component is lower that 10%.

We try to estimate a common component by pairs of countries in Mercosur. The experiment is consistent with the previous outcomes: Uruguay probably shares the same proportion of common components as in the three country model (even if the test here is less significant), and the Brazilian shocks do not share any common component either with Argentina or Uruguay. We got identical results as in the case of *PPI* shocks, with evidence of a common component between Argentina and Uruguay (Table A.4.5.)

In the case of the other shocks - domestic interest rates, money aggregate, *Real Exchange Rate*s - we did not find any hints of a common trend (Tables A.4.6, A.4.7, A.4.8.). As the last three shocks account more or less for economic policy, it is once more a proof of the lack of coordination between the three main partners of Mercosur. In short, these outcomes confirm the conclusions of Eichengreen and Taylor (2004) outlining the lack of policy coordination within the Mercosur. The lack of common components for *M2* also confirm the conclusion of our VAR: the money demand in the three countries follows idiosyncratic patterns!

5. CONCLUSION

Following the exogenous approach of OCA, our results converge to indicate that the Mercosur countries are not predisposed to form a monetary union either between them, or with the United States. May we conclude that in any case, Mercosur may not consider the adoption of a common currency? In line with one of our main conclusions stressing the importance of exchange rate regime adjustments in the face of macroeconomic shocks, the weak cycle synchronicity demonstrated in this paper is not *per se* an impediment to the formation of a monetary union.

As stressed by Frankel and Rose(1998), the adoption of a common currency can lead to an intensification of bilateral trade which in turn increases cycle synchronicity. This line of argument, as shown in numerous empirical papers, rests on the feature of national specialization: cycle synchronicity improves in the intra-industry trade case but not in the inter-industry trade one. Moreover, empirical studies suggest that the OCA endogeneity is relevant when bilateral trade between candidate countries to the currency union is already significant. From these two points, it is not the case for Mercosur countries. Then, weak cycle synchronicity – due to the choice of different exchange rate regimes - reduces the opportunity of economic policy convergence, even if institutional mechanisms exist to promote coordination inside the area.

At last, thought these results stem from VAR studies including more variables than the majority of papers published on the subject, we must interpret with caution these results. On one hand, the period of study is relatively short. On the other hand, the strong sensitivity of these countries to international capital flows was not explicitly taken into account here. So, a development of this study will a have to capture more precisely the financial instability of these countries and its consequences on the relative costs and benefits of a monetary union[13]. It is thus advisable to integrate into our analysis EMBI

[13]. Edwards (2006) uses probit panel regressions to investigate whether countries forming a monetary union have a lower occurrence of sudden stop episodes and of current account reversal episodes, and whether they are better able to absorb external shocks. His answers are negative: belonging to a currency union has not lowered the probability of facing a sudden stop or a current account reversal, and external shocks have been amplified in currency union countries.

spreads and the implications of dollarization, namely as far as the presence of balance-sheet effects following currency depreciations is concerned.

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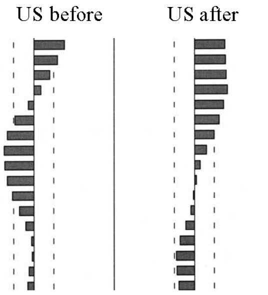
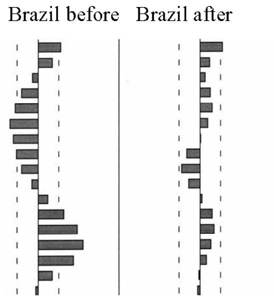
Appendix 1 *IPI* Cross-correlations

Argentina – United States



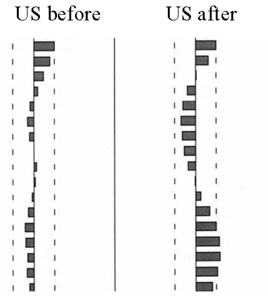
	lag	lead
0	0.3935	0.3935
1	0.3084	0.4070
2	0.2092	0.4150
3	0.0946	0.4291
4	-0.0708	0.3786
5	-0.2390	0.3198
6	-0.3430	0.2611
7	-0.3818	0.1637
8	-0.3734	0.0788
9	-0.3438	0.0273
10	-0.2748	-0.0102
11	-0.1823	-0.0478
12	-0.0985	-0.1128
13	-0.0307	-0.1828
14	-0.0222	-0.2335
15	-0.0602	-0.2256
16	-0.0774	-0.2047

Argentina - Brazil



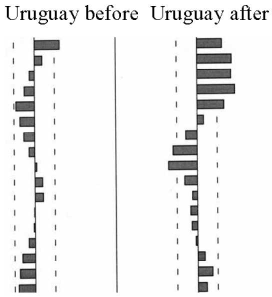
	lag	lead
0	0.2928	0.2928
1	0.1837	0.1237
2	-0.0691	0.0718
3	-0.2069	0.1347
4	-0.2917	0.1565
5	-0.3539	0.1060
6	-0.3124	0.0115
7	-0.2726	-0.1688
8	-0.2112	-0.2304
9	-0.0793	-0.1450
10	0.1307	0.0304
11	0.3341	0.1595
12	0.5013	0.1823
13	0.5772	0.1422
14	0.4583	0.0843
15	0.1856	-0.0087
16	-0.0324	-0.0285

Brazil – United States



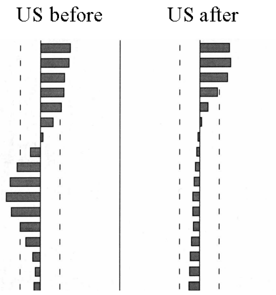
	lag	lead
0	0.2678	0.2678
1	0.2125	0.1690
2	0.1291	0.0092
3	0.0542	-0.1046
4	-0.0483	-0.1610
5	-0.0751	-0.1880
6	-0.0493	-0.1713
7	0.0056	-0.1458
8	0.0359	-0.0956
9	0.0242	-0.0079
10	-0.0171	0.0731
11	-0.0714	0.1826
12	-0.1103	0.2661
13	-0.1012	0.3043
14	-0.0765	0.3185
15	-0.0882	0.2816
16	-0.0567	0.2145

Argentina - Uruguay



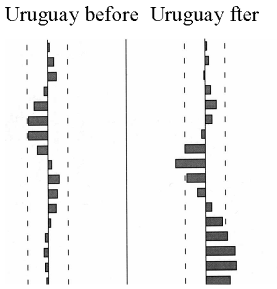
	lag	lead
0	0.3245	0.3245
1	0.0985	0.4427
2	-0.0655	0.4384
3	-0.1295	0.4840
4	-0.2346	0.3451
5	-0.1858	0.0849
6	-0.1390	-0.1416
7	-0.0700	-0.3109
8	0.0248	-0.3630
9	0.1032	-0.1604
10	0.1080	-0.0614
11	-0.0003	-0.0880
12	-0.0134	-0.0688
13	-0.0765	-0.0245
14	-0.1578	0.0930
15	-0.1955	0.1941
16	-0.2050	0.1187

Uruguay – United States



	lag	lead
0	0.3862	0.3862
1	0.3766	0.4051
2	0.3191	0.3610
3	0.3062	0.2304
4	0.2771	0.1114
5	0.1689	0.0269
6	0.0401	-0.0213
7	-0.1277	-0.0397
8	-0.2953	-0.0562
9	-0.3893	-0.0737
10	-0.4354	-0.0858
11	-0.3760	-0.0849
12	-0.2547	-0.0778
13	-0.1877	-0.1049
14	-0.0906	-0.1197
15	-0.0602	-0.1304
16	-0.0787	-0.1363

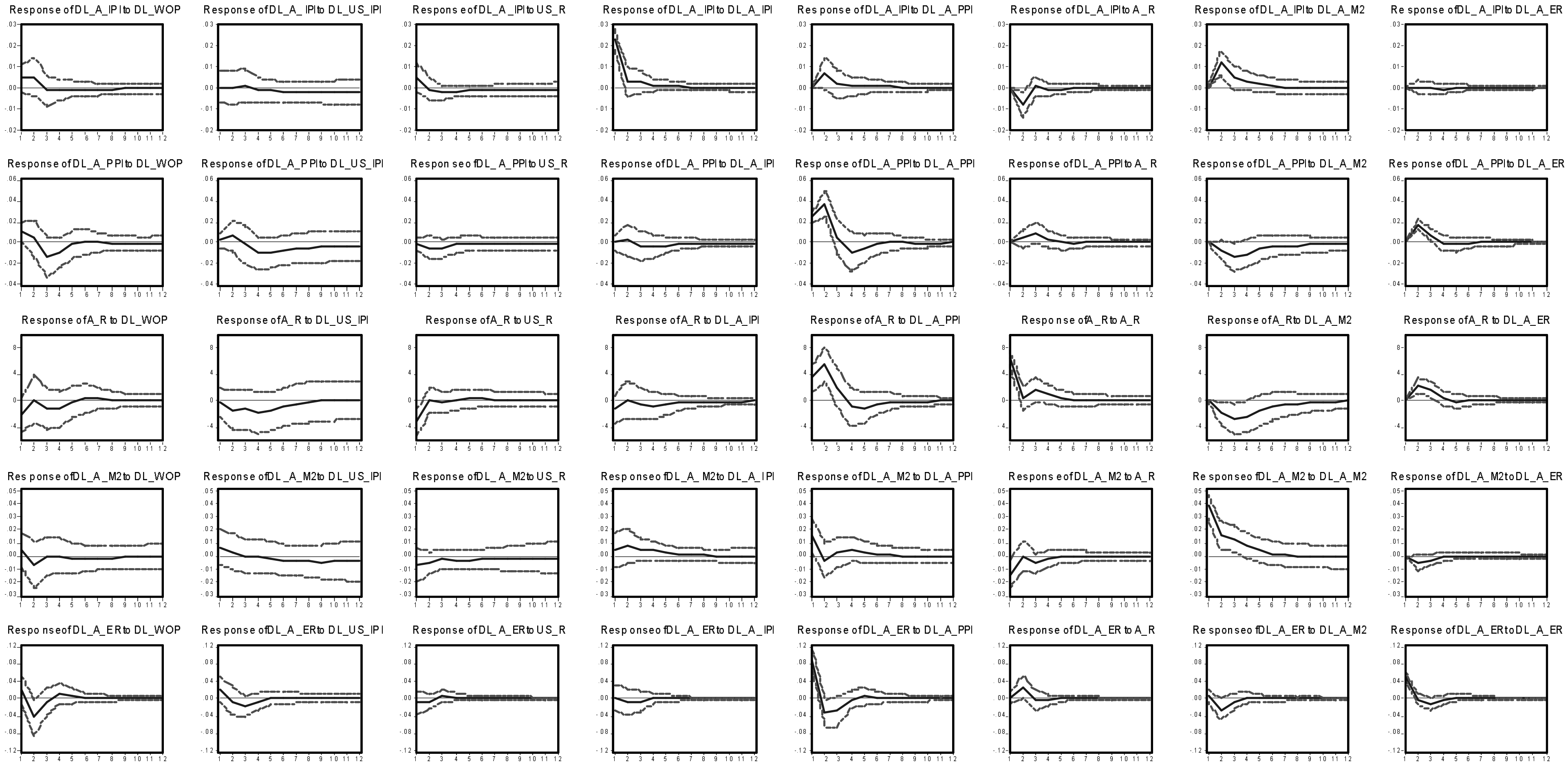
Brazil – Uruguay



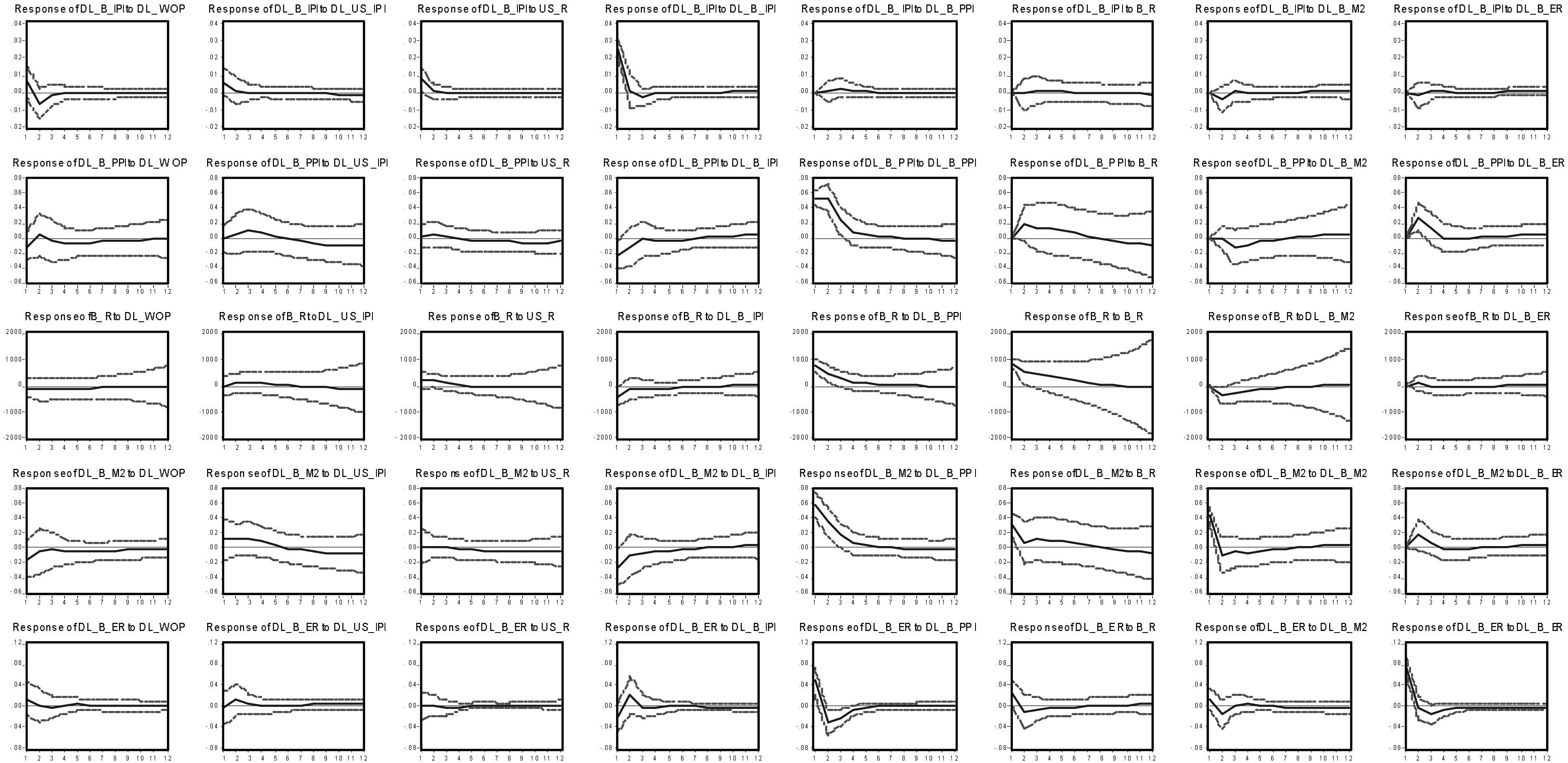
	lag	lead
0	0.0292	0.0292
1	0.0881	0.0548
2	0.1177	-0.0104
3	-0.0430	0.0764
4	-0.1779	0.1490
5	-0.2517	0.0954
6	-0.2523	-0.0440
7	-0.1360	-0.2656
8	0.0522	-0.3881
9	0.1495	-0.2422
10	0.1301	-0.0990
11	0.1088	0.0887
12	0.0397	0.2271
13	-0.0344	0.2935
14	-0.0540	0.3914
15	-0.0406	0.4042
16	-0.0206	0.3251

Appendix 2 Impulse responses

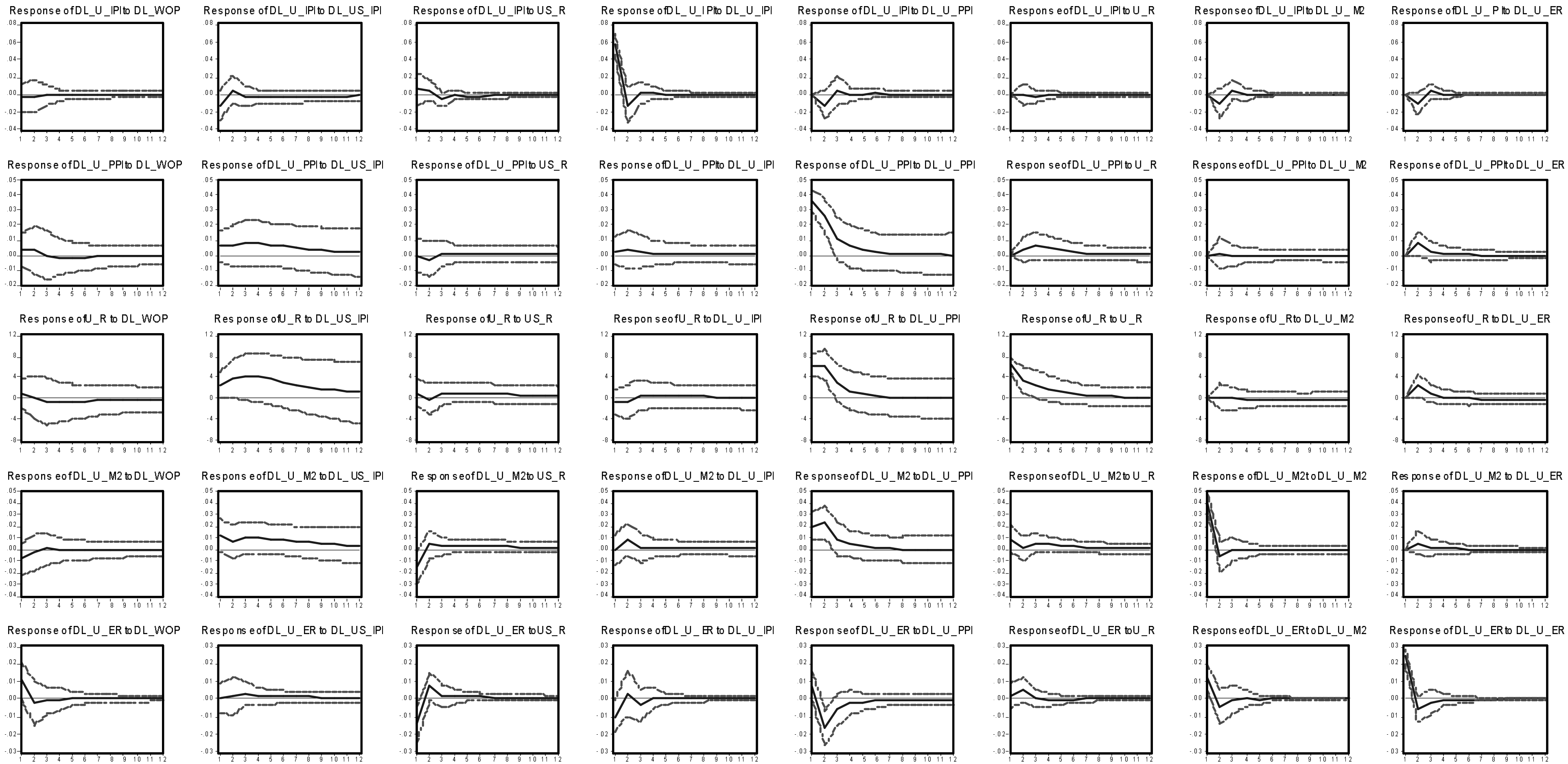
A.2.1. Argentina: Responses to Cholesky One S.D. Innovations ±2 S.E.



A.2.2. Brazil: Responses to Cholesky One S.D. Innovations ±2 S.E.



A.2.3. Uruguay: Responses to Cholesky One S.D. Innovations ±2 S.E.



Appendix 3 Variance Decompositions

A.3.1. Argentina

Variance decomposition of A_*IPI*:								
Period	*WOP*	*US_IPI*	*US_R*	A_*IPI*	*A_PPI*	*A_R*	*A_M2*	*A_ER*
1	3.76	0.02	4.21	92.01	0.00	0.00	0.00	0.00
4	5.55	0.24	3.63	59.34	5.80	6.89	18.49	0.06
12	5.45	3.75	4.25	56.21	5.68	6.55	18.04	0.07

Variance decomposition of *A_PPI*:								
Period	*WOP*	*US_IPI*	*US_R*	A_*IPI*	*A_PPI*	*A_R*	*A_M2*	*A_ER*
1	15.33	0.71	0.32	0.00	83.64	0.00	0.00	0.00
4	11.48	4.43	1.53	0.74	58.75	3.56	9.05	10.45
12	10.57	10.29	1.50	0.79	54.40	3.27	9.59	9.60

Variance decomposition of *A_R*:								
Period	*WOP*	*US_IPI*	*US_R*	A_*IPI*	*A_PPI*	*A_R*	*A_M2*	*A_ER*
1	6.01	0.09	14.93	2.27	16.88	59.83	0.00	0.00
4	5.02	4.68	7.37	1.74	31.91	31.78	11.60	5.90
12	4.88	6.82	7.09	2.00	30.62	29.74	13.33	5.53

Variance decomposition of *A_M2*:								
Period	*WOP*	*US_IPI*	*US_R*	A_*IPI*	*A_PPI*	*A_R*	*A_M2*	*A_ER*
1	1.01	2.33	2.46	0.87	11.65	9.67	72.03	0.00
4	2.32	2.13	3.28	4.15	9.86	8.12	68.90	1.23
12	2.57	5.48	4.12	4.21	9.69	7.60	65.17	1.15

Variance decomposition of *A_ER*:								
Period	*WOP*	*US_IPI*	*US_R*	A_*IPI*	*A_PPI*	*A_R*	*A_M2*	*A_ER*
1	3.14	3.61	0.83	0.01	68.66	0.01	0.36	23.39
4	13.79	4.72	1.07	0.57	55.35	4.30	4.37	15.83
12	13.95	4.77	1.09	0.58	55.21	4.28	4.36	15.76

A.3.2. Brazil

Variance decomposition of *B_IPI*:								
Period	*WOP*	*US_IPI*	*US_R*	*B_IPI*	*B_PPI*	*B_R*	*B_M2*	B_ER
1	5.47	4.72	7.15	82.66	0.00	0.00	0.00	0.00
4	9.48	4.50	6.59	76.06	1.06	0.35	1.59	0.38
12	9.43	4.93	6.76	74.90	1.11	0.68	1.71	0.49

Variance decomposition of *B_PPI*:								
Period	*WOP*	*US_IPI*	*US_R*	*B_IPI*	*B_PPI*	*B_R*	*B_M2*	B_ER
1	3.64	0.03	0.19	14.89	81.25	0.00	0.00	0.00
4	2.35	2.27	0.39	7.61	67.80	7.48	2.37	9.72
12	3.51	5.68	2.34	7.41	59.27	9.48	3.15	9.17

Variance decomposition of *B_R*:								
Period	*WOP*	*US_IPI*	*US_R*	*B_IPI*	*B_PPI*	*B_R*	*B_M2*	B_ER
1	0.49	0.05	2.34	11.29	38.82	47.01	0.00	0.00
4	2.55	1.39	2.56	7.65	30.67	44.48	10.16	0.54
12	3.69	2.47	2.84	7.57	27.95	44.05	10.55	0.88

Variance decomposition of *B_M2*:								
Period	*WOP*	*US_IPI*	*US_R*	*B_IPI*	*B_PPI*	*B_R*	*B_M2*	B_ER
1	3.04	1.69	0.06	9.67	45.06	13.49	26.98	0.00
4	2.75	4.48	0.12	8.40	47.32	12.62	20.98	3.33
12	3.48	6.33	1.32	8.25	43.66	13.54	19.92	3.50

Variance decomposition of *B_ER*:								
Period	*WOP*	*US_IPI*	*US_R*	*B_IPI*	*B_PPI*	*B_R*	*B_M2*	B_ER
1	2.34	0.20	0.00	5.15	23.17	6.85	2.10	60.19
4	1.92	1.50	0.08	7.51	29.37	6.67	3.52	49.45
12	2.08	2.09	0.40	7.44	28.83	6.96	3.65	48.54

A.3.3 Uruguay

Variance decomposition of *U_IPI*:								
Period	*WOP*	*US_IPI*	*US_R*	*U_IPI*	*U_PPI*	*U_R*	*U_M2*	*U_ER*
1	0.32	4.18	1.13	94.37	0.00	0.00	0.00	0.00
4	0.43	4.41	2.39	83.22	3.66	0.14	2.88	2.88
12	0.43	5.54	2.80	81.74	3.64	0.16	2.84	2.84

Variance decomposition of *U_PPI*:								
Period	*WOP*	*US_IPI*	*US_R*	*U_IPI*	*U_PPI*	*U_R*	*U_M2*	*U_ER*
1	0.97	2.48	0.01	0.56	95.97	0.00	0.00	0.00
4	1.04	7.68	0.35	1.10	84.41	2.71	0.07	2.64
12	1.24	12.48	0.61	1.22	78.64	3.28	0.07	2.46

Variance decomposition of *U_R*:								
Period	*WOP*	*US_IPI*	*US_R*	*U_IPI*	*U_PPI*	*U_R*	*U_M2*	*U_ER*
1	1.07	7.35	1.39	0.67	44.65	44.87	0.00	0.00
4	0.77	24.54	1.47	0.76	40.85	28.56	0.04	3.01
12	0.93	35.39	3.06	1.03	33.01	24.09	0.06	2.42

Variance decomposition of *U_M2*:								
Period	*WOP*	*US_IPI*	*US_R*	*U_IPI*	*U_PPI*	*U_R*	*U_M2*	*U_ER*
1	2.68	5.57	9.63	0.00	15.36	3.42	63.33	0.00
4	2.09	9.98	7.65	2.09	27.66	3.67	45.98	0.88
12	1.97	16.19	7.96	2.07	25.31	3.88	41.81	0.81

Variance decomposition of *U_ER*:								
Period	*WOP*	*US_IPI*	*US_R*	*U_IPI*	*U_PPI*	*U_R*	*U_M2*	*U_ER*
1	9.38	0.00	17.12	8.05	5.09	0.27	11.88	48.20
4	6.99	0.85	15.33	7.21	21.96	1.98	9.37	36.31
12	6.93	1.30	15.48	7.13	21.99	1.97	9.28	35.92

Appendix 4 Unobservable Components Models Estimations

Foreign Variables Shocks: Impact on the three economies

A4.1. Oil Prices

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.819431	0.016923	48.42136	0.0000
C(2)	0.686534	0.019256	35.65248	0.0000
C(3)	0.823999	0.027538	29.92181	0.0000

A.4.2. US IPI

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.724298	0.032420	22.34090	0.0000
C(2)	0.623213	0.029792	20.91877	0.0000
C(3)	0.680470	0.030621	22.22210	0.0000

A.4.3. US Federal Funds Rates

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.713784	0.047974	14.87868	0.0000
C(2)	0.515605	0.016995	30.33916	0.0000
C(3)	0.621358	0.031831	19.52076	0.0000

Domestic Variables Shocks:

In all our results. C(1), C(2), and C(3) point out the weight of common component in the structural shocks for Argentina, Brazil and Uruguay respectively. The reference country is defined as the country of which the cycle has a dominant weight during the attribution of the values of initialization. When Argentina is present, it is chosen as country of reference to the cycle of which are compared the other cycles. Otherwise, the reference country is Brazil. This choice is arbitrary, but it does not modify the results. In particular, it does not hide the presence of a common component when there is such component.

A.4.4. Domestic IPI

Three Countries

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.988419	0.075659	13.06418	0.0000
C(2)	0.062053	0.066537	0.932605	0.3510
C(3)	0.089826	0.052552	1.709269	0.0874

Argentina - Brazil

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.996318	0.075475	13.20067	0.0000
C(2)	0.061896	0.066450	0.931472	0.3516

Argentina - Uruguay

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.992016	0.072712	13.64311	0.0000
C(3)	0.089716	0.052350	1.713791	0.0866

Brazil - Uruguay

	Coefficient	Std. Error	z-Statistic	Prob.
C(2)	0.999858	0.082655	12.09675	0.0000
C(3)	-0.011601	0.066542	-0.174339	0.8616

A.4.5. Domestic PPI

Three Countries

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.986720	0.038162	25.85603	0.0000
C(2)	0.060653	0.056806	1.067715	0.2856
C(3)	0.099918	0.039829	2.508659	0.0121

Argentina - Brazil

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.996488	0.039015	25.54144	0.0000
C(2)	0.060459	0.056643	1.067373	0.2858

Argentina - Uruguay

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.990184	0.035279	28.06742	0.0000
C(3)	0.099788	0.039647	2.516874	0.0118

Brazil - Uruguay

	Coefficient	Std. Error	z-Statistic	Prob.
C(2)	0.998744	0.087787	11.37696	0.0000
C(3)	-0.034753	0.049299	-0.704946	0.4808

A.4.6. Domestic Interest Rates

Three Countries

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.998135	0.058554	17.04639	0.0000
C(2)	0.031792	0.070349	0.451915	0.6513
C(3)	0.029897	0.061313	0.487616	0.6258

Argentina – Brazil

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.999029	0.057348	17.42039	0.0000
C(2)	0.031783	0.069328	0.458445	0.6466

Argentina-Uruguay

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.999101	0.057251	17.45115	0.0000
C(3)	0.029889	0.060465	0.494313	0.6211

Brazil - Uruguay

	Coefficient	Std. Error	z-Statistic	Prob.
C(2)	0.995383	0.060596	16.42666	0.0000
C(3)	0.067176	0.048546	1.383755	0.1664

A.4.7. Domestic Monetary Aggregates

Three Countries

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.996839	0.081676	12.20484	0.0000
C(2)	0.013360	0.112377	0.118888	0.9054
C(3)	0.054749	0.090159	0.607243	0.5437

Argentina - Brazil

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.999819	0.082357	12.14010	0.0000
C(2)	0.013348	0.112580	0.118566	0.9056

Argentina - Uruguay

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.997006	0.048762	20.44652	0.0000
C(3)	0.054746	0.090161	0.607206	0.5437

Brazil - Uruguay

	Coefficient	Std. Error	z-Statistic	Prob.
C(2)	0.998854	0.112688	8.863914	0.0000
C(3)	-0.033048	0.076812	-0.430248	0.6670

A.4.8. Real Exchange Rates

Three Countries

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.998111	0.098674	10.11523	0.0000
C(2)	0.018343	0.057335	0.319934	0.7490
C(3)	0.039594	0.070296	0.563239	0.5733

Argentina - Brazil

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.999676	0.098761	10.12216	0.0000
C(2)	0.018334	0.057094	0.321123	0.7481

Argentina - Uruguay

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.998435	0.097671	10.22239	0.0000
C(3)	0.039590	0.069968	0.565824	0.5715

Brazil - Uruguay

	Coefficient	Std. Error	z-Statistic	Prob.
C(2)	0.997283	0.063833	15.62330	0.0000
C(3)	0.052956	0.055387	0.956107	0.3390