5 - MACROECONOMIC VARIABLES AND FOREIGN CAPITAL FLOWS IN BRAZILIAN STOCK MARKET

Mariana Rodrigues, Universidade de São Paulo – FEA-RP/USP, São Paulo, Brasil, marinarodrigues.rodrigues@gmail.com
Tabaraja Pimenta Júnior, Universidade de São Paulo – FEA-RP/USP, São Paulo, Brasil, taba.jr@usp.br
Luiz Eduardo Gaio, Universidade de Campinas - UNICAMP, São Paulo, Brasil, luiz.gaio@ymail.com
Fabiano Guasti Lima, Universidade de São Paulo – FEA-RP/USP, São Paulo, Brasil, fabianoguastilima@gmail.com

Abstract
The objective of this paper is detect, measure and analyze the relationship between the behavior macroeconomic variables - interest rate, inflation, country risk, oil price and exchange rate - and the behavior of foreign capital flows for investments in Brazilian market. Analyzed data refers to 12 years period between 2004 and 2016. Granger causality tests, variance decomposition analyzes and impulse response functions analysis were performed from a vector auto regression model. Results showed that, contrary to what was pointed out in previous studies, none of the selected variables showed a statistically significant relationship with foreign capital flows. However, interest and exchange rates showed some influence in explaining such flows behavior variance.
Key-words: Macroeconomic Variables; Foreign Investment; Stock Market.

VARIÁVEIS MACROECONÔMICAS E FLUXOS DE CAPITAL ESTRANGEIRO NO MERCADO BRASILEIRO DE AÇÕES

Resumo
O objetivo deste artigo é detectar, medir e analisar a relação entre as variáveis macroeconômicas do comportamento - taxa de juros, inflação, risco-país, preço do petróleo e taxa de câmbio - e o comportamento dos fluxos de capital estrangeiro para investimentos no mercado brasileiro. Os dados analisados referem-se ao período de 12 anos entre 2004 e 2016. Testes de causalidade de Granger, análises de decomposição de variância e análise de funções de resposta a impulsos foram realizadas a partir de um modelo de auto-regressão vetorial. Os resultados mostraram que, ao contrário do apontado em estudos anteriores, nenhuma das variáveis selecionadas apresentou relação estatisticamente significativa com os fluxos de capital estrangeiro. No entanto, as taxas de juros e câmbio mostraram alguma influência na explicação da variação do comportamento desses fluxos.
Palavras-chave: Variáveis Macroeconômicas; Investimento estrangeiro; Mercado de ações.

1 Introduction

From a historical point of view, a measure adopted that culminated in the arrival of larger flows of foreign capital into Brazil was the Annex IV regulation, implemented through Resolution No. 1832 of the National Monetary Council (CMN) in 1991. The purpose of the regulation was to discipline the composition and management of securities portfolios maintained in the country by institutional investors, such as pension funds, own portfolios of financial institutions, insurance companies and mutual investment funds established abroad.

Brazil, Argentina, and Mexico were the Latin American countries that received most foreign investment in the early 1990s, as pointed out by Calvo, Leiderman and Reinhart (1996), and one of the factors that favored Brazil was the adoption of more stable policies, such as the Plano Real in 1994, when inflation was partially eliminated, as Garcia and Didier (2003)

The impact of Annex IV and the implementation of the Plano Real, as evidenced by Silva and Coronel (2012), provided Brazilian Stock Exchange development, increasing business volume and efficiency of allocation. According to that author, Brazilian financial market had received more attention from foreign investors, who sought to diversify their portfolios.

Leal and Rêgo (1997) and Gomes (2006) also concluded that Annex IV and the Plano Real contributed to secondary stock market liquidity increases. Gomes (2006) found that between 1969 and 2004, near by 57.87% of the foreign capital flows to Brazil were destined to shares purchases. Since 1990, when foreign investment gained strength, until 2004, funds raised from foreign investments in Brazilian stock market reached 44.37% of total foreign investment portfolio loans. According to BM&FBovespa (2017), foreign capital participation in Brazilian shares in the last three years, from 2014 to 2016, surpassed the 50% level. These capital flows from developed to emerging countries, such as Brazil, are a important factor, since they can positively stimulate the economy and share's value, attracting more and more investments.

Munhoz (2013) suggests that capital flows ascendancy to Brazil and financial crises around the world encourage theoretical-empirical research on these issues. This paper will consider the behaviors of variables that may be related to foreign capital flows. Given the current financial globalization context and significant volume of foreign capital present in Brazilian stock market, this paper was developed to investigate the influence of certain macroeconomic variables on foreign investment flows, seeking a response to the following research question: Are there relationship between interest rates, inflation, exchange rate, country risk and oil prices, and foreign investment flows, in the Brazilian stock market?

The aim of this paper is to detect, to measure and to analyze relationship between interest rate, inflation, country risk, oil price and exchange rate, and foreign capital flows to the Brazilian Stock Market.

2 Literature Review

Twenty years ago, Cardoso and Goldfajn (1997) wrote a paper in which they analyzed the determinants of foreign capital flows to Brazil and concluded that external interest rates and contagion effects were the most influential factors. Garcia and Valpassos (1998) confirmed that the huge differential between domestic and foreign

interest led to the entry of significant volumes of foreign capital into the country, especially short-term ones. In that paper, they also showed that, after 1995, foreign direct investment (FDI) was stimulated by the extensive privatization process in Brazil. These finds were confirmed by Garcia and Barcinski (1998), Holland and Vieira (2003) and by Terra e Soihet (2006). This latest study revealed that foreign investment flows to Brazil were influenced by the economy stabilization with the Plano Real and international financial crises from Mexico, Russia and Southeast Asia.

Considering the period after the Plano Real, from 1995 to 2004, Pinheiro and Amin (2004) looked for relationships between foreign capital flows, public debt, country risk, interest differential and foreign exchange stock in Brazil. Using Vector Auto-Regression (VAR) models, they obtained results that showed that the internal and external interest differential was the main factor to a more dynamic relationship with other variables behavior, including foreign capital flows.

Veríssimo and Holland (2004) included in their paper an innovative variable, the Brazilian legislation, in the variables set already considered in previous researches. They found that changes in laws, increasing flexibility to foreign investments in the Brazilian capital market, did not show a positive impact on the capital attraction in 1995 to 2002 period. On the other hand, other variables, mainly interest rate and country risk, showed influence on foreign investment flows, validating the results of previous papers.

Franzen et al. (2009) related volumes of foreign investment in Brazilians variable income portfolios, Ibovespa return, and macroeconomic variables – exchange rate, interest rate and country risk. The paper involved time series with monthly data for the period of 10 years from 1995 to 2005. The results revealed the existence of a negative relationship between exchange rates and country risk and foreign investment volumes in stock market. Munhoz (2013) developed a similar research, adding Tax on Financial Operations (IOF) in the set of variables. The results validated conclusions of Franzen et al. (2009) about other common variables, and IOF not showed a significant impact on foreign capital flows.

In the international context of the 1990s, Froot, O'Connell and Seasholes (2001) analyzed the daily foreign capital flows to 44 countries, including emerging ones. The main results showed that capital inflows to capital markets were strongly influenced by past stock index returns and also showed that country risk was negatively related to these flows. Also, Nonnenberg and Mendonça (2005) investigated factors that motivated Foreign Direct Investment (FDI) flows in 38 developing countries, considering data from a period of 25 years, from 1975 to 2000. The main factors were size, pace and GDP (Gross Domestic Product) growth, labor qualification, economy openness level to external capital, country risk and stock market indices behavior. Mattos, Cassuce and Campos (2007) obtained similar results, except for GDP.

Peres et al. (2013) investigate an inverse relationship between economic variables and capital flows. They investigated macroeconomic determinants of short-term foreign capital flows in Brazil for 2000 to 2013 period. Results indicated that an increase in US interest rate has a negative effect on foreign investment flows, and an increase in US industrial production index has a positive effect on short-term investments in Brazil.

Peres and Yamada (2014) developed a research whose purpose was to analyze determinants of foreign direct investment (FDI) inflows in Brazilian economy, in 1980-2010 period. Determinants of IEDs were divided into push factors and pull factors. The first ones are related to companies and origin countries characteristics, and the latter ones are related to locational factors. The results showed that main push factors were

advanced economies real GDP growth rate and Dow Jones index (DJIA) rate; and main pull factors were domestic GDP growth rate, the Ibovespa, exchange rate and, to a lesser extent, the Economic Freedom index.

Ribeiro, Leite and Justo (2016) examined the influences of the macroeconomic variables interest rate, exchange rate, industrial production index and Dow Jones Index in Brazilian stock market, considering an eighteen years period from 1995 to 2012. The results showed that Ibovespa index reacts in long-term equilibrium trajectory to short-term changes in macroeconomic variables.

Autors	Research	Conclusions
Cardoso and Goldfajn (1997)	Capital flows to Brazil.	External interest rates and contagion effects were primarily responsible for capital flows.
Garcia and Barcinski (1998)	Capital flows to Brazil.	Differential Brazilian interest rate caused greater capital flows.
Garcia and Valpassos (1998)	Capital flows to Brazil.	Differential Brazilian interest rate caused greater capital flows.
Froot, O'Connell and Seasholes (2001)	Foreign Investment flows to 44 countries.	Returns from stocks influence capital flows; There is a relation between country risk and external investments (IE); Share prices suffer positive and relevant effect of IE.
Holland and Vieira (2003)	Capital flows to Brazil, macro economy and capital control.	Capital controls react to IE. Variable-income portfolios are more affected than FDI. There is a relationship between interest rates and country's default probability.
Pinheiro and Amin (2004)	Capital flows to Brazil and macroeconomics variables relationship	Interest differential maintains a more dynamic relationship with analyzed variables.
Veríssimo and Holland (2004)	Capital flows to Brazil, macro economy and Law system.	Interest rate and country risk were more relevant for observed capital flows.
Nonnenberg and Mendonça (2005)	Direct Investment flows to emerging markets.	Size, pace and GDP growth, job qualification, economic openness, country risk and stock markets are factors that affect foreign direct investment flows.
Terra and Soihet (2006)	Capital flows to Brazil and Law system.	Capital flows were affected by: interest, legislation, economic stabilization, and Mexican, Asian, and Russian crises.
Mattos, Cassuce and Campos (2007)	Direct Investment flows to Brazil and macroeconomics variables.	Inflation rate, Brazil risk and economy openness are sensitive to FDI flows, but foreign exchange and GDP.
Franzen *et al.* (2009)	Capital flows to Brazil, stock market and macroeconomics variables.	Negative ratio between exchange rate and foreign investment in capital market; the same applies to country risk variable.
Munhoz (2013)	Capital market, macroeconomics variables and IOF relationship.	IOF does not have a significant impact on capital flows, which is more linked to exchange rate and country risk.
Peres et al. (2013)	Capital flows to Brazil and macroeconomics variables.	US interest rate has a negative effect and US industrial production index has a positive effect on short-term investments in Brazil.
Peres and Yamada (2014)	Direct Investment flows to Brazil determinants.	*Push Factors*: GDP (developed economies) and Dow Jones; *Pull Factors*: domestic GDP, Ibovespa e exchange rate.

Ribeiro, Leite and Justo (2016)	Capital flows to Brazil, stock market and macroeconomics variables.	Bovespa index was influenced by macroeconomics variables.

Fig. 1 - Theoretical Referential Summary

In summary, papers of Cardoso and Goldfajn (1997), Garcia and Barcinski (1998), Garcia and Valpassos (1998), Veríssimo and Holland (2004), Pinheiro and Amin (2004) and Terra e Soihet (2006) related capital flows to Brazil with differential levels of Brazilian interest rate and developed countries interest rate. Franzen et al. (2009) found a negative relationship between exchange rate and foreign investments in Brazil. Terra e Soihet (2006) and Mattos, Cassuce and Campos (2007) investigated relationship between inflation and capital flows to Brazil. Froot, O'Connell and Seasholes (2001), Veríssimo and Holland (2004), Nonnenberg and Mendonça (2005), Mattos, Cassuce and Campos (2007) and Franzen et al. (2009) founded a link between capital flows and country risk. Finally, Peres and Yamada (2014), in a broad research, identified push factors and pull factors, which basically consisted of economic growth rates and stock market indices.

The papers reviewed in this section investigated relationships between economic variables and foreign capital flows. Most of them investigated these relationships with data concentrated in periods of major economic, political and legal transformations that occurred in the early 1990s (market opening, deregulation, Plano Real, global financial crises, among others). The exception is the paper of Peres and Yamada (2014), which analyzed data from a long period of 30 years, since 1980.

A motivating point of this paper is the possibility of detecting relations between capital flows and economic variables considering data after the 1990s, and therefore of those specific transformations, but with enough scope to contemplate precursors of the current economic situation. The 2004 – 2016 period includes a important growth phase (IPO expansion) and improvement of Brazilian capital market (2004 – 2008), the outbreak of the last major international financial crisis (2008), the post-crisis period (2009 to 2012), and Brazilian political and economic crisis period (2013 – 2016).

In addition, this paper involves a multivariate time series analysis econometric technique, Vector Auto-Regression (VAR), which is an interesting and effective way of characterizing dynamic interactions between economic variables, without dependence on potentially inadequate theoretical constraints, which would normally be a traditional structural econometric model (SIMS, 1980).

3 Metodology

This research can be characterized as a conclusive, descriptive and quantitative research, as it aimed to test specific hypotheses, sought to describe a causal relationship between variables and employed mathematical techniques to obtain results.

The dataset is composed of secondary data and was collected in the Bloomberg database and Brazilian Central Bank Bulletins. The period of analysis is between June 1, 2004 and May 31, 2016, thus comprising a 12 years time interval. Time series of monthly quotations of the variables: interest rate, as measured by SELIC; Inflation rate as measured by the IPCA; exchange rate, using the PTAX; oil price, measured by international price of Brent oil barrel; country risk rate using Credit Default Swap (CDS) index; and amount (R$) of foreign investment on the São Paulo Stock Exchange. The E-Views software was used to analyse data.

A presente pesquisa baseou a sua metodologia abordada na análise econométrica de estudo anterior de Pimenta Júnior e Higuchi (2008). Foi aplicado o Teste de Causalidade de Granger para testar as relações de precedência entre as séries e; a partir de um modelo *VAR* (*Vector Auto-Regression*) estimado, foram feitas a Análise das Decomposições das Variâncias *(VDC – Variance DeComposition)* e as Funções de Resposta a Impulso *(IFR – Impulse Response Function)* para detectar o nível de influência das variáveis independentes sobre o comportamento da variável dependente.

In this study, methodology is based on econometric analysis of a Pimenta Junior and Higuchi (2008) paper. The Granger Causality Test was applied to test the precedence relations between the series and; from an estimated Vector Auto-Regression (VAR) model, Variance DeComposition Analysis (VDC) and Impulse Response Functions (IFR) were used to detect variables influence level on dependent variable behavior.

The estimated VAR model is given by the following vector equation:

$$\boldsymbol{y_t = C + \Phi_1 y_{t-1} + \Phi_2 y_{t-2} + \cdots + \Phi_p y_{t-p} + \varepsilon_t}$$

Where:

$\mathbf{C}$ is a nx1 vector of constants;

$\boldsymbol{\Phi_1}$ is a nxn matrix of autoregressives coeficients;

$\boldsymbol{\varepsilon_t}$ is a nx1 vector, white noise generalization;

$\mathbf{E}[\boldsymbol{\varepsilon_t}] = \mathbf{0}$;

$\mathrm{E}[\boldsymbol{\varepsilon_t}, \boldsymbol{\varepsilon_\tau}] = \boldsymbol{\Omega}$, for $\mathrm{t} = \tau$ and $\mathrm{E}[\boldsymbol{\varepsilon_t}, \boldsymbol{\varepsilon_\tau}] = 0$, for $\mathrm{t} \neq \tau$;

$\boldsymbol{\Omega}$ is a positive simetric matrix whit order n.

Augumented Dickey-Fuller (ADF) test, proposed in Dickey and Fuller (1981), was adopted to test time series stationarity.

Granger Causality Test was employed to show that a time series causes another series if its lagged values are significant predictors of this other series. The existence of Granger causality effect between two time series is an indication that a VAR model can be developed to model and design interrelated series.

According to the concept of causality proposed by Granger (1980), if:

$$\sigma^2(X_t|Z_{t-1}) \leq \sigma^2(X_t|Z_{t-1} - Y_{t-1})$$

and

$$\sigma^2(Y_t|Z_{t-1}) \leq \sigma^2(Y_t|Z_{t-1} - X_{t-1})$$

then there is a *feedback* between $X\ and\ Y$.

The first n lines of VAR model, represented by:

$$\boldsymbol{\Psi_{t+s} = v_{t+s} + F v_{t+s-1} + F^2 v_{t+s-2} + F^3 v_{t+s-3} + \cdots + F^{s-1} v_{t+1} + F^s \Psi_t}$$

form a vector generalization of equation:

$$Y_{t+s} - Y_\mu = f_{11}^s\left(Y_t - Y_\mu\right) + f_{12}^s\left(Y_{t-1} - Y_\mu\right) + \cdots + f_{1p}^s\left(Y_{t-p+1} - Y_\mu\right) +$$

$$+\varepsilon_{t+s} + w_1\varepsilon_{t+s-1} + w_2\varepsilon_{t+s-2} + \cdots + w_{s-1}\varepsilon_{t+1}$$

Where:

$w_j = f_{11}^j$

This equation represents a stationary autoregressive process of order p, an AR (p), which expresses values of $Y_{t+s} - Y_\mu$ in terms of initial values $Y_t - Y_\mu$, $Y_{t-1} - Y_\mu$, ...

And subsequent values of $\varepsilon_{t+1},\ \varepsilon_{t+2},\ \varepsilon_{t+3},\ \ldots,\ \varepsilon_{t+s}$.

Vector generalization is given by:

$$\boldsymbol{Y_{t+s}} = \boldsymbol{Y_{\mu}} + \boldsymbol{F_{11}^{s}}\left(\boldsymbol{Y_t} - \boldsymbol{Y_{\mu}}\right) + \boldsymbol{F_{12}^{s}}\left(\boldsymbol{Y_{t-1}} - \boldsymbol{Y_{\mu}}\right) + \cdots + \boldsymbol{F_{1p}^{s}}\left(\boldsymbol{Y_{t-p+1}} - \boldsymbol{Y_{\mu}}\right) +$$

$$+\boldsymbol{\varepsilon_{t+s}} + \boldsymbol{W_1\varepsilon_{t+s-1}} + \boldsymbol{W_2\varepsilon_{t+s-2}} + \cdots + \boldsymbol{W_{s-1}\varepsilon_{t+1}}$$

If the eigenvalues of F lie within the unit circle $|\lambda| < 1$, then $\boldsymbol{F^s} \to \boldsymbol{0}$, as $s \to \infty$, and $\boldsymbol{Y_t}$ X can be expressed as a convergent sum of the values of ε :

$$\boldsymbol{Y_t} = \boldsymbol{Y_{\mu}} + \boldsymbol{\varepsilon_t} + \boldsymbol{W_1\varepsilon_{t-1}} + \boldsymbol{W_2\varepsilon_{t-2}} + \cdots = \boldsymbol{Y_{\mu}} + \boldsymbol{W(L)\varepsilon_t}$$

What is the representation of a vector process of moving averages of infinite order, a MA(∞).

Interpretation of $\boldsymbol{W}$ matrix is:

$$\frac{\partial y_{t+s}}{\partial \varepsilon_t'} = \boldsymbol{W_s}$$

This means that element ij of $\boldsymbol{W_s}$ matrix identifies the consequences of a unit increment on the innovation of jth variable, at date t ($\boldsymbol{\varepsilon_{it}}$), on value of ith variable, at time t+s ($y_i, t+s$), keeping all other innovations unchanged, on all dates.

If first element of vector $\boldsymbol{\varepsilon_t}$ is changed by δ_1, at same time that second element is changed by δ_2, ... , and the nth element is changed by δ_n, the combined effect of these changes on value of vector $\boldsymbol{y_{t+s}}$, is given by:

$$\Delta\boldsymbol{Y_{t+s}} = \frac{\partial \boldsymbol{y_{t+s}}}{\partial \boldsymbol{\varepsilon_{1t}}}\delta_1 + \frac{\partial \boldsymbol{y_{t+s}}}{\partial \boldsymbol{\varepsilon_{2t}}}\delta_2 + \cdots + \frac{\partial \boldsymbol{y_{t+s}}}{\partial \boldsymbol{\varepsilon_{nt}}}\delta_n = \boldsymbol{W_s\delta}$$

Where:

$\boldsymbol{\delta} = [\delta_1, \delta_1, \ldots, \delta_1]^t$

The function that gives values of the matrix $\boldsymbol{W_s}$ as a function of s, is called Impulse Response Function (IRF). It describes the response of $\boldsymbol{y_{i,t+s}}$ to an impulse at a single moment in $\boldsymbol{y_{i,t}}$ with all other variables held constant.

Variance Depreciation (VDC) has ability to show the fraction of error variance projected for each return, which results from effects of the innovations themselves and those derived from innovations in other markets. IRFs shows the response of each market's return to an impact of a standard error unit on market returns.

Monte Carlo technique is very useful for simulation of innovations and consequent adjustment of VDCs and IRFs. Simulation is a great way to get these dynamic multipliers numerically. Random extractions of VAR covariance matrix are constructed, and at each extraction, VAR model, VDCs and IRFs are adjusted. Thus, simulation takes following form: values of $\boldsymbol{y_{t-1}} = \boldsymbol{y_{t-2}} = \cdots = \boldsymbol{0}$; make $\boldsymbol{\varepsilon_{jt}} = \boldsymbol{1}$ and all other elements of $\boldsymbol{\varepsilon_t} = \boldsymbol{0}$; Then system simulation is done:

$$\boldsymbol{y_t} = \boldsymbol{K} + \boldsymbol{\Phi_1 y_{t-1}} + \boldsymbol{\Phi_2 y_{t-2}} + \cdots + \boldsymbol{\Phi_p y_{t-p}} + \boldsymbol{\varepsilon_t}$$

For dates t, t+1, t+2, t+3, ..., with c and all elements $\boldsymbol{\varepsilon_{t+1}, \varepsilon_{t+1}}, \ldots$ equal to zero; The value of the vector $\boldsymbol{y_{t-s}}$ at date t+s of simulation, corresponds to jth column of the matrix $\boldsymbol{W_s}$. By making separate simulations for each of innovations (j = 1, 2, ..., n), all columns of the matrix $\boldsymbol{W_s}$ are calculated

4 Results

A regression model can only be estimated when variables are stationary, that is, when time series are convergent and develop around a constant mean over time. ADF Test was used in order to verify stationarity of variables. ADF Test results are showed in Table 1:

Table 1 –ADF Test results (level series)

	IE	SELIC	IPCA	CDS	BRENT	PTAX
Level	-10,86875	-2,96774	-6,14576	-9,89941	-7,45892	-10,11171
I(I)	0	0	0	0	0	0
Critical*	1% (-3,48559)		5% (-2,88565)		10% (-2,57971)	

* MacKinnon critical values for unit root hypothesis rejection.

Table 1 shows that null hypothesis of non-stationary series can be rejected at the 1% level for all variables except SELIC. Therefore, for series to be stationary at the 1% confidence level, a new ADF test was performed with series in first difference. Table 2 presents the results of new test applied.

Table 13 –ADF Test results (first difference series)

	IE	SELIC	IPCA	CDS	BRENT	PTAX
Level	-10,46721	-15,05726	-11,05783	-10,95398	-11,06050	-10,17630
I(I)	1	1	1	1	1	1
Critical*	1% (-3,48655)		5% (-2,88607)		10% (-2,57993)	

* MacKinnon critical values for unit root hypothesis rejection.

Data presented in Table 2 show that non-stationarity null hypothesis can be rejected for all variables, including SELIC, at 1% confidence level.

Granger Causality Test was adopted in order to identify if the behavior of macroeconomic variables addressed in this study affects Foreign Investment behavior in Brazilian stock market and if variables values precede Foreign Investment flows.

Table 3 – Granger Causality test results

Null hypothesis	Obs	F Statistic	Probability
SELIC does not cause (Granger) Foreign Investment	143	1,82676	0,1598
IPCA does not cause (Granger) Foreign Investment	143	0,27021	0,7587
CDS does not cause (Granger) Foreign Investment	143	0,19697	0,9013
Brent does not cause (Granger) Foreign Investment	143	0,60973	0,5834
PTAX does not cause (Granger) Foreign Investment	143	0,34128	0,7209

Results presented in Table 3 show that five macroeconomic variables (SELIC, IPCA, CDS, Brent and PTAX) are not significant predictors of Foreign Investment flows in Brazilian stock market. Granger Causality relations are statistically non-significant.

Results obtained with Variance DeComposition (VDC) analysis are presented in Table 4.

Table 4 – Variance De Composition (VDC) analysis

Period	Standart Error	IE	SELIC	IPCA	CDS	Brent	PTAX
1	5,71262	100,0000	0,00000	0,00000	0,00000	0,00000	0,00000
2	5,94570	93,38508	4,97142	0,05038	0,01024	0,50003	1,297069
3	6,09087	88,58947	7,97671	0,62994	0,12250	0,99682	1,898537
4	6,15137	86,85958	8,14692	0,63160	1,02150	1,63985	1,915141
5	6,18962	85,43345	8,03185	0,62512	1,05107	1,76278	3,321505
6	6,25128	84,47362	8,03339	0,62919	1,07905	1,96009	4,056154
7	6,26973	83,86679	8,41775	0,62671	1,06923	1,96419	4,288044
8	6,28635	83,58760	8,41052	0,66843	1,12285	2,01482	4,42967
9	6,28999	83,45388	8,41836	0,66862	1,18194	2,01407	4,497604
10	6,29587	83,36140	8,46316	0,67320	1,18247	2,04642	4,507815

Results indicate that perturbations suffered by Foreign Investment variance can be explained mainly by lagged values of variable itself. Influence declines from 100% in first month to 88% in third month, and practically stabilizes at 83% from seventh month. Table 4 shows that other variables have little explanatory power on Foreign Investments variance. In descending order: SELIC shows a 8% from third month explanation power; PTAX reaches 4% of explanation power from fourth month; BRENT variable reaches a 2% explanation power in eighth month; CDS presented an explanatory power about 1% from fourth month; and IPCA inflation index showed a practically irrelevant influence, ranging from 0.63% to 0.67%, starting from third month.

Figure 2 shows Impulse Response Functions analysis results. Each graph shows disturbance suffered by Foreign Investment variable as an effect of a one standard deviation magnitude in each macroeconomic variable (SELIC, CDS, PTAX, IPCA and BRENT).

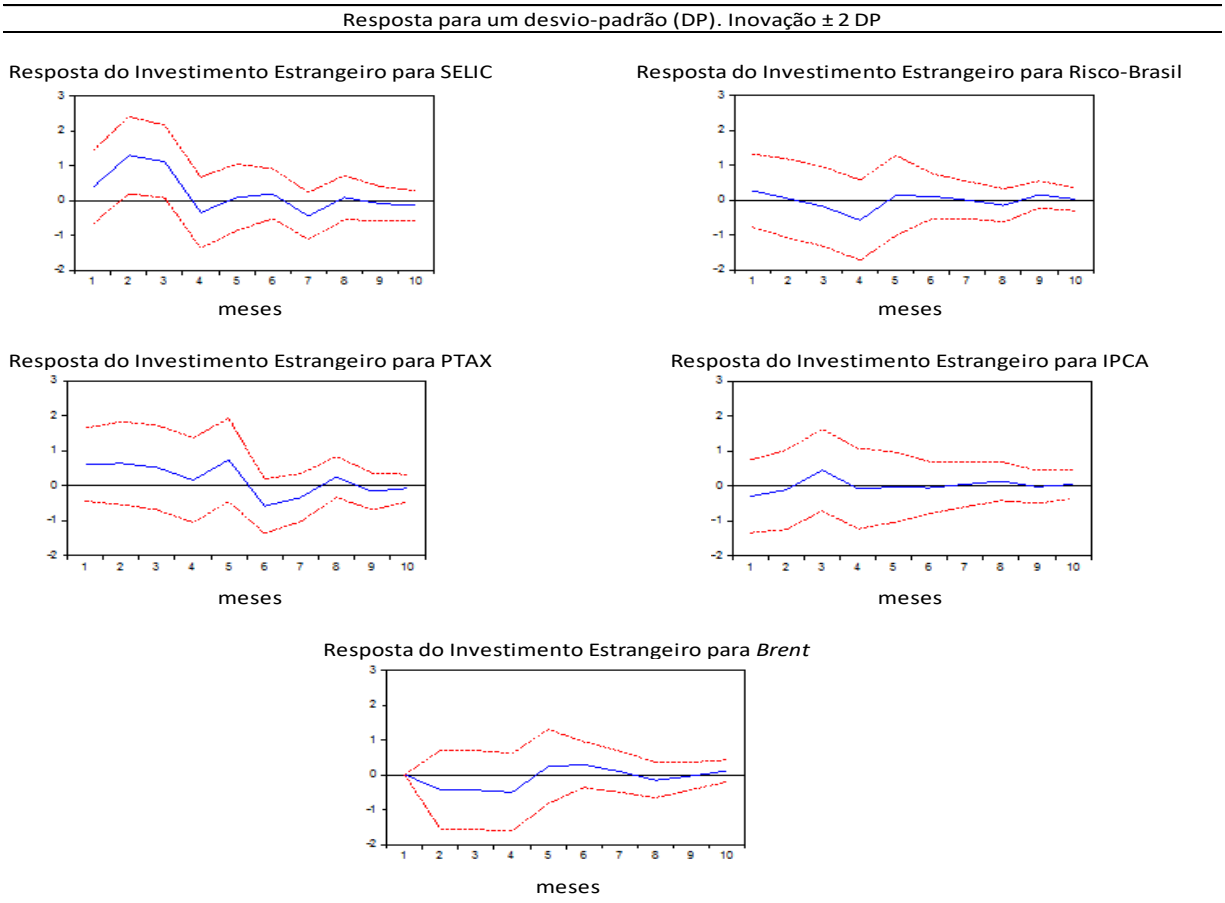

Fig. 2 – Impulse Response Functions analysis results

Graphics in Figure 2 show that impulses applied in five macroeconomic variables time series do not exert a statistically significant influence on Foreign Investment behavior.

5 Conclusion

In order to reach the objective proposed in this study, a multivariate approach of Vector Auto-Regression technique (VAR) was used. Granger Causality Test was applied in order to identify if each selected macroeconomic variables behavior affected, isolated and together, Foreign Investment flows behavior, in Brazilian stock market and also if inverse occurred. It can be concluded, based on tests results, that causal relationship (in precedence sense) between economic variables and Foreign Investment flows is statistically insignificant.

On the existence and magnitude of macroeconomic variables influence in explaining foreign investment flows variance, in Brazilian stock market, Variance DeComposition (VDC) technique allowed to conclude that macroeconomic variables with greater explanatory power, although they are not very influential, are SELIC interest rate (maximum of 8.5%) and PTAX exchange rate (maximum of 4.5%).

Impulse Response Functions analysis showed that impulses provoked on macroeconomic variables did not exert a statistically significant influence on Foreign

Investment flows behavior, corroborating results founded Variance Decompositions analysis.

In summary, obtained results allowed to conclude that none of macroeconomic variables has a statistically significant relationship with behavior Foreign Investment flows, in Brazilian stock market.

However, in spite of this paper conclusion, considering foreign capital investment importance to Brazilian economy, it is suggested that new researches be developed based on another variables set that possibly have greater predictive power on those capital inflows behavior.

References

BM&FBOVESPA. Bolsa de Valores, Mercadorias e Futuros. (2014) Part. Investidores no Vol. Financeiro Total - Segmento Bovespa. São Paulo, 2014.

BM&FBOVESPA. Bolsa de Valores, Mercadorias e Futuros. (2013) Relatório Anual 2013. São Paulo, 2013.

Calvo G. A., Leiderman L., Reinhart, C. M. (1996) Inflows of capital to developing countries in the 1990s. Journal of Economic Perspectives, 10, (2), 123-139

Cardoso, E., Goldfajn, I. (1997) Capital Flows to Brazil: The Endogeneity of capital Controls. IMF Working Paper.

Dickey, D. A., Fuller, W. A. (1981) Likelihood ratio statistics for autoregressive time series with a unit root. Econometrica, 49, (4), 1057-1072.

Franzen, A., Meurer, R., Gonçalves, C. E. S., Seabra, F. (2009) Determinantes do fluxo de investimentos de portfólio para o mercado acionário brasileiro. Estudos Econômicos, 39, (2), 301-328.

Froot, K. A., O'Connell, P. G. J.; Seasholes, M. (2001) The portfolio flows of international investors. Journal of Financial Economics, 59, (2), 151-193.

Garcia, M. G. P., Barcinski, A. (1998) Capital flows to Brazil in the nineties: macroeconomic aspects and the effectiveness of capital control. The Quarterly Review of Economics and Finance, 38, 3, 319-357.

Garcia, M. G. P., Valpassos, M. V. F. (1998) Capital flows, capital controls and currency crisis: the case of Brazil in the nineties. Texto para Discussão PUC-Rio, 389.

Gomes, M. N. (2006) Os investimentos estrangeiros em ações como fonte de financiamento para as empresas brasileiras. Atualidade Econômica, 49.

Granger, C. W. J. (1980) Testing for causality: a personal viewpoint. Journal of Economic Dynamics and Control, 2, 329–352.

Holland, M., Vieira, F. V. (2003) Country risk endogeneity, capital flows and capital controls in Brazil. Revista de Economia Política, 23 (1), 12-38.

Leal, R. P., Rêgo, R. B. (1997) Impacto do Anexo IV no mercado de capitais brasileiro. Revista de Administração, 32 (3), 82-88.

Mattos, L. B. de, Cassuce, F. C. da, Campos, A. C. (2007) Determinantes dos investimentos diretos estrangeiros no Brasil, 1980-2004. Revista Economia Contemporânea, 11(1), 39-60.

Munhoz, V. da C. V. (2013) Vulnerabilidade externa e controle de capitais no Brasil: uma análise das inter-relações entre câmbio, fluxos de capitais, IOF, juros e risco-país. Nova Economia, 23 (2), 371-402.

Nonnenberg, M. J. B., Mendonça, M. J. C. de. (2005) Determinantes dos investimentos diretos externos em países em desenvolvimento. Estudos Econômicos, 35 (4), 631-655.

Peres, S. C., Yamada, T. H. (2014) Determinantes do investimento estrangeiro direto no Brasil: uma aplicação do modelo de vetores autorregressivos (VAR) no período 1980-2010. Revista Economia e Desenvolvimento, 26, (2), 1-20.

Peres, S. C., Tonin, J. R.; Ramalho, M., Araújo, E. C. (2013) Determinantes macroeconômicos dos fluxos de capital de curto prazo para o Brasil no período 2000 a 2013: uma aplicação do modelo SVAR. XVI Encontro de Economia da Região Sul, ANPEC/SUL.

Pinheiro, A. M., Amin, M. M. (2004) Fluxos de Capitais e Componentes Macroeconômicos: análise de inter-relações através da aplicação de um modelo de vetores auto-regressivos (VAR). XXXII Encontro Nacional de Economia. ANPEC.

Ribeiro, A. A. S., Leite, A. R., Justo, W. R. (2016) Análise de cointegração e causalidade entre variáveis macroeconômicas e o índice Dow Jones sobre o Ibovespa. Revista de Administração UFSM, 9 (1), 121-137.

Silva, F. M., Coronel, D. A. (2012) Análise da causalidade e cointegração entre variáveis macroeconômicas e o Ibovespa. Revista de Administração FACES, 11 (3), 31-52.

Sims, C.A. (1980) Macroeconomics and reality. Econometrica, 48, 1-48.

Terra, M. C., Soihet, E. (2006) Índice de controle de capitais: uma análise da legislação e seu impacto sobre o fluxo de capital no Brasil no período 1990-2000. Estudos Econômicos, 36 (4), 721-745

Veríssimo, M. P., Holland, M. (2004) Liberalização da conta de capital e fluxos de portfólio para o Brasil no período recente. X Fórum Banco do Nordeste de Desenvolvimento. ANPEC.