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Does a Monetary Union protect again foreign shocks? An assessment of Latin American integration using a Bayesian VAR

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Does a Monetary Union protect again foreign shocks? An assessment of Latin American integration using a Bayesian VAR

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Abstract:

This paper analyses the monetary consequences of the Latin-American trade integration process. We consider a sample of five countries –Argentina, Brazil, Chile, Mexico and Uruguay- spanning the period 1991-2007. The main question raised pertains to the feasibility of a monetary union between L.A. economies. To this end, we study whether this set of countries is characterized by business cycle synchronization with the occurrence of common shocks, a strong similarity in the adjustment process and the convergence of policy responses. We focus especially our attention on two points. First, we try to determine to what extent international disturbances influence the domestic business cycles through trade and/or financial channels. Second, we analyze the impact of the adoption of different exchange rate regimes on the countries' responses to shocks. All these features are the main issues in the literature relative to regional integration and OCA process.

Key-words : Business Cycles, OCA, Bayesian VAR, Latin American Countries

JEL Classification: C32, E32, F42.

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1. Introduction

The 1990s were characterized by an intensification of Regional Trade Agreements in the Americas. The main agreements are the Southern Common Market (MERCOSUR) –signed in 1991 between Argentina, Brazil, Paraguay, Uruguay (and more recently Venezuela), with Bolivia, Chili, Peru, Colombia, and Equator as associates- and the North American Free Trade Area (NAFTA) –signed in 1994 between Canada, Mexico and the United States with more and more agreements with other Latin American countries (LACs) (Chili, Peru, Equator…)[1]. Since 1994, a Free Trade Area Agreement for the Americas has been discussed, as an extension of the NAFTA. In the spirit of Eichengreen and Taylor (2004), this paper analyses the monetary consequences of this trade integration process. We consider a sample of five countries –Argentina, Brazil, Chile, Mexico and Uruguay- that account for some 70 per cent of the region's GDP spanning the period 1991-Q1 – 2007-Q1. The paper assembles a quarterly dataset (see Appendix 1 for data sources) including both main international macroeconomic variables –such as the GDP of the Group of seven countries and the world commodities prices index- and main domestic variables –such as GDP ant real exchange rates. In addition, we consider variables based on the literature dedicated to the sudden stop problem (Calvo et al., 2004): the Emerging Economy spread index and the foreign exchange reserves.

The main question raised in this paper refers to the feasibility of a monetary union between these countries. To this end, we study whether this set of countries is characterized by business cycle synchronization with the occurrence of common shocks, a strong similarity in the adjustment process and the convergence of policy responses. We focus especially our attention on two points. First, we try to determine to what extent international disturbances influence the domestic business cycles through trade and/or financial channels. Second, we analyze the impact of the adoption of different exchange rate regimes on the countries' responses to shocks. As showed in appendix 2, studied countries adopted very different exchange rate regimes over the 1991-2007 period. While at the beginning, the set of countries ranges from hard peg (Argentine currency board) to intermediate regimes, at the end, it exhibits a clear switch toward floating regimes.

The present paper is linked to two separate strands of literature. The first one, dedicated to the debate of monetary union versus dollarization, includes numerous papers analyzing the

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[1]. We can also mention the CARICOM (Caribbean Community and Common Market, 1973), the CACM (Centre America Common Market, 1960), CAN (Andean Community, 1969)

situation of Central and Latin American countries relative to the United States[2]. Empirical studies suggest that dollarization is not an obvious solution, even for Mexico. For instance, Karas (2003) finds that Mexican output fluctuations have been negatively correlated with the American fluctuations. According to Hallwood et al (2006), Brazilian, Chilean and Uruguayan permanent shocks are correlated with Argentina suggesting that monetary union could be a better solution than dollarization. The second strand of literature analyses the sources of business cycles fluctuations in emerging countries. Two lessons from this literature are especially interesting for our purpose. On the one hand, a large body of studies suggests that the main source of fluctuations originated from external factors. Aiolfi et al (2006) – considering a sample of four LACs[3]- identify the presence of a common regional factor. Taking into account the weak intra-regional trade integration, this result suggests that the regional business cycle (major turning points are common to the four countries) is driven by external variables and common external shocks. On the other hand, the financial channel – based on international interest rates for instance- seem more significant than the trade channel in understanding the influence of external shocks on domestic business cycle fluctuations in LACs[4].

The remainder of this paper is organized as follows. Section 2 explains the methodology adopted in this paper and founded on Bayesian structural VAR models. Section 3 presents the macroeconomic variables included in the VAR, the results and the policy implications. Section 4 concludes.

2. Methodology of the Study

This paper rests on two important methodological points: on the one hand, we propose a way to take into account the structural breaks affecting LACs over the period and, on the other hand, we use a Bayesian structural VAR.

2.1. Non-Stationarity and Structural Breaks: the Special Case of Emerging Economies

The emerging economies case –and more especially LACs- is not the simplest one to use times series methodology. Indeed, this group of countries exhibits numerous structural breaks –e.g. the end of hyperinflation and the dramatic increase in commodities prices after 2000- and/or changes in policy regimes such as the exchange rate regimes collapses that result in

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[2]. See for instance Salvatore (2001), Corbo (2001), Alesina et al. (2003), Karas (2003), Larrain and Tavares (2003), Hallwood et al. (2006), and Allegret and Sand-Zantman (2007 and 2008).
[3]. Argentina, Brazil, Chile, and Mexico over the period 1870-2004. See also Canova (2005) and Maćkowiak (2007).
[4]. See Ahmed (2003), Canova (2005), and Österholm and Zettelmeyer (2007).

new monetary policy frameworks. Since the seminal works of Nelson and Plosser (1982), most macroeconomic time series in level are considered unit root process. On the same sample than Nelson and Plosser, Perron (1989) challenged this interpretation, indicating that most macroeconomic variables are trend stationary, coupled with structural breaks. Looking at the Latin-American macroeconomic time series, we assert the same hypothesis: the econometricians had to take into account structural breaks due to non random external and internal shocks and change of policy regimes. The right way to deal with this question consists (in the Perron procedure) to test for unit roots in the presence of structural change at known date. If the date of the break is uncertain, other tests are available (Vogelsang and Perron, 1998, or Zivot and Andrews, 2002) on common softwares. However, as shown in Le Bihan (2004) all these procedures are powerless when the number and the date of the break are unknown. Overall, the combination of a short sample and multiple breaks weaken the break diagnosis compared to the following unit root test.

We choose a rougher but probably more securing method. First we identified the noticeable breaks of the figures[5] as being the well-known historical ones (due for instance to balance of payments crisis, or switches of policy regime): the results are displayed in Appendix 3. As particular (and generally deterministic) events, these breaks can hardly be considered as the N.I.D. stochastic innovations of a random walk. Second, in order to stationarize the macroeconomic series, we clean them from the various deterministic trends and intercept leaps, using simply time trends and dummy variables. We finish with a common A.D.F. test, finding all series stationary. Thus, we can exclude any cointegration relationship but a VAR in level is an available alternative to the VECM one; so we choose a recursive semi-structural approach for a VAR in level of the detrended series.

2.2. A Bayesian Structural VAR

Undeniably, the sample is short and the number of variables fairly high. In this case, Litterman (1979, 1984) suggests specifying blurred restrictions on the mean and variance of the coefficients instead of brutal "ad hoc" exclusions. As Doan (2007) concludes, "in a vector autoregression, we must concern ourselves not only with the lags of the dependent variables, but also with the lags of the other endogenous variables. Because of the stability conditions, we have some pretty good information about the size of lag coefficients in a simple autoregression. However, it's not so clear what the sizes of the coefficients on the other variables should be, and these depend, in part, on the relative scales of the variables

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[5]. To this end, we use Chow tests.

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involved". As indicated by Canova (2007), priors on the mean and variance of the variable allow dealing with over parametrization.

The choice of priors is the simplest one: overweighting the first lags of endogenous variables of each equation. Although a fine tuning prior is unrealistic, a deeper investigation must allow a better assessment of the consequences of innovations but it could be time-wasting.

In the same way, this version uses a semi structural BVAR. Using a Bayesian justifies once more avoiding a structural orthogonalization: Canova (2007) shows that the combination of Bayesian methods and structural hypothesis is not the simplest one, particularly for economies characterised by a succession of policy regimes.

3. The Model and the Results

3.1. Variables selection

Our variables are based on the traditional one for VARs analyzing external shocks and macroeconomic packages in open economies and on the literature dedicated to the sudden stop problem.

Each domestic VAR includes three external variables. As real external shocks, we consider (i) the Gross Domestic Product for the G7 (noted *LGDPG7*) and (ii) the world commodities prices excluding oil (noted *WCPNO*). Our choice to exclude oil from our commodities prices index is due to the fact that some LACs (for instance Brazil and Mexico) are both producers and consumers of oil.

The Emerging Economy spread index of J.P. Morgan (*EMBI*)[6] accounts for the international financial shock. Many studies chose US interest rates or international interest rates –such as LIBOR- to estimate the impact of external financial shocks on emerging markets. We prefer to use the *EMBI* in order to disentangle monetary policy shocks and financial shocks. Further, over our sample period, the *EMBI* does not seem significantly influenced by *LIBOR*, confirming the González-Rozada and Levy-Yeyati (2005) results which show that spreads are determined by global factors[7]. Uribe and Yue (2006) analyze the respective influence of US

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[6] We merged two time series: the EMBI for the period 1991Q1-1997Q4 and the EMBI+ from 1998Q1. As indicated in Cunningham (1999), the main differences between these indices are (i) the number of financial instruments embodied (the EMBI tracks returns and spreads on Brady Bonds and some other restructured sovereign debts, the EMBI+ tracks returns on a wider range of instruments), (ii) the number of countries (11 for the EMBI, 16 for the EMBI+). However, in both indices the weight of the LAC is very important (respectively 83.8% and 70.2%). Amongst the LAC, both Argentina and Brazil account for 47.6% of the EMBI+. In 1999, J.P.Morgan released a new index, the EMBIG (for "global") embodying more countries (27) and more titles. In this last index, LAC decreased to 61.5%.

[7]. We perform different experiments in our VARs: first, we include both *LIBOR* and *EMBI*; second, we include only *LIBOR*. Results do not significantly change. Granger causality tests do not exhibit relations between *EMBI* and *LIBOR*.

interest rates and EMBI shocks on the macroeconomic fluctuations in a sample of seven emerging countries covering the period 1994-2001. An important finding is that EMBI shocks exacerbate the US interest rate shocks, implying a strong macroeconomic volatility in the studied emerging countries.

For the domestic variables, we took the foreign reserves (*FOREX*) as proxy for the balance of payments, the gross domestic product (*GDP*), the consumption prices index (*CPI*), the nominal money market interest rate (*R*) and the real effective exchange rate[8] (*ER*).

Calvo et al. (2004) stress that sudden stop episodes are characterized by both international reserves losses and sharp current account reversals. The former increases the country vulnerability to shocks while the latter leads to output and employment contractions. Balance of payments quarterly data are not reliable and subject to sizable revisions. As a result, our VARs does not include current account data. As a proxy for sudden stop problems, we chose to include central bank's foreign exchange reserves. In order to test the robustness of the results, we substitute the deseasonalized exports-imports ratio to *FOREX*. This ratio represents a proxy for the intertemporal constraint of the current account: a decrease in capital inflows imposes the reduction of absorption in order to increase exports and decrease imports. Interestingly, the results do not change significantly. As a result, we prefer to consider only the *FOREX* variables in order to avoid some interpretation difficulties owing to the fact that the ratio obeys in part to competitive factors, and not exclusively to financial factors.

3.2. The Model

The model is tested separately for each LAC. The number of lags –two in each model- has been selected using the common set of criteria and tests. As the inverse roots of the AR polynomial lie in the unit circle, VARs satisfy the stability condition.

The following order of Choleski factorization is deduced from our theoretical interpretation of the contemporary correlation matrix of the reduced form residuals of each country model and from block exogeneity Wald tests.

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[8]. An increase (decrease) in the real exchange rate means real depreciation (appreciation).

$$
\begin{pmatrix}
CYC\_LGDPG7(t) \\
CYC\_LWCPNO(t) \\
CYC\_EMBI(t) \\
CYC\_Li\_GDP(t) \\
CYC\_Li\_CPI(t) \\
CYC\_Li\_FOREX(t) \\
CYC\_i\_R(t) \\
CYC\_Li\_ER(t)
\end{pmatrix}
+
\begin{pmatrix}
C_{1(1,1)} & & C_{1(1,8)} \\
& C_{1(i,j)} & \\
C_{1(8,1)} & & C_{1(8,8)}
\end{pmatrix}
\begin{pmatrix}
CYC\_GDPG7(t-1) \\
CYC\_LWCPNO(t-1) \\
CYC\_EMBI(t-1) \\
CYC\_Li\_GDP(t-1) \\
CYC\_Li\_CPI(t-1) \\
CYC\_Li\_FOREX(t-1) \\
CYC\_i\_R(t-1) \\
CYC\_Li\_ER(t-1)
\end{pmatrix}
+
$$

$$
\begin{pmatrix}
C_{2(1,1)} & & C_{2(1,8)} \\
& C_{2(i,j)} & \\
C_{2(8,1)} & & C_{2(8,8)}
\end{pmatrix}
\begin{pmatrix}
CYC\_GDPG7(t-2) \\
CYC\_LWCPNO(t-2) \\
CYC\_EMBI(t-2) \\
CYC\_Li\_GDP(t-2) \\
CYC\_Li\_CPI(t-2) \\
CYC\_Li\_FOREX(t-2) \\
CYC\_i\_R(t-2) \\
CYC\_Li\_ER(t-2)
\end{pmatrix}
+
\begin{pmatrix}
e_{CYC\_LGDPG7} \\
e_{CYC\_LWCPNO} \\
e_{CYC\_EMBI} \\
e_{CYC\_Li\_GDP} \\
e_{CTC\_Li\_CPI} \\
e_{CYC\_Li\_FOREX} \\
e_{CYC\_i\_R} \\
e_{CYC\_Li\_ER}
\end{pmatrix}
$$

with = *A* for Argentina, *B* for Brazil, *C* for Chile, *M* for Mexico, and *U* for Uruguay.

External variables are considered as the most exogenous. We assume that real external variables are predetermined relative to external financial ones. In addition, we consider that the *GDP* of the G7 countries exerts an influence on commodities prices through a demand effect. For domestic variables, different plausible orders have been experimented. They do not significantly change results.

3.3. Econometric findings

Using this framework, we combine the impulse response functions (tracing out the time paths of the effects of pure shocks on the set of variables, see Appendix 4), and the forecast error variance decomposition (indicating the proportion of the movements in a sequence due to its own shocks versus to the other variables, see Appendix 5). This allows us to assess the degree of similarities in the reactions of macroeconomic variables to shocks amongst the set of countries. At the same time, we get a first outline of the specific -versus common- economic consequences of shocks in terms of spontaneous adjustments, as well as in terms of policy responses[9].

Responses of domestic variables to external shocks: is transmission real or financial?

In all studied countries, *GDP* fluctuations are significantly influenced by foreign variables. Our results show that in Argentina, Brazil, and Chile foreign variables explain at least 29% of the *GDP* variance decompositions after 16 quarters. In Mexico and Uruguay, the shares are 16.1% and 20% respectively. Above all, no domestic variables –except *GDP* themselves- exert a higher influence than foreign innovations in all countries.

As expected, *GDP* increases after a shock on *GDPG7*. The positive influence of *GDPG7* means that improvement (vs degradation) of the business cycle in G7 countries can result in

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[9]. All results mentioned in the text but not displayed are available upon request to the authors.

an increase (vs slowdown) of growth in LACs. The weak influence of *GDPG7* is Brazil rests on the fact that this economy is a closed economy relatively to other studied countries.

In all countries except Uruguay, *GDP* increases after a shock on commodities prices (*WCPNO*) confirming the importance of commodities in LACs' business cycles. Not only contemporaneous responses are significant and positive but we also observe significant persistent effects.

A large body of empirical literature dedicated to business cycle in LACs stresses that growth in these economies follows international capital flows. More precisely, these studies suggest that the behavior of capital inflows is pro-cyclical: they tend to increase when growth in LACs improves. As a result, we can expect a significant influence of *EMBI* shocks on *GDP* during the period on our sample of countries. We find that *GDP* decreases after a shock on *EMBI*. The magnitude of the *GDP* response is important in Argentina and Uruguay, and to a lesser extent in Mexico. The Chilean case is particularly interesting. While Chilean spread stayed substantially below EMBI+ or Latin American spread over the period, its *GDP* responds negatively to *EMBI* shock. Even if the response is weakly significant from a statistical point of view, this result suggests that this type of shock is global, i.e. affects all countries, even economies beneficing from low idiosyncratic risk premium.

Our findings confirm Allegret and Sand-Zantman (2008) about the specific sensitivity of Argentina to *EMBI* shock. During the first half of the 90s, Argentina was one of the main borrowers in international capital markets enjoying very favorable financing conditions, while in the second half of the decade the economy suffered from a sudden-stop of capital inflows. In addition, the monetary policy constraints due to the currency board limited the ability of authorities to react in the face of *EMBI* shocks, inducing strong and ample macroeconomic variability.

Overall, LACs differ according to the respective influence of trade and financial channels. Two groups of countries can thus be distinguished: a first one, including Brazil, Chile and Mexico in which trade channels predominate and a second group, composed of Argentina and Uruguay where the financial channels exert the main influence on *GDP* variances. In addition, as suggested by the Chilean experience, international financial shocks have a global nature.

The relevance of the sudden stop

Two main points characterize the sudden stop literature. First, external factors exert a decisive influence on capital inflows into emerging markets. Second, depreciation results in contractionary output in emerging markets while it produces the traditional expansionist

effects in industrialized countries (Calvo and Reinhart, 2001). Indeed, exchange rate crises in emerging markets are followed by a sudden stop to capital inflows. These countries suffer from reserve losses and severe reversal in the current account deficit. Such reversal is based on a major decline in aggregates.

In order to assess the relevance of the sudden stop literature, we determine what variables – foreign or domestic, real or financial- exert the main influence on *FOREX* included in our VARs as a proxy of international capital flows. The theoretical prediction is that international financial shocks, here the *EMBI* shock- are the main variables influencing *FOREX* in our five countries. In addition, we analyze the influence of *FOREX* on other domestic variables. According to the sudden stop literature, a negative shock on *FOREX* must lead to a contraction in *GDP*.

Interestingly, from the sudden stop literature standpoint, *FOREX* is influenced by international variables, and more specifically by financial variables. Thus, the international financial shock produces the expected effects when significant. An increase in the spread – meaning degradation in the financial conditions for emerging countries- leads to a decrease in *FOREX* in Argentina and Brazil, and to a lesser extent in Chile after 3 quarters. Variance decompositions support the significant influence of *EMBI* on the behavior of *FOREX*. In Argentina, Brazil and Chile, *EMBI* innovations explain 15.4%; 8.2% and 7.8% of the *FOREX* variance. In the three countries, *EMBI* is its main explanatory variable. In addition, we find that *FOREX* does not respond to interest shocks. In other words, increasing the domestic interest rates is insufficient to favor the accumulation of international reserves. Such result is in accordance with the sudden stop literature that suggests that *FOREX* responds more to global shocks than domestic ones.

FOREX shock generates few domestic fluctuations. This deceptive result does not necessarily contradict the sudden stop literature. Indeed, as stressed by Izquierdo et al. (2007), episodes of financial volatility tend to produce effects on real variables only in short-run. A plausible explanation is that the more significant effects of sudden stop on domestic variables are absorbed extremely rapidly, within one or two quarters. VAR models in level are not well-equipped to detect these types of changes. Indeed, such models analyze the responses of macroeconomic variables to shocks of standard magnitude (usually one standard deviation), and not to unusual disturbances proper to crisis episodes. In addition, the main purpose of VAR models is not to identify crisis events. Crisis episodes are relevant only if they lead to structural breaks in the studied macroeconomic series.

Finally, we see that *GDP* decrease in the aftermath of the real depreciation. Three competing explanations are advanced in this paper. First, real depreciations may be synonymous of economic activity slowdown in the medium-term. This interpretation is not confirmed by the behavior of the *FOREX* variable. Indeed, while a negative response of *FOREX* to a real depreciation is expected –due to capital flows out- we observe in fact insignificant reactions of this variable. Real exchange rates innovations do not explain a significant share of *FOREX* variance in the five countries. Second, an alternative explanation of the negative relationship between *GDP* and real depreciations rests on the presence the presence of negative balance sheet effects. The inability to abroad in local currency –the so-called original sin- and the dollarization of the domestic economy can induce currency mismatch in the balance sheets of public and private agents. Using the degree of dollarization estimated by Reinhart, Rogoff and Savastano (2003), such explanation seems relevant only in Argentina and Uruguay[10]. Finally, a last explanation, most likely relevant in countries with low degrees of dollarization (Brazil, Chile and Mexico) suggests that the negative correlation between *GDP* and real exchange rate depreciations stems from shocks that induce both a real depreciation and a decline in *GDP*. Negative terms of trade shocks result in such negative correlation.

Credibility matters

Given the importance of inflationary history of numerous LACs, the responses of interest rates to innovations on consumption prices are particularly significant. Responses of interest rates are especially important to consider because they allow us to discriminate between credible and less credible countries. In Argentina and Chile, interest rates decrease or do not react after a *CPI* shock. In these two countries, inflation expectations are well anchored by the monetary regime in place in each country. Recall that from 1991 to 2001, Argentina had experienced a currency board arrangement while Chile had adopted an inflation targeting framework since 1991. In countries with soft pegs and a monetary policy not based on inflation targeting framework –as Brazil, Mexico and Uruguay- inflation expectations are imperfectly anchored. So, in such countries, shocks on prices induce higher fluctuations. Variance decompositions exhibit a clear picture. In Argentina and Chile, *CPI* innovations explain a mild or marginal share of the interest rates variances, respectively 8.7 and 0.2 contemporaneously; and 12.8 and 1.8 after 16 quarters, while in Brazil the respective shares

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[10]. According to the authors, Argentina and Brazil belong to Type I dollarization in which domestic and external liability dollarization co-exist; Uruguay is a dollarized economy of Type II where dollarization is predominantly of a domestic nature; and Chile and Mexico are Type III dollarization: the main part of debt in foreign currencies is external. Degrees of dollarization differ among our countries: high in Argentina (index 20 on a scale that goes from 0 to 30) and Uruguay (21), but weak in Brazil (7), Chile (7) and Mexico (5).

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are 70.9% and 68.2%. In this latter country interest innovations explain only a weak share of the *CPI* variance (0% contemporaneously and 10.2% after 16 quarters). As expected, *CPI* shocks lead to real exchange rate appreciations. In comparison with countries enjoying an imperfect monetary credibility, the responses of the real exchange rate are short-lived in Argentina and Chile.

3.4. Policy recommendations

Previous results result in three main economic policy implications. First, from an optimal currency area perspective, our study shows that foreign variables engender a near-common business cycle in the region. Indeed, LACs tend to react similarly to same foreign shocks whatever the exchange rate regime. Contrary to several studies, we find that real channels seem as important as financial ones in explaining the influence of foreign variables on domestic ones in the majority of the studied LACs. Above all, we do not detect significant adverse asymmetric external shocks among our studies countries even if different degrees and types of dollarization imply that LACs are more or less sensitive to international financial shocks. In other words, most external shocks are common to LACs and characterize global shocks. As a result, putting the house in order is a necessary but not sufficient condition to avoid cyclical fluctuations due to global shocks. An important question is to determine to what extent a monetary union may insulate against such shocks. Using 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, Edwards (2006) finds that belonging to a currency union has not lowered the probability of a sudden stop or a current account reversal, and external shocks have been amplified in currency union countries.

From this perspective, a sustainable monetary union rests on mechanisms internalizing repercussions from such adverse shocks. On way is to favour more exchange rates flexibility in order to use them as shock absorber. Since 2002, LACs exhibit a clear shift to more flexible exchange rates. But this process may be unfavourable to economic and financial integration if it leads to higher bilateral exchange rates volatility. In order to improve the ability of LACs to cope with external shocks, economic policy coordination between them needs to be strengthened. The institutional framework for such purpose already exists. Indeed, the Treaty of Ouro Preto (2000) 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. In 2002 has been launched the project of the Monetary Institute for Mercosur. Clearly, policy coordination improves the ability of LACs to respond to external shocks, but coordination does not suffice. As, according to our results, global shocks are largely symmetric, LACs may create a regional monetary fund in order to use it in case of adverse external shocks. Such regional fund, already envisaged in East and South-East Asia, may function as a mutual insurance mechanism.

A second policy implication refers to the question of the monetary policy credibility. Indeed, our estimates do not allow us to distinguish countries according to their exchange rate regimes. A better distinction to analyze the responses to similar shocks is based on the different degrees of credibility. As well-known, LACs have a long history of inflation resulting in fragile inflation expectations anchor. Since the beginning of 1990s, credibility gains have been impressive in LACs. The main point is that, as suggested by the endogenous OCA approach, differences in authorities' credibility may represent an impediment to the convergence targets. To favor an economic policy convergence, it seems important that LACs adopt a similar anchor. Shock asymmetry between the LACs and the United States implies that the US dollar is not a good candidate. As a result, LACs need an alternative anchor to dollarization to avoid "the perennial misuse of monetary policy" by their central banks (Corbo, 2001: 246). Trade diversity from a geographic point of view may favor a peg to a common currency basket. But such peg lacks transparency. An alternative solution, suggested by Rose (2006), would be for LACs to adopt a similar inflation target in the conduct of their monetary policy. Brazil, Chile and Mexico have already adopted such monetary framework. Their central banks have benefited from inflation targeting to strengthen their credibility. Interestingly, all these countries have experienced better inflation performance than Argentina and Uruguay that have adopted a monetary aggregate target in the aftermath of their exchange rate regime collapse[11].

Finally, the lack of financial structure convergence -mainly due to different degrees and types of dollarization- is an additional factor explaining the slow economic policy convergence. Indeed, dollarized countries such as Argentina and Uruguay are especially sensitive to specific shocks limiting their ability to converge with Brazil from an economic policy point of view. From an economic policy standpoint, the development of domestic bonds markets must continue in order to reduce the currency mismatch and, then, the financial vulnerabilities of

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[11]. In addition, recent Argentine and Uruguayan experiences suggest that the authorities of these two countries follow a *de facto* managed floating regime in which their exchange rates are confined within a very narrow range. As a consequence, these multiples objectives damage the credibility of their central banks leading to a slowdown of their inflation convergence towards Brazil and Mexico (the best performers).

LACs. Credibility gain may lead to a decrease in the dollarization degree in the region and favor the convergence of financial structure of these countries. Recall that dollarization remains high in Uruguay meaning that its financial vulnerabilities are still important.

4. Concluding remarks

Our results converge to indicate that LACs are influenced by foreign variables, either the real one for Brazil, Chile, and Mexico, or the financial one for Argentina and Uruguay. Our attempt to test the relevance of the sudden stop literature leads us to mixed conclusions. If our proxy of international capital inflows –the *FOREX* variables- is significantly explained by foreign financial variables, the analysis of domestic variable responses to *FOREX* shocks does not follow the predictions of common knowledge.

We need to be cautious in the interpretation of our results. On the one hand, our analysis does not take into account the real convergence process. Camarero et al. (2006) study such process by considering productivity differences among Mercosur countries. Over the period 1960-1999, the authors find the presence of a "Mercosur club" meaning a real convergence process. Regional integration has played a significant role in this process. As suggested by Camarero et al. (2006), real convergence raises the question of the level of the exchange rate chosen by each country at the entering date in the monetary union. Indeed, as most LACs know a catching-up process, their equilibrium exchange rates may change. On the other hand, our VAR models ignore regional interdependencies despite the fact that spillovers within the region exert a significant influence on the LACs' business cycles. For instance, Uruguayan economic activity depends mainly on Argentine and Brazilian business cycles. In addition, some empirical studies suggest that financial markets interdependencies may explain exchange rates movements within the region[12].

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Appendix 1 Data and Sources

Data	Sources
GDP Group of Seven	OECD
World commodities prices excluding oil	IMF, International Financial Statistics
EMBI	Ministry of Economy and Production of the Republic of Argentina (http://www.mecon.gov.ar/peconomica/basehome/infoeco_ing.html)
GDP	IPEA (http://www.ipea.gov.br) for Argentina, Brazil, Chile, and Mexico Central Bank of the Republic of Uruguay
Consumption Prices Index	IMF, International Financial Statistics
Foreign Exchange Reserves	IMF, International Financial Statistics
Money Market Interest Rates	IMF, International Financial Statistics for Argentina, Brazil, Mexico, and Uruguay Central Bank of Chile for Chile
Real Exchange rates	IMF, International Financial Statistics for Chile and Uruguay Central Bank of Argentina for Argentina IPEA for Brazil OECD for Mexico

Appendix 2 Exchange Rate Regimes in the Selected Latin American Countries

Countries	Year/Month	Exchange rate regime	Countries	Year/Month	Exchange rate regime
Argentina	1990-M1	Independently floating	*Brazil (cont.)*	1998-M4	Forward-looking crawling peg
	1991-M1	Horizontal band		1999-M1	Independently floating
	1991-M3	Currency board	*Chile*	1990-M1	Backward-looking crawling peg
	2001M12	Managed floating		1998-M9	Forward-looking crawling peg
	2004M11	Other tightly managed floating		1999-M9	Independently floating
Brazil	1990-M1	Backward-looking crawling peg	*Mexico*	1990-M1	Forward-looking crawling peg
	1990-M3	Managed floating		1994-M12	Independently floating
	1991-M5	Backward-looking crawling peg	*Uruguay*	1990_M1	Backward-looking crawling peg
	1994-M7	Tightly managed		1992_M1	Forward-looking crawling peg
	1995-M3	Backward-looking crawling peg		2002-M6	Independently floating

Source: from A. Bubula and I. Ötker-Robe's Database.

Appendix 3: Structural breaks

International Variables

The Commodity Prices and the *EMBI* are both marked by a structural break from the last quarter of 2001, due to the simultaneity of a Commodity Prices hiking and a decrease of *EMBI*.

Domestic Variables

Argentina :
Except the economic mayhem at the beginning of the 90s, the only structural break (intercepts and trends) comes from the exchange rate collapse of 2002. Attacks on Foreign Reserves are perceptible since 2001, with the unhooking of both the Foreign Reserves and the Interest Rate. About one year later, it hits the Exchange Rate, the *GDP* and the *CPI*.
Let us note in particular that the Tequila contagion (after the Mexican Crisis of 1994-95) is not obviously perceptible.

Brazil:
Two well known events are worthy of note: the Real Plan in 1994 and the currency crash of 1998-99. But in 2002, the Argentinean crisis contagion and the political uncertainty of the presidential election weighted on the Exchange Rate. Except this point, we had to introduce a break for 1994 in the *CPI*, the Foreign Reserves, and the Interest Rate (but curiously neither for the real Exchange Rate nor the *GDP*). The 1998-1999 crisis hits significantly the Exchange Rate and the Foreign Reserves (but neither the *CPI* nor the interest rate).

Chili:
The Chilean economy is particularly sensible to international financial mayhem: so, the main break is due to the Asian Crisis, in 1997, hitting all the variables except the *GDP*. But the uncertainty following the Argentinean crisis is perceptible as much on the Exchange Rate as on the Interest Rate.

Mexico:
Obviously, the Currency Crash of 1994-95 hit all the real and nominal variables, beginning in the last quarter of 1994 with the Foreign Reserves, the Interest Rate, and then hurting the Exchange Rate, the *CPI*, and the *GDP* in 1995.

Uruguay:
The introduction of structural breaks in the case of Uruguay could be discussed. Although some shocks are obviously non-random ones, the high frequency of macro-fluctuations in the Uruguayan case turns break detection difficult. However, two shocks are clearly perceptible, with a break on the *GDP* (due to the Brazilian Currency Crash at the end of 1998) and a break on all the macroeconomic variables (except the CPI) after the Argentinean Crisis of 2002.

Appendix 4 Forecast Error Impulse Responses of One Standard Deviation (Innovations ±2 SE)

1- Are International Transmission Real or Financial?

Figures display for each country **the responses of GDP to GDPG7, WPNCO and EMBI shocks** respectively.

Argentina: **shocks**
GDPG7 WPNCO EMBI

Brazil: **shocks**
GDPG7 WPNCO EMBI

Chile: **shocks**
GDPG7 WPNCO EMBI

Mexico: **shocks**
GDPG7 WPNCO EMBI

Uruguay: **shocks**
GDPG7 WPNCO EMBI
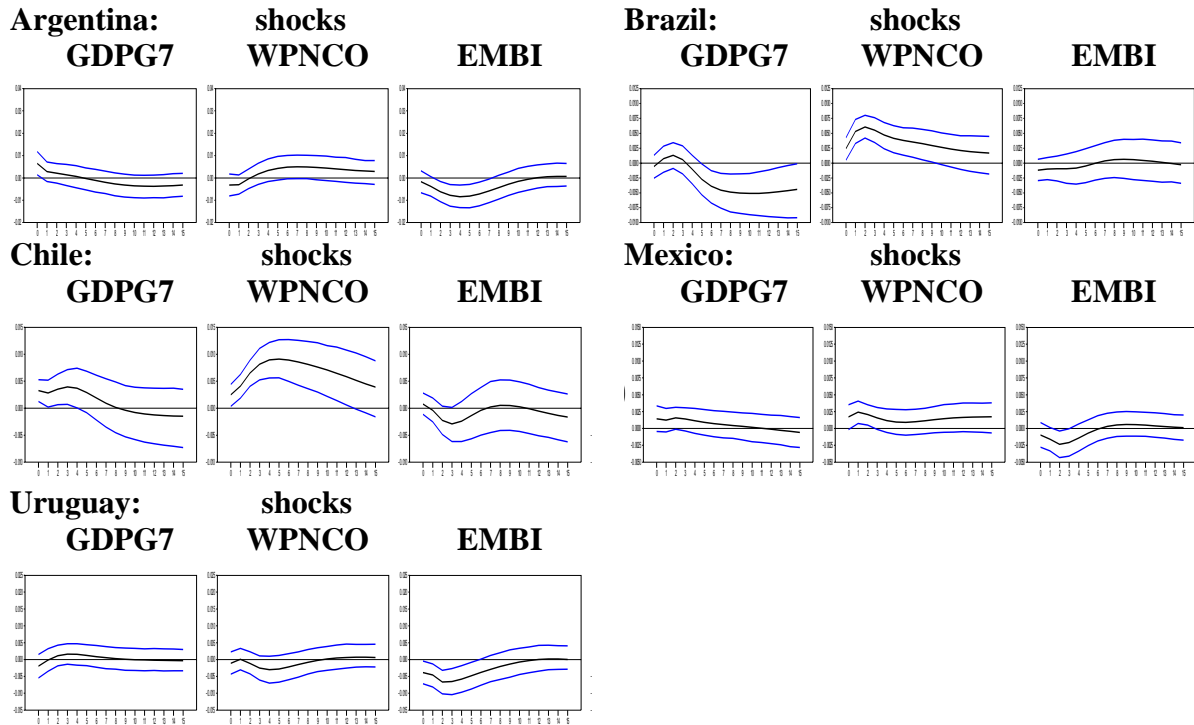
2- Credibility matters

Figures display for each country **the responses of R and ER to CPI shocks** respectively.

Argentina: **Responses of**
R ER

Brazil : **Responses of**
R ER

Chile : **Responses of**
R ER

Mexico: **Responses of**
R ER

Uruguay : **Responses of**
R ER

18
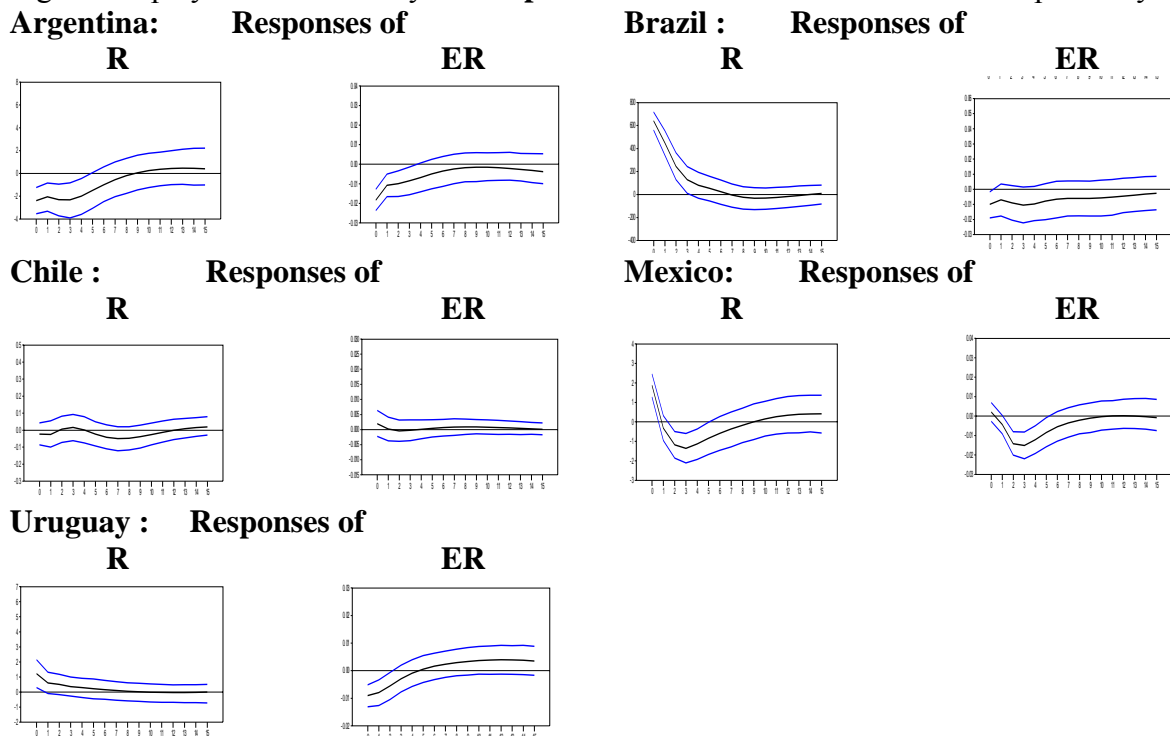
Appendix 5 Forecast Error Variance Decomposition for 16 periods, in percentage

The results display the fraction of variance in a given variable (in %) after 16 quarters due to foreign and domestic shocks indicated in columns.

Decomposition of Variance for Series GDP

	LGDPG7	LWCPNO	EMBI	GDP	CPI	FOREX	R	ER
Argentina	6.75	7.73	14.79	61.71	0.37	6.22	1.27	1.15
Brazil	26.48	23.48	0.98	29.89	7.35	4.67	0.48	6.68
Chile	5.26	39.04	1.57	31.86	11.22	2.91	4.31	3.85
Mexico	3.16	7.79	5.12	60.18	4.75	1.06	5.73	12.22
Uruguay	1.27	3.18	15.50	67.32	0.18	0.70	8.25	3.59

Decomposition of Variance for Series CPI (Prices Indexes)

	LGDPG7	LWCPNO	EMBI	GDP	CPI	FOREX	R	ER
Argentina	11.28	12.88	2.43	14.91	36.05	16.62	4.96	0.87
Brazil	8.44	4.07	2.77	6.60	64.12	1.53	10.20	2.27
Chile	0.22	11.80	5.86	0.32	69.46	10.00	0.09	2.25
Mexico	2.42	0.31	1.49	3.21	80.15	11.85	0.13	0.43
Uruguay	16.01	31.10	10.04	6.46	21.63	1.04	9.05	4.68

Decomposition of Variance for Series FOREX (Foreign Exchange)

	LGDPG7	LWCPNO	EMBI	GDP	CPI	FOREX	R	ER
Argentina	2.38	3.09	15.43	17.72	3.13	56.73	1.02	0.49
Brazil	7.33	1.20	8.21	5.51	2.63	69.92	3.06	2.13
Chile	1.11	0.71	7.79	0.29	3.72	85.67	0.58	0.12
Mexico	5.23	10.76	0.63	2.42	14.99	61.79	3.02	1.15
Uruguay	2.09	1.41	1.68	8.49	0.52	80.88	2.84	2.09

Decomposition of Variance for Series R (Domestic Interest Rates)

	LGDPG7	LWCPNO	EMBI	GDP	CPI	FOREX	R	ER
Argentina	8.79	2.68	1.28	4.59	12.79	1.70	51.94	16.21
Brazil	3.97	0.37	1.79	9.59	68.19	4.74	10.81	0.52
Chile	12.33	4.32	21.37	4.29	1.84	3.85	51.75	0.25
Mexico	6.59	4.44	6.98	6.46	21.35	8.24	44.31	1.63
Uruguay	0.78	0.23	3.19	2.11	3.77	2.68	84.78	2.45

Decomposition of Variance for Series ER (real exchange rates)

	LGDPG7	LWCPNO	EMBI	GDP	CPI	FOREX	R	ER
Argentina	2.98	15.99	1.29	21.42	12.86	9.24	8.80	27.41
Brazil	8.88	2.22	7.57	3.65	5.38	3.39	6.59	62.31
Chile	4.72	7.82	4.09	2.11	0.78	3.63	0.82	76.04
Mexico	0.34	3.05	2.17	3.44	21.87	4.74	17.43	46.96
Uruguay	8.12	2.55	13.32	15.14	7.84	8.02	1.88	43.13