

MACROECONOMIC CHALLENGES FOR MERCOSUR COUNTRIES IN THE POST-CRISIS SCENARIO: A GVAR APPROACH*

NELSON NOYA**

nelsonn@cinve.org.uy

BIBIANA LANZILOTTA***

bibiana@cinve.org.uy

GONZALO ZUNINO****

gzunino@cinve.org.uy

Date of reception: June 2015

Date of acceptance: November 2015

RESUMEN

Este estudio evalúa cuantitativamente las principales consecuencias macroeconómicas de los países del MERCOSUR ante un nuevo escenario plausible en la economía mundial, con un enfoque especial sobre las consecuencias en la política fiscal. Para abordar este objetivo, se aplicó la técnica de vectores autorregresivos globales (GVAR) para estimar un modelo global multi-país con datos trimestrales entre 1994Q1 y 2012Q4. Dentro de este marco, se simuló el escenario mundial posterior a la crisis a partir de un choque mixto compuesto por un aumento en la tasa de interés de corto plazo de Estados Unidos y una desaceleración de la economía china, que determina endógenamente una contracción en los precios internacionales de los productos básicos. La dinámica endógena de nuestro modelo global determina que la desaceleración china resulte transitoria mientras que el aumento en la tasa de interés de Estados Unidos es permanente. Como consecuencia de este shock, se genera un nuevo entorno económico para los países del MERCOSUR, que se caracteriza por la desaceleración del crecimiento, un mayor tipo de cambio real y aproximadamente la misma tasa de inflación. La reacción de las variables fiscales a este nuevo contexto muestra algunas diferencias entre los países del MERCOSUR, y también entre el corto y largo plazo. Sin embargo, la tendencia general es similar: los países del MERCOSUR parecen tener margen de la política fiscal para hacer frente a este choque y al mismo tiempo mantener la sostenibilidad fiscal a largo plazo.

Palabras clave: GVAR, MERCOSUR, política fiscal, modelos multi-país, normalización de la política monetaria, desaceleración de China, super ciclo de los productos básicos.

Clasificación JEL: C32, E17, F47.

* The authors thank A. Izquierdo, H. Ahumada and M. H. Pesaran for their valuable comments to the proposal and previous versions of this paper and an anonymous referee of *Revista de Economía*. The Inter American Development Bank Research Center Network financially supports this work.

** Researcher. Centro de Investigaciones Económicas, CINVE. Montevideo, Uruguay.

*** Researcher. Centro de Investigaciones Económicas, CINVE. Montevideo, Uruguay.

**** Researcher. Centro de Investigaciones Económicas, CINVE. Montevideo, Uruguay.

ABSTRACT

This study quantitatively assesses the main macroeconomic consequences for MERCOSUR countries of a plausible new scenario in the global economy, with a special focus on the fiscal policy consequences. To address this objective, Global Vector Autoregressive techniques are applied to estimate a multi-country global model with quarterly data between 1994Q1 and 2012Q4. Within this framework, we simulate the post-crisis global scenario by a mixed shock composed by a rise in the US short-term interest rate and a deceleration on China's economy, which endogenously determines a contraction on the international commodity prices. The endogenous dynamic of our global model determines that China deceleration results transitory while the rise on US interest rate is permanent. As a consequence of this shock, a new economic environment for MERCOSUR countries is generated, characterized by growth deceleration, higher real exchange rate and almost the same inflation rate. The reaction of the fiscal variables to this new context shows some differences among MERCOSUR countries, and also between the short and long run term. Nevertheless, the overall trend is similar: MERCOSUR countries appear to have fiscal policy margin to deal with this shock and simultaneously maintain long-run fiscal sustainability.

Keywords: GVAR, MERCOSUR, fiscal policy, multi-country models, normalization of monetary policy, China's deceleration, commodities super-cycle.

JEL classification: C32, E17, F47

1. INTRODUCTION

There are at least three main features that characterize the world economy in the last years. First, the extraordinarily growth acceleration of China since the 80s. Second, real commodity prices are at exceptionally high levels from a historical perspective. Third, after the international financial crisis of 2008, the compensatory expansionary monetary policies adopted by central banks of developed countries, especially the US Federal Reserve, lead to an unprecedented long period of nearly zero short-term interest rates in the main international currencies.

On the other hand, there is a consensus among economists that these three drivers of the world economy are transitory at some significant degree, and will be reverted, totally or partially in the medium run. China's growth would decelerate because a number of well-known facts, including, among others, many sectorial and macroeconomic disequilibria, declining productivity of capital investments, deceleration of urbanization, ending of the demographic bonus, financial sector restructuring, etc. Some of these mechanisms are behind the labels of "growth convergence", "catch-up" and "middle-income growth trap". See, for instance, Eichengreen et al. (2012), Malkin & Spiegel (2012) and Haltmaier (2013). Real commodity prices of the current decade are often diagnosed to be at the peak of a super-cycle (Erten & Ocampo 2013; Jacks, 2013). Despite geopolitical risks, oil prices will also decrease in the medium term. The main drivers behind these expected price changes are an increased production capacity due to investment maturations, the effect of higher interest rates on the cost of holding inventories, and a deceleration in the demand from China. Finally, monetary policies, especially in the US, necessarily will return to normality as the recovery consolidates, implying higher levels of short-term interest rate, i.e., towards the more frequent historical levels between 3 and 5%. The movements in reverse of these three driving factors of the global economy characterize what we call "the post-crisis scenario".

The purpose of this paper is to quantify the eventual effects of this scenario over MERCOSUR (Mercado Común del Sur) economies. Even though we consider the main macroeconomic variables (GDP, inflation, real exchange rate), we focus the analysis on the effects over fiscal policy indicators, primary result and public debt. Due to data availability, we concentrate on three countries of MERCOSUR: Argentina, Brazil, and Uruguay.

Like other Emerging Economies, MERCOSUR members have had favorable conditions to access international capital markets during the last decade. Nonetheless, the expected rise of interest rates in developed countries would generate a higher financial cost of fiscal deficits and debt rollover in the next years. On the other hand, the post-crisis scenario will probably induce a GDP growth deceleration among the MERCOSUR economies, either because of China's GDP growth deceleration or because of lower export commodity prices. The increasing significance of China for Latin America in the last decades is a well-documented fact; see, for instance Cesa-Bianchi et al. (2012). This scenario implies a growth deceleration of public revenues, either because of lower real growth in tax basis linked to GDP or lesser revenues levied directly or indirectly from commodity exports. The combination of these factors defies the sustainability of fiscal policies.

In recent years, many Latin American countries have responded to the 2008 international financial crisis by implementing countercyclical fiscal policies with moderate success (see Daude et al., 2010). Yet, for some MERCOSUR countries, it seems difficult to reverse the expansive fiscal stance after the recovery of 2010. Therefore, the persistence of the successful countercyclical macroeconomic management during the crisis could render into a weakening of fiscal positions. Hence, if, as expected, growth falls in the new scenario, the current fiscal policy may imply a decline into the public debt sustainability indicators. Additionally, during the transition period, it is likely that MERCOSUR economies will face strong external shocks. If governments respond to these shocks developing counter-cyclical fiscal policies again, they might find difficulties to revert expansive fiscal stances, and the declining process of sustainability indicators could worsen.

Our objective is to measure the effects of these potential changes on the global economic environment. We use a relatively new methodology, the Global Vector Autoregressive (GVAR) technique, initially developed by Pesaran et al. (2004) and further extended by Déés et al. (2007) to address these problems. This will provide us with a multi-country model of the global economy that captures both the inter-country spillover's effects and the domestic dynamics of macro variables. Within this framework we simulated a combined shock to US interest rates and a slowdown in China's GDP to address the impact of the post crisis scenario on the MERCOSUR economies.¹

1 We also simulated the effects of individual shocks to US interest rate and China's GDP that are included in Annex.

There exists a growing literature on fiscal spillovers and fiscal policy reactions using a GVAR methodology or similar approaches. Most of this research is on developed countries, particularly the Euro Area, probably explained by the recent sovereign debt crisis in this region.

Caporale & Girardi (2013) examine the interlinking effect of fiscal policies between Euro Area members over public borrowing costs. Hebous & Zimmermann (2013) estimate the impact of an Euro Area-wide fiscal shock on the country members' GDP. They find a positive impact surpassing that of a domestic shock. Since the cost of participating in the area-wide shock is lower than the cost of a similar size sum of domestic shocks, their finding indicates the relevance of coordinated fiscal policies in the Euro Area. Contrasting results are obtained by Hollmayr (2013) using an structural New Keynesian model for the original Euro Area members, and Bayesian techniques to estimate country-level VARs.

Nickel & Vansteenkiste (2013) study the impacts of fiscal spending shocks on financial variables for eight developed countries. They conclude that these shocks have significant domestic and international spillover effects on financial variables. One of the more interesting results is that the impacts are different in perceived risk-free government bond countries (US and Germany) than in peripheral countries. In the first two countries, a shock on government consumption increases equity prices and government bond yield both domestically and internationally. In peripheral countries, the same shock results in an increase in domestic government bond yields while it reduces the yields in the perceived risk-free government countries.

Ricci Risquete (2012) provides an extensive analysis of the of fiscal policy shocks in the Euro Area. He analyses the behavior of fiscal and monetary authorities, the current external account and the behavior of GDP and consumption prices. The database covers the US plus all EU-15 country members except Luxembourg, with annual frequency. He finds a high degree of heterogeneity in the impacts to foreign shocks among EU-15 and, interestingly, similar effects of domestic fiscal policy and EU-15 global shocks. The last result has the relevant policy implication that there are benefits in fiscal policy coordination among EU-15.

A major contribution is Favero et al. (2011). They use the available heterogeneity of fiscal policy shocks in a sample of countries, concluding that there is no unconditional fiscal policy multiplier. Instead, fiscal policy

effects differ depending on debt dynamics, degree of openness, and fiscal reaction functions by country.

To our knowledge, there are no attempts to use GVAR modeling techniques to assess fiscal policy impacts and challenges in Latin American countries. The main reference in applying GVAR to Latin America is Cesa-Bianchi et al. (2012). They analyze the impact of global shocks over a set of larger Latin American economies (Argentina, Brazil, Chile, Mexico, and Peru) and to the aggregate of all of them, as a proxy for the entire Latin American economy.

Other examples of the application of GVAR methodology for the study of the region are the following. Boschi (2012) analyzes the determinants of capital flows to Argentina, Brazil, and Mexico, assessing the relative importance of domestic and global factors. Boschi & Girardi (2011) disentangle the relative contribution of domestic, regional and international factors to the fluctuation of GDP in Argentina, Bolivia, Brazil, Chile, Mexico and Peru, finding that, contrary to received wisdom, domestic and regional factors explain a large part of fluctuations.

The rest of this document is organized as follows. Section 2 presents briefly the GVAR methodology. Section 3 describes the main characteristics of the database used in the empirical analysis. Section 4 presents the GVAR model used in this research. Section 5 shows the results of the empirical analysis. Finally, section 6 concludes.

2. THE GVAR METHODOLOGY

2.1. General Considerations about the Econometric Methodology

To conduct our empirical analysis, we use a variant of the global vector autoregressive (GVAR) methodology, originally developed by Pesaran et al. (2004) and further developed by Déés et al. (2007). The GVAR approach is a relatively novel empirical methodology to examine a global macroeconomic environment. This methodology combines time series, panel data and factor analysis techniques. Pesaran & Smith (2006) provide an overview of this modeling technique. di Mauro & Pesaran (2013) offer a broad-based collection of the more relevant studies using GVAR in the last decade.

This methodology was chosen for several reasons. First, because the GVAR approach allows to study the effect of external shocks on a specific region considering international country linkages. This characteristic of the methodology is particularly pertinent to study global shocks since it allows us to capture both direct effects and second-run effects derived from the impacts on trade partners. Moreover, we can study how countries respond to specific policies, considering their policies spillovers to the rest of the global economy.

Second, the GVAR approach has great flexibility in the treatment of each country specific model. In the first stage of the estimation process, different VAR techniques are used to estimate the initial country specific system, meanwhile the external variables are treated as weakly exogenous. The assumption of weak exogeneity is typically upheld when tested. This flexibility allows introducing dummy variables for outliers or anomalous behavior, or structural breaks treatments, as well as other techniques to improve the goodness of fit.

Third, GVAR methodology allows estimating long-run relationships coherent with economic theory and short-run relationships that are consistent with the data.

Fourth, this methodology has been used successfully in studying the international linkages in the Euro Area. Actually, several papers have applied this strategy to analyze the response of the Euro Area economies to different global economic shocks. The advantages of the strategy lead to an increasing number publications based on this kind of estimations.

Finally, we can access the data needed to carry out the specific GVAR model. We depart from the dataset used by Pesaran et al. (2009), updated and described in detail in Zhang et al. (2011) called the 2011 vintage. We extend the database in four ways: introducing a new country to de base (Uruguay); considering fiscal variables for MERCOSUR countries, updating the sample including information up to 2012Q4 and introducing another international commodity price (for foodstuffs).

First Stage in Implementing the GVAR Approach

The GVAR approach is a two-stage methodology. In the first stage, each country is separately modeled as a small open economy by estimating

country-specific vector error correction (VEC) model in which domestic macro variables are related to both country-specific foreign variables and global variables common across all countries (i.e., international prices of oil and foodstuffs).

Consider $N+1$ countries in the global economy, indexed by $i=0,1,2,\dots,N$. With the only exception of country 0 (following the standard literature of GVAR is the United States), all the rest of N countries are modeled as small open economies. For each economy, a set of domestic variables (x_{it} , to be specified) is related to a set of country-specific foreign variables, x_{it}^* through an augmented vector autoregressive (known as VARX*) model in which the $k_i \times 1$ vector x_{it} is related to the $k_i \times 1$ vector of country-specific foreign variables x_{it}^* and the $m_d \times 1$ global common variables d_t , plus a constant and a deterministic time trend.

$$\Phi_i(L, p_i)x_{it} = a_{i0} + a_{i1}t + Y_i(L, q_i)d_t + \Lambda_i(L, q_i)x_{it}^* + u_{it}$$

with $t = 0, 1, 2, \dots, T$. Here, $\Phi_i(L, p_i) = I - \sum_{i=1}^{p_i} \Phi_i L^i$ is the lag polynomial matrix of the coefficients associated with x_{it} , a_{i0} is a $k_i \times 1$ vector of fixed intercepts; a_{i1} is the $k_i \times 1$ vector of coefficients on the deterministic time trends, $Y_i(L, q_i) = \sum_{i=0}^{q_i} Y_i L^i$ is the matrix lag polynomial of the coefficients associated with d_t ; $\Lambda_i(L, q_i) = \sum_{i=0}^{q_i} \Lambda_i L^i$ is the matrix lag polynomial of the coefficients associated with x_{it}^* ; u_{it} is a $k_i \times 1$ vector of country-specific shocks, which we assume to be serially uncorrelated, with zero mean and a nonsingular covariance matrix Σ_{it} , namely, $u_{it} \sim \text{i.i.d.}(0, \Sigma_{it})$.

The vector of country specific foreign variables x_{it}^* plays a key role in the GVAR approach. For each country i at time t , this vector is constructed as the weighted average across all countries j of the corresponding variables in the model. As mentioned above, the existing GVAR literature generally uses bilateral trade share weights.

Second Stage in Implementing the GVAR Approach

In the second stage, we constructed the global model by combining all the estimated country-specific models. We linked country-specific models through a matrix of predetermined cross country linkages using bilateral trade shares.

3. DATABASE

Our data set is a partially update and extension of the one in Pesaran et al. (2009) which covers the period 1979Q4 to 2009Q4 for macroeconomic variables and the period 1980 to 2009 (annual data) for trade shares. We extended this database in four ways.

First, we include a new country (Uruguay) to the base. Secondly, we introduce the fiscal variables for MERCOSUR countries. These variables are the ratios of primary public balance to nominal GDP and the ratio of net public debt to GDP. As is a common practice in the GVAR applied literature, for the construction of these variables, nominal GDP is approximate by real GDP multiplied by CPI, in order to maintain a closed system of general price indexes. For Brazil, the source of data was the Central Bank of Brazil (BCB). The source of the data for Argentina was the Ministry of Economy and Public Finance (MECON) and Institute of Statistics and Census (INDEC).² The source of data for Uruguay was the Ministry of Economy and Finance (MEF) and the Central Bank of Uruguay (BCU). The source for Uruguayan short interest rate, trade shares and nominal exchange rate was also BCU. When some of the fiscal variables are not available in a consistent manner at quarterly frequency, we interpolate annual data applying the methodology explained in Smith & Galesi (2001), Appendix B. This is the case for public debt of Argentina between 1995Q4 and 1998Q1, and for public debt for Uruguay until 2000Q1. Third, we extend the sample of macroeconomic and trade variables of all countries to 2012Q4. To update the original database, we used the same sources and definitions employed in Pesaran et al. (2009) and described in detail in Zhang et al. (2011). Lastly, we introduce another international commodities price for foodstuff, considering the Commodity Research Bureau (CBR) Foodstuff Index.

We seasonally adjust GDP and CPI series applying the TRAMO-SEATS (Time Series Regression with ARIMA Noise, Missing Observations and Outliers) method developed by Maravall & Planas (1999).

² In order to avoid problems with the INDEC CPI series for Buenos Aires, we use for the period beginning in 2007 a national average of some provinces CPI taken from the blog “Cosas que pasan”, <http://elhombrecitodelsombbrero.orgis.blogspot.com/p/ipc-y-tcre.html>.

Finally, for aggregated variables across a set of countries, like, for example, Euro Area or MERCOSUR members, we use the weights of Pesaran et al. (2009), which are based on current GDP measured in power purchase parity US dollars, averaged over 2006-2008, taken from the World Bank.³

4. A GVAR FOR MERCOSUR IN THE WORLD ECONOMY

We apply the GVAR methodology, originally developed by Pesaran et al. (2004) and further developed by Déés et al. (2007) adapting a previous model estimated by Cesa-Bianchi et al. (2012). Estimations were made using the GVAR Toolbox 1.1 developed by Smith & Galesi (2001).

The GVAR model considers the 25 major advanced and Emerging Economies plus the Euro Area, covering more than 90 percent of the world GDP. Moreover, since we focus the analysis in MERCOSUR economies, our GVAR model includes a new county-specific model for Uruguay.⁴ We use quarterly data from 1994:1 to 2012:4.

Three different types of VARX* models were estimated. Firstly, we estimated the richest models for MERCOSUR economies since our study focuses in these economies. Secondly, for non-MERCOSUR economies, we estimated models like in Cesa-Bianchi et al. (2011), though we exclude some variables due to our shorter time series sample and the introduction of new variables. We specifically excluded the equity price indexes. Finally, for the United States we estimated a different model because, as usual, its model includes the global common variables as endogenous. We tried an alternative specification of the GVAR, introducing the real price index of foodstuffs as endogenous in the China's country-specific model. The statistical results are not good enough and the economic meaning of the estimations is difficult to interpret. Because of these, we return to a more traditional specification and consider all common international variables as endogenous only to the United States country-specific VARX*. As far as we know, the only GVAR application that use a similar treatment of international commodity prices is Galesi & Lombardi (2009).

³ Database is available on request from the authors.

⁴ Paraguay and Venezuela were excluded in this version due to data collection difficulties.

For non-MERCOSUR countries, except for United States, each country VARX* model includes as endogenous variables:

- the natural logarithm of real GDP (y_{it}),
- the inflation rate (π_{it}), calculated as the first difference of the natural logarithm of the quarterly average of monthly consumer price indexes (CPI), i.e., $\pi_{it} = \ln CPI_{it} - \ln CPI_{i,t-1}$,
- the real exchange rate, defined as $e_{it} - p_{it} + p_{it}^*$,
- a short term real interest rate (r_{it}),
- a long run real interest rate (lr_{it}), when data is available.

Each individual model also includes as weakly exogenous variables, specific foreign variables:

- foreign real GDP (y_{it}^*),
- foreign inflation rate (π_{it}^*),
- foreign short-term real interest rate (r_{it}^*),
- two global variables of the system, the real oil price (oil_t), measured by the difference between the natural logarithms of oil price in dollars and the US CPI, and the real price of foodstuff ($comali_t$), measured by the difference between the natural logarithms of foodstuff index price in dollars and CPI of US.

For MERCOSUR members, we estimated VARX* models with the same specific foreign and global variables of the non-MERCOSUR economies but adding two fiscal variables, the primary public balance (pb_{it}) and the public debt (d_{it}), both measured as ratios over nominal GDP, proxied by real GDP multiplied by CPI.

The rationale for use primary public balance and public debt together lies in the need to capture the fiscal policy reaction function or fiscal policy implicit rule without biases due to anticipation behavior of private sector. Following Chung & Leeper (2007) and Favero & Giavazzi (2007) after a discretionary or exogenous fiscal policy shock measured directly by the primary balance or after applying some filtering techniques on it, sooner or later the intertemporal budget constraint for the public sector must be fulfilled. Forward-looking private sector agents will discount the future adjustment in primary budget, and reacts accordingly. At the extreme, if

Ricardian equivalence holds, there is no effect of shocks in primary balance on aggregate demand. Then, any VAR modeling of fiscal policy must include the public debt dynamics between primary balance and the stock of public debt, otherwise, estimated impact coefficients of primary balance would be downward biased.

Finally, the VARX* for United States includes as endogenous variables, the real GDP, the inflation rate, a short-term real interest rate (r_{it}), a long run interest rate (lr_{it}), and the two global variables included in the system.

Table 1. Country Specification of the Country-Specific VARX* Models

MERCOSUR economies		Non-MERCOSUR economies		US economy	
<i>Domestic</i>	<i>Specific-Foreign</i>	<i>Domestic</i>	<i>Specific-Foreign</i>	<i>Domestic</i>	<i>Specific-Foreign</i>
y_{it}	y_{it}^*	y_{it}	y_{it}^*	y_{it}	y_{it}^*
π_{it}	π_{it}^*	π_{it}	π_{it}^*	π_{it}	π_{it}^*
e_{it}	r_{it}^*	e_{it}	r_{it}^*	r_{it}	e_{it}^*
r_{it}		r_{it}		lr_{it}	
pb_{it}		lr_{it}^*		oil_t	
d_{it}				$comali_t$	

Note: The country-specific models for MERCOSUR and non-MERCOSUR economies also include the global foreign variables: the oil and the foodstuff. * It is included only when data is available.

The GVAR model estimated link country-specific models through a matrix of predetermined cross country trade shares linkages. Specifically, the matrix of linkages was constructed based on the average bilateral trade shares of the period 2009-2012.^{5 6}

5 We estimated other two versions of the model using two different sets of bilateral trade-weights 2000-2012 and 2005-2012. The overall results were similar.

6 We tried to alternatively construct this matrix based on financial weights, but the lack of information made unfeasible this option.

5. EMPIRICAL RESULTS

The empirical analysis has three parts. First, given the importance of the weak exogeneity assumption and parameter stability in the estimation of the GVAR and the construction of simulations, we submit these assumptions to formal statistical tests.

Second, we analyze the estimated weight matrix which specifically shows trade linkages between countries, focusing on the MERCOSUR countries.

Third we attempt at quantify the impacts of the shocks that define the post-crisis scenario to the MERCOSUR countries. As we discuss above, we define this scenario by:

- a raise of the US real short interest rate,
- a deceleration in China's GDP,
- a decrease in the international price of commodities.

We analyze a combination of two of them, as a proxy of what can be considered a plausible post-crisis global scenario. Nevertheless, in Appendix II we include GIRFs corresponding to each individual shock separately.

The instruments of the analysis are the Generalized Impulse Response Functions (GIRFs) with a horizon of 20 quarters. The interpretation of the GIRFs is different from the more usual Impulse Response Functions used in the context of post-analysis of VARs or Structural VARs (SVARs) models. A common critique on GVAR and on the use of GIRFs to study policy effects is that GVAR methodology a per se does not allow to identify independent exogenous shocks on any endogenous variable. For example, GVAR modeling cannot identify if a particular shock is a demand shock or a supply shock. Identification of shocks is possible only by referring the estimated model to an ex-ante theoretical model or by using only the shocks in the long-run cointegration relationships than can be interpreted accordingly to some theory. The main advantage of GVAR applications is that they capture and describe the transmission of shocks over the system with reasonable accuracy. Because of these, GIRFs cannot be interpreted as a causal-effect description. However, in policy simulations and forecasting, GIRFs can be used to interpret and describe the dynamic of the system.

5.1 Weak exogeneity and parameter stability analysis

As we explained above, we treat the foreign variables as weakly exogenous for all countries. As in Cesa-Bianchi et al. (2012), to test for the weak exogeneity of country-specific and global foreign variables, first we estimate each country-specific model if foreign variables are indeed weakly exogenous. Then, the resultant error correction terms are included in auxiliary equations for country-specific foreign variables, and their statistical significance is jointly tested using F statistic.

Table 2 shows the results of the tests. The null hypothesis of weak exogeneity cannot be rejected for most of the exogenous variables considered. In fact, only 6 out of the 153 exogeneity tests reject the null hypothesis. Particularly, the weak exogeneity hypothesis holds for core world economies, such as those of the United States and China and for MERCOSUR economies. Considering that we use a 5% significance level, we will expect that, on average, at least 5% of the 153 tests reject the null hypothesis, i.e., in 7 or 8 cases, even if the weak exogeneity hypothesis is valid in all cases. Then, the overall result of the tests supports in an acceptable degree the weak exogeneity assumption.

Table 2. Tests for Weak Exogeneity of Country-Specific Foreign Variables at the 5% Significance Level

Country	F test	Fcrit_0.05	ys	Dps	eps	rs	lrs	poil	commali
ARGENTINA	F(2,51)	3,17880	0,10285	0,93018	-	0,48491	2,44904	0,08219	-6,03921
AUSTRALIA	F(2,53)	3,17163	0,19472	0,00222	-	0,61080	0,03931	0,13202	2,60217
BRAZIL	F(4,49)	2,56112	0,34899	0,93752	-	0,01051	0,17260	0,51112	0,31112
CANADA	F(2,53)	3,17163	1,71283	1,35054	-	0,68881	0,28215	1,46175	0,71690
CHINA	F(2,55)	3,16499	1,23773	0,51129	-	2,86439	0,01831	0,57987	1,45511
CHILE	F(2,55)	3,16499	-6,3210	0,02495	-	1,85056	0,02483	2,46368	1,62555
EURO	F(2,53)	3,17163	0,12947	0,03424	-	0,03822	0,19540	0,40069	0,47014
INDIA	F(2,55)	3,16499	0,66084	0,86791	-	0,76783	4,90429	1,32216	3,42882
INDONESIA	F(3,54)	2,77576	2,31115	2,8384	-	0,84841	0,97660	2,33054	1,96468
JAPAN	F(2,53)	3,17163	0,05169	0,05950	-	1,64197	0,02220	0,02487	0,03419

KOREA	F(2,53)	3,17163	-15,819	-25,457	25,9000	2,01915	22,4512	-26,2436
MALAYSIA	F(3,54)	2,77576	0,98058	3,5310	1,81859	1,38357	0,48659	1,09267
MEXICO	F(2,55)	3,16499	0,11318	0,32317	0,33462	2,85971	0,80284	-0,38237
NORWAY	F(2,53)	3,17163	0,02905	0,22818	0,75019	0,28826	0,01737	0,35133
NEW ZEALAND	F(2,53)	3,17163	0,59762	0,05998	0,16399	4,65887	3,29321	-1,54088
PERU	F(1,56)	4,01297	3,21893	2,48038	0,12408	0,03180	5,7254	0,08429
PHILIPPINES	F(0,57)							
SOUTH AFRICA	F(2,53)	3,17163	0,99950	0,08593	1,89865	0,00086	1,58419	1,20177
SAUDI ARABIA	F(2,55)	3,16499	-12,874	24,3491	22,9511	23,9629	23,2185	-11,8380
SINGAPORE	F(1,56)	4,01297	0,03860	0,39833	0,50606	1,44663	0,42146	5,23257
SWEDEN	F(2,53)	3,17163	0,13092	0,15962	1,60645	0,09673	0,03808	-0,45993
SWITZERLAND	F(1,54)	4,01954	0,03088	0,20836	0,00143	2,65110	0,29609	0,79398
THAILAND	F(1,56)	4,01297	0,04270	0,19826	0,05746	0,08804	0,03411	0,33538
TURKEY	F(1,56)	4,01297	0,05976	0,47866	2,47087	0,19542	1,07654	1,34718
UNITED KINGDOM	F(2,53)	3,17163	0,49811	0,97088	0,70834	1,33649	1,04569	0,91600
URUGUAY	F(4,49)	2,56112	-11,595	-7,9884	-4,2497	0,05328	-4,0281	-0,26242
USA	F(1,56)	4,01297	0,06100	0,07672	1,78802			

Note: Bold italics figures represent non-significant values.

Source: Authors' calculations based on the estimated GVAR model.

Another analysis, particularly relevant for the counter-factual simulation exercises, is the parameter stability analysis. In order to test parameter stability, maximal OLS cumulative sum (CUSUM) statistics, denoted by PKsup, was performed. Table 3 reports the results of these statistics. The null hypothesis of no structural breaks cannot be rejected at 99% of confidence for all cases.⁷ However, if 95% level of confidence is used, some structural breaks can be founded. This result deserves more attention in future developments. Notwithstanding, accordingly to Déés, et al., (2007) and Pesaran, Schuermann and Weiner, (2004), the GVAR implicitly accommodates co-breaking, which implies that the VARX* models that make up the GVAR are more robust to the possibility of structural breaks than standard VAR models or single equation models.

⁷ Critical values are included in Appendix I.

Table 3. Structural Stability Tests (PKsup statistics)

Variables	y	Π	e-p	R	LR	pb	D	poil	Commali
PK sup									
ARGENTINA	0,51573	0,68231	1,0843	0,82815	0,65727	0,66072			
AUSTRALIA	1,81319	0,6127	0,7693	0,68271			1,19347		
BRAZIL	0,7842	0,80508	0,85709	0,7653	0,57545	0,80773			
CANADA	1,23488	0,52002	1,11946	0,88415			0,85166		
CHINA	0,44901	0,47131	0,60331	0,41899					
CHILE	0,63723	0,63526	1,42112	0,8126					
EURO	1,3765	0,77615	0,73202	0,80998			0,65089		
INDIA	0,97608	0,40438	0,71881	0,3986					
INDONESIA	0,67645	0,85226	0,52482	0,62342					
JAPAN	0,57268	0,58518	0,85142	0,56263			0,37436		
KOREA	1,10366	0,39611	0,63661	0,60756			0,76374		
MALAYSIA	1,9115	0,39086	0,85634	0,72281					
MEXICO	0,87234	0,53159	0,82014	0,95636					
NORWAY	0,70957	0,37671	0,81822	0,73589			0,49846		
NEW ZEALAND	0,95314	0,43507	1,09636	0,56707			0,70413		
PERU	0,43357	0,46405	0,33263	0,77729					
PHILIPPINES	0,60784	0,51752	0,80939	0,75072					
SOUTH AFRICA	0,55043	0,53901	0,97897	0,57144			0,61321		
SAUDI ARABIA	0,69231	0,94572	0,94527	1,25304					
SINGAPORE	0,39637	0,45056	1,28277	0,91023					
SWEDEN	1,8368	0,32859	0,90937	0,94199			1,33248		
SWITZERLAND	3,45691	0,41671	1,23625	0,8583			1,03351		
THAILAND	0,65204	0,58141	0,97781	0,74839					
TURKEY	0,71257	0,45659	1,08067	0,4175					
UNITED KINGDOM	1,14932	0,45453	0,57324	0,75246			0,56871		
URUGUAY	0,78059	0,5766	0,82616	0,78586	0,49241	0,45823			
USA	0,99068	1,0966		0,67787			0,5264	0,48247	0,72004

Note: Bold italics figures represent significant values at 99% confidence level.

Source: Authors' calculations based on the estimated GVAR model.

5.2. Linkages between MERCOSUR countries

One of the main interests in modeling MERCOSUR into a GVAR model was that it might be interactions among these countries. These interactions could be relevant to explain the path of shock transmission for each of these countries and the whole region. Note that although we estimate models at a country level we also try to derive regional responses to shock.

The estimated matrix of linkages (weight matrix) states for the interactions between all the countries and regions considered in this work. As we have explained before, the weight matrix was constructed based on the average bilateral trade shares for the period 2009-2012.

We will focus the analysis on MERCOSUR countries. Table 4 reports the estimated shares corresponding for our three focus economies.

Table 4. Estimated Trade Weight Matrix (selected countries)

Country / region	Argentina	Brazil	Uruguay
Argentina	Nc	8.6%	16.4%
Brazil	31.1%	nc	23.0%
China	12.9%	15.8%	18.8%
Euro	16.2%	19.7%	14.9%
Uruguay	2.5%	1.1%	nc
USA	10.9%	23.1%	8.9%
MERCOSUR	33.6%	9.7%	39.4%

Note: Complete matrix is provided in the supplement material.

Source: Authors' calculations based on the estimated GVAR model.

As can be noted, trade interactions are especially relevant between MERCOSUR countries. First, the matrix shows that the share of Brazil in the Argentine and Uruguayan trade is very relevant: accounts for about 30% and 20% of their total trade, respectively. Meanwhile, Argentina accounts for a minor part of the two other MERCOSUR economies' trade and Uruguay, even less. Consequently, the region is determinant in Uruguayan's trade pattern (almost 40% of its total trade) and is also

important for Argentina (more than 30% of its trade). Nevertheless the MERCOSUR is not so relevant in Brazilian trade (MERCOSUR accounts for hardly 10% of the trade).

Other important information that emerges from the matrix is that USA, Euro area and China have an important role in the trade pattern of Brazil. These three economies account for almost 60% of total trade in Brazil. Nevertheless, for Uruguay and Argentina they are less important (they account for about 40% of their total trade).

Hence, from the matrix we can derive that all MERCOSUR countries are strongly exposed to shocks in US and China. This fact is crucial since our post-crisis scenario is composed by shocks in both countries. However, while in Brazil the impact of shocks is mostly direct; in Uruguay and Argentina second-run effects are more important. Brazil plays a key role in the transmission of shocks to the rest of MERCOSUR.

5.3. Impacts of a Combined Shock in Federal Funds Rate and China's GDP Deceleration

Characteristics of the combined shock

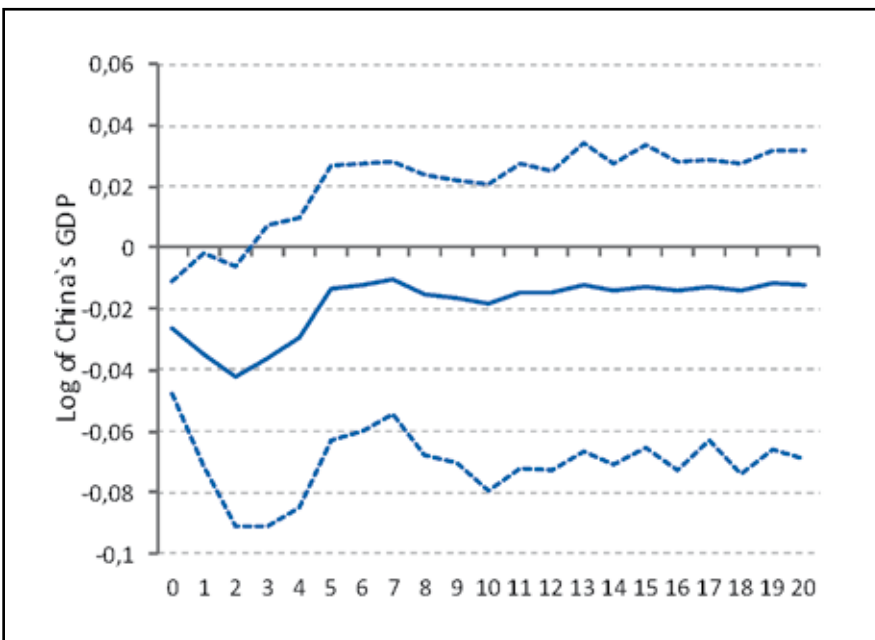
In this section, we will introduce in the model a combination of shocks with the objective to simulate a plausible post-crisis scenario in the world economy. The mixture of shocks is composed by a contractive shock of 1.4 standard errors on the Chinese GDP (equivalent to a growth deceleration of roughly 2.5%) and an expansive shock of 7 standard errors on the US real short interest rate (equivalent to a rise of nearly two hundred basic points). It is important to take in mind that due to the GVAR estimation methodology, both shocks are independent, but in the real world they can interact. Figure 1 presents the GIRFs of China GDP and US short interest rate corresponding to these shocks.

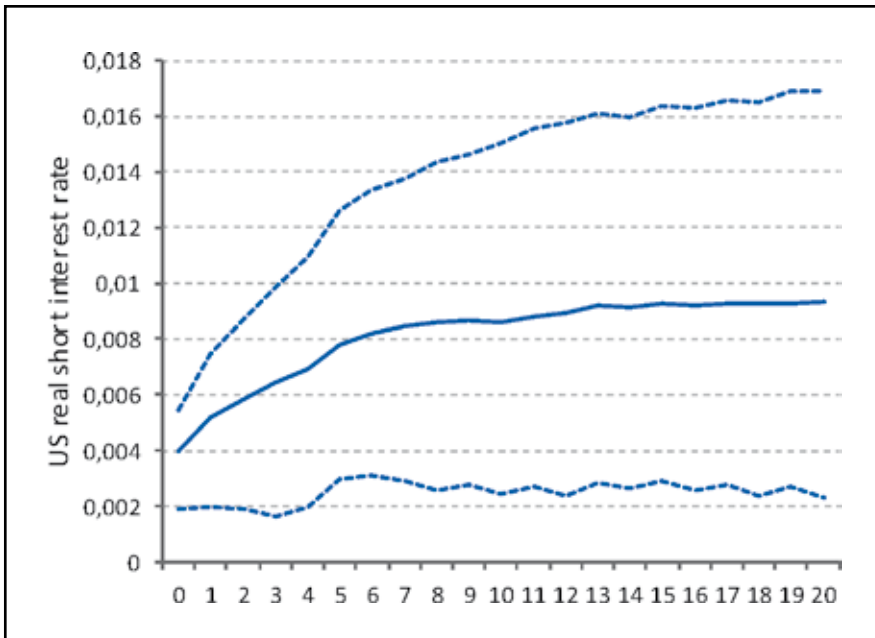
These GIRFs as well as the ones in the following section must be interpreted as the accumulated response in each quarter of the variable measured in the vertical axis to a change in the shocked variable at time zero. As we notice above, this cannot be interpreted as a causal effect, since the responses are the results of the reaction of all the system to the new path of the shocked variables. We can interpret the result as sort of data consistent evolution of the variables considered within the context of the new trajectory of US real short-term interest rate and China's GDP.

As we can see in Figure 1, the negative effect on China’s GDP becomes non-significant fourth quarters after the initial shock. This dynamic is explained by the characteristics of our system in which China’s growth is nearly linear and presents a low persistence of shocks. Therefore, in this context, simulate a permanent negative shock on China’s GDP involves a structural break in the dynamic of the system.

In contrast, the initial shock on US real short interest rate becomes stronger in the second year and it remains significant for all the horizon of analysis. Therefore, in this case the shock is permanent on the system. Different to China GDP, US interest rate follows a dynamic behavior near to a random walk with very high persistence of shocks. The combined shock determines an initial impact on the US interest rate of approximately 1.6% (annualized) that converges after twenty quarters to a rise of nearly 3.5%.

Figure 1. Generalized Impulse Responses of China GDP and US short interest rate to the Combination of Post-Crisis Shocks (-2.5% in China’s GDP, and 200 bps in Fed Funds Rate). (Bootstrap Median Estimates)





Source: Authors' calculations based on the estimated GVAR model.

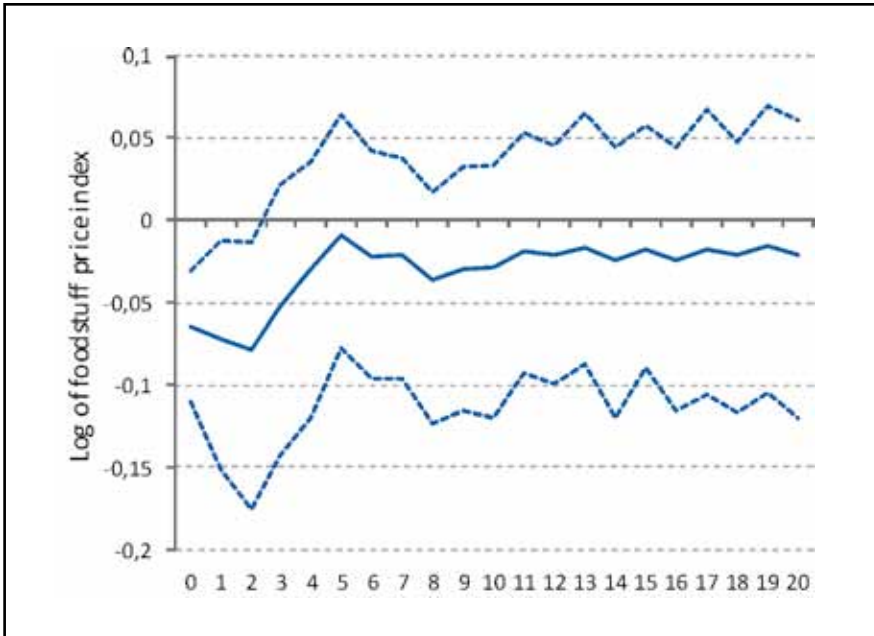
The simulated mixed shock determines endogenously an initial contraction on the international commodity prices. In the first three quarters after the mixed shock the foodstuff price decrease approximately 8%. However, from the fourth quarter, it reverts the decreasing trend and the effect becomes non-significant. The oil price shows a similar pattern in the response, even though, in this case the effect is larger. In the first three quarters after the mixed shock, the oil price presents a big contraction of approximately 30%. After that, the effect becomes non-significant. Therefore, our mixed shock generates a transitory endogenous contraction on commodity prices (see Figure 2).

In summary, the mixed shock simulated in the system combines all the features that characterize a plausible post-crisis scenario, that is, a deceleration on China's GDP, a rise on US short interest rate and a decrease on commodity prices. However, the dynamic of the estimated model determines that the shock on US interest rate is the only one persistent. China's deceleration and the fall on commodity prices are transitory effects in this analysis.

This characteristic of the shock represents a weakness of our methodology to simulate a plausible post crisis scenario, particularly if we think in a permanent deceleration of China. Since we are using an empirical multi-country global model estimated with historical data, simulate a new environment that probably imply a structural break in the model compared with the past behavior of the variables represents a big challenge. Nonetheless, our mixed shock allows us to obtain very interesting conclusions based on the response of MERCOSUR economies under current patterns of the system, considering both, direct and indirect effects. Assuming that the effects of global shocks on MERCOSUR countries will not change dramatically the new environment, our prospective analysis remains valid even though some structural breaks might arise in the model.

Figure 2. Generalized Impulse Responses of Commodity Prices to the Combination of Post-Crisis Shocks (-2.5% in China’s GDP, 200 bps in US Short Interest Rate). (Bootstrap Median Estimates)





Source: Authors' calculations based of the estimated GVAR model.

MERCOSUR responses to the combined shock

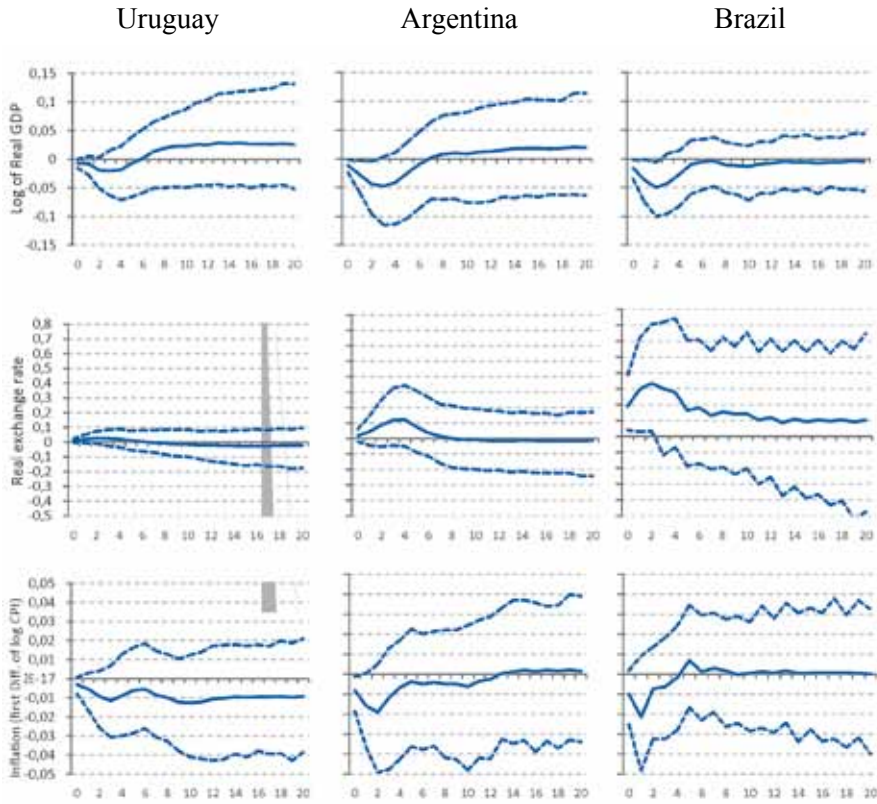
Figure 3 shows the responses of the main macroeconomic variables on MERCOSUR countries to the mixed shock. The GDP responses are heterogeneous in values, but they present the same sign and a very similar time pattern. The three economies show a significant contraction of GDP's growth on the first three quarters. Like the dynamic of China's GDP, after the fourth quarter the deceleration is reverted and becomes non-significant. The transitory impact in Argentina and Brazil are similar in the short-run: they show a progressive deceleration attaining its maximum of 5% of GDP at the end of the first year. In Uruguay, the effect on activity is lower, with a maximum fall in the rate of growth of nearly 2.5%.

The second line of GIRFs of Figure 3 presents the real exchange rate responses of MERCOSUR countries to the combined shock. Again, there is a high degree of heterogeneity in the magnitude of the responses but there is a similar pattern in the three countries. First, there is a sharp contrast between Brazil, where the real exchange rate depreciates approximately

30% (at the third quarter after the shock) and the other countries, where the real exchange rate does not move beyond 10%. The estimated response of Argentina (in median) exhibits a real depreciation during the first year, even though it does not result significant. Uruguay smoothly depreciates its real exchange rate less than 5% in the first two quarters after the shock. The response becomes non-significant from the third quarter. Like any other econometric technique, GVAR estimation captures the historical patterns of the data, including the policy rules. These disparities in the real exchange rate responses between the three countries seem to fit reasonable well with the last decades developments in exchange rate policies and regimes. Brazil is viewed as having more exchange rate flexibility and its real exchange rate seems to react effectively to nominal depreciations. Meanwhile, Argentina and Uruguay are more closely to have the “fear of floating” syndrome, in part due to domestic partial financial dollarization Lorenzo et al. (2011).

Finally, the third line in Figure 3 suggests that the simulated mixed shock almost has not inflationary effects on MERCOSUR countries. The responses are not statistical significant in any of the cases. In the short run, the three countries face some transitory deflationary responses but in the long run it converges to a null effect. The post-crisis scenario may probably yield two opposite effects on MERCOSUR’s economies inflation. On one hand, the depreciation of real exchange rate raises the inflation on tradable goods. On the other hand, the growth deceleration has a negative impact on the inflation for non-tradable goods. The combination of both effects determines a nearby null inflationary response. Our mixed shock captures the two effects in the short run. However, in the long run, both, growth deceleration and real exchange rate depreciation are non-significant.

Figure 3. Generalized Impulse Responses of Non-Fiscal Variables of MERCOSUR Countries to the Combination of Post-Crisis Shocks (-2.5% in China GDP and 200 bps in Fed Funds Rate). (Bootstrap Median Estimates with 95% Error Bounds)



Source: Authors' calculations based of the estimated GVAR model.

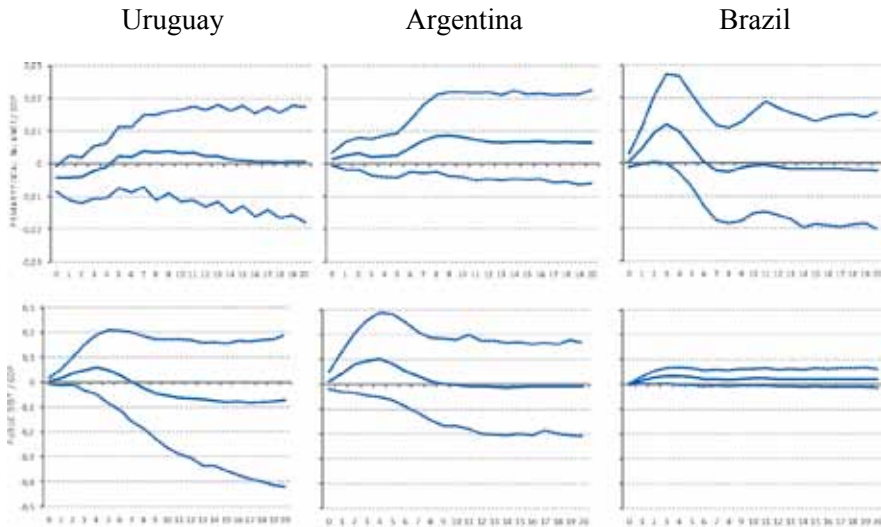
In summary, the mixed shock that attempts to simulate the post-crisis scenario generates a new economic environment for MERCOSUR countries, mainly characterized by a short-run growth deceleration, especially in Argentina and Brazil, a higher real exchange rate, notably in Brazil, and almost the same inflation rate for all countries. All the macroeconomic effects found are temporary, consistently with the transitory shock on China's GDP and the temporary decrease of commodity prices.

In Figure 4 we observe the responses of fiscal policy variables, that is, the ratios of public balance and public debt over GDP for MERCOSUR countries to the combined shock. There are some differences across countries in public balance responses. Several factors could explain the different pattern of responses found in the public balance impact. First, the response of public balances may be affected by exogenous fiscal policy reaction of governments to the shock. Second, particularly for Argentina, public sector revenues are more associated to the export sector, so, the primary balance response could improve, because the shock is associated with a real exchange rate depreciation and therefore, with a positive price shock to the export sector. Finally, the endogenous reaction of GDP affects in different degree the public sector revenues across countries.

Public balances of Argentina and Brazil show an improvement in the first year after the shock; nevertheless this response is only significant for Brazil. In the long run there are non-significant effects in both countries. In contrast, public balance in Uruguay presents a significant decline in the first quarter after the shock. The worse performance of the Uruguayan public balance respect to the other MERCOSUR countries is not explained by the GDP reaction because the short-term negative effect on economic activity is smaller in Uruguay. A more countercyclical fiscal policy response in Uruguay, in order to compensate the negative shock on GDP, probably explains the differences respect to Argentina and Brazil. Also for Uruguay the long run effects derived from the shock are non-significant.

Public debt exhibits in the short run a similar pattern of response among all MERCOSUR countries. In all cases, the median estimate shows an initial rise, although this response is almost not significant in Argentina. Uruguay exhibits a rise of public debt in the first three quarters after the shock (even is not strictly significant at 95% of confidence), attaining a maximum impact of approximately 5% of GDP. The impact in Uruguay becomes non-significant in the long run. Finally, Brazil presents a small response of the public debt to the shock, significant in all the horizon of analysis. Brazilian public debt permanently rise approximately 2% of GDP.

Figure 4. Generalized Impulse Responses of MERCOSUR Members Public Primary Balance and Public Debt over GDP to the Combination of Post-Crisis Shocks (-2.5% in China GDP and +2% in Fed Funds Rate). (Bootstrap Median Estimates with 95% Error Bounds)



Source: Authors' calculations based of the estimated GVAR model.

These results suggest that the simulated mixed shock composed by a permanent rise of US interest rate and a transitory shock on China GDP has not big effects on fiscal variables for MERCOSUR countries. Only for Brazil we find a significant negative effect on public debt in the first six quarters after the shock. However we find a short run public balance deterioration and public debt rise for Uruguay in line with the transitory Chinese shock. However, these results suggest that a slowdown in China's growth would entail permanent effects on the Uruguayan fiscal variables, which would set up a potential challenge for the fiscal policy.

In summary, our mixed shock does not entail a negative shock to fiscal sustainability indicators on MERCOSUR countries. With a transitory shock on China's growth, our results suggest that the current fiscal management of MERCOSUR countries can cope with the adverse shocks without major consequences in fiscal sustainability. However, if the slowdown of China's GDP was permanent, this scenario could be different.

6. FINAL CONCLUSIONS AND FURTHER RESEARCH AGENDA

The post-crisis scenario is defined as a mix of a rise in the Federal Fund rate and a deceleration in China's GDP growth. The combined shock that attempts to simulate a plausible negative post-crisis global scenario generates a new economic environment for MERCOSUR countries, characterized by growth deceleration, especially in Argentina and Uruguay, higher real exchange rate, remarkably in Brazil, and almost negligible changes in inflation. These effects are significant only in the short run and tend to disappear in the long run. This result is consistent with the characteristic of the shock on China's growth.

From the simulation exercise we derive some conclusions in terms of economic policy for MERCOSUR country:

Firstly, although the responses of fiscal policy variables of MERCOSUR countries show differences across countries, the qualitatively movement in public primary balance does not lead to unsustainable fiscal balance path. Therefore, our results suggest that MERCOSUR economies, under current fiscal management, can cope with the more plausible adverse shocks of a post-crisis scenario without major consequences in fiscal sustainability.

The short run effects on public debt are in line with the path of the Chinese shock, which in the model is simulated as a temporary shock. However, these results may suggest that a permanent deceleration on China's growth could imply permanent effects on MERCOSUR fiscal variables and therefore a worse fiscal scenario and greater challenges for policy makers. This is consistent with many previous studies that reveal the China-dependent of the recent growth acceleration in Latin America. However we cannot test this hypothesis because simulated shocks to China's GDP growth in the model are not permanent.

Secondly, since the MERCOSUR countries have a similar international specialization, the regional economy operates as an amplifier of global shocks. The global shocks studied in this paper affect with the same sign all the MERCOSUR countries. Therefore, the second round effects derived from the regional linkages will have the same sign that the original global shocks. A positive global shock would be amplified for

the second round regional effects, but, on the other hand, negative global shocks are also amplified with second round effects.

Lastly, an indirect result emerges from the heterogeneous of the responses between the three countries to different external shocks. Although general patterns of responses are similar, the magnitudes of the effects on the main macro variables differ. These differences may explain the difficulties to implement any macroeconomic policy coordination agenda.

The main differences between country responses are observed in the response of real exchange rates and in the policy fiscal reaction to the shock. Respect to the first one, there is a sharp contrast between Brazil and the other countries. In Brazil the real exchange rate depreciates approximately 30% (at the third quarter after the shock). On the contrary, in Argentina and Uruguay the real exchange rate does not move beyond 10%. Brazil is viewed as having more exchange rate flexibility and its real exchange rate seems to react effectively to nominal depreciations. Meanwhile, Argentina and Uruguay are more closely to have the “fear of floating” syndrome.

Regarding the fiscal policy responses, we find heterogeneous reactions on the public balance (over GDP). While Argentina and Brazil show an improvement of the public balance in the first year after the shock, Uruguay presents a significant decline in the first quarter after the shock. The worse performance of the Uruguayan public balance respect to the other MERCOSUR countries is not explained by the GDP reaction because the short-term negative effects on economic activity are smaller in Uruguay. Therefore, a more countercyclical fiscal policy response (at least to negative shocks) in Uruguay, in order to compensate the negative shock on GDP, probably explains the differences respect to Argentina and Brazil.

This document present a first GVAR approach to measure the MERCOSUR responses to external shocks. Future extensions of this work might lift some of its main limitations.

Some other possible further extensions of our analysis are relatively easy to incorporate. This is the case for a sensibility analysis of the results to different weights in the combined shock. The comparison of results may reveal another set of findings.

Other extensions of the analysis include the introduction of any forward-looking macroeconomic variables, in order to capture expectations, the extension to other countries of MERCOSUR and Latin America, and the inclusion of the domestic fiscal policy dynamics in each country-specific VARX* model. Considering the inclusion of forward-looking variables, the more obvious candidates are long-run domestic interest rates and equity price index, frequently used in GVAR applications. Alternatively, considering the good results usually obtained in developing macroeconomic models for developing when the country risk premium in sovereign debt is included, it could be useful to specify a GVAR with them.

Finally, it is useful to remember some limitations of the analysis as caveat recognition. As any VAR methodology, GVAR could not capture adequately potential non linearity features of the real world, such as quantitative restrictions, sudden stops, fat tail risks, etc. This is particularly relevant as our model aims at capture the implicit dynamic of public debt dynamic can lead to error due to a lot of sources of non linearity: absence of explicit inflationary public finance channels, impacts of exchange rate movements on debt, absence of country risk premiums, etc.

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APPENDIX I

**Table 5. Structural Stability Tests:
Critical Values of PKsup at 95% of Confidence**

Critical Values	y_95%	Dp_95%	ep_95%	r_95%	rf_95%	d_95%	lr_95%	poil_95 %	commali_95%
PK sup									
ARGENTINA	4,51501	3,3066	3,56683	1,63206	1,44834	3,59766			
AUSTRALIA	3,47253	1,15396	2,3925	4,04437			3,66357		
BRAZIL	6,05366	2,36161	6,30065	4,00315	3,64963	5,79695			
CANADA	6,09964	3,6327	5,73555	5,76442			2,45261		
CHINA	5,7767	2,30122	3,98684	5,02757					
CHILE	5,47536	4,97533	4,65117	3,84335					
EURO	6,75381	5,42014	4,4539	6,88018			6,63171		
INDIA	3,5405	2,57228	3,16126	5,07867					
INDONESIA	4,64512	0,7573	2,5386	3,30295					
JAPAN	5,96849	3,12109	5,0303	5,96708			6,19475		
KOREA	1,81513	1,01529	1,04022	2,16004			2,59273		
MALAYSIA	3,59371	4,60811	1,70714	4,15201					
MEXICO	4,74157	1,77939	3,62204	1,81954					
NORWAY	3,75798	1,63794	3,43414	5,00412			4,49902		
NEW ZEALAND	5,36834	4,11863	4,36934	6,3776			6,15042		
PERU	1,09866	0,59966	0,94562	0,89435					
PHILIPPINES	0,77683	0,82529	0,77098	0,78872					
SOUTH AFRICA	5,33544	1,65067	2,67143	1,72104			2,367		
SAUDI ARABIA	2,86152	0,93068	2,84884	4,78016					
SINGAPORE	3,93937	2,9159	3,38577	3,6169					
SWEDEN	5,30559	4,43714	3,81325	5,17061			4,4697		
SWITZERLAND	5,71689	4,03659	1,53659	4,78822			4,43979		
THAILAND	1,99506	0,90983	0,98656	0,89979					
TURKEY	2,63022	1,18448	2,35491	1,03002					
UNITED KINGDOM	4,58982	3,25372	3,4967	4,75039			4,56523		
URUGUAY	4,52028	2,41802	4,07403	4,32246	4,11507	4,40597			
USA	1,02515	0,92228		1,06614			0,98318	1,1496	0,97660

**Table 6. Structural Stability Tests:
Critical Values of PKsup at 99% of Confidence**

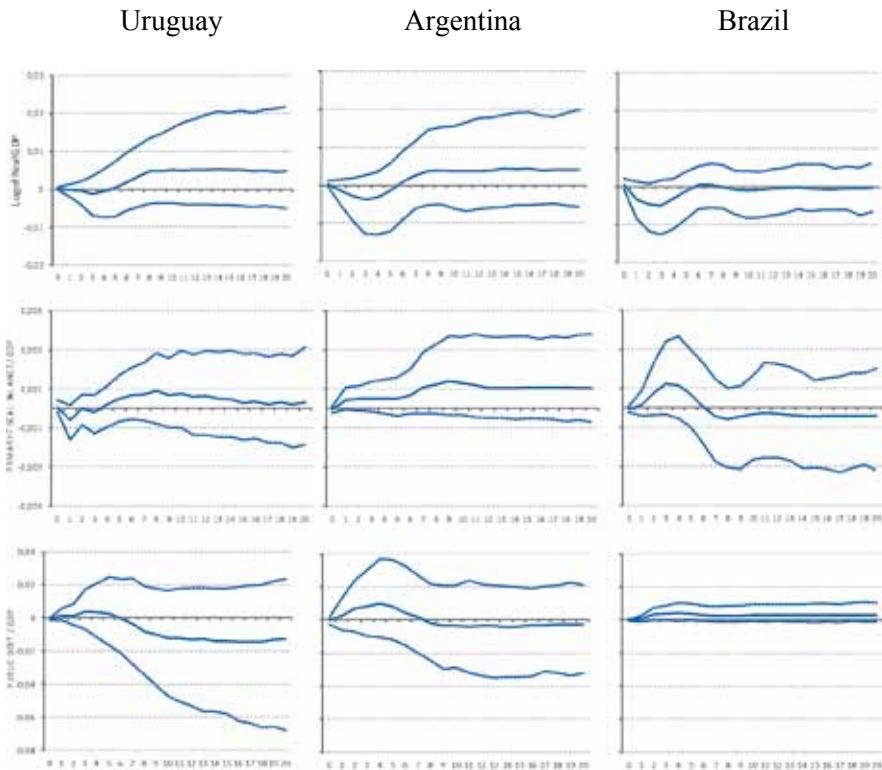
Critical Values	y_99%	Dp_99%	ep_99%	r_99%	rf_99%	d_99%	lr_99%	poil_99%	commali_99%
PK sup									
ARGENTINA	5,4004	4,6009	4,8041	2,6573	2,0633	4,7418			
AUSTRALIA	4,7163	1,7087	3,0843	5,4196				4,9751	
BRAZIL	7,1029	3,6970	7,1510	5,0016	4,7541	6,8897			
CANADA	7,0478	5,1795	6,9285	6,8791				4,9624	
CHINA	6,5788	4,3477	5,1455	6,4773					
CHILE	6,3991	5,9014	5,8426	5,3030					
EURO	7,2097	6,1670	5,6418	7,2499				7,0532	
INDIA	4,9930	3,3630	4,2496	5,9115					
INDONESIA	5,9823	1,0255	4,4990	5,1901					
JAPAN	7,0083	5,1980	6,3439	7,0018				7,0257	
KOREA	2,5031	1,5073	1,6432	3,0826				3,4978	
MALAYSIA	5,9761	5,1456	2,5758	5,6206					
MEXICO	5,3776	3,1981	5,2756	2,3140					
NORWAY	5,6506	3,2204	6,0804	6,7242				6,5248	
NEW ZEALAND	6,7118	5,6905	5,3763	7,0101				7,0096	
PERU	2,9065	0,7238	2,7426	1,1443					
PHILIPPINES	0,9066	1,0380	0,8640	0,8847					
SOUTH AFRICA	6,6683	2,7005	4,3610	3,7794				4,3945	
SAUDI ARABIA	5,3329	1,4754	5,4955	6,0882					
SINGAPORE	4,6509	4,6108	4,4035	4,6181					
SWEDEN	6,8356	6,7734	6,8311	7,0395				6,9369	
SWITZERLAND	6,4281	5,7979	3,3458	5,9413				5,4876	
THAILAND	2,7766	1,6903	1,8626	2,0887					
TURKEY	3,6569	2,6277	3,5538	1,2474					
UNITED KINGDOM	6,1096	4,7677	4,5741	5,8362				5,5144	
URUGUAY	5,1951	3,8282	5,4359	5,5139	4,7755	5,6088			
USA	1,2633	1,0297		1,2215			1,1367	1,5404	1,0726

APPENDIX II

This appendix includes the GIRFs of the three individual shocks:

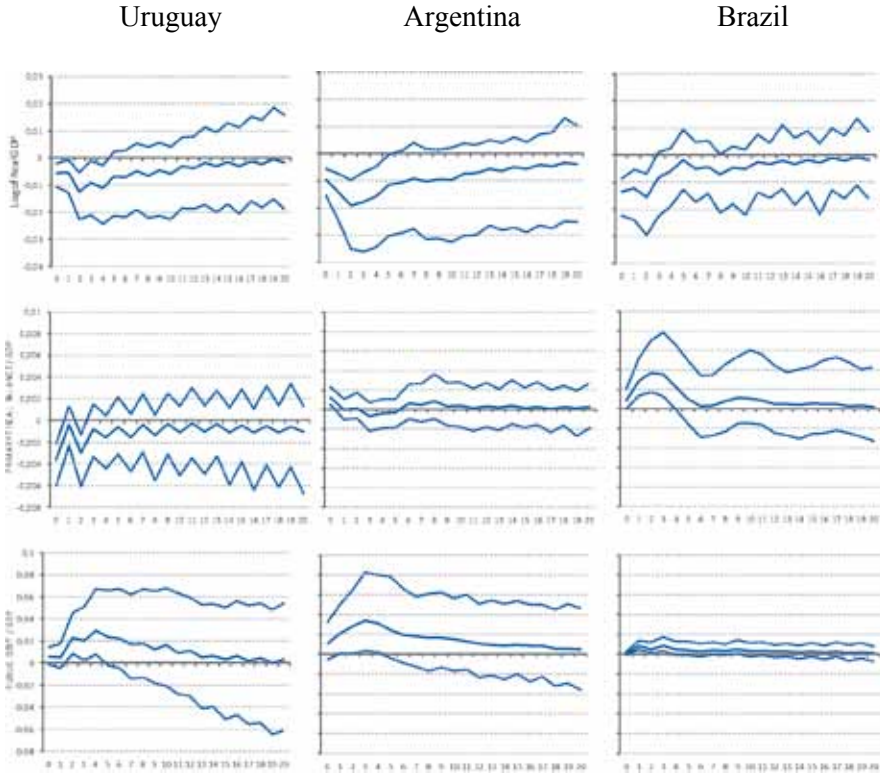
- i. a raise of the US real short interest rate,
- ii. a deceleration in China's GDP,
- iii. a decrease in the international price of commodities.

Figure 5. Generalized Impulse Responses of a One Standard Error Positive Shock to Federal Funds Rate (approximately 0.3%) on MERCOSUR's Countries. (Bootstrap Median Estimates with 95% Error Bounds)



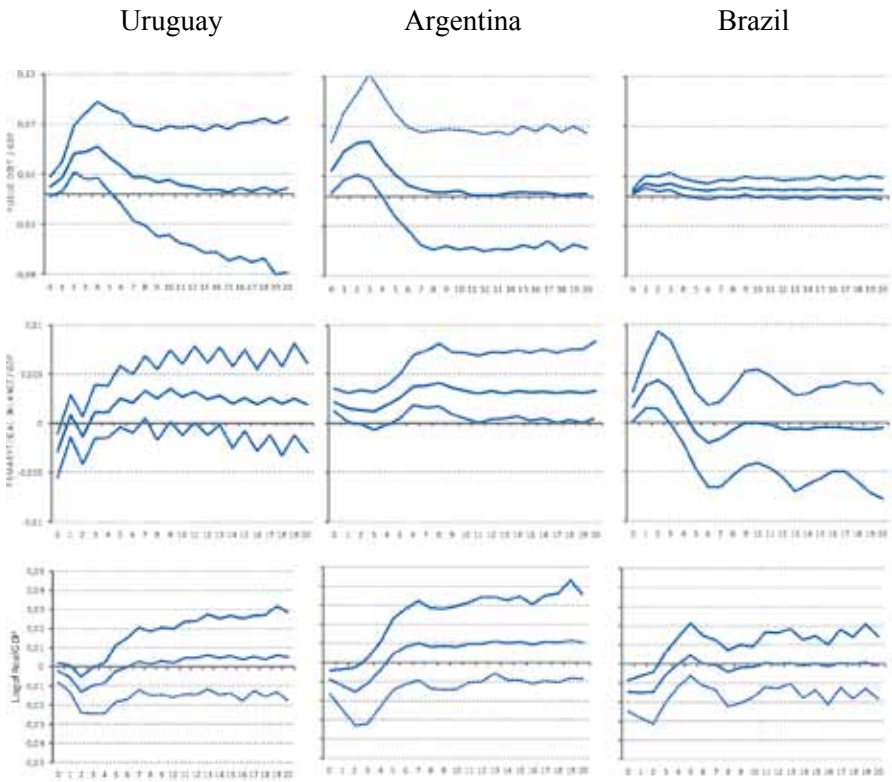
Source: Authors' calculations based of the estimated GVAR model.

Figure 6. Generalized Impulse Responses of a One Standard Error Negative Shock to China’s Real GDP (-2.1%) on MERCOSUR’s Countries (Bootstrap Median Estimates with 95% Error Bounds)



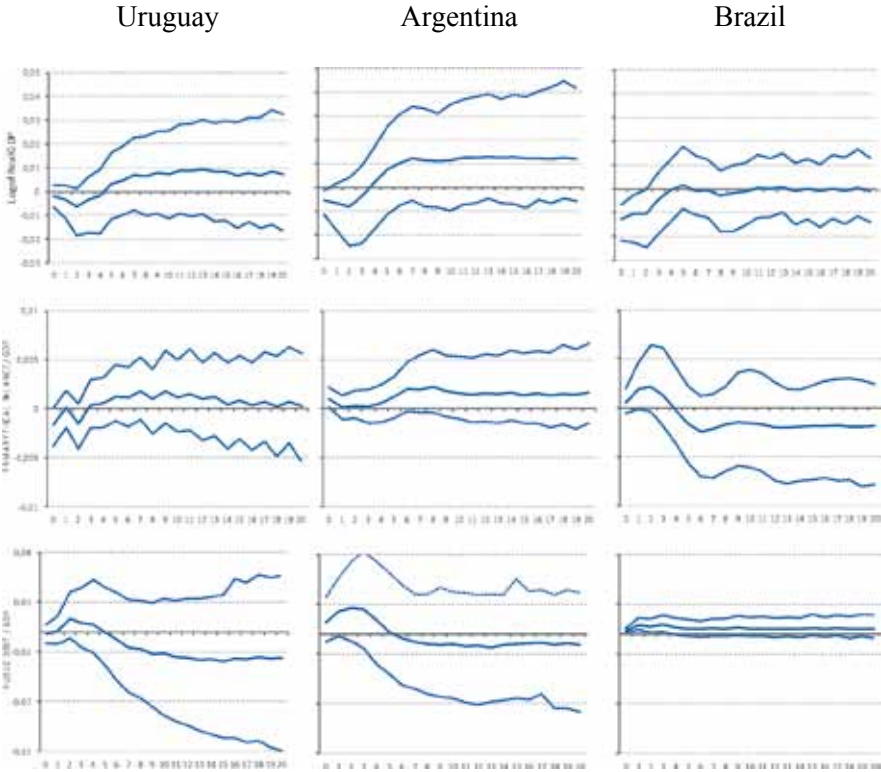
Source: Authors’ calculations based of the estimated GVAR model.

Figure 7. Generalized Impulse Responses of a One Standard Error Negative Shock to Natural Logarithm of Real Oil Price (-36%) on MERCOSUR's Countries.
 (Bootstrap Median Estimates with 95% Error Bounds)



Source: Authors' calculations based of the estimated GVAR model.

Figure 8. Generalized Impulse Responses of a One Standard Error Negative Shock to the Natural Logarithm of Real Foodstuff Prices (-10%) on MERCOSUR's Countries.
(Bootstrap Median Estimates with 95% Error Bounds).



Source: Authors' calculations based of the estimated GVAR model.