

Bank of Canada



Banque du Canada

**Explaining the Transmission of World Shocks
to Emerging Market Countries: An Empirical Analysis**

by

Brigitte Desroches

International Department
Bank of Canada
Ottawa, Ontario, Canada K1A 0G9
bdesroches@bankofcanada.ca

DRAFT, FOR COMMENTS ONLY

I am grateful to Ehsan Choudhri, Jeannine Bailliu, James Haley, Robert Lafrance, Larry Schembri, David Tessier, and Bank of Canada and Canadian Economics Association seminar participants for helpful comments and suggestions. Any remaining errors or omissions are mine.

Contents

1. Introduction.....	2
2. Review of the Literature.....	4
3. Empirical Framework.....	6
4. Data and Specification of the Model.....	8
4.1 Data Sources.....	8
4.2 Time Series Properties.....	9
4.3 Specification of the VAR.....	10
5. Results.....	11
5.1 Benchmark Model.....	11
5.2 Groupings.....	12
5.2.1 Regional Groups.....	13
5.2.2 Exchange Rate Regime.....	14
5.2.3 The Size of the Trade Sector.....	18
5.2.4 Capital Flows.....	19
5.3 Sensitivity Analysis.....	20
6. Conclusion.....	21
References.....	30
Figures	
1. Argentina.....	23
2. Thailand.....	23
3. United Kingdom.....	24
4. Asia.....	24
5. Latin America.....	25
6. Exchange Rate Regimes: Response of the Real Exchange Rate.....	25
7. Exchange Rate Regimes: Response of Domestic Output.....	26
8. Trade Sector: Response of Domestic Output.....	26
9. Trade Sector: Response of the Real Exchange Rate.....	27
10: Capital Flows Sector: Response of Domestic Output.....	27
11: Capital Flows Sector: Response of Domestic Output.....	27
12: Capital Flows Sector: Response of the Real Exchange Rate.....	28
Appendix A.....	29

1. Introduction

Understanding business cycles is the first step in designing appropriate stabilization policies (Lucas, 1977). A central stylized fact of international data is that when one country's output is above (below) its trend, the output of many other countries also tend to be above (below) their trend. This is the essential stylized fact of an international business cycle. No country is isolated from the world economy and external shocks are becoming increasingly important. In the context of increased globalization of the past few years, the question of how different countries react to different shocks has become a topic of increasing importance.

The study of comovement, or integration, is important because its results can guide policy in an era of heightened globalization. This paper evaluates the extent to which economic fluctuations in the emerging market (EM) countries are caused by shocks originating in industrialised countries by identifying the channels of business cycle transmission.

This paper seeks to document the sources of macroeconomic fluctuations in EM countries (focusing on Asia and Latin America) by measuring the relative importance of domestic and external shocks. Previous studies have typically looked only at industrialised countries. Although there is no *a priori* reason to believe that business cycles are transmitted differently to industrialised and EM countries, there could be interesting differences in the way EM countries import business cycle disturbances. Drawing

general conclusions on EM countries could help policymakers design more appropriate policies for these countries. For example, this paper will further our understanding of the relative importance of the different shocks that drive output and real exchange rate fluctuations in EM countries. Consistent with the Mundell-Flemming model, we measure two specific linkages that could transmit a crisis or shock from one country to another: a world real output shock as well as a world real interest rate shock. In order to assess whether the discrepancies in the transmission of shocks among countries is due to different economic structures or to the exchange rate regime, this paper will divide the countries in our sample into groupings. The groupings considered are the region to which a country belongs, trade openness, the exchange rate regime and capital flows.

This paper contributes to the literature on three fronts. First, country characteristics are used in order to determine the source of the divergent responses to shocks for the different EM countries. Second, the sample considered contains 22 EM countries, which is considerably more than what is typically found in the literature.¹ Finally, this paper treats world variables as being exogenous, considering all EM countries to be small-open economies.

The remainder of the paper is organized as follows. Section 2 reviews the relevant literature. Section 3 presents the empirical framework and section 4 provides details on the

1. For example, Hoffmaister and Roldos (1996) look at the case of Brazil and Korea, Kydland and Zarazaga (1997) analyse the case of Argentina and Rodrigez-Mata (1997) look at economic fluctuations in Costa Rica.

data and the specification of the model. Section 5 summarizes the results and presents the different groupings. Section 6 concludes.

2. Review of the Literature

There is a substantial literature on the transmission of business cycles. As well, the idea that fluctuations in Southern economic activity are largely caused by shocks originating from the North is widely studied in the traditional North-South literature. The basis of this argument is that Southern economies are specialized in the production of primary goods and therefore rely on the North for its supply of manufactured goods and demand for its primary output. For example, Kouparitsas (1996) builds a general equilibrium model of North-South trade. He finds that the model contains a strong mechanism for the transmission of business cycles from one region to the other. Indeed, 70% of variation in Southern consumption is caused by Northern aggregate output within this model.

The most commonly used empirical framework in the literature is a small open economy version of the structural vector autoregression (SVAR) model proposed by Blanchard and Quah (1989). The SVAR model adds economic restrictions to an otherwise statistical model to identify the sources of macroeconomic fluctuations. SVARs are widely used since they represent an appropriate framework to look at the transmission of shocks. Using this framework, authors identify the relevant shocks and describe the response of

the system to shocks by analysing impulse responses (the propagation mechanism of the shocks) as well as variance decompositions.

Using the empirical framework described above, Hoffmaister and Roldós (1997a) compare business cycles in Asia and in Latin America using panel data. They confirm the stylized facts found for the U.S. economy in previous studies: the main source of output fluctuations are domestic supply shocks, even in the short run.² External factors account for approximately 20% of output movements. Hoffmaister and Roldós also conclude that in Latin America external shocks (in particular world interest rate shocks³) and demand shocks affect output fluctuations more than in Asia.

Other studies focus on the analysis of stylised features of macroeconomic fluctuations. For example, Agénor et. al. (2000) find that there are many similarities between macroeconomic fluctuations in EM and industrialised countries as well as important differences. Some of the studies focus on specific stylized facts and then construct theoretical models that can replicate those facts. Representative papers include Kydland and Zarazaga's (1997) work on Argentina and Rodrigez-Mata's (1997) analysis of fluctuations in Costa Rica. In all studies, industrialized countries are found to have a significant impact on EM economies. For example, a study presented in the World Economic Outlook (IMF, 2001) shows that a one percent change in G-7 growth is associated with a 0.4 percent change in growth in developing countries. As well, their results show that a

2. Similar conclusions are reached in Hoffmaister and Roldós (1996), which analyses Brazil and Korea.

3. This is consistent with the important role assigned to world interest rates shocks by Calvo, Leiderman and Reinhart (1994).

one percent fall in world real interest rates translates into a 0.3 percent increase in developing country's growth. However, most of the studies based on stylized facts focus on unconditional correlations between different variables (such as output, exchange rates and prices). In such a framework, the unconditional correlations may be small because they average the effects of different types of shocks. It is therefore important to develop and estimate a structural model.

3. Empirical Framework

This section presents the empirical framework used in this study. In the past, researchers have mostly followed the structural vector autoregression (SVAR) approach as proposed by Blanchard and Quah (1989).⁴ This methodology is useful because it relies on long-run restrictions stemming from economic theory. However, in these studies, the short-run dynamics are unrestricted. The empirical framework chosen for this study therefore differs by treating the world aggregates as being exogenous. Consequently, EM countries have no impact on world variables in the long-run or the short-run.

Our empirical model allows us to measure the importance of external shocks relative to domestic shocks in explaining macroeconomic fluctuations in EM countries. The world aggregates are treated as being exogenous and the EM countries' domestic variables are treated as being endogenous. The foreign shocks are identified by a small-economy

4. This methodology was also proposed by Shapiro and Watson (1988) and extended to large open economies by Clarida and Gali (1994).

assumption. The implication of using such a framework is that domestic variables are not allowed to affect world aggregates neither in the short-run nor in the long-run. This framework is realistic since the analysis considers EM countries.

The structural form of the model is:

$$A_0 y_t = (B_0 x_t + A_1 y_{t-1} + u_t) \quad (1)$$

where x_t is a vector of exogenous variables (i.e. world real output and interest rates, y_t is a vector of endogenous variables (i.e. domestic real output, real exchange rate, domestic prices), A_0 represents the contemporaneous relations among the variables, A_1 is a matrix finite-order lag polynomial and u_t is a vector of disturbances. The structural model above is not directly estimable. However, the reduced form is obtained by multiplying equation (1) by A_0^{-1} :

$$y_t = (A_0^{-1} B_0 x_t + A_0^{-1} A_1 y_{t-1} + A_0^{-1} u_t) \quad (2)$$

$$y_t = (C_0 x_t + C_1 y_{t-1} + e_t) \quad (3)$$

where the e 's are the reduced-form innovations with zero mean and $E[ee'] = \Omega$.

Equation (3) can be used to obtain the vector moving average representation:

$$y_t = \sum_{i=0}^{\infty} C_1^i C_0 x_{t-i} + \sum_{i=0}^{\infty} C_1^i e_{t-i} \quad (4)$$

where $C_1^i = A_0^{-1} A_1$ and $C_0 = (A_0^{-1} B_0)^i$.

The impulse responses analyzed are:

$$\frac{\partial y_t}{\partial x_t} = C_0 \quad \text{and} \quad \frac{\partial y_t}{\partial x_{t-i}} = C_0 C_1^i \quad (5)$$

Throughout this paper, impulse responses trace out the response of current and future values of each of the variables to a one-unit increase in the current value of the exogenous variables.

4. Data and Specification of the Model

In order to analyze the sources of real exchange rate and real per capita output fluctuations in EM countries, several specifications of the above model are looked at. This section describes the data used as well as the specification of the benchmark model.

4.1. Data Sources

The data consists of annual observations from 1970 through 2002 for 22 EM countries. 13 Latin American and 9 Asian economies are considered (see the country list in Appendix 1). Most data series are taken from the International Financial Statistics (IFS): (i) domestic per capita output is measured as GDP at 1995 prices (line 99b divided by 99bipzf)⁵; (ii) the real exchange rate is calculated as the relative price of nontraded goods in terms of traded goods, proxied by the ratio of the CPI (line 64) divided by the product of the

5. Data on population was taken from the World Bank database, line SP.POP.TOTL

nominal exchange rate (line rf) and the PPI (line 63) of the United States⁶; the domestic price level is measured by the CPI.

The G-7 economies are used as a proxy for world aggregates. World real GDP is a sum of the G-7 economies (line 99b.czf/99birzf, converted into U.S. dollars using line rf.zf...h from the IFS). The world interest rate is an average over the G-7 countries (treasury bill rate, line 60c).⁷ The time-varying weights used in this average are based on each country's share of real GDP in the total. The real interest rate is obtained by subtracting CPI inflation from the interest rate of each of the G-7 countries.

4.2. Time Series Properties

The modelling techniques used assume that all the series are stationary, and that levels of these series are not cointegrated. These assumptions are supported by the data. Augmented-Dickey-Fuller (ADF) tests are performed on all of the series⁸ for all of the countries in the sample and we could not reject the null of a unit root.⁹ However, it appears that the first difference of these series are stationary. As well, Johansen's test of cointegration suggests that there is no evidence of cointegration (the null hypothesis of zero cointegration vectors ($r=0$) is not rejected).¹⁰

6. This consumption-based real exchange rate is used by many authors, for example Hoffmaister (1997).

7. Data for Japan is from the BIS database.

8. World real GDP, world real interest rate, domestic real GDP, and real exchange rate.

9. There are three exceptions. We reject the null of a unit root in the real exchange rate for Bangladesh, Thailand and the Philippines. However, the same specification will be imposed for all countries.

10. The results are available from the author.

4.3. Specification of the VAR

The shocks in our model fit nicely with the transmission process in the Mundell-Fleming framework. Therefore, the most important channels through which shocks are transmitted are world real output and real interest rate. This is the basis for the following analysis.

The specification of the benchmark model is as follows. The vector of endogenous variables includes the first difference of the log of real per capita output as well as the first difference of the log of the real exchange rate for each of the 22 EM countries. Based on the Akaike Information Criterion (Akaike(1973)) and on the Schwarz Criterion (Schwarz (1978)), two lags of each endogenous variable are included in the VAR. As well, the VAR includes two exogenous variables: world real output and world real interest rate. The first difference of those series are included contemporaneously in the model.

For each country included in the sample, the above model is constructed in order to understand the transmission of shocks from industrialised to EM economies. As well, in order to compare the response to shocks of EM countries with the response of industrialised countries, the same empirical framework will be used for a control group composed of industrialised countries that are small open economies (Canada, United Kingdom and Australia). We will therefore be able to assess whether the response of shocks in EM countries is any different than in other industrialised small open economies, an analysis that was not included in previous studies.¹¹

5. Results

This section describes the impulse response functions obtained with the benchmark model and contrasts them with the results for the control group. Then, different groupings are compared. The latter section is the most promising avenue for understanding the discrepancies in the response of domestic variables to external shocks. Finally, a sensitivity analysis is performed.

5.1. Benchmark Model

In order to assess the response of domestic variables to world shocks for different EM countries, impulse response functions (IRFs) are used. This descriptive device represents the reaction of each variable to shocks in the different equations of the system. Across all 22 countries, the response of the domestic variables is different, we could not observe a clear pattern. Only two general conclusions can be drawn and are illustrated in Figures 1 and 2 with Argentina and Thailand. First, the domestic variables (real per capita output and real exchange rate) respond similarly to domestic shocks across the sample. Second, for a substantial fraction of the sample, the initial impact to a domestic shock is larger than a world shock.

But the similarities across the sample end here. The conclusions regarding the propagation mechanism following an external shock are not as obvious. Indeed, there are

11. Other studies have focused on industrialised countries, but to the author's knowledge, there has never been a study analysing the transmission of shocks of industrialised and EM countries within the same empirical framework.

important divergences among the sample. As well, the EM countries analyzed demonstrate a different adjustment to shocks than the control group composed of industrialised countries (see Figure 3 for the IRF of the United Kingdom which is representative of the industrialised country group). Indeed, the adjustment to shocks is more erratic in EM countries. We cannot draw any major conclusions regarding the similarity of the transmission of shocks. Therefore, the particular responses of EM countries do not only reside in the fact that they are small open economies as they react differently than other advanced small open economies. Consequently, there must be other characteristics explaining the different responses.

The response of domestic variables to world shocks vary markedly across the countries studied (see the IRF of Argentina and Thailand in Figures 1 and 2 for an illustration). Given that different countries show different responses to external shocks, we will now turn to the analysis of the causes of such divergent responses. To do so, four groupings are studied. The greater importance of external shocks in some countries raises the question of whether these differences arise from differences in economic structure (i.e. openness to trade and capital flows) or whether they may be due to differences in exchange rate regimes. The following section attempts to answer these questions and represents the most important contribution of this paper to the literature.

5.2. Country Groupings

In an attempt to explain the discrepancies between the response of domestic variables (real output per capita and real exchange rate) to external shocks, four groupings are

used. First, the different responses could be caused by factors that are particular to the different regional groups. There is therefore an attempt to see whether the response among Asian and Latin American countries are similar. Then, we identify whether the exchange rate regime can cause the different patterns observed across EM countries. As a third alternative explanation, the size of the trade sector is looked at. And finally, the capital flows of each country is analyzed.

5.2.1. Regional Groups

The macroeconomic experience of the EM countries in Latin America and in Asia during the past 25 years has differed markedly. For example, the two regions have different inflation rate, savings rate and fiscal responsibility. It is therefore plausible that the different characteristics of the IRFs come from the dissimilarities between the two regional blocks. If that hypothesis is true, we should observe common features within Asian and Latin American countries as well as discrepancies between the two regional groups.

In Figures 4 and 5, we see the average IRFs of Asian and Latin American countries. When looking at the average responses between regional groups, we observe important discrepancies across certain countries and we cannot see any clear pattern within a region. The reason for the different responses therefore does not reside in the different characteristics of the regions. As well, we can see in Figures 4 and 5 that the response of domestic output to a world output shock is very similar across regional blocks. As

expected, we observe a positive impact of a world output shock on domestic output, followed by an adjustment and the impact dies out after 6 periods.

Another important feature of the model is the response of the real exchange rate to a world interest rate shock. Across countries, we see different responses of the real exchange rate. Separating the sample by regional groups does not yield a good explanation for the difference across countries. In many countries, we observe the typical response of real depreciation following the world interest rate shock. Indeed, following a positive world interest rate shock, the interest rate differential between the EM countries and the world interest rate widens and capital flows would be expected to move out of the EM countries thus causing a real exchange rate depreciation. In some countries, however, the reverse is observed and a real appreciation occurs. This cannot be explained on the basis of the regional group, as we do not see any clear pattern among Asian or Latin American countries.

We can therefore conclude that looking at regional groups does not provide a good explanation for the differences among the EM countries for the transmission of shocks. We therefore turn to another potential reason for divergence: the exchange rate regime.

5.2.2. Exchange Rate Regime

In order to explain the diverging responses of the real exchange rate to a world interest rate shock, we look at exchange rate regimes. In order to do so, we use the IMF's official classification of exchange rate regimes based on self-identification by member

countries.¹² Ghosh et al. (1997) use the IMF's data to develop a different classification scheme for 136 countries over the period from 1960 to 1990. They aggregate the nine-regime classification reported by the IMF into a tripartite classification where exchange rate regimes are classified as either flexible, intermediate, or pegged. Their scheme is adopted as our classification and we extend their grouping to 2002 using the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*.

ER Regime Category	IMF Classification
Pegged	- currency boards - single-currency pegs - basket pegs
Intermediate	- crawling pegs - target zones
Flexible	- floats with some intervention (but no predetermined range for intervention) - pure floats

We average the countries' exchange rate regimes over 1990-2002 in order to classify the countries. The classification for each country is provided in Appendix A.¹³

A priori it is not clear whether the responses to shocks would be larger in a fixed or in a floating exchange rate regime. On the one hand, in a floating exchange rate regime, the exchange rate can absorb some of the adjustment, and the variables might not have to change by as much as they would in a fixed rate regime. On the other hand, countries

12. The IMF publishes this classification annually in its *Annual Report on Exchange Arrangements and Exchange Restrictions*.

13. A country with either an intermediate ER regime or moving from flexible to pegged and vice versa would be considered in the analysis to fall under "mixed".

with floating exchange rates (especially if the volatility is very high) may sometimes be regarded as more risky than those with credible pegs.

Hoffmaister et. al. (1997b) look at the sources of macroeconomic fluctuations in sub-Saharan African countries¹⁴ and find that external shocks appear to have a greater influence on fluctuations of output and the real exchange rate in fixed exchange rate regime countries as the exchange rate does not (partially) buffer these countries from external shocks.

We find that the type of exchange rate regime is a critical determinant for the transmission of external shocks. Indeed, the finding from section 5.2.1., that some countries experience a real appreciation following a world real interest rate shock, can be better understood when considering the exchange rate regime. As shown in Figure 6, countries classified as having a flexible exchange rate exhibit an expected real depreciation when the world real interest rate increases. However, countries under a fixed exchange rate regime have a counter intuitive response, as they experience a real appreciation.

The model shows that if a country is under a fixed exchange rate or if it is considered as having an intermediate exchange rate regime, it would experience a real appreciation following a world interest rate shock. This counterintuitive reaction can be explained as follows. Since the exchange rate is fixed, the adjustment must come through prices.

14.The study compares the CFA franc countries with the non-CFA franc countries.

Consistent with the Mundell-Flemming framework, a world interest rate shock would result in a decline in the domestic price level, as well as a fall in the foreign price level.

Many authors (Agenor and Aizenman (1999) among others) who hypothesize that there are important nominal rigidities in EM countries, have reported the presence of numerous distortions and a dualism in the labour market in EM countries. It seems appropriate to think that the domestic price level does not move instantaneously in response to unanticipated disturbances, but adjusts slowly over time. Then, it is possible for the currency to experience a real appreciation, as observed for the countries with a fixed exchange rate or under an intermediate exchange rate regime.¹⁵

In addition, our model suggests that countries under a fixed or a flexible exchange rate regime are less vulnerable following a world real output shock than countries under an intermediate system. As shown in Figure 7, a flexible exchange rate acts as a shock absorber as was expected, since the initial impact as well as the response of domestic output is rather small. The same is observed for the fixed exchange rate: those countries are more protected from shocks. We can therefore conclude that a country is more vulnerable to external shocks when it is not on either end of the exchange rate regime spectrum. However, it is possible that we obtain this result because of self-selection as inherently instable countries cannot maintain exchange rate regimes at either end of the spectrum. Countries at both ends of the spectrum are therefore more stable by definition.

15. This could also reflect some other factors such as the nominal exchange rate adjustment with respect to third countries.

5.2.3. The Size of the Trade Sector

A third country grouping is considered. The hypothesis to be tested is simple: the more open a country is, the more it should react to foreign variables. We therefore expect that countries that are more open react more to external shocks. In order to assess this possibility, countries are divided into two groups: “most” and “least” open. Our measure of trade openness is a standard openness ratio (ratio of imports and exports to GDP¹⁶). If the ratio is higher than the median, the country is considered to be more open. Otherwise it is considered to be less open.

First, we look at the response of domestic output following an external output shock. As seen in Figure 8, trade openness does not have an impact on the transmission. Whether the country is more or less open, the dynamics are the same: a positive world output shock has a positive impact on EM countries.

As well, we see in Figure 9 that trade plays a role in the response of the real exchange rate to a world interest rate shock. Indeed, on average, a country that is more open will have the typical response described in the previous section (real depreciation), while countries that are relatively closed experience a counter intuitive response (real appreciation). This supports our hypothesis in section 5.2.2. Most countries that have a fixed exchange rate regime and that experience a real exchange rate appreciation are relatively closed.¹⁷ This reinforces our explanation for the nominal price rigidities, as those countries do not face as much competition through trade.

16.Data on trade is from the IFS, line 70..dzf and 71..dzf

17.Examples of countries include Argentina and Bangladesh.

5.2.4. Capital Flows

The last country grouping considered to explain the differences in the transmission mechanisms for EM countries is capital flows. Our premise is that the less capital flows across its borders a country has, the less it will be affected by world interest rate shocks. In order to assess that possibility, we use a measure of gross capital flows to GDP.¹⁸

As shown in Figure 10, output of countries with restricted capital flows react less to a world interest rate shock initially. Low capital mobility dampens the effect of the foreign shock to the asset markets. This result suggests, as expected, that financial linkages are more important, in terms of transmission of business cycles, for economies that are more open to capital flows. We can also observe in Figure 11 that the amplitude of the initial impact of a world output shock on domestic output is smaller for a country that experiences less capital flows.

The results are in line with stylized facts that if world interest rates rise after a period of low levels of interest rates and abundant liquidity, countries experiencing more capital flows are more vulnerable to capital outflows as interest rates in industrialized countries rise. It is therefore consistent with what we observe in our sample that the impact on domestic output is more negative for countries with more open capital accounts.

Furthermore, we find that the level of development matters to explain the transmission of shocks. Our results show that countries with higher levels of real GDP per capita are

18.Data on gross capital flows is from the World Bank database (line bg.kac.fnei.gd.zs).

affected negatively by a world interest rate shock, while lower real GDP per capita countries are affected positively. Countries at higher levels of development have better functioning financial systems and therefore borrow more on international capital markets. While the increase in world interest rates diminishes the relative attractiveness of emerging market bonds and increase the cost of borrowing, a recovery in industrialized countries also affects emerging markets through the trade channel (resulting from stronger growth in industrialized countries). These offsetting effects will have different impacts on different countries. Our results show that following a world interest rate shock, countries with higher levels of real GDP per capita are affected more by the financial channel, while lower real GDP per capita countries are affected more by the trade channel.

5.3. Sensitivity Analysis

In order to test the robustness of the benchmark model, a sensitivity analysis is performed. The results show that the model is robust to different specifications. For example, when a fifth variable is added to the model (domestic prices), the results discussed in sections 5.1. and 5.2. still hold.

Different world aggregates are also considered. World output, as proxied by the G-7 economies, is replaced by U.S. real output and the U.S. federal funds rate is substituted in place of the world interest rate shock. The adjustment pattern is in most cases the same, but the amplitude of the response is higher following a U.S. shock compared to a G-7 shock.

6. Conclusion

The study of comovement is important because its results can guide policy in an era of globalization. As we have seen in the latest slowdown of the world economy, business cycles are transmitted across countries. This paper evaluates the extent to which economic fluctuations in the EM countries are caused by shocks originating in the industrialised countries by identifying the channels of business cycle transmission.

By documenting the sources of macroeconomic fluctuations in EM countries (focusing on Asia and Latin America) and measuring the relative importance of domestic versus external shocks, the paper draws important conclusions. Consistent with the Mundell-Flemming model, we measure two specific linkages that could transmit a crisis or shock from one country to another: a world real output shock as well as a world real interest rate shock. This paper increases our understanding of the relative importance of the different shocks that drive output and real exchange rate fluctuations in EM countries.

The results obtained show that there are major differences in the transmission mechanism across different EM countries. In order to assess whether the discrepancies in the transmission of shocks is due to different economic structures or to the exchange rate regime, this paper divides the sample following groupings. The results indicate that a critical factor is the exchange regime, although the restrictions on capital flows also play a crucial role. We have also shown that the role played by regional groups and trade openness is not as important in determining the transmission of business cycles. When analysing the impact of external shocks on real output and the real exchange rate for EM

countries, exchange rate regimes as well as restrictions on capital flows existing in those countries should be the two major factors taken into consideration.

While this paper provides a number of preliminary results, other models with a richer specification could be used to enhance our understanding of the transmission of business cycles in order to improve our conduct of macroeconomic policies in an increasingly integrated world economy.

Figure 1: Argentina

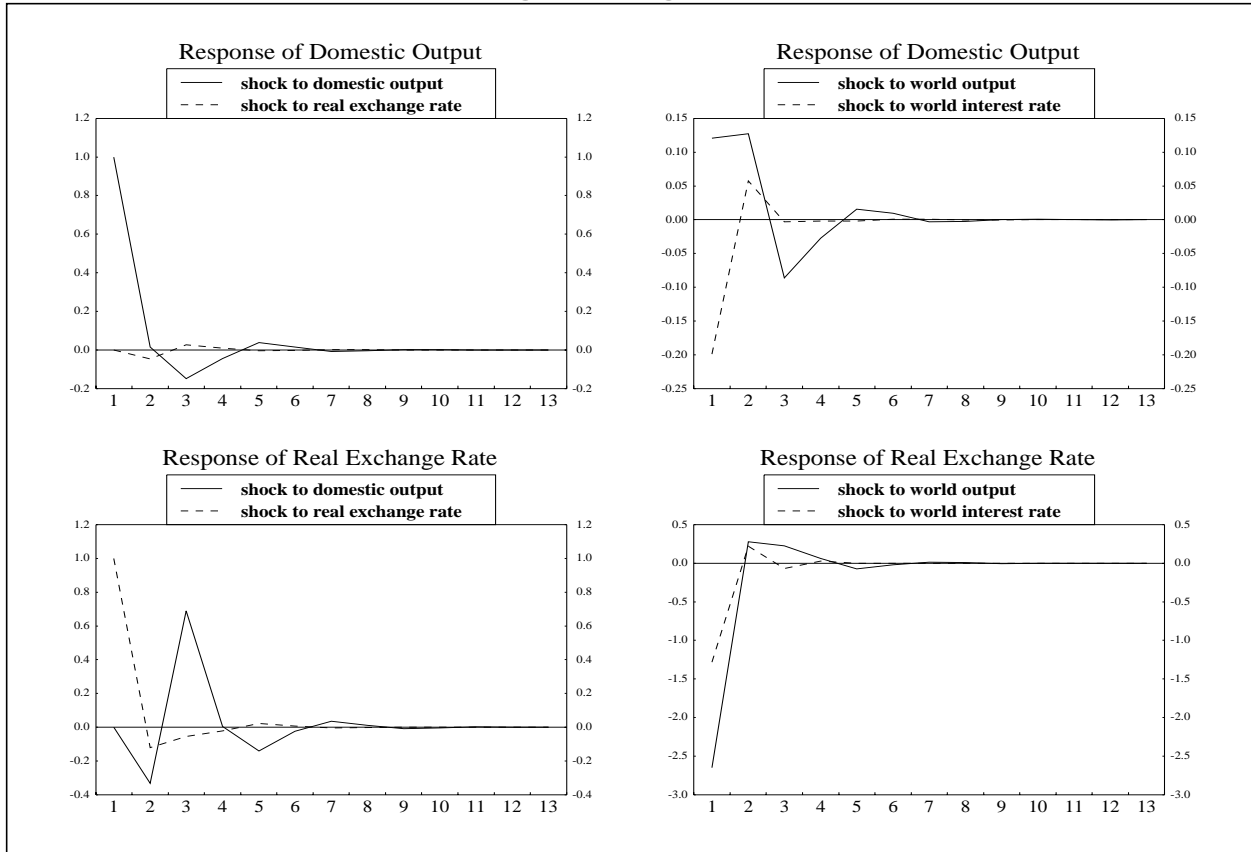


Figure 2: Thailand

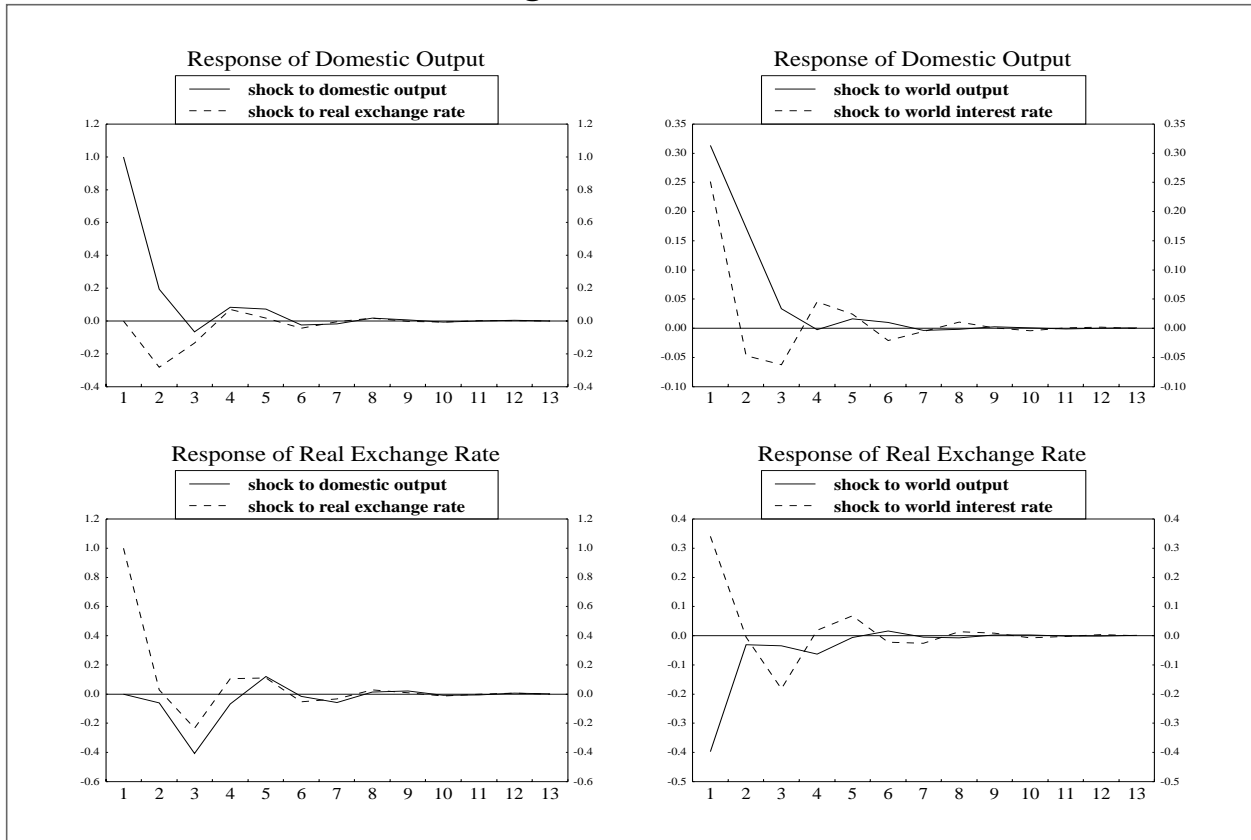


Figure 3: United Kingdom

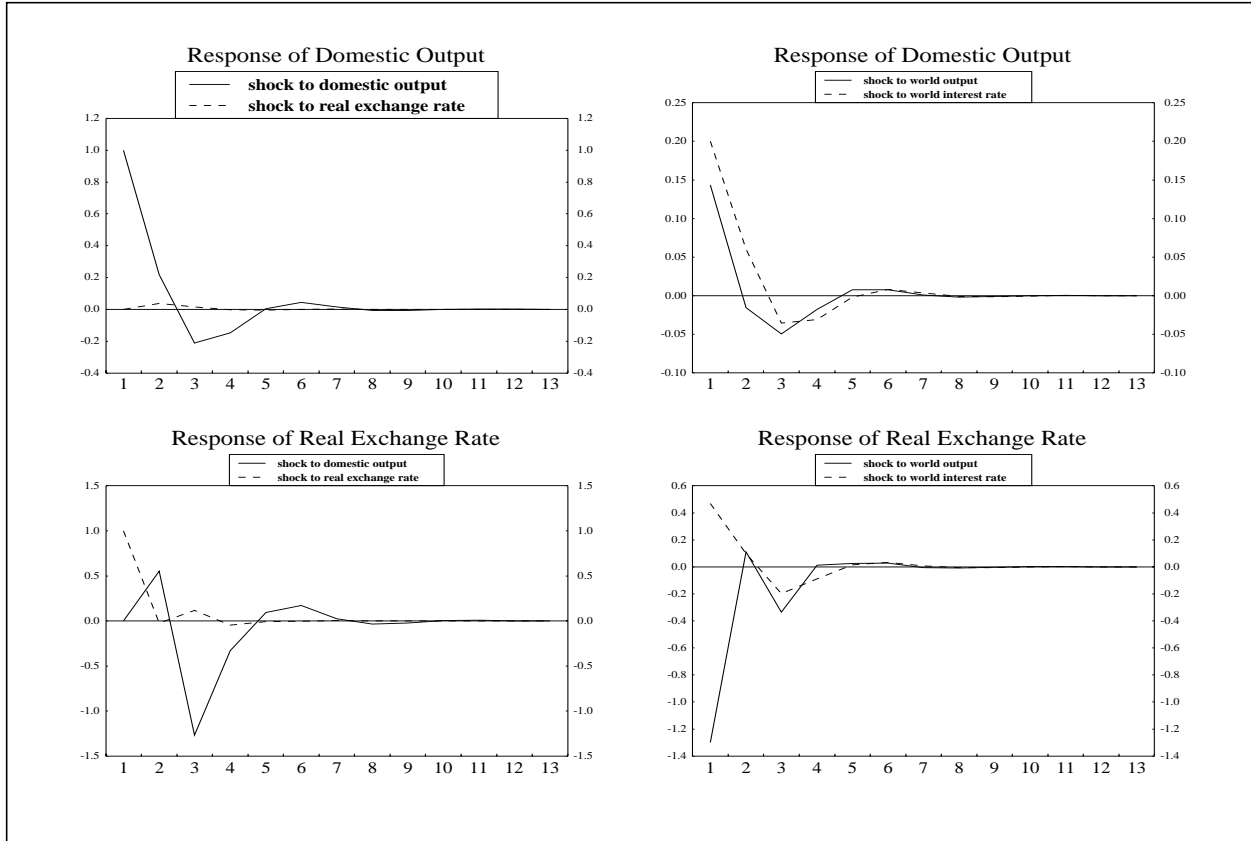


Figure 4: Asia

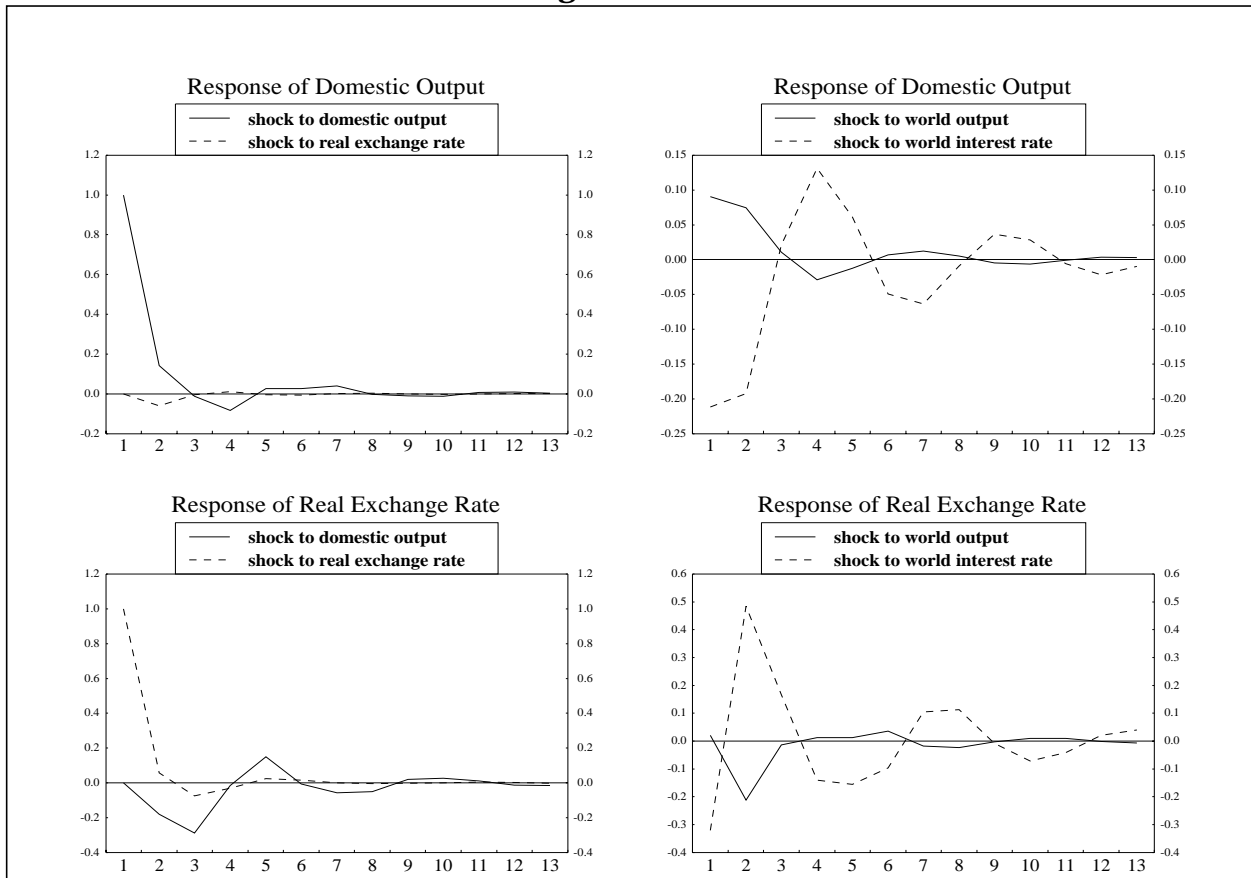


Figure 5: Latin America

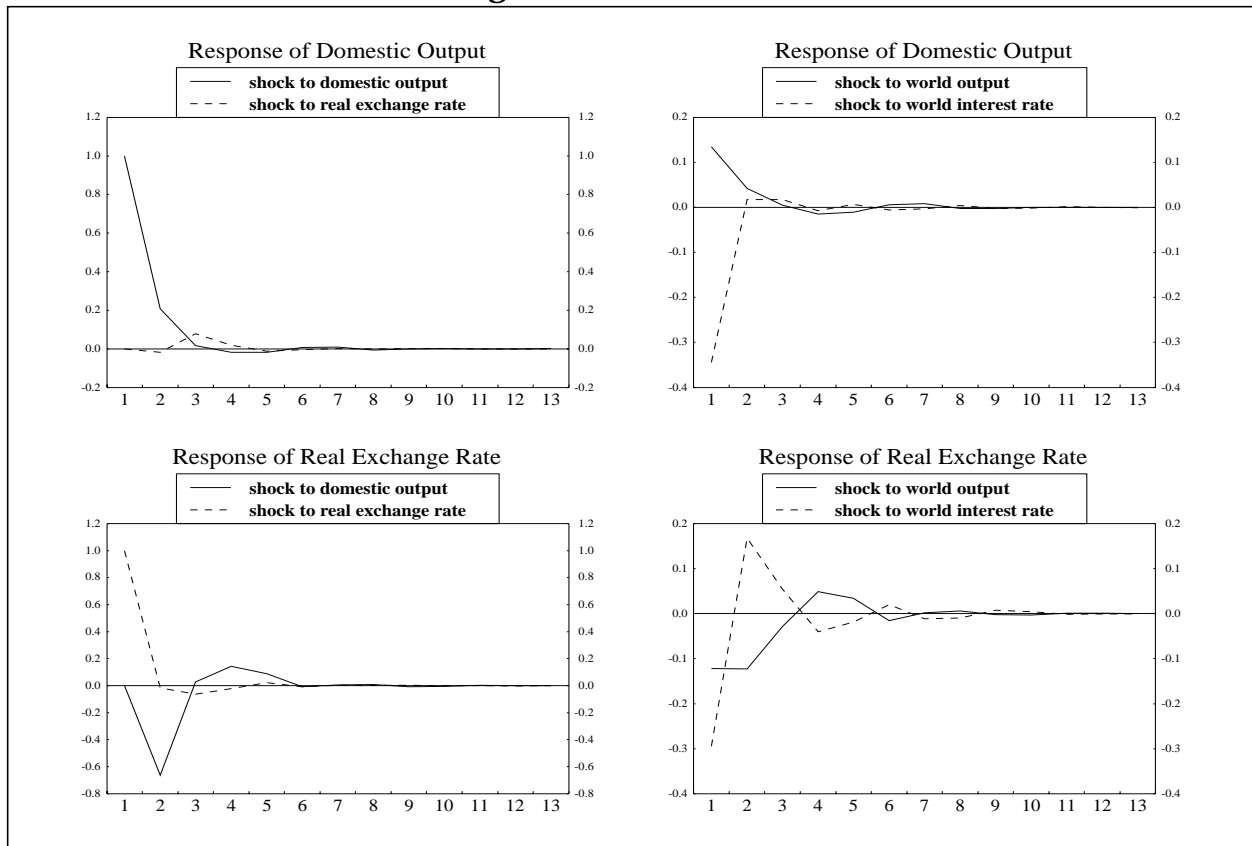


Figure 6: Exchange Rate Regimes: Response of the Real Exchange Rate

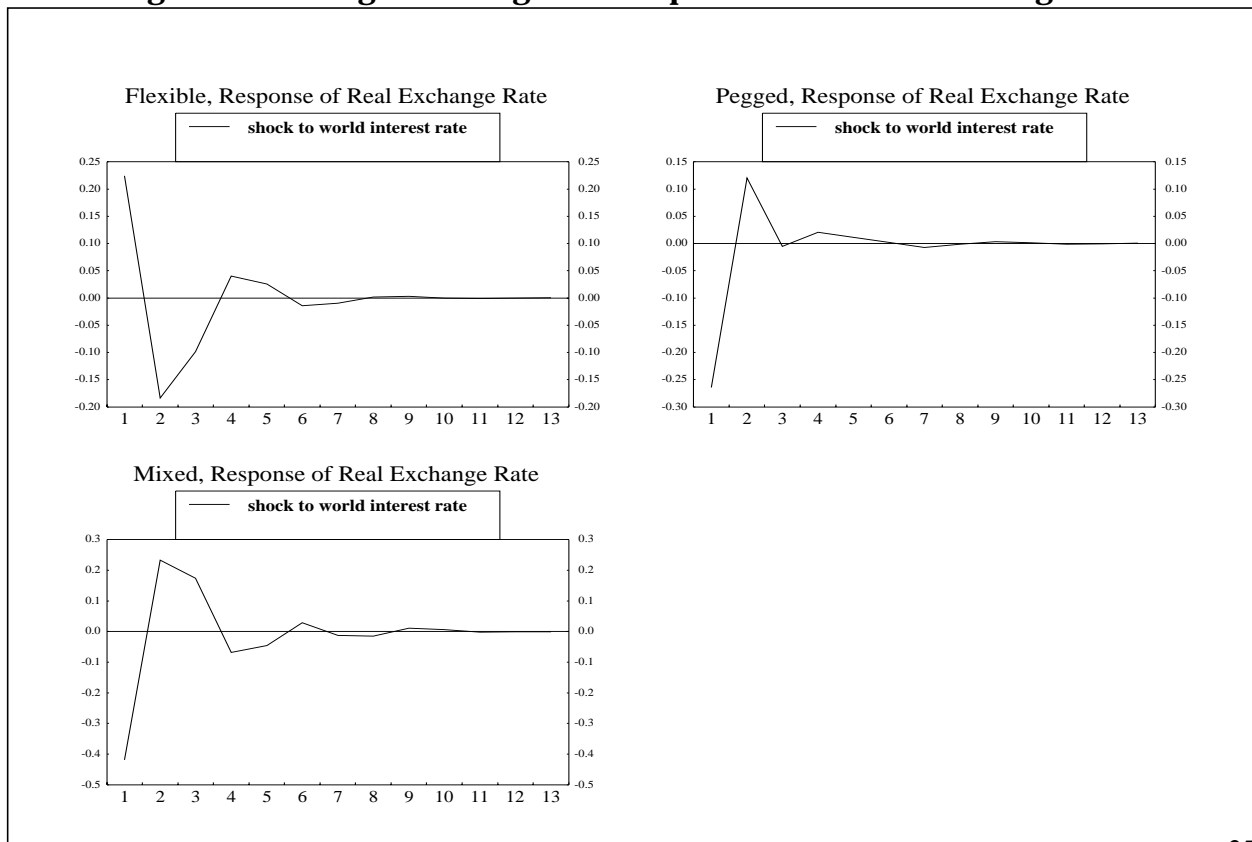


Figure 7: Exchange Rate Regimes: Response of Domestic Output

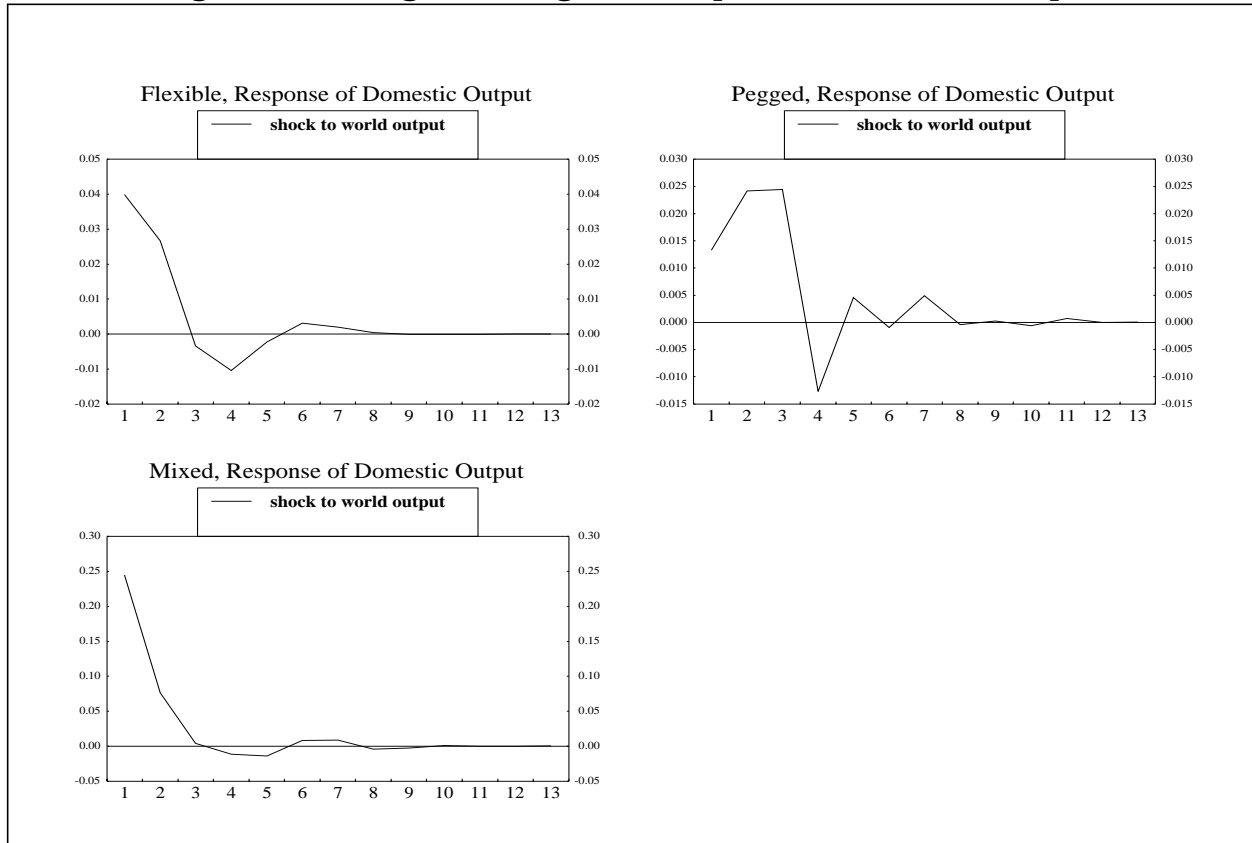


Figure 8: Trade Sector: Response of Domestic Output

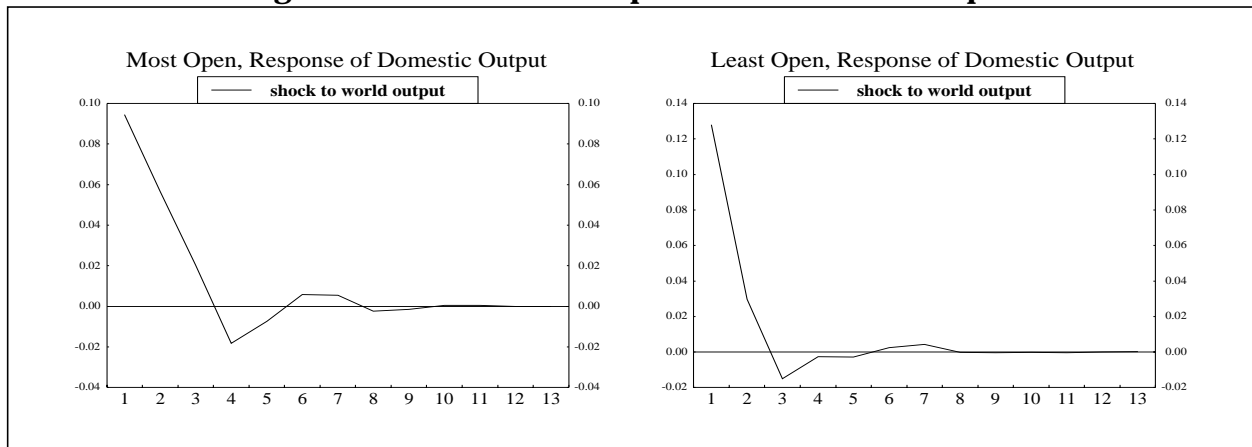


Figure 9: Trade Sector: Response of the Real Exchange Rate

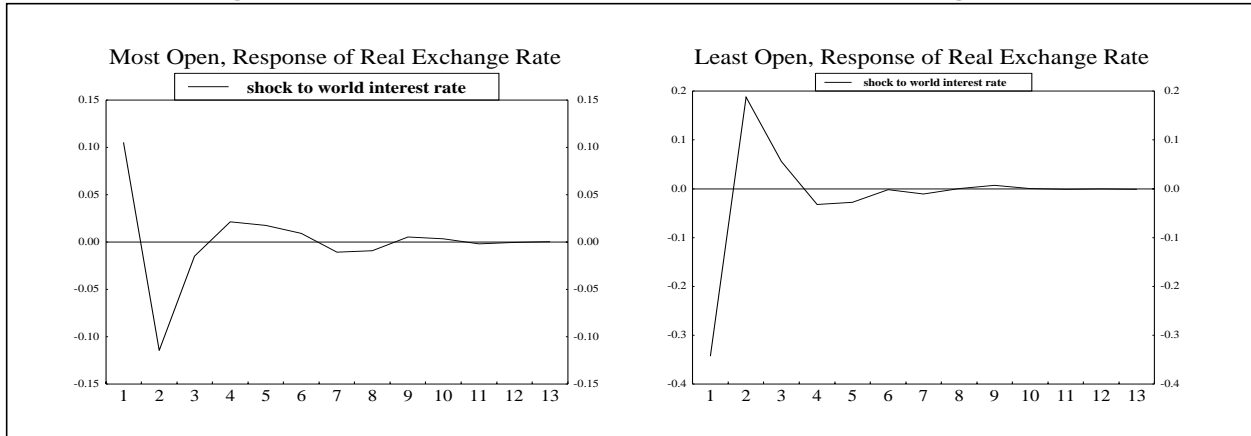


Figure 10: Capital Flows Sector: Response of Domestic Output

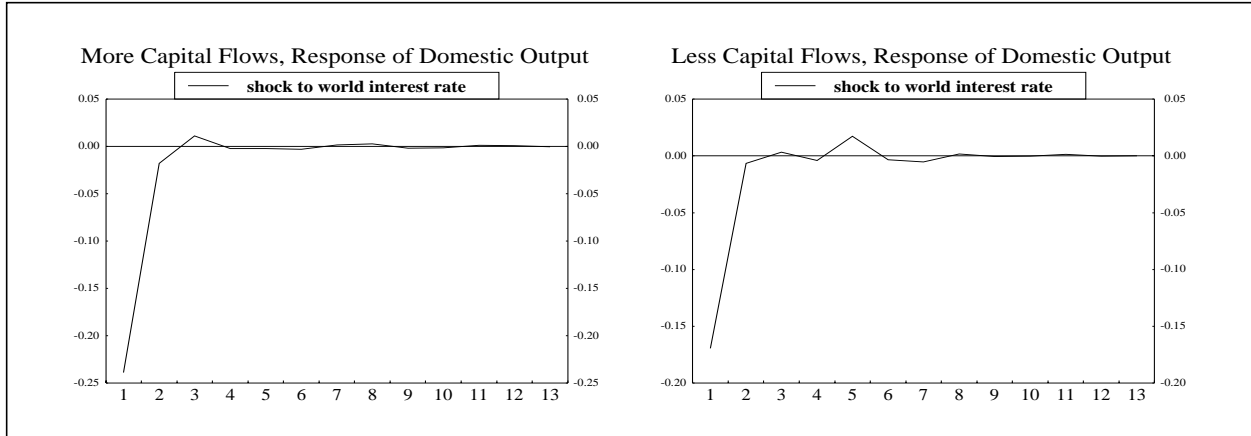


Figure 11: Capital Flows Sector: Response of Domestic Output

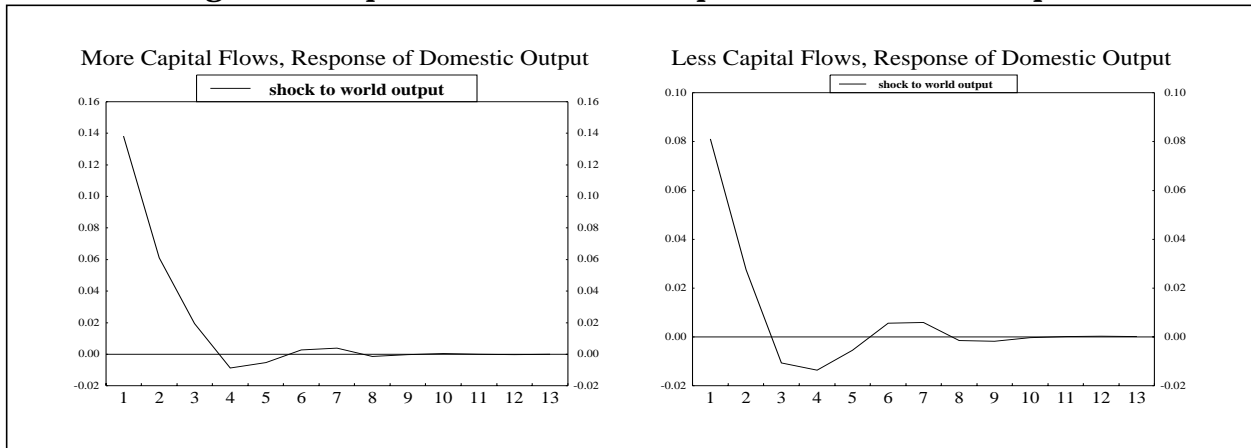
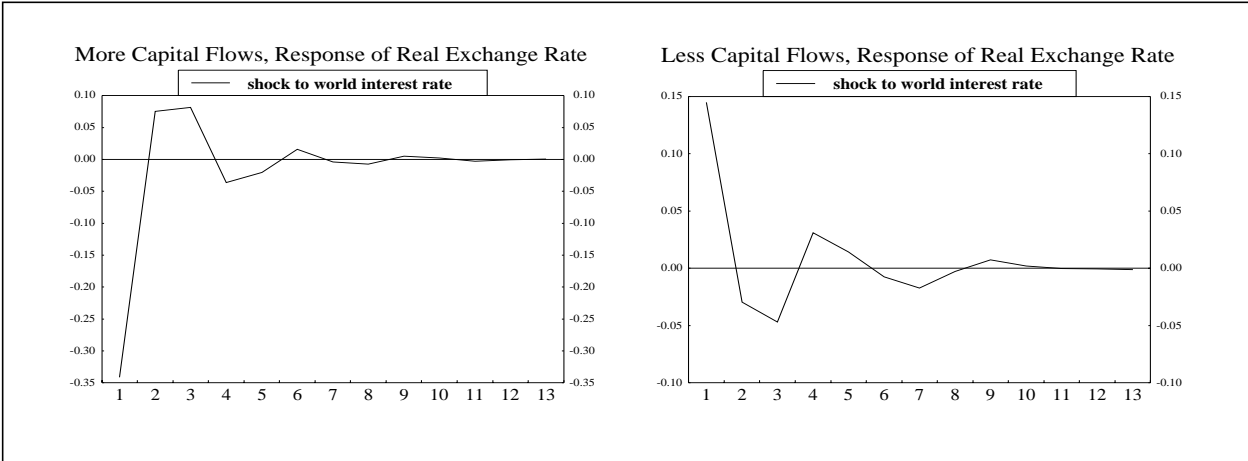


Figure 12: Capital Flows Sector: Response of the Real Exchange Rate



Appendix A

List of Countries with Classification for Groupings

	Regional Group	Measure of Trade Openness	Measure of Restrictions on Capital Flows	Exchange Rate Regime
Argentina	Latin America	least open	more flows	pegged
Brazil	Latin America	least open	less flows	mixed
Chile	Latin America	most open	more flows	mixed
Colombia	Latin America	least open	less flows	mixed
Costa Rica	Latin America	most open	less flows	mixed
Dominican Republic	Latin America	most open	less flows	flexible
Ecuador	Latin America	most open	more flows	pegged
El Salvador	Latin America	least open	less flows	mixed
Guatemala	Latin America	least open	more flows	flexible
Mexico	Latin America	most open	less flows	flexible
Peru	Latin America	least open	less flows	flexible
Uruguay	Latin America	least open	more flows	mixed
Venezuela	Latin America	most open	more flows	mixed
Bangladesh	Asia	least open	less flows	pegged
India	Asia	least open	less flows	flexible
Indonesia	Asia	most open	less flows	flexible
Malaysia	Asia	most open	more flows	pegged
Pakistan	Asia	least open	less flows	flexible
Philippines	Asia	most open	more flows	flexible
Singapore	Asia	most open	more flows	flexible
Sri Lanka	Asia	most open	more flows	flexible
Thailand	Asia	most open	more flows	mixed

References

Agénor, Pierre-Richard, C. John McDermott , and E.S. Prasad, 2000, “Macroeconomic Fluctuations in Developing Countries: Some Stylized Facts”, *The World Bank Economic Review*, Vol. 14, No. 2, pp 251-85.

Agénor, Pierre-Richard, and J. Aizenman, 1999, “Macroeconomic Adjustment with Segmented Labor Markets”, *Journal of Development Economics*, Vol. 58, pp. 277-96.

Arora, Vivek, and Martin Cerisola, 2000, “How Does U.S. Monetary Policy Influence Economic Conditions in Emerging Markets?”, IMF Working Paper 00/148 (Washington: International Monetary Fund).

Arora, Vivek, and Athanasios Vamvakidis, 2001, “The Impact of U.S. Economic Growth on the Rest of the World: How Much Does It Matter?”, IMF Working Paper 01/119, (Washington: International Monetary Fund).

Blanchard, Olivier J., and Danny Quah, 1989, “The Dynamic Effects of Aggregate Demand and Supply Disturbances”, *American Economic Review*, Vol. 79 (September), pp. 655-73.

Calvo, Guillermo, Leonardo Leiderman, and Carmen Reinhart, 1994, “The Capital Inflows Problem: Concepts and Issues”, *Contemporary Economic Policy*, Vol. 12 (July), pp. 54-66.

Clarida, Richard, and J. Gali, 1994, "Sources of Real Exchange Rate Fluctuations: How Important are Nominal Shocks?", *Canergie-Rochester Conference Series on Public Policies*, Vol.4, pp. 1-56.

Ghosh, A.R., A.-M. Gulde, J.D. Ostry, and H.C. Wolf, 1997, "Does the Nominal Exchange Rate Regime Matter?", NBER Working Paper No. W5874.

Hoffmaister, Alexander W., and Jorge E. Roldós, 1997a, "Are Business Cycles Different in Asia and Latin America", IMF Working Paper 97/9, (Washington: International Monetary Fund).

Hoffmaister, Alexander W., and Jorge E. Roldós, 1996, "The Sources of Macroeconomic Fluctuations in Developing Countries: Brazil and Korea", IMF Working Paper 96/20, (Washington: International Monetary Fund).

Hoffmaister, Alexander W., Jorge E. Roldós, and Peter Wickham, 1997b, "Macroeconomic Fluctuations in Sub-Saharan Africa", IMF Working Paper 97/82, (Washington: International Monetary Fund).

International Monetary Fund, October 2001, "How Do Fluctuations in the G-7 Countries Affect Developing Countries?", *World Economic Outlook*.

International Monetary Fund, *Annual Report on Exchange Arrangements and Exchange Restrictions*, 1990-2000.

Kose, M. Ayhan, Eswar S. Prasad, and Marco E. Terrones, 2003, "How Does Globalization Affect the Synchronization of Business Cycles?", IMF Working Paper 03-27, (Washington: International Monetary Fund).

Kouparitsas, Michael, April 1998, "North-South Business Cycles", Federal Reserve Bank of Chicago Working Paper No. 96/9.

Kydland, Finn E., and Carlos and Zarazaga, 1997, "Is the Business Cycle of Argentina Different?" *Federal Reserve Bank of Dallas Economic Review*, pp. 21-36.

Loayza, Norman, Humberto Lopez, and Angel Ubide, 1999, "Sectorial Macroeconomic Interdependencies: Evidence for Latin America, East Asia and Europe", IMF Working Paper 99/11, (Washington: International Monetary Fund).

Lucas, Robert E., 1977, "Understanding Business Cycles", in *Carnegie-Rochester Series on Public Policy*, ed. by Brunner and Mettler, (Amsterdam: North Holland).

Rodriguez-Mata, Margarita, 1997, "Cyclical Patterns of the Costa Rican Economy", Central Bank of Costa Rica.

Shapiro, Matthew, and Mark Watson, 1988, "Sources of Business Cycle Fluctuations", in *NBER Macroeconomics Annual*, ed. by Stanley Fischer (Cambridge, Massachusetts: MIT Press), pp. 111-48.