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DO FOREIGN PORTFOLIO FLOWS INCREASE RISK IN EMERGING STOCK MARKETS? EVIDENCE FROM SIX LATIN AMERICAN COUNTRIES 1999-2008

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Evidence from six Latin American countries 1999 -2008.

Abstract

Foreign portfolio flows have been blamed for causing instability in emerging markets, especially during financial crises. This study measured the effect of foreign capital flows on volatility and exposure to world market risk in the six largest Latin American stock markets: Argentina, Brazil, Colombia, Chile, Mexico and Peru, for around 10 years including the 2008's World financial crisis. This will test whether these flows cause instability for those markets and increase their exposure to international stock market returns. A proprietary database, from Emerging Portoflio.com and time series models, both univariate (ARCH - GARCH) and multivariate (VAR), are used to estimate the effect foreign portfolio flows on the risk variables and the causality of these effects. We found no strong evidence to support the hypothesis that foreign flows cause instability in the Latin American stock markets, in spite of some evidence of causing price pressure. Instead, the evidence points to a strong dependence of market returns on international stock and foreign exchange markets, both in means and in volatility, instrumental to transmit crisis to those markets.

Key Words: Foreign portfolio flows, Emerging Markets, market risk, ARCH-GARCH, VAR

JEL Classification: F32, G01, G15,

Introduction.

Increasing financial integration between financial markets around the world in the lasts 30 years has brought new investment opportunities. International Investors have looked to take advantage of important capital gains, increased diversification, foreign exchange appreciation and differentials in interest rates. (Ferrer, 1999; Di tella, 2004). As part of an increasing interest on financial integration, academics have been studying the effect of portfolio funds on emerging financial markets. Whether foreign portfolio funds have been overall helpful or harmful for emerging markets is a complex, and still not completely solved question, that reappears from time to time, especially during times as the 2008 World financial crisis.

On the positive side, some authors have associated foreign portfolio funds to the decreasing cost of capital for listed companies (Miller, 1999; Errunza y Miller, 2000; Bekaert y Harvey, 2000), increasing market efficiency (Kim y Singal, 2000) and more diversification choices for investors (Villariño, 2001).

On the other hand, Krugman (1998, 1999) and Stiglitz (2000) expressed fears of excessive volatilities and inflation, increased boom and bust cycles and appreciation of exchange rates caused by the instability of foreign investor's flows and holdings. Unlike foreign direct investment, which is widely regarded as beneficial, foreign portfolio flows are considered potentially damaging for emerging economies. Foreign portfolio investments, sometimes dubbed 'hot money', might flee from a developing country at the first sign of trouble during times of financial stress, further disrupting its capital markets. Empirical studies as Brennan and Cao (1997), Warther (1995) and Griffin, Nardari y Stulz (2004) have supported this point of view. Moreover, this behavior has been criticized in the context of the worldwide financial crises during the 90's, especially the Mexican crisis (Villarino, 2001) and the Asian crisis. (Flood y de Paterson, 2008). A more recent example is provided by the 2008 World financial crisis, when most emerging markets experienced important withdrawals of foreign capital along with large negative returns. As a consequence some economists have called for increasing regulation on foreign flows to emerging markets (Rubin and Weisberg; 2003; Ffrench-Davis and Griffith-Jones, 2002; Ito and Portes,1998; and Eichengreen 1999).

In contrast, Edwards (1999) argues against capital controls in emerging countries due to being costly and ineffective in avoiding crises, and fostering corruption. Although most of the emerging markets identified by Standard and Poors (2004) currently have few or no direct barriers to the entry of foreign investors, still countries such as India, China, Colombia, India, Indonesia, the Philippines, Saudi Arabia, Taiwan and Thailand have either formal restrictions for foreign outflows or ceilings to foreign ownership. In Latin America, from 2007 to 2009, Colombia and Brazil restricted the mobility of foreign flows in and out the security markets in order to stabilize and mitigate appreciations of their currencies against the dollar. Still, the question of whether foreign flow causes increasing risk in emerging markets is to be solved empirically.

Excessive volatility is widely regarded as harmful in stock markets. From a theoretical standpoint there are at least three reasons for this. First, classical Asset pricing models require higher expected returns (i.e. "Equitiy Risk premium") in more volatile markets (Cochrane, 2001), implying a higher cost of capital for projects and companies, and lower market value. Second, in the efficient market literature (Fama, 1979) price is an unbiased estimator or the intrinsic value of an asset, but higher volatilities reduce the value of market price as an indicator for economic decisions, thus impairing the market efficiency (Shiller, 1981). Finally, in the market microstructure models, higher volatility leads to lower liquidity, by increasing the adverse selection and inventory costs for a market marker. (Ho y Stoll, 1981; Kyle, 1985; Glosten and Milgrom, 1985).

Empirical evidence of increasing volatility in emerging markets due to foreign flows has been provided by Bekaert, Harvey and Lumsdaine (2002), Frenkel y Menkhoff (2003), both studies analyzing the period around the liberalization of the markets. Moreover, Bae, Chan y Ng (2004) provide evidence at firm level that links higher volatility with share ownership by foreign investors. Besides Richards (2005), provide evidence of increasing volatility due to foreign trading in six emerging markets of Asia during a period just after the Asian crisis. However, the issue is far from being settled: Rea (1996), Froot, O’Connell y Seasholes (2001) and Alemmanni and Haas (2006) don’t find larger volatility related to foreign flows, whereas Choe, Kho, and

Stultz (1999), Bekaert and Harvey (1998), Henry (2000), y Kim and Singal (2000) can't find evidence of increasing volatility on the liberalization of the markets.

Excessive comovement of emerging stock markets with international markets, as measured by the beta or correlation, is also generally perceived as negative, at least for two reasons. First, it clearly reduces the benefit of international diversification for both local and foreign investors in emerging markets. Second, higher comovements are especially harmful during financial crises, those times where risk reduction is likely to be needed the most (Bekaert y Harvey, 2003).. Transmission of negative returns across stock markets has been shown being too large to be justified by fundamental factors during crises, which has been dubbed ‘Contagion’ (Bekaert y Harvey, 2003). Contagion has been attributed to portfolio recomposition or behavioural effects by international traders (Bikhchandani, Hirshleifer and Welch, 1992; Calvo 1998; Calvo and Mendoza, 2000). Whereas increasing correlation upon liberalization has been evidenced in different studies (Bekaert y Harvey, 2000), the eventual link between foreign flows and increasing correlation in a post-liberalization period hasn't been tested to our knowledge.

In this context, we study the effects of foreign portfolio flows on six Latin American emerging stock markets: Argentina, Brazil, Chile, Colombia, México and Perú. We estimate the effects of those short-term flows on two risk measures: First, the volatility of the local stock market returns and, second, the local market systemic risk, measured as the market sensitivity (beta) to international stock market returns. This is achieved modeling the relationship between risk measures, and measures of foreign flows, in two type of econometric models of the return: univariate ARCH_GARCH models at daily frequency, return, and multivariate 4-VAR models at monthly frequency. In both types of models, it is critical to control for variables that might well explain increasing risk, as international equity market returns and foreign exchange rate returns.

This paper contributes to the literature by testing directly a relationship between foreign flows and increasing betas, which hasn't been done before. Besides, it uses a proprietary database of foreign flows that hasn't been used in this branch of study, and more updated data that reflects the effects of foreign flows in Latin-America during the 2008 World financial crisis.

This paper is organized as follows: The first section describes the data set used and examines the evolution and possible relationships between the variables in the studied period, the second section explains the econometric models used to test them and defines the hypothesis to be tested, the third section presents and discusses the results, and finally, fourth section concludes and presents suggestions for future research.

Data.

This study comprises the six largest stock exchanges of Latin America: Argentina, Brazil, Chile, Colombia, México and Perú. Summary statistics for the markets are presented in Table 1. Portfolio flows are taken from the proprietary database of Emerging Portfolio. Starting in 1993, this database compiles the buys and sales of more than 1.500 funds that invest in 65 emerging markets, with more than US$ 160 billion in capital, comprising about 90% of the foreign portfolio investments in those markets. For each country, holdings and net flows (buys minus sales) are reported in dollars on a monthly basis. Figure 1 presents the total monthly net flows for the six countries of the study from April 1995 to December 2008. It’s apparent the increasing size and volatility of those flows, the inflow peaks during 2005 and 2007, corresponding to the boom in emerging stock markets, and the huge outflows during 2008, related to the World financial crisis.

On the other hand, daily values for the main index of the local stock market, the S&P500 and the dollar exchange rate were taken from Bloomberg, whereas total trading values and market capitalizations of the six markets, at a monthly frequency, come from the database of the World Federation of Exchanges (WFE).

Econometric modeling of returns, foreign flows and control variables require transformations that guarantee stationarity. Specifically, local market returns, S&P500 returns, and foreign exchange returns are calculated as the logarithmic difference of the market indexes in local currency (*RETURN*), the S&P500 index in dollars (*SP500_RET*), and the dollar exchange rate (*FEX_RET*) respectively, both at daily and monthly frequencies. Net portfolio fund flows are normalized by the monthly market capitalization, obtaining the share of market capitalization due to foreign portfolio investment (*FOR_CAP*) [1]. Dickey-Fuller and Philipps-Perron tests were applied to each series to assure stationarity.

Volatility of the returns is one of the two risk measures of the study. The daily univariate model requires a proper specification of the conditional volatility in models of the ARCH_GARCH type, as usual in the literature (Campbell, Lo and MacKinlay, 1997). For the multivariable monthly models, monthly volatility (*VOLAT*)[2] is defined as the average absolute value of the daily returns within the month, as follows:

$$VOLAT_t = \frac{1}{n}\left[\sum_{k=1}^{n} \left|R_{t,k}\right|\right] \quad [1]$$

Where

$R_{t,k}$: Daily return of the local stock index, in month t, day k.

n : number of trading days in month t

For the monthly multivariable model we calculate the *BETA* variable, as the sensitivity of the local stock market to world stock market returns. *BETA* is estimated for each month "t" in the following OLS regression

$$R_{t,k} = BETA_t \times R_{m,t,k} + C_1 \quad [2]$$

Where

$R_{t,k}$: Daily return of the local stock index, in month t, day k.

$R_{m\,t,k}$: Daily return (in US$) of the S&P500 index, in month t, day k.

The study period for each country, listed in Table 2, is defined not only by the availability of data, but also, in three cases by structural changes in the series of returns, induced by times of

[1] Alternative measures were considered, as the share of holdings by foreign investors or its first difference, base on the total value of foreign portfolio holdings, also available from Emerging Portfolio. Total value traded in dollars, as taken from the WFE, was also tried as an alternative normalizing variable. Those were discarded either for excessive volatility, not stationarity or both.

[2] The following two alternative measures of volatility were also considered, but performed poorly in the multivariate model: the standard deviation of daily returns, and the average conditional volatility measured with a GARCH(1,1) . Results can be obtained from the authors on request.

excessive volatility or institutional changes[3], that demanded the partition of the series,. Specifically, for the daily univariate model Argentina's series are divided around November 2001, due to the excessive instability in markets brought on by the 'Corralito crisis". Colombia sample period starts in July 2001, with the starting of the Colombian Stock Exchange, formed from the merger of the three previous regional exchanges. Colombian series had to be divided in two, excluding the months of May and June of 2006, when the Colombian securities market experienced a deep drop and excessive volatility. For similar reasons the Peru series were partitioned on early July 2006.

To motivate the analysis of this paper, the time series plot of the main variables of the study are presented for each country in figures 2 to 7 : The main stock market index, the volatility, beta, *FOR_CAP* and the share of foreign investors on market capitalization. Volatility and beta are calculated on daily returns during a six-month window.

Overall the series of the six Latin-American markets present a general pattern that can be described as follows: Prices tend to increase in the sample period, reaching a peak between 2007 and 2008. Increases were particularly dramatic for Colombia and Peru. The indexes for those markets grew about 10-fold between July 2001 and January 2008. Argentina prices dropped by 47% between July and November 2001 corresponding to the Corralito crisis. Colombia experienced a quick crash in prices and a similarly swift rebound in prices between May and July in 2006. None of those two events appear to be associated to a dramatic change of foreign flows in either market. On the contrary, the drop in prices in the last part of 2008, corresponding to the World financial crisis, is associated with a reduction in the foreign share in all the countries, with the sole exception of Chile.

Volatility for each country tends to move stably within a range, but increases dramatically to a peak around October 2008, corresponding to the World financial crisis. Other than that, there are peaks in volatility in Argentina in 2001 associated with the Corralito crisis, and in Colombia in the middle of 2006 to the aforementioned crash and rebound. The volatility series don't seem to move along with either foreign flows or foreign share for any of the six countries. Foreign flows are actually very volatile, but their clusters don't match the ones of the return volatility.

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[3] Chow Breakpoint tests were performed to check for structural changes, as required. Results can be obtained from the authors on request.

The beta series present a more varied behavior across countries. In Argentina, Chile and Colombia, beta moves in a range between 0 and 1.0, with some peaks and valleys associated with high volatility times. In Brazil, it oscillates between 0 and 1.0 until a period beginning in 2004 when it rises, going as high as 2.5. Indeed Brazil has been known in recent years to have become a market very sensitive to the US market movements. In Mexico, beta moves between 0.5 and 1.5, until 2006, where it reaches a peak of 2, and then progressively decreases until 0.7. Perú's Beta exhibits a different behavior: very low and relative stable values, mostly between 0 and 0.5, until 2006, and then a lot of variation in a wider range between -1 and 2.0. In all countries peaks in beta are found between 2006 to 2007, corresponding to the boom in emerging markets but tapers off from 2008 onwards. This suggests a relationship with foreign share that also experienced a local or global peak in each country between 2006 and 2007 and decreased in the last part of the sample. On the other hand, the cases of Chile, México and Peru don't support that relationship, taking the whole 10 year sample period, since foreign shares have decreased but betas have risen.

All in all, the time series plots don't show any apparent relationship between volatility and foreign flows, but do suggest some relationship between foreign holdings and betas. This has to be tested formally in an econometric model that properly controls for other factors. Indeed it might be that the beta –foreign holdings relationship is spurious. For example, at the peak of the boom cycle, emerging markets tend to be more volatile and attract more foreign portfolio investment. Now, higher volatility also increases the beta with respect to international markets[4]. Thus, an anecdotic observation might lead to inferring that foreign investors make emerging markets more volatile and more sensitive to international markets. At the same time, real economic relationships may exist but may be too entangled to appear at first glance. Econometric models are called for to perform a proper test of these relationships.

[4] Holding constant the correlation between the two markets and the US market risk, higher local volatility leads to higher beta, since beta = correlation × stand. Dev Local market / stand. Dev. US market

Econometric Models

Daily univariate models

As mentioned before, this paper uses two types of models to test for the effects of foreign flows on the risk of six Latin American stock exchanges. First, at daily frequency, a univariate model from the ARCH-GARCH family is used to model daily returns and conditional volatility, since they provide for conditional heteroskedasticity of the variance, and allowing to include exogenous factors. These models account for volatility clusters, whereas allowing to control effects on the mean or the conditional volatility from exogenous variables. When required EGARCH models were also used, since they account for the leverage effect, namely that negative returns have a larger effect on conditional volatility than positive returns (Nelson, 1991). The general model is as follows:

$$R_t = C + \sum_{k=1}^{n} C_k X_k + \sum_{k=1}^{p} \varphi_k \gamma_{t-k} \sum_{k=1}^{q} \theta_k \; a_{t-k} \qquad [3.a]$$

$$a_t \sim iid\; N(0,1)$$

$$\sigma_t^2 = f(\sigma_0^2, \sigma_{t-1}^2, a_{t-1}^2, ABS\_SP500_t, ABS\_FEX\_RET_t, FOR\_CAP_t) \qquad [3.b]$$

Where R_t is the daily return of the local stock market, whereas X_k are the exogenous factors, previously defined: *FEX_RET*, *SP500_RET*, *FOR_CAP*. The coefficient for the S&P500 can be clearly identified with the beta, a measure of the sensitivity of the local market to the US market. The model also includes a trend variable T , and two interactive variables *SP500×T* y *FOR_CAP×SP500*, that account for changes on beta over time and changes on beta due to foreign flows. Terms γ_{t-k} and a_{t-k} account for AR y MA effects, respectively, required for assuring white noise in the residuals.

Besides, the conditional variance equation [3.b] includes past conditional variance and past disturbance effects, as usual in a GARCH model. It also includes the absolute value of the S&P500 and the Foreign Exchange returns, *ABS_SP500* and *ABS_FEX_RET*,

respectively, to account for volatility transmission from those markets on the local stock market. *FOR_CAP* is included in the variance equation to test for the assumed effects of foreign investors on the volatility of the local market. The exact functional form will depend on whether a GARCH or EGARCH model are required.

Dummy variables were included to filter out day of the week, month and holiday effects, both in the equations of the mean and the variance of model [3]. Some dummies were used to filter our extreme returns as required. The level of the ARMA model in the mean and the GARCH model are determined based on the residual and square-of-residual correlograms This procedure assures that the residuals of equation [3.a] are white noise in levels and squares.

Expected signs of the coefficients for the different regressors in model [3] as given by the extant empirical and theoretical literature. Regarding the foreign exchange returns, two basic arguments are usually presented. First, the 'Portfolio Balancing" premise of Frankel (1983) argues that a bullish trend in the equity markets usually attracts foreign investors, driving down the foreign exchange rate. This has been empirically supported by Ferrari and Amalfi (2007) in Colombia and Muller and Vershoor (2004) for Taiwan. In contrast, the " market of goods" argument of Dornbusch and Fischer (1980) states that, providing that most of the local listed companies are net exporters, higher foreign exchange rates lead to higher earnings and returns on the local stock market. Evidence on this has been provided on developed and emerging countries by Beer y F. Hebein (2008) in 10 developed markets and Harmantzis y Miao (2009). Actually, both effects might be working at the same time in a given country, depending on the degree of globalization of the companies, and the relevance of foreign flows in its security markets. Based on anecdotal evidence that supports the 'Portfolio Rebalancing" theory, it is expected that for the Latin American case there is a negative relationship between foreign exchange and local market returns.

It's very much expected that the S&P500 return be positively related to local stock market returns. Both fundamental and trading-related reasons have been provided to explain this. Economic globalization in the last 30 years has strengthened the economic ties between countries, whereas financial liberalization has meant that foreign speculators are increasingly more important players in the emerging stock markets (Edison and Warnock, 2009). In this context, the existent of a worldwide systematic risk seems indisputable (Bodie, Kane y Marcus, 2005). This strong relationship of Latin American markets with international ones, especially the US, has been documented by Benelli and Gangully (2007), Lucey and Zhang(2007), Miralles y Miralles (2005), among others. Therefore we do expect a positive relationship between the S&P500 return (measured in US dollars) and the local stock market return (measured in local currency) [5] and a positive coefficient of the interactive $SP500 \times T$ term.

On the effect of foreign flows (*FOR_CAP*) on returns, a positive relationship is hypothesized, as given by two empirical observations on the extant literature. The first, called "price pressure" (Froot, O'Connell y Seasholes, 2001), assumes that foreign buys (sell), due to their larger liquidity demand and size of trade rises (lower) emerging market prices. The "price pressure" might also come from informational reasons, since there is some evidence that foreign buys (sells) are positive (negative) signal for an emerging market (Richards, 2005). Alternatively, positive (negative) returns on emerging markets should lead to buys (sells) from foreigners, as they might extrapolate that this trend continues, in what is called " return chasing" (Choe, Kho and Stulz, 2005).

Regarding to the increasing effect of foreign flows in both volatility and betas, there are studies that do find such effects (Frenken and Menkhoff, 2003; Bae, Chan and Ng, 2004), while other don't (Rea, 1996, Dvorak, 2001; Alemmani and Hass, 2006). We assume, as the null hypothesis, that in the variance equation [3.b] the coefficient of *FOR_CAP* is not different from zero, and so the coefficient of the interactive variable $FOR\_CAP \times SP500$ in the mean equation [3.a]. The term $SP500 \times T$ is included in the mean equation to control for any economic factor, different to foreign flows, that increases over time the systemic risk of the local market. Such an effect might

[5] Whether US return should be measured in US dollars or in the local currency in the model is, in principle, an open question. We tried both and found the first a more meaningful measure, since entering the US return in local currency exaggerates the corresponding effect of the Foreign exchange return. Moreover, local traders in Colombia track closely the SP 500 expressed in US dollars.

be due, among others, to increasing financial or commercial integration with developed markets, or an increasing role of ADRs, implying that the term *SP500×T* has a positive coefficient on the mean equation.

<u>Monthly multivariate model</u>

Whereas univariate models are fit to describe high frequency financial series, they are not appropriate to model in lower frequencies (De Arce Borda, 2004). Since we are interested in the effects of foreign flows not only during a time span of a few days, but also during several months; modeling returns and flows in a monthly basis are needed. Additionally, univariate models don't describe multiple interactive effects between critical variables in a stock market. Thus, following the literature on Foreign flow effects (Bekaert, Harvey and Lumsdaine, 2002; Richards, 2005; Griffin, Nardari and Stulz, 2006) we propose a non-structural monthly vector autoregressive model (VAR). Non-structural VAR models are defined as a system of linear simultaneous equations in which each variable is modeled as dependent of its own lags and of those of the other variables, thus treating, in principle, all variables as endogenous. For this study, we take as endogenous variables, the monthly returns, monthly volatility (*VOLAT*), the sensitivity to international markets (*BETA*), and the measure of foreign flows (*FOR_CAP*). The proposed model is expressed as follows:

$$RETURN_t = \propto_1 + \sum_{k=1}^{L} \beta_{1,K} RETURN_{t-K} + \sum_{k=1}^{L} \rho_{1,K} VOLAT_{t-K} + \sum_{k=1}^{L} \delta_{1,K} BETA_{t-K} + \sum_{k=1}^{L} \tau_{1,K} FOR\_CAP_{t-K} + \varepsilon_{1,t}$$

$$VOLAT_t = \propto_2 + \sum_{k=1}^{L} \beta_{2,K} RETURN_{t-K} + \sum_{k=1}^{L} \rho_{2,K} VOLAT_{t-K} + \sum_{k=1}^{L} \delta_{2,K} BETA_{t-K} + \sum_{k=1}^{L} \tau_{2,K} FOR\_CAP_{t-K} + \varepsilon_{2,t}$$

$$BETA_t = \propto_3 + \sum_{k=1}^{L} \beta_{3,K} RETURN_{t-K} + \sum_{k=1}^{L} \rho_{3,K} VOLAT_{t-K} + \sum_{k=1}^{L} \delta_{3,K} BETA_{t-K} + \sum_{k=1}^{L} \tau_{3,K} FOR\_CAP_{t-K} + \varepsilon_{3,t}$$

$$FOR\_CAP_t = \propto_4 + \sum_{k=1}^{L} \beta_{4,K} RETURN_{t-K} + \sum_{k=1}^{L} \rho_{4,K} VOLAT_{t-K} + \sum_{k=1}^{L} \delta_{4,K} BETA_{t-K} + \sum_{k=1}^{L} \tau_{4,K} FOR\_CAP_{t-K} + \varepsilon_{4,t} \quad [4]$$

Where

$RETURN_t$:	Monthly return for the Exchange, as given by the market index
$VOLAT_t$:	Monthly volatility for the Exchange, as defined in eq. [1]
$BETA_t$:	Sensitivity to international markets, defined as the beta of eq. [2]
FOR_CAP_t :	Measure of foreign flows , defined before.
$\varepsilon_{1t}, \varepsilon_{2t}, \varepsilon_{3t}, \varepsilon_{4t}$:	disturbance terms in each equation
L:	Number of lags required by the model, specific for each country.

A VAR model has two main technical requirements. First, it requires to find the number of optimal number of lags to obtain a parsimonious model, which is accomplished by minimizing the Akaike (AIC) and Schwartz (SBC) statistics[6]. Second, white noise has to be achieved in residuals of the model, as measured by the the LM autocorrelation and the VAR heterokesdaticity tests. Whenever required, lags were increased or dummy variables were included for specific dates to filter out extreme values, assuring white noise.

VAR models allow to test whether a given variable might cause changes in other variables. To do so, we performed the Block Exogeneity Wald test, which excludes the lags of the assumed exogenous variable in a given equation (corresponding to an assumed endogenous variable), and measures whether the model changes significantly. If that's the case, it is said that the exogenous variable is said to Granger-cause the endogenous one (Enders, 1995, pg. 316). Now, the Granger causality test doesn't indicate either the sign or the dynamics of the effect between the variables. Instead, this can be seen in the Impulse-Response function, which traces the response of the endogenous variables to a standardized shock on the exogenous variable[7].

The Expected signs on the VAR model are also taken from the above mentioned references for the univariate model. It is expected that positive shocks on the foreign flows (*FOR_CAP*) induce positive shocks on the volatility of the market (*VOLAT*), and the beta with the US market (*BETA*). In turn, the 'price pressure' hypothesis implies that positive shocks on *FOR_CAP* cause

[6] Whenever the two indicators gave contradictory results, SBC was upheld, since it has show better asymptotical behavior (Enders, 2005. Pg 88)

[7] A Cholesky decomposition is required in Unstructured VAR models to orthogonalize the disturbances, allowing to resolve a system of matricial equations. This requires to define an order on the variables. Usual practice requires to invert the variables orders and verify that the IRF results doesn't depend critically on it.

positive shock on *RETURN*, whereas the 'return chasing' story implies the same positive relationship but that the causal relationship runs the other way around.

Results

<u>Univariate model.</u>

Table (x) presents the results of the univariate model [3] with effects ARMA and conditional volatility Coefficients and corresponding p-values are listed. There are nine versions of the model corresponding to six countries, since, as explained before, the series of three countries had to be divided in two because of structural breaks.

First, we discuss the resulting coefficients of the control variables. The foreign exchange variable (*FEX_RET*) has a negative coefficient, significant at 5% level, in five out of nine cases. Exceptions are Colombia in both periods, and Argentina II. In general, the evidence of Latin American Markets support the 'Portfolio balance' point of view of Frankel (1983). Only in one case, Argentina after Corralito, there is a positive and significant coefficient for this variable, supporting the 'market of goods" rationale of Dornsbuch and Fischer (1980)

As expected, the *SP500_RET* coefficient is significant and positive in seven cases, with the exceptions of Colombia I and Perú II. This is clear evidence of the integration of Latin American stock markets to that of the U.S. In contrast, Betas are lower or not significant for Colombia and Peru, which might be explained by being historically less developed and internationally integrated stock markets.

The coefficient of the *SP500×T* term is significant and positive, at least at the 10% level, for five out of nine cases, detecting an increasing beta over time, as expected. This effect is particularly high for Brazil and both periods of Argentina, with betas rising on 0.3, 0.43 and 0.48, respectively[8]. Exceptions are Colombia I and II, México and Peru II.

Now, we turn to the effect of Foreign flows on the mean equation [3.a]. This is given by two coefficients, the corresponding to *FOR_CAP* and *FOR_CAP×SP500*. *FOR_CAP* is significant,

[8] Calculated as the estimated coefficient multiplied by the number of estimated trading days of the period.

at least at the 10% level, for Colombia I, Argentina I and Perú I. As explained before, these results are consistent with both the ‘price pressure” and “return chasing” stories, but don’t distinguish between the two. *FOR_CAP×SP500* variable, which measures how foreign investors increase the sensitivity to international markets, is only significant for Colombia I and Peru II, at 5% and 10% levels respectively. It’s is notable that this result only shows up in the historically less developed stock markets of the region (at least until 2005, see Table 1), during their periods of lower foreign holding shares (see fig 5 and 7)

Table 3 also presents the results of the conditional variance equation [3.b]. Regarding the transmission of volatility from the foreign exchange rate and international equity markets, the coefficient of *ABS_FEX_RET* appears significant at the 5% level in three cases: Chile, Perú and Argentina II with the expected positive sign; whereas the *ABS_SP500_RET* coefficient is positive and significant for Colombia II, Chile, Perú and Brazil. Taking together the above results on the equation [3], they agree with Flannery and Protopapadakis (2002) in the sense that if a variable is a risk factor for the stock market, its volatility should transmit to stock returns.

Finally, we focus on the coefficient of *FOR_CAP* on the conditional variance equation [3.b]. It appears as positive and significant at the 10% level in México and Perú, consistent with foreigners inducing volatility in emerging stock markets. Nevertheless, the same variable has a negative and significant coefficient in Argentina II and Chile. Taken together the evidence is inconclusive in the role of Foreign investors in causing volatility in the studied markets[9].

Multivariate Model.

The results for the multivariate model [4], Granger causality –Block exogeneity tests and Impulse-Response function (IRF) plots, are presented in Table 4 and Figures 8 to 10. Tables 4present the result of the Wald statistic p-value testing whether the row variable Granger causes

[9] Alternative measures of foreign flows didn’t have a strong effect on volatility either.

the column variable. Significant statistics at the 5% level are in bold, at the 10% level are underlined. The sign and dynamics of the causality can be inferred from the IRF plots[10].

First, we check the causality between foreign flows and return. Argentina and Mexico show evidence of Granger causality from returns to foreign flows, and the short-term response in the corresponding IRF plot is consistent with the 'return chasing' explanation. Conversely, Brazil and México exhibit the reverse causality: foreign flows Granger cause returns, and the IRF plot show a positive response, which is consistent with the 'price pressure' story.

The Granger causality tests along with the IRF plots show returns causing volatility in Brazil and Argentina, in an inverse relation: positive (negative) returns induce an increase (reduction) of volatility, consistent with the Leverage effect (Nelson, 1991).

Similarly, the multivariate model results present volatility causing betas for Colombia, México and Perú, in a direct direction: positive shocks to volatility cause higher betas. This relationship seems to reflect the persistence on volatility and the fact that, holding correlation and the S&P500 volatility constant, beta increase with an increase of volatility[11].

The proposed VAR model also provides an answer to the central question of this study. First, the results of the Granger causality test support in no case that foreign flows induce higher volatility and neither the IRF plots. Second, with the only exception of México, there is no evidence of Foreign flows causing Beta. Even in the case of México, the IRF plot doesn't show a clear effect, but if anything it appears to be inverse, contradicting the assumed hypothesis. All things considered, the multivariate model indicates that foreign flows don't have a discernible effect on the volatility and systemic risk of the six Latin American markets of the study.

Conclusions

Several authors using different methodologies, theories and data have studied the influence of Foreign Portfolio flows in emerging markets. Considering the results together, the results are

[10] To obtain the IRFs, the Cholesky decomposition requires to rank the variables. The order chosen was, initially: *RETURN, VOLAT, BETA* and *FOR_CAP*. Robustness of IRF relations were checked by inverting the order of the Cholesky decomposition. Results are qualitatively the same, and available from the authors upon request.

[11] BETA = correlation × stand. Dev Local market / stand. Dev. US market

ambiguous. This study contributes to the literature, testing not only effects on volatility but also in systematic risk, and using a not yet used data, more recent sample periods that includes the 2008 World financial crisis, two different econometric models, and focusing on six emerging markets of the same region.

The results of this study, taken together, indicate that there is no significant evidence that foreign portfolio flows increase the risk of the six Latin American markets. In particular, we observe the following:

- Only in two out of nine cases, is there a positive and significant effect from foreign flows on the betas to S&P500 returns: Colombia, before the 2006 crisis, and Perú, after July 2006. We suspect that this result might be due to the relative low development and integration of both markets, which might make them more sensitive to Foreign flows. Moreover, the fact that those effects don't show up in the VAR monthly model suggest that, if anything, those effects are either spurious or very short-lived.
- According to the VAR monthly model, there is no evidence of Foreign flows having lasting effects on the volatility of the markets. In turn, the univariate model shows only a positive effect in two out of nine samples, but a negative and significant effect in two others.

The evidence presented here does support empirical regularities reported in other studies on the behavior of returns on emerging markets. It reports an important dependence of the local stock returns on the returns of the foreign exchange rate and international equity markets, both in mean and in volatility. We leave to future research to prove that the causality runs from those markets to the stock one, and if those economic variables are priced risk factors of the equity market. We find also evidence of returns causing higher foreign flows in some countries ('return chasing') but also of foreign flows causing higher returns ('price pressure'), that has also been found in other emerging markets.

We conclude that foreign exchange and international returns do have a more important role on increasing risk and dependence on international markets than foreign flows, providing no support to the policy of restricting foreign portfolio flows due to alleged increasing risks or causing instability in Latin American stock markets. We have left for future studies whether they have disrupting effects on the foreign exchange rate markets.

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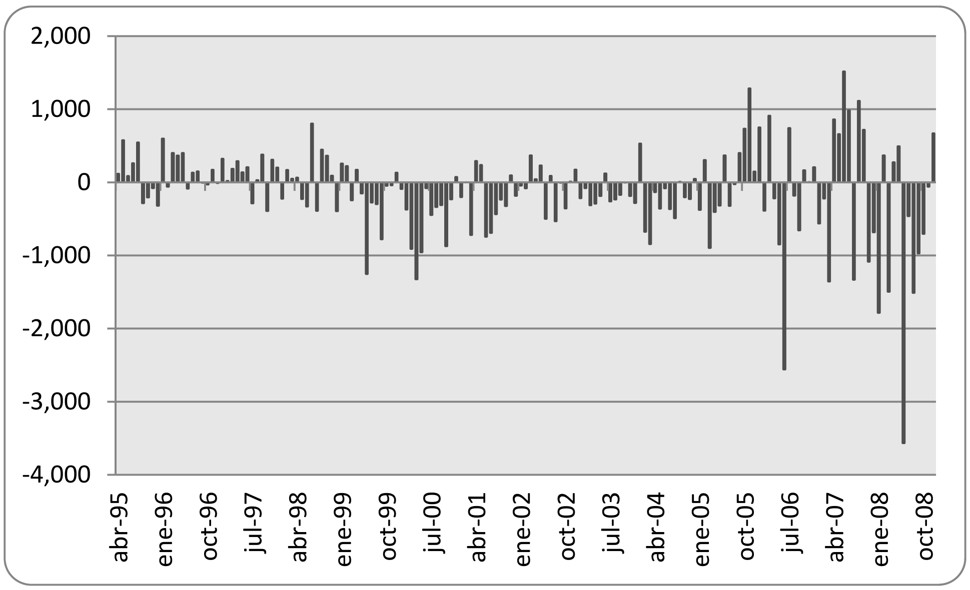
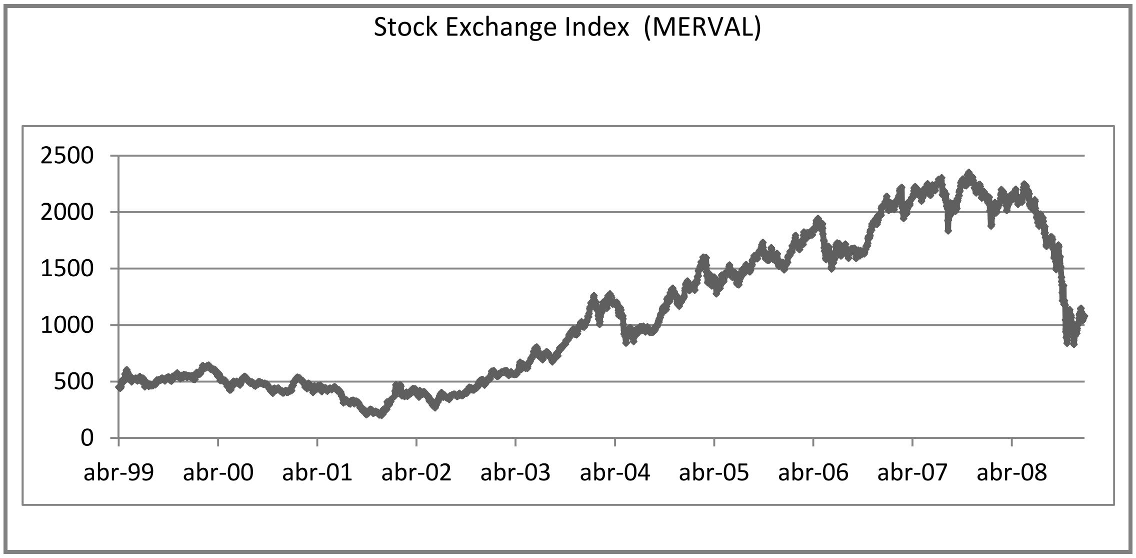
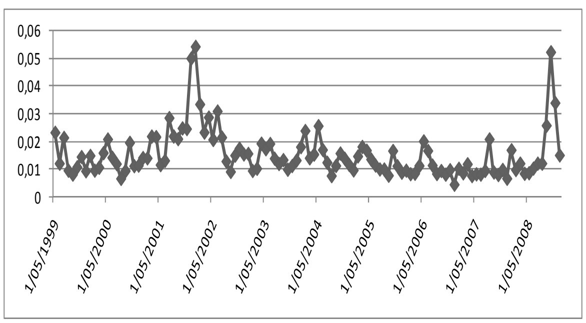


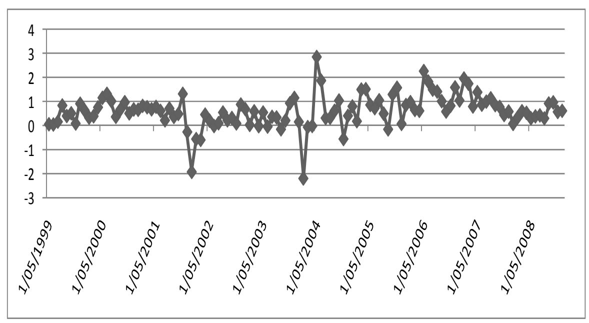
Figure 1. Total Foreign Portfolio Net flows in Six Latin American Countries. Source: Emerging Portfolio



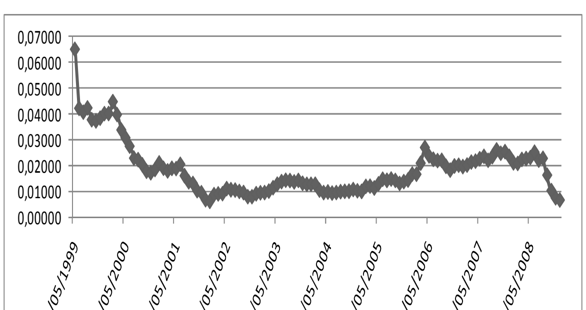
Volatility



Beta



Share of Foreign Portfolio Holdings



FOR_CAP : Net Foreign Flows / Market value

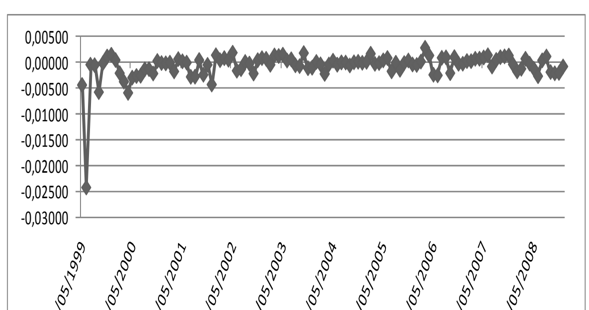
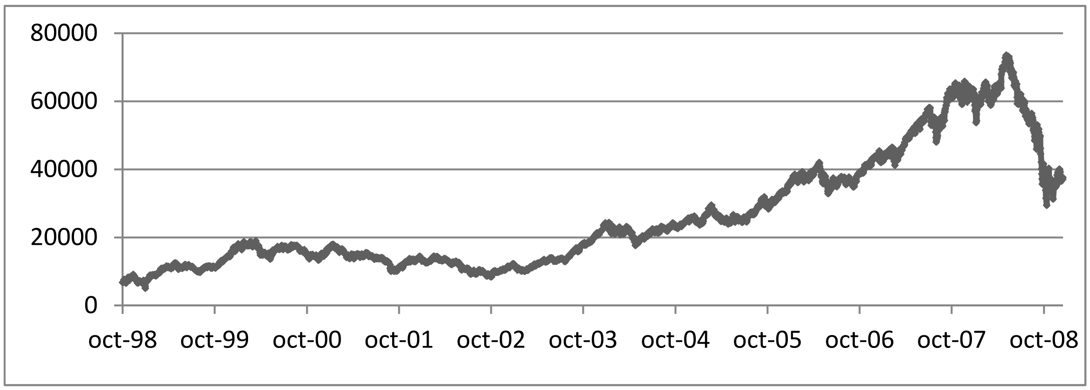
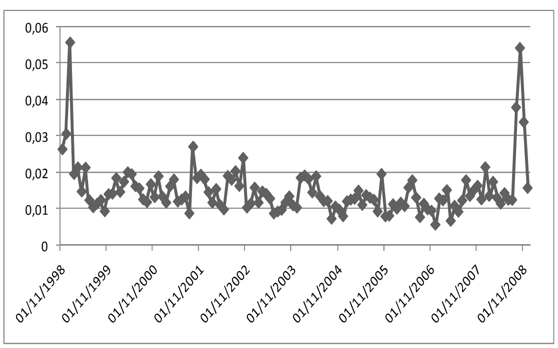


Fig 2. Summary statistics for Argentina.

Stock Market Index (BOVESPA)



Volatility



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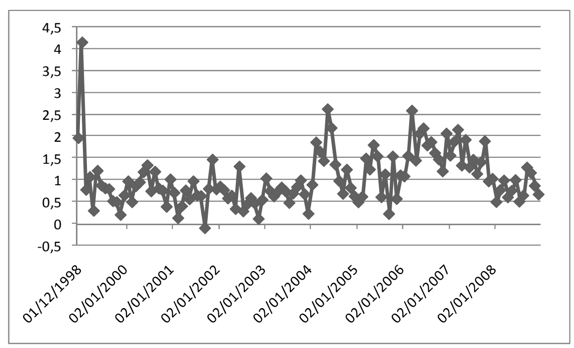
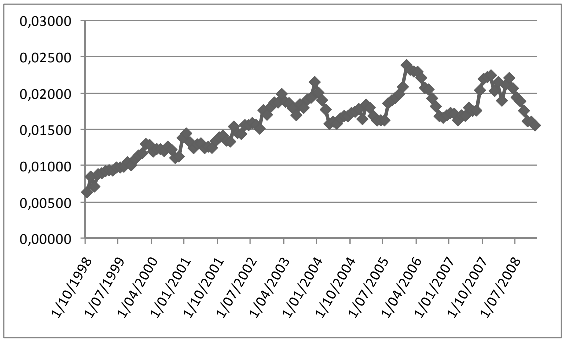


Share of Foreign Portfolio Holdings



FOR_CAP : Net Foreign Flows / Market value

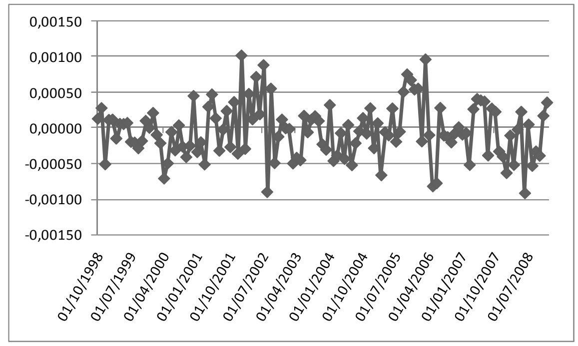
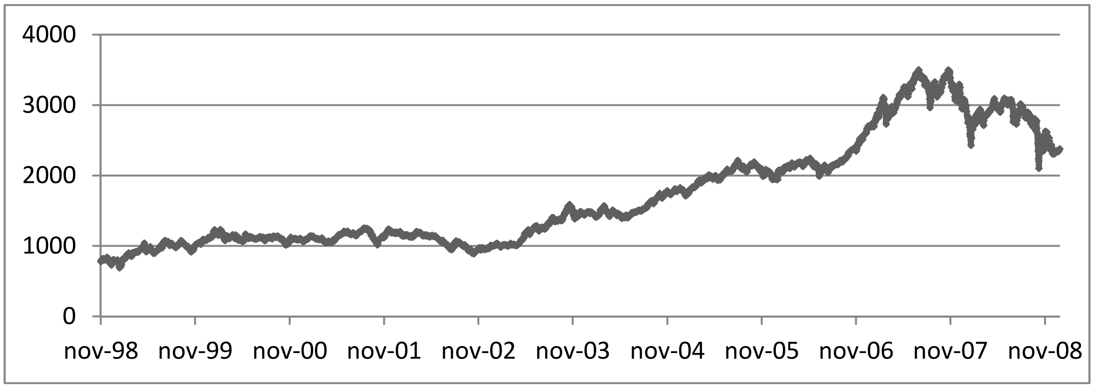
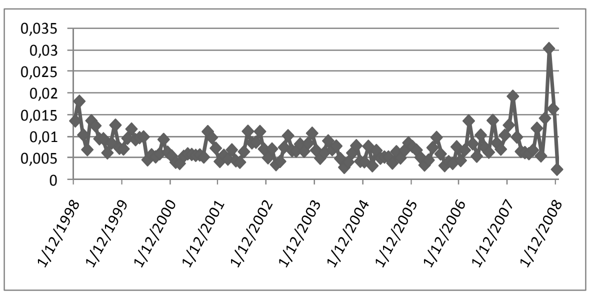


Fig 3 Summary statistics for Brazil

Stock Market Index (IPSA)



Volatility



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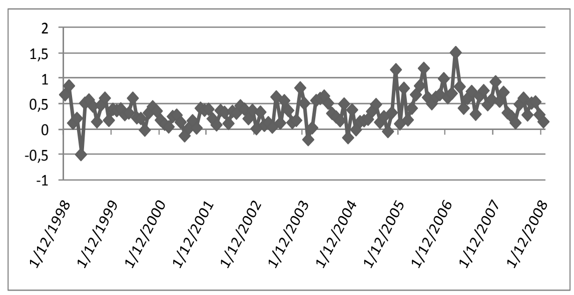
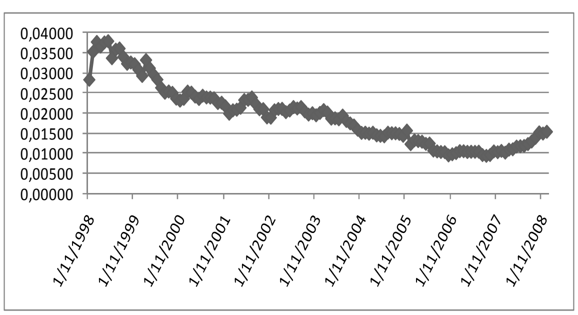


Share of Foreign Portfolio Holdings



FOR_CAP : Net Foreign Flows / Market value

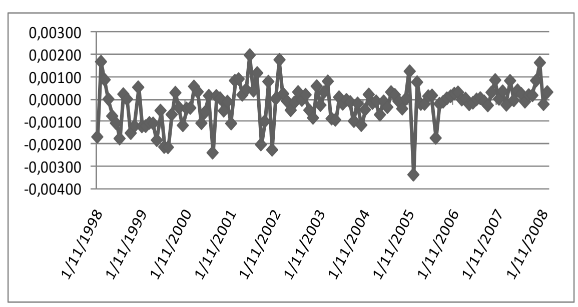
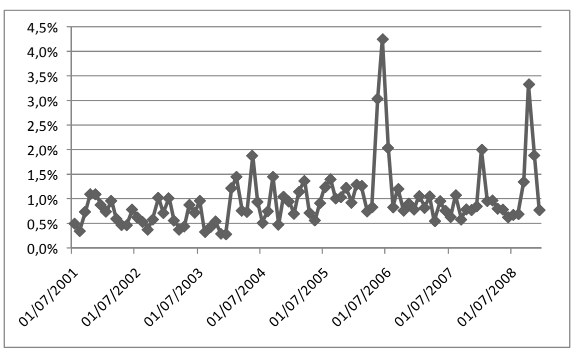


Fig 4. Summary statistics for Chile

Volatility



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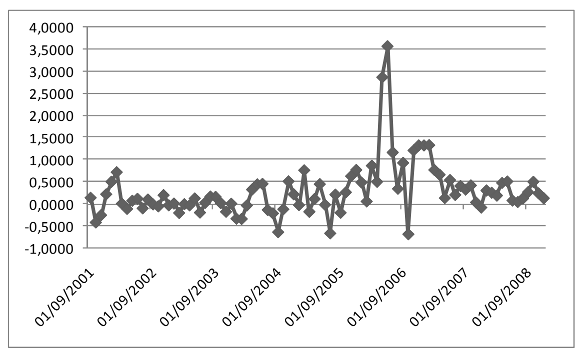
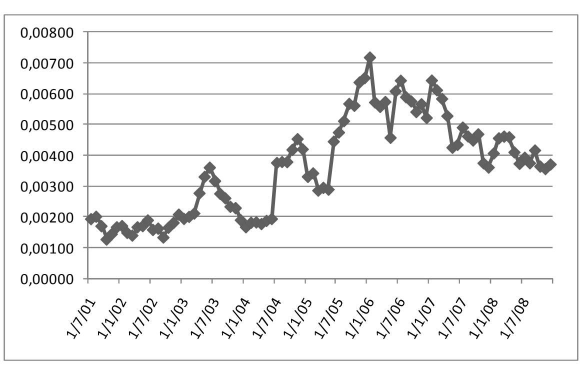


Share of Foreign Portfolio Holdings



FOR_CAP : Net Foreign Flows / Market value

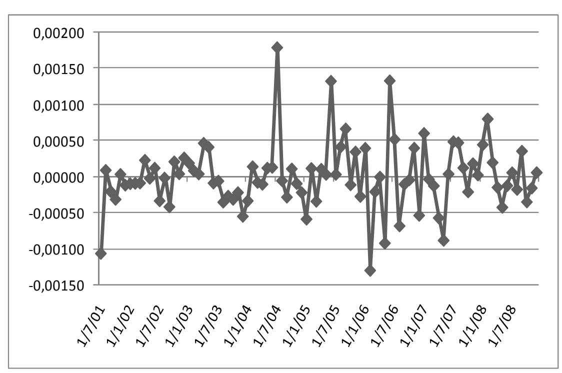
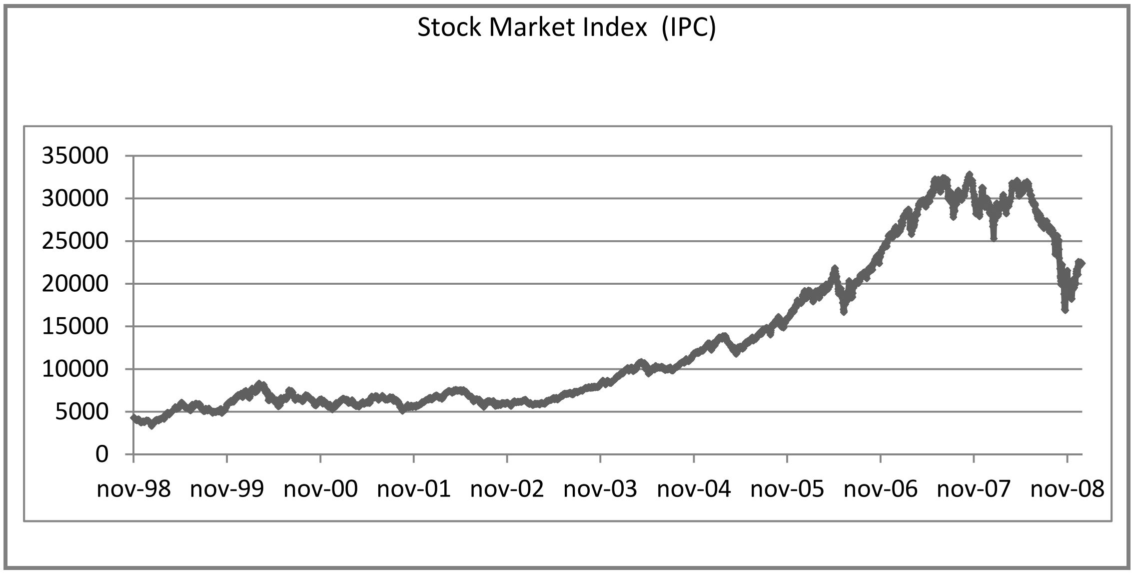
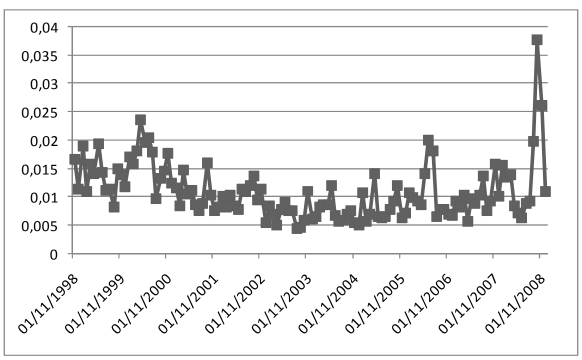


Fig 5. Summary statistics for Colombia



Volatility



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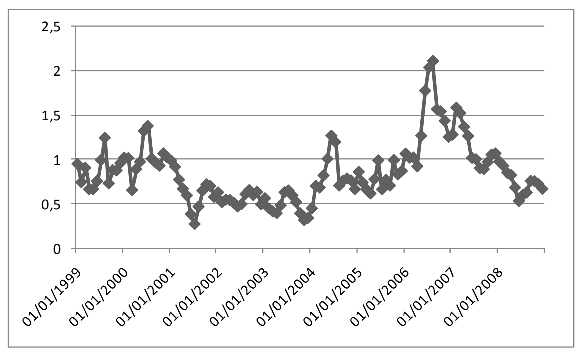
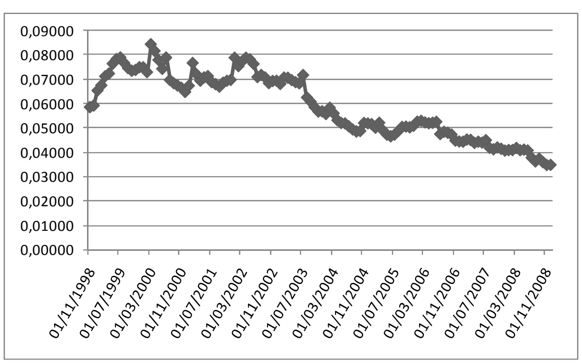


Share of Foreign Portfolio Holdings



FOR_CAP : Net Foreign Flows / Market value

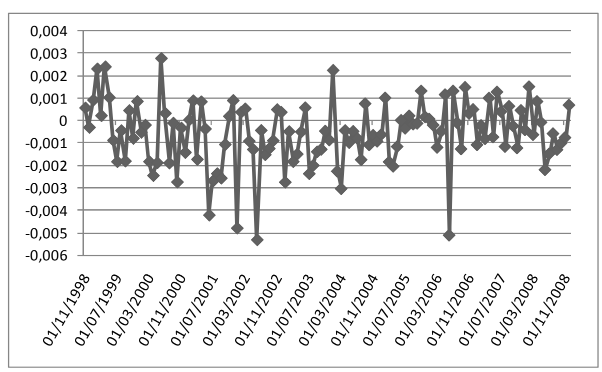
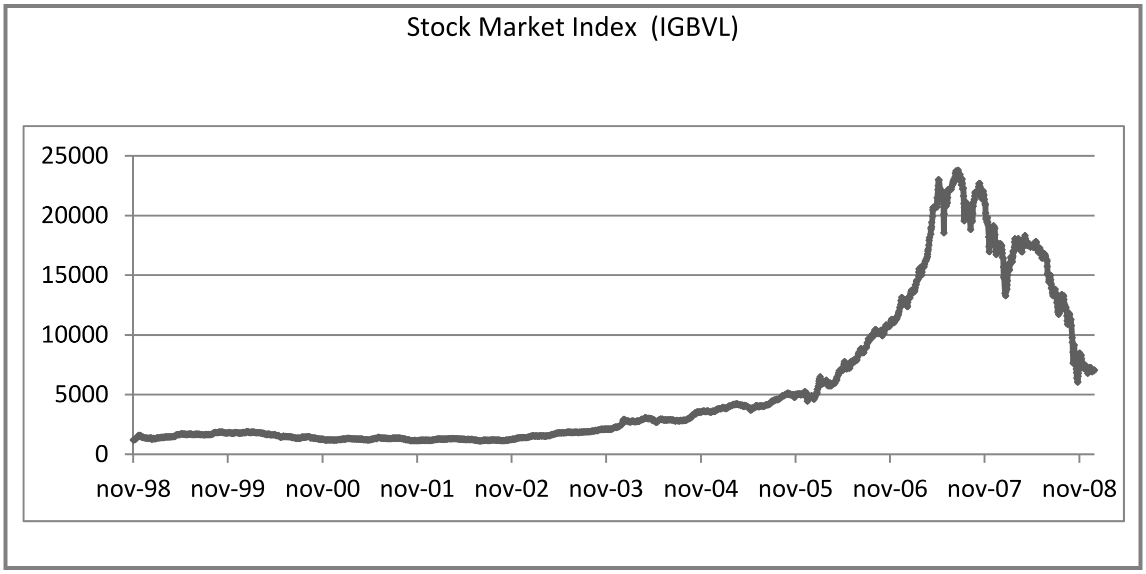
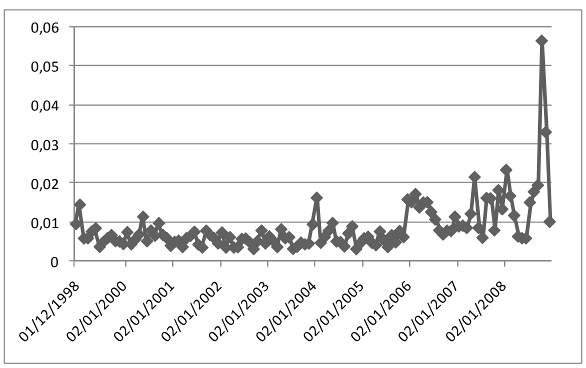


Fig 6. Summary statistics for Mexico



Volatility



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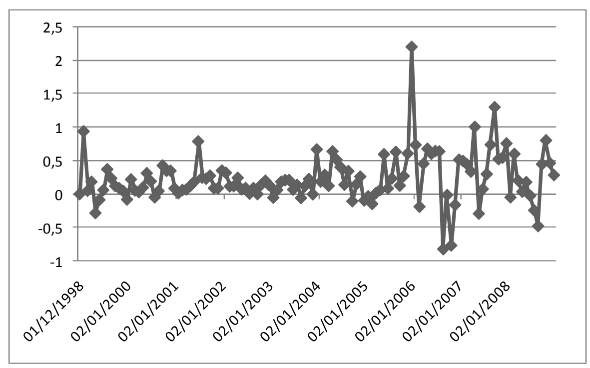
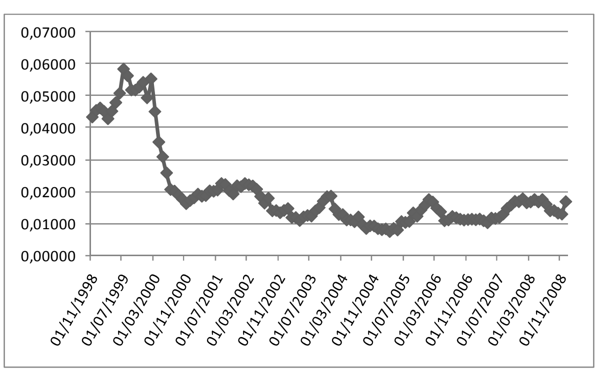


Share of Foreign Portfolio Holdings



FOR_CAP : Net Foreign Flows / Market value

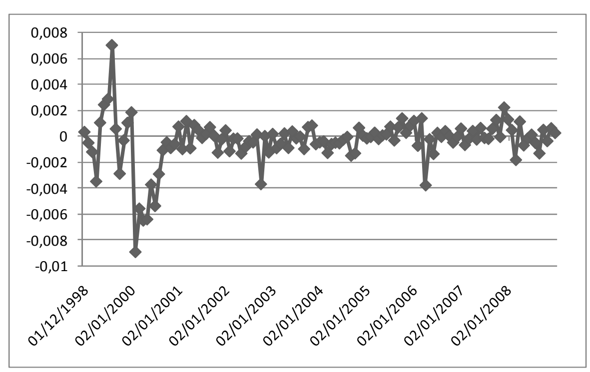


Fig 7. Summary statistics for Perú

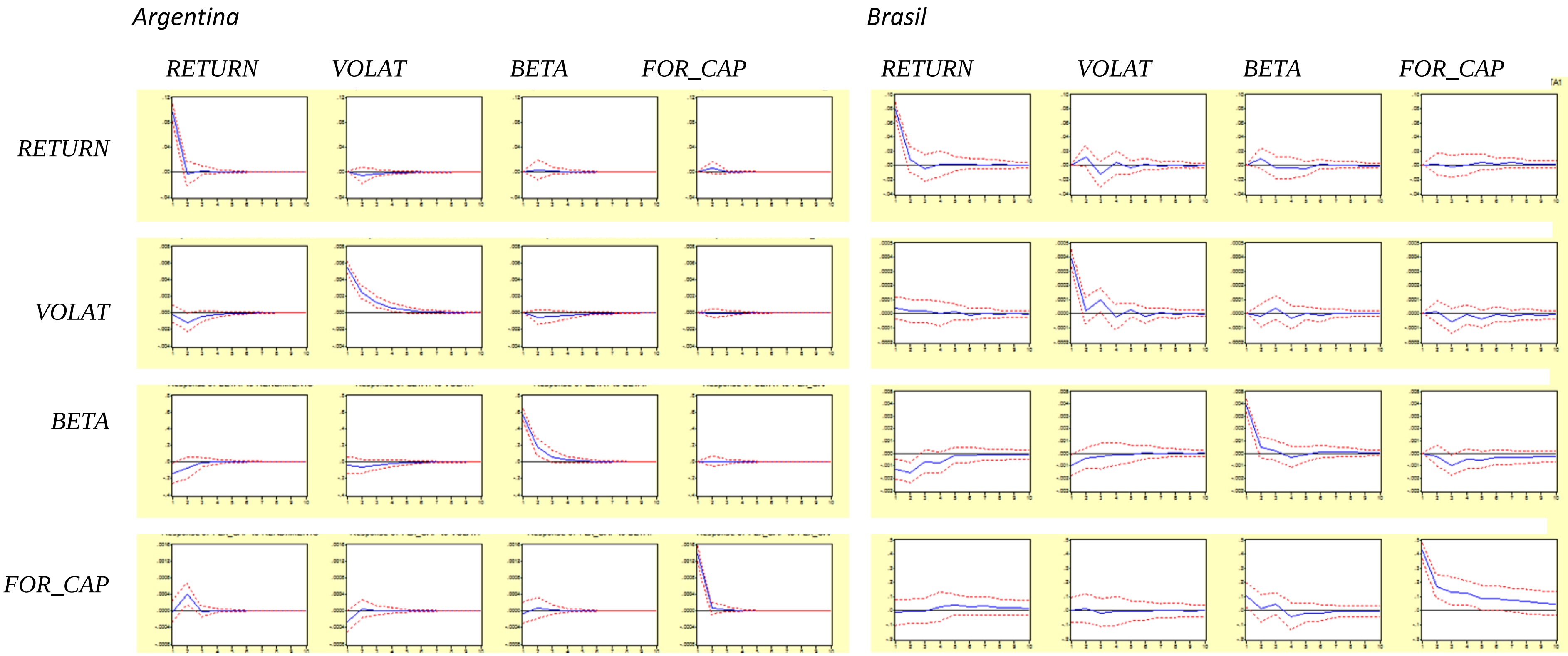


Fig. 8. Impulse response function plots for the monthly 4-VAR model.

Response of the row variable to a 1 normalized standard-deviation impulse of the column variable.

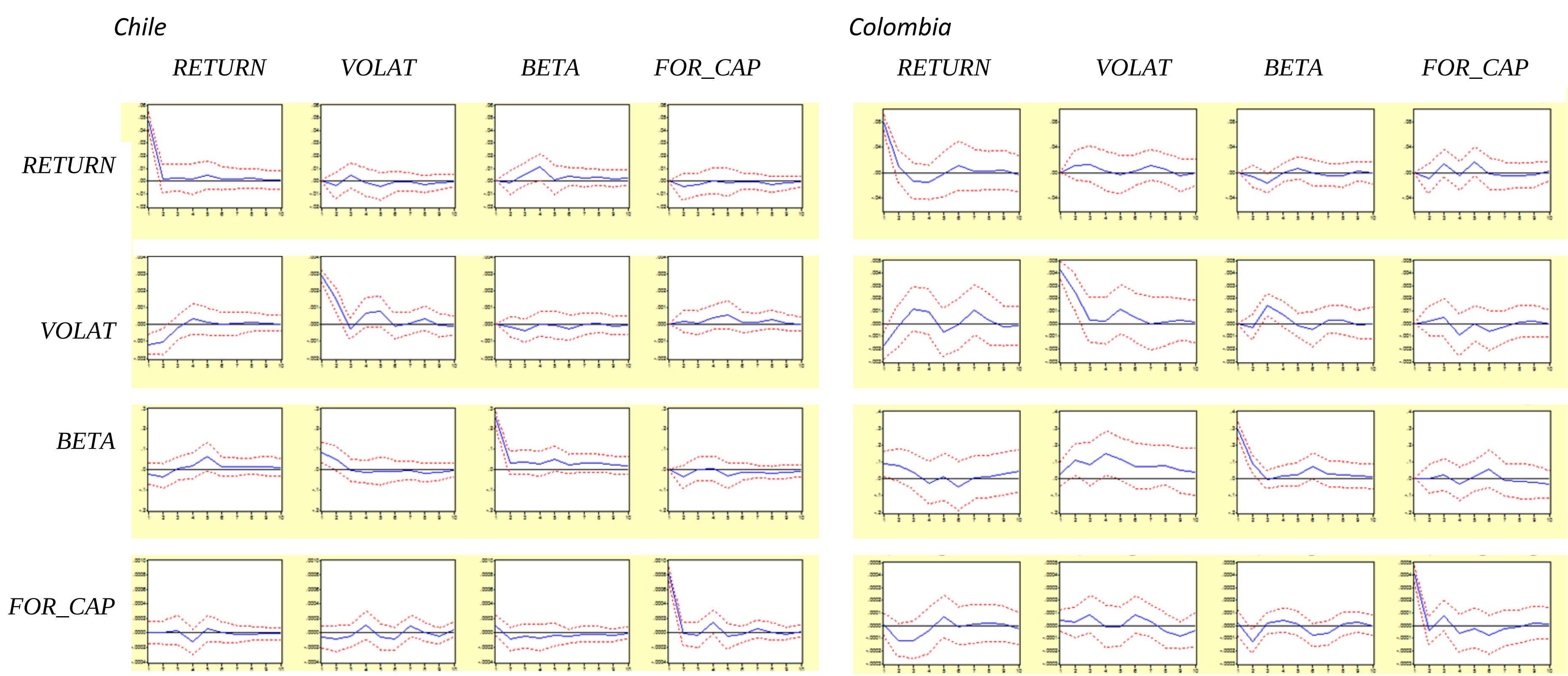


Fig. 9. Impulse response function plots for the monthly 4-VAR model.

Response of the row variable to a 1 normalized standard-deviation impulse of the column variable.

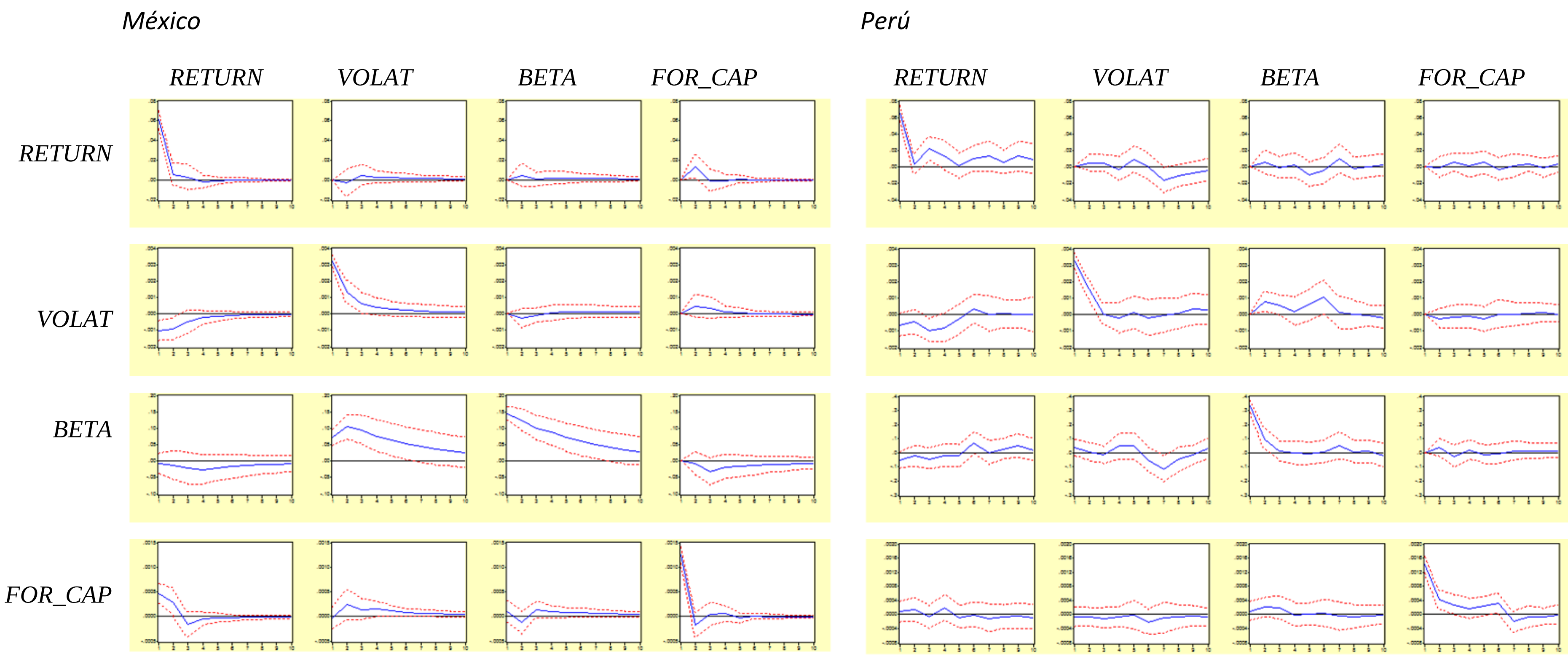


Fig. 10. Impulse response function plots for the monthly 4-VAR model.

Response of the row variable to a 1 normalized standard-deviation impulse of the column variable.

Market Capitalization in US D Millions						
AÑO	Brasil	Argentina	Colombia	Perú	Mexican	Chile
2000	226,152.3	45,839.3		9,749.8	125,203.9	60,400.8
2001	186,237.6	33,384.0		9,790.4	126,258.4	56,309.7
2002	121,640.5	16,548.6		11,441.4	103,941.2	49,827.7
2003	226,357.7	34,994.7	14,258.5	14,125.0	122,533.0	87,508.4
2004	330,346.6	40,593.8	25,222.9	17,974.8	171,940.3	116,924.3
2005	474,646.9	47,590.3	50,500.8	24,139.7	239,128.0	136,493.3
2006	710,247.4	51,240.1	56,204.3	40,021.6	348,345.1	174,418.8
2007	1,369,711.3	57,070.2	101,956.0	69,386.5	397,724.6	212,910.2
2008	591,965.5	39,850.4	87,716.2	37,876.8	234,054.9	131,808.0

Source: World Federation of Exchanges

Trading Value in US D Millions						
	Brasil	Argentina	Colombia	Perú	Mexico	Chile
2000	101537.4	9700.8	0	2517.9	45768.4	6083.3
2001	63475.4	7564.1	0	934.2	38468.9	4450.4
2002	46300.2	1277.4	0	1186.6	32285.6	3011.2
2003	66427.521	3078.17684	805.9	1139.84411	25867.9889	6647.29996
2004	103990.062	4832.08021	2079.55822	1560.38359	45388.823	12123.4871
2005	165275.62	6852.87138	9418.94124	2650.06446	56682.8363	18961.232
2006	276149.798	5276.58993	14845.4124	5486.2541	96917.9055	29620.2985
2007	597995.344	7381.24828	16775.4924	11266.4662	143945.378	47996.597
2008	724199.236	6616.68299	20273.5829	6328.92342	110473.888	36196.1863

Source: World Federation of Exchanges

Table 1. Market capitalization and Total Trading Value of the six Latin American stock exchanges.

	Univariate Model		Multivariate Model	
	Starts	Ends	Starts	Ends
Argentina	7-Apr-1999	20-Nov-2001	31-May-1999	30-Dec-2008
	21-Nov-2001	30-Dec-2008		
Brazil	4-Nov-1998	30-Dec-2008	31-Jan-1999	30-Dec-2008
Chile	4-Nov-1998	30-Dec-2008	30-Nov-1998	30-Dec-2008
Colombia	4-Jul-2001	28-Apr-2006	31-Jul-2001	30-Dec-2008
	4-Jul-2006	30-Dec-2008		
Mexico	4-Nov-1998	30-Dec-2008	30-Nov-1998	30-Dec-2008
Perú	3-Nov-1998	4-Jul-2006	31-Jan-1999	30-Dec-2008
	5-Jul-2006	30-Dec-2008		

Table 2. Study Period for each country for the Univariate and Multivariate Models.

VARIABLES / COUNTRY		COLOMBIA				ARGENTINA				MEXICO		CHILE		BRASIL		PERU			
		I		II		I		II								I		II	
	Expected sign	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Mean equation [3.a]																			
FEX_RET	+/-	0.0067	0.902	0.060852	0.288			0.120531	0.019	-0.380357	0.000	-0.135377	0.000	-0.617492	0.000	-0.373843	0.000	-0.369496	0.019
SP500_RET	+	-0.0291	0.408	0.621432	0.000	0.45871	0.000	0.320513	0.000	0.674816	0.000	0.188717	0.000	0.633611	0.000	0.078879	0.018	0.19223	0.119
FOR_CAP	+	2.2071	0.012	2.69544	0.179	0.316668	0.099	0.197855	0.524	0.15999	0.133	-0.08417	0.725	0.98444	0.153	0.201642	0.082	-1.166061	0.347
FOR_CAP×SP500	+	116.1709	0.067	-209.5266	0.057	12.14835	0.421	32.9021	0.146	-11.1782	0.133	-9.906241	0.549	-92.19098	0.142	0.511082	0.949	213.5546	0.000
SP500×T	+	0.0001	0.314	-0.000778	0.002	0.000574	0.063	0.000275	0.000	3.69E-05	0.204	8.80E-05	0.000	0.00012	0.000	6.12E-05	0.091	2.36E-05	0.936
T		0.0000	0.223	-5.88E-06	0.047	-1.08E-05	0.005	-1.81E-06	0.014	3.41E-07	0.279	2.04E-07	0.449	-3.82E-08	0.917	1.42E-06	0.000	-1.71E-05	0.000
AR order		1		1						2		1		3		1			
MA order		-		1		1		1										1	
Cond. Variance eq. [3.b]																			
ABS_FEX_RET	+	0.8357	0.901	5.585302	0.595			4.011262	0.008	1.24E-01	0.124	0.000453	0.007	0.000292	0.237	0.001096	0.044	24.73722	0.118
ABS_SP500	+	-5.7205	0.066	12.80492	0.021	2.30619	0.580	1.064602	0.344	5.70E-01	0.570	0.00028	0.004	0.001283	0.000	-0.000168	0.049	14.63956	0.001
FOR_CAP	+	18.9250	0.582	18.05959	0.902	-1.78286	0.635	-21.63706	0.003	0.00E+00	0.000	-0.001075	0.030	-0.001921	0.382	-0.000347	0.126	106.0113	0.096
model		EGARCH		EGARCH		EGARCH		EGARCH		GARCH		GARCH		GARCH		GARCH		EGARCH	
R^2		0.146675		0.312206		0.188704		0.230667		0.43428		0.263756		0.458901		0.213646		0.196546	
Durbin-Watson		2.025143		2.019129		1.987022		1.95168		1.931821		2.037855		1.976398		1.907857		2.085485	
N° observations		1178		607		654		1753		2343		2531		2516		1908		621	

Table 3. Results of the univariate time series model for daily returns

Country		*RETURN*	*VOLAT*	*BETA*	*FOR_CAP*
ARGENTINA	*RETURN*		***0.0129***	0.5328	***0.0018***
	VOLAT	0.5206		0.2756	0.5174
	BETA	0.7232	0.2332		0.6192
	FOR_CAP	0.1933	0.7795	0.9941	
BRAZIL	*RETURN*		***0.0057***	0.9861	0.9701
	VOLAT	0.534		0.4516	0.4516
	BETA	0.8558	***0.053***		0.4612
	FOR_CAP	***0.0598***	0.8037	0.9484	
CHILE	*RETURN*		0.1525	0.5927	0.7824
	VOLAT	0.6486		0.378	0.5391
	BETA	0.1992	0.798		0.5044
	FOR_CAP	0.8554	0.467	0.4098	
COLOMBIA	*RETURN*		0.498	0.1312	0.3848
	VOLAT	0.2847		***0.0159***	***0.0065***
	BETA	***0.0353***	***0.0004***		***0.0014***
	FOR_CAP	0.3101	0.2693	0.4595	
MEXICO	*RETURN*		0.2032	0.7519	***0.0063***
	VOLAT	0.8228		***0.0446***	***0.0294***
	BETA	0.7586	0.4779		***0.0932***
	FOR_CAP	***0.0651***	0.2541	***0.0814***	
PERU	*RETURN*		0.1236	0.1706	0.5045
	VOLAT	***0.0742***		***0.0642***	0.6146
	BETA	0.3347	***0.0146***		0.8493
	FOR_CAP	0.9565	0.9034	0.7295	

Table 4. Results of the Granger causality test, in a monthly 4-VAR model.

p-values of the Wald test of excluding the row variable in the equation of the column variable.