Response Asymmetry of Latin American Stock Markets to the U.S. Money Market

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ABSTRACT

Studies have shown that relative increase (decrease) in the U.S. interest rate is associated with capital outflows (inflows) from the emerging. For example, changes in 3months U.S. Treasury Bill yield has slow and varying impact on Latin American stock markets. This paper investigates the existence (if any) of asymmetries in equity markets of Mexico, Brazil, Chile and Argentina to increase and decrease in the U.S. interest rates. We find that the magnitude and the duration of time in which the increase in the U.S. interest rate is fully reflected in equity markets of Latin America is significantly different from that of the decrease in the U.S. interest rates. The results are consistent with the view that international investors react to downturns more heavily than rewarding such upturns in the U.S. economy. We conclude that if portfolios are formed based on average co-movements, which assume symmetry, the performance of the investment could be worse than expected in the down markets.

Keywords: Equity markets, Latin America, Response Asymmetries

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1. Introduction

Over the past decade Latin American emerging markets have gone through an eventful financial liberalization process. The capital flows in the region have increased rapidly as investors included these emerging market securities in their portfolios to take advantage of potential diversification benefits. To better understand the underlying characteristics of these emerging markets, researchers have investigated the transmission patterns of equity market movements between the U.S., Mexico, Argentina and Brazil (Soydemir, 2000; Meric et al. 2001a, b; Ratanapakorn and Sharma, 2002); interconnectedness of Latin American equity markets (Ratner and Leal, 1996; Choudhry, 1997; Meric et al. 1998; Christofi and Pericli, 1999; Pagan and Soydemir, 2000; Chen et al., 2000; Pretorius, 2002; Johnson and Soenen, 2003); macroeconomic variables and Latin American equity markets (Bailey and Chung, 1995; Bilson et al., 2001; Adrangi et al., 2001); impact of the U.S. interest rates on Latin American equity markets (Soydemir, 2002); response pattern of Latin American equity markets to cross-county macroeconomic movements (Verma and Ozuna, 2005); time series characteristics of Latin American equity markets (Ortiz and Arjona, 2001); and the issue of contagion (Calvo and Reinhart, 1996; Bazdresch and Werner, 2000).

However, an area of research that has achieved little attention in the literature is whether Latin American equity market reacts differently in terms of speed and magnitude to increase and decrease in the U.S. interest rates. This issue is important because these emerging fragile equity markets could be vulnerable to asymmetric spillovers and contagion effects from the U.S. economy. As such, understanding the co-movement of these emerging markets with the U.S. economy in different market scenarios is important for portfolio management.

This study extends prior research by analyzing whether Latin American equity markets react differently to the positive as opposed to negative shocks in the U.S. money market. Specifically, we investigate the existence of Magnitude and pattern asymmetry in the case of equity markets of Mexico, Brazil, Argentina and Chile. Answers to questions are important since the state of the U.S. money market (up and down) might play an important role in forecasting the Latin American equity market movements. They also have important implications for policymakers that seek to reduce country spillover effects and investors who aim to improve their portfolio performance.

Using the generalized impulse responses from the VAR model and monthly data, we find that the magnitude and the duration of time in which the increase in the U.S. interest rate is fully reflected in equity markets of Latin America is significantly different from that of the decrease in the U.S. interest rates. The results are consistent with the view that international investors react to downturns more heavily than rewarding such upturns in the U.S. economy. We conclude that if portfolios are formed based on average co-movements, which assume symmetry, the performance of the investment could be worse than expected in the down markets.

This paper is organized as follows: Section two discusses the theoretical background on response asymmetry and stock prices while sections three and four presents the econometric methodology and the data. Section five discusses the empirical results and this is followed by the concluding remarks provided in section six.

2. Theoretical framework

Conceptually, response asymmetries may rise from different sources. If stock returns are drawn from symmetric distributions, co-movements between markets during upturn and downturn should be similar. However, recent evidence suggest that the return distributions are not symmetric for the U.S. (Fama, 1965; Richardson and Smith, 1993); for developed markets (Harvey and Zhou, 1993) and for the emerging markets (Harvey, 1995).

Asymmetries may arise from differences in return expectations among investors about the potential international impact of changes in foreign stock markets (Erb, Harvey and Viskanta, 1994; Odier and Solnik, 1993). For example, a small downturn in the U.S. market could trigger relatively larger downturn in the Latin American markets due to widespread earnings disappointment among investors rather than as a result of the particular magnitude of the U.S. market decline. Therefore it is the disappointment (satisfaction) arising from the decrease (increase) in the price of a stock that matters most to the investors rather than the real magnitude of this change.

Asymmetries may occur due to the investment strategies based on incomplete and irrelevant information. Such information set could lead to biased investments leading to irrational buying or selling. In such cases the effect of capital flows on equity markets could be dissimilar for upturn than downturn. Aitken (1996) suggest that institutional investor sentiments towards emerging markets can help determine equity prices in these markets. The institutional investors lacking local knowledge about each individual country's fundamentals may treat these markets as if they belong to a unique class. However, the importance of local information is increasing due to the segmented nature of emerging markets (Harvey, 1995). Therefore investment strategies based on biased information could lead to asymmetric responses.

Asymmetries may also occur due to the unidentified component of risk which is priced in equity markets. Fama and French (1992) suggest the existence of multidimensional risks associated with any stock. One dimension of risk is the unidentified risk which is nonetheless reflected in stock prices. However, the relationship between the unidentified components of risk with stock returns may not be linear and therefore may lead to dissimilar positive and negative returns to investors. Downs and Ingram (2000) provide evidence in support of this argument and find that up market betas are not equal to down market betas in absolute terms. Similarly, there is evidence in support of positive (negative) relationship between beta and returns in up market (down market) for the U.S. market by Pettengill, Sudaram and Mathur (1995) and for international equity markets by Fletcher (2000).

The economic rationale for asymmetric response can also be explained from the behavioral standpoint of investor psychology. Investors, in general, are more concerned about market downturns than upturns, partly due to their risk-aversion. Thus, this tendency towards risk-aversion will be reflected in market prices, causing greater market responses to downturns in other markets. The evidence on momentum profitability and reversals suggest the effect of investor sentiments on the stock market may be asymmetric (Hong, Lim and Stein, 2000; Hong and Stein, 1999). The asymmetric effect of sentiments on the stock market is attributed to the limits to arbitrage (Brown and Cliff, 2004) and overconfidence (Gervais and Odean, 2001; Daniel, Hirshleifer and Subrahmanyam, 1998).

Price movement asymmetries have been found in Asian markets (Bahng and Shin, 2003); Australian equity market (Iorio and Faff, 2000); EMS exchange rates (Laopodis, 2001); commodity markets (Karrenbrock, 1991); goods market (Peltzman, 2004) and real and underground output in New Zealand (Giles, 1999). In the light of the above theoretical propositions and empirical findings, we can expect asymmetric responses of Latin American equity markets to external positive and negative shocks. Specifically, upturns and downturns in the U.S. market could lead to asymmetry since the U.S. business condition is the major global factor affecting these markets (Taylor and Sarno, 1997). Although asymmetries could be as a result of one or more than above mentioned sources, our objective is to identify the existence of asymmetries rather than quantify the contribution of each of these sources.

3. Econometric methodology

We undertake two approaches to investigate the presence/absence of asymmetric response of Latin American stock prices to the U.S. money market. Specifically, we test for the existence of magnitude asymmetry and pattern asymmetry.

3.1 Magnitude asymmetry

Returns in equity market *i* (R_i) are defined to have a magnitude asymmetric impact if an increase in the equity market *j* (R_j) affects equity market *i* differently than a decrease of equal magnitude. The statistical model takes the following form (Eqs.1-3). The statistical model captures contemporaneous relationships of equity returns between the markets (see Karoyli and Stulz, 1996).

$$R_{it} = \alpha_0 + \alpha_1 RI_{jt} + \alpha_2 RD_{jt} + \alpha_3 R_{it-k} + \varepsilon_t \qquad (1)$$

$$RI_t = P_t - P_{t-1}, \text{ if } P_t - P_{t-1} > 0 \text{ and } = 0 \text{ otherwise, and} \qquad (2)$$

$$RD_t = P_t - P_{t-1}, \text{ if } P_t - P_{t-1} < 0 \text{ and } = 0 \text{ otherwise.} \qquad (3)$$

where α_0 is a constant term, ε_t is error term and $\alpha_1, \alpha_2, \alpha_3$ are the parameters to be estimated. P_t and P_{t-1} are expressed in logarithms so that returns are continuously compounded returns (Tsay, 2002). All RI_t are positive or zero and all RD_t are negative and zero. In Eq.(1), we test the null hypothesis that the upturns and downturns in market *j* have the same effect on the changes in equity market *i*. For example, if the Mexican market (R_i) responds symmetrically to the U.S. money market upturn (RI_j) and downturn (RD_j), then one would expect to find $\alpha_1 = \alpha_2$. To investigate the magnitude asymmetry that markets of Mexico, Brazil, Argentina and Chile respond symmetrically to upturns and downturns in the U.S. market we test the hypothesis H_0: $\alpha_1 = \alpha_2$ by using Wald test (Greene, 2000). The lag appropriate length of *k* may be sufficient to characterize the model dynamics and capture the return generating process. In order to obtain unbiased and efficient parameter estimates, we also assume that the constant α_0 captures the average influence of factors that are not explained by changes in the U.S. market.

3.2 Pattern asymmetry

Returns in equity market *i* (R_i) are defined to have a pattern asymmetric impact if the magnitude of the effects from the upturns and downturns in the equity market *j* (R_j) changes over time (see Ng, 1998; Iorio and Faff, 2000; Peltzman, 2000; Laopodis, 2001; Pagan and Soydemir, 2001; Bahng and Shin, 2003). We investigate the presence/absence of pattern asymmetry by estimating a ten variable VAR model (Sims, 1980). Thus VAR model captures the dynamic feedback effects in a relatively unconstrained fashion and is therefore a good approximation to the true data generating process. We express the VAR model as:

$$Z(t) = C + \sum_{s=1}^{m} A(s)Z(t-m) + \upsilon(t) \qquad (4)$$

where, *Z(t)* is a column vector of variables under consideration, *C* is the deterministic component comprised of a constant, *A(s)* is a matrix of coefficients, *m* is the lag length and $\upsilon(t)$ is a vector of random error terms. By construction, $v(t)$ is uncorrelated with past $Z(t)_s$.

The VAR specification allows the researchers to do policy simulations and integrate Monte Carlo methods to obtain confidence bands around the point estimates (Doan, 1988; Genberg et al. 1987; Hamilton, 1994). The likely response of one variable at time *t*, *t+1*, *t+2* etc.

to a one time unitary shock in another variable at time *t* can be captured by impulse response functions. As such they represent the behavior of the series in response to pure shocks while keeping the effect of other variables constant. Since, impulse responses are highly non-linear functions of the estimated parameters, confidence bands are constructed around the mean response. Responses are considered statistically significant at the 95% confidence level when the upper and lower bands carry the same sign.

It is well known theoretically that traditional orthogonalized forecast error variance decomposition results based on the widely used Choleski factorization of VAR innovations may be sensitive to variable ordering (Pesaran and Shin, 1996; Koop, Pesaran and Potter, 1996; Pesaran and Shin, 1998). To mitigate such potential problems of misspecifications, we employ the recently developed *generalized impulses* technique as described by Pesaran and Shin (1998) in which an orthogonal set of innovations which does not depend on the VAR ordering. The generalized impulse responses from an innovation to the j^{th} variable are derived by applying a variable specific Cholesky factor computed with the j^{th} variable at the top of the Cholesky ordering. These generalized impulses can capture the effect of *unanticipated* components and therefore can be regarded as an appropriate choice for this study.

4. Data

We obtain all data in monthly intervals from September 1988 to December 2008 from Datastream. In addition to the U.S. money market, we include the following four Latin American countries in our study: Mexico, Argentina, Brazil, and Chile since these equity markets have exhibited phenomenal growth in the past two decades. For instance, Brazil, Mexico, Chile, and Argentina are ranked 18^{th}, 25^{th}, 30^{th},and 31^{st} respectively among top developed and emerging markets in the world (IFC, 2000). In terms of regional ranking based on market capitalization, Brazil, Mexico, Argentina, and Chile are ranked 1st, 2nd, 3rd, and 4th respectively among Latin American equity markets. As measured by the turnover ratio, Brazil (45), Mexico (33) and Chile (10) are the three most liquid stock markets in the region. Eun and Resnick (2004) suggest the liquidity in these markets have been improving significantly. Further, these markets have been found to be significantly affected by the U.S. stock market and the U.S. economy by varying degrees.

The market variable identified for these countries are the major indexes in their respective stock markets. Specifically, we include the following indexes in our study: U.S. treasury bill rate (U.S. T.B), IPC BOLSA (Mexico), BOVESPA (Brazil), General IGPA (Chile), and MERVAL (Argentina). We take the first difference of natural logarithm of all the indexes to obtain the continuously compounded return series (Tsay, 2002).

Table 1 reports the descriptive statistics for the continuously compounded monthly returns. Brazil, Mexico and Argentina's stock market have high standard deviation, suggesting highly volatile nature of these markets. In comparison, Chile exhibits low volatility, similar to the U.S. market. The Brazilian stock market has the highest mean and the highest standard deviation suggesting that investors are compensated for bearing higher risk. In all the cases, the mean values are substantially different from the median values indicating the possible existence of asymmetry. Table 2 reports the cross correlation between the variables.

[Tables 1 and 2 about here]

Before proceeding with the main results, we first check the time series properties of each variable by performing unit root tests. Table 3 reports the results of unit root tests using Augmented Dickey Fuller (ADF) test (Dickey and Fuller, 1979, 1981) and Kwiatkowski, Phillips, Schmidt, and Shin (1992) (KPSS test). Based on the consistent and asymptotically efficient *AIC* and *SIC* criteria (Diebold, 2003) and considering the loss in degrees of freedom, the appropriate number of lags is determined to be two. In the case of the ADF test, the null hypothesis of nonstationarity is rejected. In the KPSS test, the null hypothesis is that each series in stationary. We fail to reject the null hypothesis in the case of KPSS test. The inclusion n of drift/trend terms in the ADF and KPSS test equations does not change these results (Dolado, Jenkinson, and Sosvilla-Rivero, 1990).

[Table 3 about here]

5. Estimation results

We employ VAR model to examine whether the magnitude of the asymmetry is time invariant. First, we construct the variables related to upturn and downturn in all the markets based on Eqs. (2) and (3). Second, we estimate a ten variable VAR model (upturn and downturn series for each of the five markets) with two lags, in accordance with Eq. (4). Sims (1980) and Enders (2003) indicate that the VAR coefficient estimates are not very useful and that the tool we should employ to interpret the VAR results are the impulse response functions obtained from the VAR model. Thus, we analyze the generalized impulse response functions generated from the VAR model[1].

Figure 1a and 1b plot the impulse responses of Mexico's equity market to one time upturn and downturn (one standard deviation shock) in the U.S. money market. The solid line represents the mean response and the dashed lines are confidence bands around the mean response. A total of 500 draws were employed in the Monte Carlo simulations to obtain the standard errors. The responses are said to be statistically significant when the dashed responses carry the same sign. The response of the Mexican market to the U.S. upturn is shorter and less

[1] The results of the VAR estimates are reported in table 4

pronounced (figure 1a) as compared to those of the U.S. downturn (figure 1b). In case of the U.S. upturn there is a response of approximately 0.01 as compared to 0.025 in the case of the U.S. downturn. Also, in the former case, the responses are statistically significant only during the third month, while in the latter case the responses are significant from the second to the fourth month. The results suggest the presence of pattern asymmetry and provide further evidence against magnitude symmetry in the case of Mexico equity market.

[Figure 1 about here]

Figure 2a and 2b plot the impulse responses of Brazil's equity market to one time standard deviation shock in upturn and downturn in the U.S. money market. Similar to the results for Mexico, the response of Brazil's upturn to the U.S. upturn is not very pronounced and short lived (figure 2a). However, the response of Brazil's downturn to the U.S, downturn is much more pronounced and last during the second to the fourth month (figure 2a). The results from this analysis provide evidence in favor of pattern and magnitude asymmetry in the case of Brazil's equity market.

[Figure 2 about here]

Figure 3a and 3b plot the generalized impulse responses of Argentina's equity market to one time standard deviation increase in upturn and downturn in the U.S. money market. Once again the response of the upturn to the U.S. upturn is of magnitude close to 0.01 (figure 3a) as against approximately 0.025 (figure 3b) in the case of downturn to the U.S. downturn. Further, in the former case, the response is statistically significant for a small time period during the third month, while in the latter case, the responses are statistically significant from second to the fourth month. The responses to upturns become insignificant much faster than downturn responses, suggesting pattern asymmetry in the case of Argentinean equity market.

[Figure 3 about here]

Figure 4a and 4b plot the impulse responses of Chile's equity market to one time upturn and downturn (one standard deviation shock) in the U.S. money market. Similar to the earlier, results the response of downturn is of much greater magnitude and becomes insignificant slower than the response of the upturn. However, the response of Chilean equity market is less pronounced than Mexico, Brazil and Argentina. This is consistent with previous findings that Chile is less affected by the U.S. market.

[Figure 4 about here]

In summary, the results of the generalized impulse responses generated from the VAR model show that both the timing, as well as the extent of responses of the equity markets of Mexico Brazil, Argentina and Chile is not symmetric when there are shocks to the U.S. money market.

6. Conclusion

In this paper, we investigate the existence of asymmetries in Latin American equity markets to upturn and downturn in the U.S. money market. An equity market displays an asymmetric response when returns display differently to market upturns (bullish) than downturns (bearish) in terms of both speed and magnitude. The economic rationale for this asymmetric response can be explained from the behavioral standpoint of investor psychology. Investors, in general, are more concerned about market downturns than upturns, partly due to their risk-aversion. Thus, this tendency towards risk-aversion will be reflected in market prices, causing greater market responses to downturns in other markets.

The empirical results suggest the existence of magnitude and pattern asymmetries in the equity markets of Mexico, Brazil, Argentina and Chile. We find that the magnitude and the duration of time in which the upturn in the U.S. money market is fully reflected in equity markets of Latin America is significantly different from that of the downturn in the U.S. market. Specifically, the results shows that both the timing as well as the extent of responses of equity markets of Mexico, Brazil, Argentina and Chile is not symmetric when there is a shock to the U.S. money market. Further, increase in the U.S. money market disseminates to Latin American equity markets much faster than decrease. The results are consistent with the view that when investing in emerging equity markets in Latin America, investors react to negative stock market movements in the U.S. more heavily than to positive movements.

These results have important practical implications for investors and policymakers. If the portfolios are formed based on average co-movements, which assumes symmetry, the performance of the investment could be worse than expected in the down markets because the correlations increases. A direct implication of the evidence found in this study is that international asset pricing models should especially consider the role of the co-movements in different market scenarios.

Table 1
Descriptive Statistics: Returns

	Argentina	Brazil	Chile	Mexico	U.S.	U.S. T Bills
Mean	-0.0123	0.0845	0.0089	0.0409	0.0520	-0.0082
Median	0.0100	0.0350	0.0000	0.0300	0.0300	0.0000
Maximum	19.4700	26.2700	5.8700	16.5200	4.9800	42.0800
Minimum	-28.5700	-17.2400	-5.0500	-19.5900	-7.1800	-37.2100
Std. Dev.	2.5726	3.0243	0.9318	2.2664	1.0112	1.8382
Skewness	-0.5557	0.2567	-0.0111	-0.2416	-0.4544	1.3372
Kurtosis	16.5233	9.5755	7.0092	12.9448	8.0324	203.9684

Table 2
Cross-correlations of daily percentage returns

	Argentina	Brazil	Chile	Mexico	U.S. T Bills	U.S.
Argentina	1.000000					
Brazil	0.500414	1.000000				
Chile	0.370107	0.417413	1.000000			
Mexico	0.439541	0.485963	0.379924	1.000000		
U.S. T Bills	0.018948	0.039427	-0.000172	0.030982	1.000000	
U.S.	0.351211	0.365563	0.289543	0.405108	0.084027	1.000000

Table 3
Augmented Dickey-Fuller test results

	Log levels	Log return
Argentina	0.0152	-21.7161
Brazil	-2.9820	-22.9927
Chile	-1.4726	-18.0685
Mexico	-1.8174	-19.7183
U.S	-1.4503	-22.1816
U.S. T Bills	0.9887	-22.4329
Critical level: 0.01	-3.4363	
Critical level: 0.05	-2.8633	
Critical level: 0.10	-2.5677	

Table 4: VAR estimates

The variables in the VAR model are: Positive return on Argentinean stock market (RI_{arg}), negative return on Argentinean stock market (RD_{arg}), Positive return on Brazilian stock market (RI_{bra}), negative return on Brazilian stock market (RD_{bra}),Positive return on Chilean stock market (RI_{chi}), negative return on Chilean stock market (RD_{chi}), Positive return on Mexican stock market (RI_{mex}), negative return on Mexican stock market (RD_{mex}), Positive return on the U.S. stock market (RI_{usa}), negative return on the U.S. Argentinean stock market (RD_{usa}), Positive return on the U.S. 3 months treasury bills yield (RI_{tbil}), the U.S. 3 months treasury bills yield (RD_{tbil}).We take the daily first difference of each series to establish stationarity. The estimate and standard errors are shown in the table. Note * and ** denote significance levels at the 1% and 5% respectively.

	RI_{arg}	RI_{bra}	RI_{chi}	RI_{mex}	RI_{tbil}	RI_{usa}	RD_{arg}	RD_{bra}	RD_{chi}	RD_{mex}	RD_{tbil}	RD_{usa}
RI_{arg} (-1)	1.961	0.011	0.032	0.060	-0.007	0.007	0.035	-0.001	0.023	-0.002	-0.013	-0.015
	-0.006	-0.007	-0.009	-0.012	-0.009	-0.010	-0.006	-0.007	-0.009	-0.011	-0.009	-0.008
	-312.641	-1.519	-3.665	-5.185	(-0.74986)	-0.753	-5.390	(-0.07517)	-2.407	(-0.14152)	(-1.45230)	(-2.03259)
RI_{arg} (-2)	-0.969	-0.011	-0.034	-0.061	0.009	-0.008	-0.032	0.000	-0.023	0.001	0.014	0.016
	-0.006	-0.007	-0.009	-0.012	-0.009	-0.010	-0.006	-0.007	-0.009	-0.011	-0.009	-0.008
	(-154.753)	(-1.57884)	(-3.85622)	(-5.25135)	-1.086	(-0.81895)	(-4.99549)	-0.066	(-2.40702)	-0.116	-1.581	-2.068
RI_{bra} (-1)	-0.008	1.953	0.039	0.008	-0.024	0.030	0.005	0.033	0.009	0.005	-0.005	0.002
	-0.005	-0.006	-0.008	-0.010	-0.007	-0.008	-0.005	-0.006	-0.008	-0.009	-0.007	-0.006
	(-1.41919)	-323.824	-5.183	-0.802	(-3.25493)	-3.596	-0.832	-5.471	-1.125	-0.508	(-0.65166)	-0.316
RI_{bra} (-2)	0.008	-0.958	-0.038	-0.008	0.025	-0.029	-0.004	-0.030	-0.009	-0.004	0.004	-0.002
	-0.005	-0.006	-0.007	-0.010	-0.007	-0.008	-0.005	-0.006	-0.008	-0.009	-0.007	-0.006
	-1.520	(-159.863)	(-5.09334)	(-0.83696)	-3.412	(-3.53972)	(-0.71098)	(-5.04617)	(-1.08770)	(-0.41613)	-0.594	(-0.31324)
RI_{chi} (-1)	0.001	0.025	1.761	-0.007	0.012	0.086	-0.015	-0.034	-0.054	-0.005	-0.006	0.024
	-0.010	-0.011	-0.014	-0.018	-0.014	-0.015	-0.010	-0.011	-0.015	-0.017	-0.014	-0.012
	-0.103	-2.245	-127.635	(-0.40733)	-0.861	-5.661	(-1.48123)	(-3.09193)	(-3.66945)	(-0.27574)	(-0.45425)	-1.997
RI_{chi} (-2)	0.000	-0.023	-0.767	0.006	-0.009	-0.088	0.015	0.033	0.057	0.004	0.006	-0.025
	-0.010	-0.011	-0.014	-0.018	-0.014	-0.015	-0.010	-0.011	-0.015	-0.017	-0.014	-0.012
	-0.049	(-2.11512)	(-55.7904)	-0.340	(-0.64085)	(-5.85682)	-1.459	-2.942	-3.865	-0.221	-0.471	(-2.13537)
RI_{mex} (-1)	0.010	0.019	0.004	1.857	0.018	0.013	-0.007	-0.013	0.013	-0.002	0.018	0.000
	-0.006	-0.007	-0.009	-0.011	-0.009	-0.010	-0.006	-0.007	-0.009	-0.011	-0.009	-0.007
	-1.578	-2.693	-0.519	-164.227	-2.072	-1.416	(-1.14535)	(-1.82648)	-1.365	(-0.15777)	-2.062	(-0.03947)
RI_{mex} (-2)	-0.009	-0.018	-0.002	-0.863	-0.019	-0.014	0.006	0.012	-0.014	0.004	-0.017	0.001
	-0.006	-0.007	-0.009	-0.011	-0.009	-0.010	-0.006	-0.007	-0.009	-0.011	-0.009	-0.007
	(-1.45525)	(-2.53588)	(-0.19406)	(-76.2005)	(-2.23361)	(-1.42176)	-1.015	-1.776	(-1.45965)	-0.340	(-1.95074)	-0.089
RI_{tbil} (-1)	-0.013	0.005	-0.002	0.025	1.527	0.029	0.001	0.026	0.015	0.003	0.005	0.000
	-0.013	-0.015	-0.018	-0.024	-0.018	-0.020	-0.013	-0.015	-0.019	-0.022	-0.018	-0.016
	(-0.97845)	-0.345	(-0.08589)	-1.065	-85.598	-1.467	-0.085	-1.804	-0.797	-0.129	-0.273	0.000
RI_{tbil} (-2)	0.011	-0.003	0.001	-0.024	-0.532	-0.027	-0.001	-0.027	-0.014	-0.006	-0.002	0.003

	-0.013	-0.015	-0.018	-0.024	-0.018	-0.020	-0.013	-0.015	-0.019	-0.022	-0.018	-0.016
	-0.867	(-0.23217)	-0.082	(-1.01296)	(-29.8525)	(-1.34203)	(-0.09893)	(-1.83277)	(-0.73755)	(-0.29285)	(-0.08816)	-0.218
RI_{usa} (-1)	0.015	-0.001	0.052	0.030	0.016	1.506	-0.002	0.003	0.060	-0.002	0.038	-0.021
	-0.012	-0.013	-0.017	-0.022	-0.016	-0.018	-0.012	-0.013	-0.018	-0.020	-0.016	-0.014
	-1.313	(-0.07890)	-3.133	-1.360	-0.981	-82.623	(-0.16657)	-0.199	-3.392	(-0.08623)	-2.335	(-1.49829)
RI_{usa} (-2)	-0.016	-0.002	-0.051	-0.026	-0.019	-0.512	0.004	-0.001	-0.062	0.004	-0.039	0.025
	-0.012	-0.013	-0.017	-0.022	-0.016	-0.018	-0.012	-0.013	-0.018	-0.020	-0.016	-0.014
	(-1.37002)	(-0.14197)	(-3.06662)	(-1.20730)	(-1.17596)	(-27.9582)	-0.314	(-0.09596)	(-3.45294)	-0.205	(-2.40427)	-1.718
RD_{arg} (-1)	0.020	-0.019	0.000	0.002	0.009	-0.026	1.971	0.017	0.077	0.040	-0.025	0.011
	-0.007	-0.007	-0.009	-0.012	-0.009	-0.010	-0.007	-0.008	-0.010	-0.011	-0.009	-0.008
	-2.978	(-2.50630)	(-0.03583)	-0.180	-0.935	(-2.50374)	-289.717	-2.239	-7.703	-3.496	(-2.66844)	-1.369
RD_{arg} (-2)	-0.017	0.019	0.001	-0.002	-0.009	0.026	-0.975	-0.017	-0.078	-0.039	0.024	-0.011
	-0.007	-0.008	-0.009	-0.012	-0.009	-0.010	-0.007	-0.008	-0.010	-0.011	-0.009	-0.008
	(-2.63871)	-2.499	-0.078	(-0.18394)	(-0.93439)	-2.516	(-142.646)	(-2.19930)	(-7.77016)	(-3.46122)	-2.598	(-1.41883)
RD_{bra} (-1)	-0.008	0.023	0.006	0.012	-0.032	0.020	-0.002	1.964	0.011	0.016	-0.005	0.019
	-0.006	-0.006	-0.008	-0.010	-0.008	-0.009	-0.006	-0.006	-0.008	-0.009	-0.008	-0.007
	(-1.47517)	-3.654	-0.787	-1.214	(-4.15295)	-2.397	(-0.41359)	-313.575	-1.367	-1.656	(-0.61149)	-2.781
RD_{bra} -2)	0.008	-0.020	-0.007	-0.013	0.031	-0.019	0.001	-0.971	-0.012	-0.017	0.006	-0.018
	-0.006	-0.006	-0.008	-0.010	-0.008	-0.009	-0.006	-0.006	-0.008	-0.010	-0.008	-0.007
	-1.495	(-3.17718)	(-0.94654)	(-1.25032)	-3.968	(-2.21368)	-0.258	(-154.127)	(-1.42275)	(-1.81703)	-0.838	(-2.66221)
RD_{chi} (-1)	-0.006	0.017	-0.013	0.017	0.037	0.074	-0.010	-0.035	1.647	-0.014	-0.004	0.033
	-0.011	-0.012	-0.015	-0.019	-0.015	-0.016	-0.011	-0.012	-0.016	-0.018	-0.015	-0.013
	(-0.54064)	-1.428	(-0.87635)	-0.869	-2.513	-4.518	(-0.93703)	(-2.90490)	-103.338	(-0.79272)	(-0.27478)	-2.558
RD_{chi} (-2)	0.005	-0.018	0.015	-0.015	-0.038	-0.074	0.008	0.036	-0.653	0.014	0.001	-0.035
	-0.011	-0.012	-0.015	-0.019	-0.015	-0.016	-0.011	-0.012	-0.016	-0.018	-0.015	-0.013
	-0.522	(-1.51788)	-1.019	(-0.76481)	(-2.61442)	(-4.54298)	-0.765	-2.968	(-41.0085)	-0.790	-0.063	(-2.76721)
RD_{mex} (-1)	0.011	0.005	0.004	0.011	0.009	-0.006	0.007	0.017	0.011	1.898	0.022	0.022
	-0.006	-0.007	-0.008	-0.011	-0.008	-0.009	-0.006	-0.007	-0.009	-0.010	-0.008	-0.007
	-1.897	-0.696	-0.423	-1.009	-1.092	(-0.67480)	-1.198	-2.512	-1.290	-188.059	-2.749	-3.030
RD_{mex} (-2)	-0.012	-0.006	-0.004	-0.009	-0.008	0.005	-0.006	-0.015	-0.010	-0.900	-0.023	-0.021
	-0.006	-0.007	-0.008	-0.011	-0.008	-0.009	-0.006	-0.007	-0.009	-0.010	-0.008	-0.007
	(-1.98200)	(-0.82797)	(-0.42234)	(-0.85707)	(-0.93502)	-0.523	(-1.06101)	(-2.27179)	(-1.12882)	(-88.9545)	(-2.76105)	(-2.98224)
RD_{tbil} (-1)	-0.018	-0.009	0.005	0.009	0.028	0.028	0.014	0.002	0.026	0.022	1.748	0.024
	-0.010	-0.011	-0.014	-0.018	-0.014	-0.015	-0.010	-0.011	-0.015	-0.017	-0.014	-0.012
	(-1.79088)	(-0.83680)	-0.363	-0.492	-2.037	-1.834	-1.333	-0.181	-1.758	-1.291	-126.812	-1.971
RD_{tbil} (-2)	0.017	0.008	-0.005	-0.009	-0.027	-0.030	-0.012	0.000	-0.026	-0.020	-0.752	-0.025

	-0.010	-0.011	-0.014	-0.018	-0.014	-0.015	-0.010	-0.011	-0.015	-0.017	-0.014	-0.012
	-1.749	-0.739	(-0.35963)	(-0.50145)	(-1.94672)	(-1.97902)	(-1.16049)	(-0.02806)	(-1.75673)	(-1.21304)	(-55.0125)	(-2.08236)
RDUSA(-1)	-0.004	-0.017	0.023	0.001	0.007	-0.023	0.045	0.044	0.108	0.016	0.068	1.633
	-0.014	-0.015	-0.019	-0.025	-0.019	-0.021	-0.014	-0.015	-0.021	-0.023	-0.019	-0.016
	(-0.26423)	(-1.07842)	-1.182	-0.035	-0.363	(-1.09793)	-3.215	-2.881	-5.286	-0.695	-3.613	-99.255
RDUSA(-2)	0.005	0.018	-0.021	-0.003	-0.010	0.023	-0.047	-0.045	-0.102	-0.024	-0.054	-0.640
	-0.014	-0.015	-0.019	-0.025	-0.019	-0.021	-0.014	-0.016	-0.021	-0.023	-0.019	-0.017
	-0.359	-1.150	(-1.09948)	(-0.09970)	(-0.52068)	-1.083	(-3.33525)	(-2.89449)	(-4.92127)	(-1.02639)	(-2.81831)	(-38.6441)
C	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	-6.738	-5.636	-0.598	-3.710	(-1.18522)	-1.355	(-7.41973)	(-5.72504)	(-1.78596)	(-3.82910)	(-1.06228)	(-4.33141)
R-squared	1.000	1.000	0.999	0.999	0.998	0.997	1.000	1.000	0.999	1.000	0.999	0.997
Adj. R-squared	1.000	1.000	0.999	0.999	0.998	0.997	1.000	1.000	0.999	1.000	0.999	0.997
Sum sq. resids	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
S.E. equation	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Log likelihood	20124.480	19838.770	19342.860	18738.340	19377.740	19131.490	20055.170	19832.340	19187.300	18899.130	19375.940	19684.790
Akaike AIC	-17.771	-17.519	-17.080	-16.546	-17.111	-16.893	-17.710	-17.513	-16.943	-16.688	-17.110	-17.383
Schwarz SC	-17.708	-17.456	-17.017	-16.483	-17.048	-16.830	-17.647	-17.450	-16.880	-16.625	-17.046	-17.319
Mean dependent	0.001	0.002	0.001	0.002	0.001	0.001	-0.002	-0.002	-0.001	-0.002	-0.001	0.000
S.D. dependent	0.002	0.003	0.002	0.002	0.001	0.001	0.003	0.003	0.001	0.003	0.002	0.001

Determinant Residual Covariance	0.000
Log Likelihood	237996.300
Akaike Information Criteria	-210.165
Schwarz Criteria	-209.406

Figure 1
Impulse Response Functions of Mexico

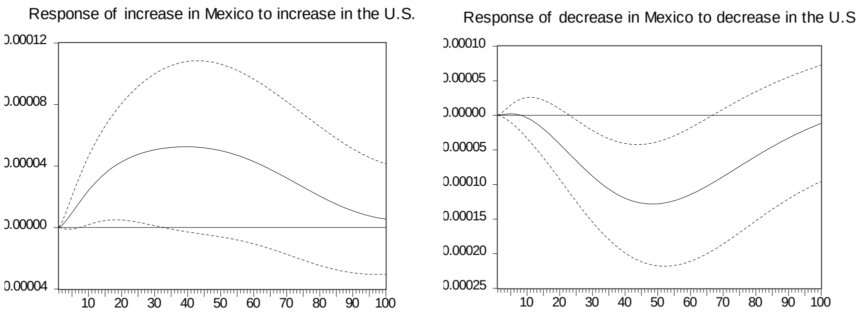

Figure 2
Impulse Response Functions of Brazil

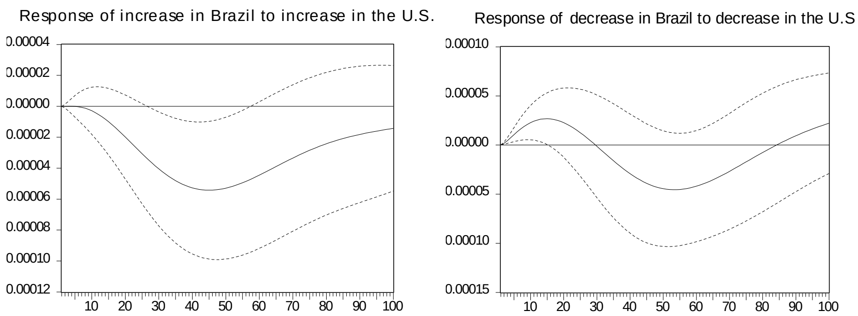

Figure 3
Impulse Response Functions of Argentina

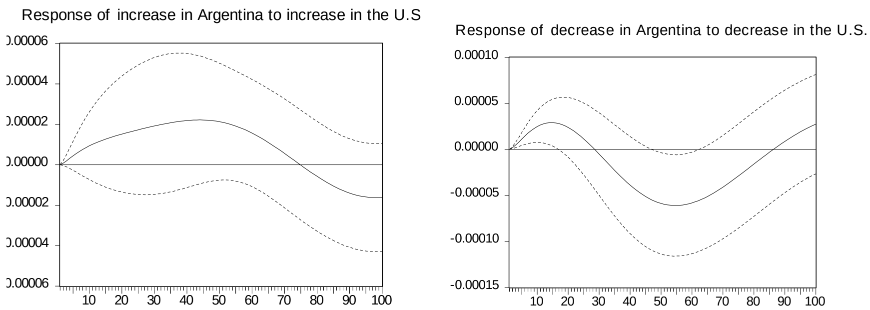

Figure 4
Impulse Response Functions of Chile