MEASURING THE IMPACT OF FINANCIAL FLOWS ON MACROECONOMIC VARIABLES: THE CASE OF BRAZIL AFTER THE 2008 CRISIS

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Abstract

The effects of changes in foreign portfolio investment flows on Brazilian GDP and investment during the financial crisis of 2008 are evaluated through impulse-response functions, parsimonious models, and out of sample forecasts. Impulse-response functions results show a positive relation between fixed income flows and GDP and investment, but this relation is not as strong between the real variables and equity flows, although these flows anticipate GDP and investment behavior. Expectations seem to have an important role in explaining GDP and investment, which also have an influence on flows. The reduced vulnerability of the Brazilian economy consequently lessened the effect of the crisis when compared with previous crisis episodes.

Keywords: Foreign Portfolio Investment, Growth, Investment, Crisis, Brazil

JEL Codes: F32, E32, E22

Resumo

Os efeitos de mudanças nos fluxos de investimento de portfólio sobre o PIB e investimento no Brasil durante a crise financeira de 2008 é avaliado através de funções de impulso-resposta, modelos parcimoniosos e previsões fora da amostra. As funções de impulso-resposta mostram uma relação positiva entre fluxos para renda fixa e PIB e investimento, mas esta relação não é tão forte quanto a que aparece entre as variáveis reais e os fluxos para ações, embora os fluxos antecipem o comportamento do PIB e do investimento. Expectativas parecem ter um papel importante na explicação do PIB e do investimento, que também têm influência sobre os fluxos. A reduzida vulnerabilidade externa da economia brasileira diminuiu os efeitos da crise em comparação com episódios anteriores de crise.

Palavras-Chave: Investimento externo em carteira, Investimento, Crescimento, Crise, Brasil

Códigos JEL: F32, E32, E22

1. Introduction

In this paper the relationship between financial flows and real variables in Brazil will be explored. The real variables are GDP and investment growth. The financial flows to be

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analyzed are foreign portfolio investment (FPI) flows trade in the country, because these flows are more prone to be immediately affected by changes in domestic and international scenarios. The hypothesis is that the financial flows are not enough to explain the downturn of the economy, but that the decisions which led to flow reversal and reduced investment are influenced by the same sort of expectations.

Foreign portfolio investors heavily withdrew resources from Brazil in the final quarter of 2008, even without changes in the country's macroeconomic fundamentals, which could help to explain the fall in GDP and investment during the crisis through a financial channel, the FPI flows, due to changes in expectations. Such a change in expectations could be a higher uncertainty perception and the "fly to quality" result as a consequence. These possibilities will be tested through the relation between GDP growth and changes in investments and the following financial variables: domestic interest rate, real effective exchange rate, country risk, and FPI flows. Results show that the drops in investment and GDP were greater than what would be expected from the outflow of FPI. This means that domestic agents reacted to the crisis in a very pessimistic way, or were more risk averse, which led to a greater fall in GDP and investment than the reaction of FPI, without previous deterioration of external or fiscal accounts. On the other hand, historical experience shows that flows react to fiscal and external accounts figures, which means that if the variables related to them were not good, the fall could have been even worse. In other words, it seems that sound macroeconomic policy paid off and allowed for a relatively fast recovery of the Brazilian economy.

There is an important theoretical and empirical relation between risk and interest rates. In a fixed exchange regime, higher risk should lead to a higher interest rate, in order to attract capital and avoid the depletion of international reserves. In other words, when the risk is higher on bonds from domestic issuers, the interest rate has to be higher to maintain parity with international rates. In a floating exchange rate regime the higher risk results in capital leaving the country, and domestic currency will then depreciate. Given a pass-through from external to internal prices, exchange rate depreciation has to be followed by higher interest rates in order to fight inflation rates. This means that risk should lead the policy interest rate.

The relation between risk and exchange rate depends on the exchange rate regime. It is customary for the Brazilian Central Bank to intervene in the market, trying to influence the exchange rate or its volatility. Risk, on the other hand, is only market determined. Both risk and exchange rates can be influenced by the same perceptions and information, but the exchange rate should be less sensitive, because of its relations to the real economy through imports, exports, factor remunerations, and not only financial market indicators like risk. Flows may depend on operational arrangements, unlike risk. Thus, flows will not react to the other variables as fast as risk. As the Brazilian Central Bank adopted a semi-fixed exchange rate from 1995 to 1998, a dummy variable will be included for this period.

The crisis has shown again that financial variables have an influence on the behavior of the real economy and how strong this influence can be. Suppressing or reverting previous finance flows had strong impacts on economic growth around the world. In the specific case of Brazil, there was an initial belief that the crisis initiated in 2008 would not strongly affect the

economy because it was not generated in the country and Brazilian economic fundamentals were strong. In fact, Brazil and other emerging economies were harshly affected. If the cause of decreased output in emerging economies is not in respective local economy fragilities or economic policies, there has to be a link between the local and world economies which leads to the fall. Given that this crisis originated mainly in the financial system (AÏT-SAHALIA et al., 2010), the operation of the financial system or international flows of resources could be a good first guess for the origin of the problem. If the flows were responsible, an econometric model linking the flows and real variables should detect them as the cause. The question raised in this paper is if the reversal of FPI flows is enough to explain the slowdown of the Brazilian economy after the crisis. The channels that are working are not modeled, but some hints of the operation can be derived from the results.

The paper is structured as follows. In the second section a very brief theoretical revision is presented. It relates to financial flows and their importance for growth, current account and foreign reserves and their relation with economic policy and the exchange rate regime. In the third section the data are explained and put in perspective, along with the descriptive statistics. Section four shows the econometric results and discussion. It covers the impulse-response functions, parsimonious models, and out of sample forecasts. Section five presents the concluding remarks. The results show that the changes in the real variables are not only a reaction to the flow, but that expectations, not only the flows themselves, seem to have had a major role.

2. Importance of flows, balance of payments, and exchange rate

Relying on FPI for financing economic growth assumes the risk that a country become dependent on FPI flows, and if and when these flows revert, domestic growth is hampered (GRIFFITH-JONES and OCAMPO, 2009). The effects of the instability of the financial flows are explored in literature on sudden stops (CALVO, 2003) and current account reversals (EDWARDS, 2008). When a sudden stop happens it is necessary to reduce domestic absorption, because less international financing is available as a counterpart to the current account deficit. This lessens the demand for imported products but also for domestic output with foreign inputs, induced by higher costs of imported products given by a depreciated exchange rate or barriers to imports. In more open countries the costs are lower (EDWARDS, 2008). The sudden stop has more immediate effects on the economy than current account reversals (EDWARDS, 2007).

International financing through FPI can have a stabilizing effect on the economy if the flows occur when the asset prices are low. FPI can also be a feasible financing alternative, diversifying sources of finance. The volatility of the flows is unavoidable because they react to constantly revised information (ERRUNZA, 2001). The “market sentiment” plays an important role in the determination of flows (BAEK, 2006).

The effect of the flows on real variables can happen through the effect on demand via exchange rate or credit, or indirectly by influencing the behavior of the financial system. The effect through exchange rate or credit means that higher inflows would lead to an

appreciation of the domestic currency, stimulating imports and making domestic production relatively costly, thus inhibiting its growth. On the other hand, an appreciated currency can induce higher investment in imported equipment and software. The domestic financial institutions or firms could employ international resources as funding to expand domestic credit or investment, thus leading to higher growth.

The short run effects, through current account financing and exchange rates, are important and the strong swings in flows give importance to the effects of the FPI. Because of these interrelations between flows and real variables beyond the flows, other variables that are important for the behavior of GDP and investment have to be considered. The exchange rate will affect prices of domestic output relative to foreign, which has an impact on output. On the other hand, the exchange rate reacts to expectations and could be a risk indicator in the short run. Expectations about the domestic economy will also be reflected in the country's risk. The hypothesis is that GDP and investment are negatively affected by local currency depreciations and higher country risk. The channel for this could be the financial gap, because of the influence on flows, or shared expectations about the Brazilian economy among domestic producers, consumers, and foreign investors. This would lead to the possibility that foreign investment flows are related to domestic GDP and investment not only because there is more (less) financing available in periods of optimism (pessimism) but also that the evaluation of the future of the economy by domestic and foreign agents is similar. The interest rate is also included and could work through a direct relation to demand for consumption or investment or indirectly through the exchange rate, with a negative relation between interest rate and GDP and investment.

The economic fundamentals and their expectations have an important role in the behavior of financial variables, because in the long run financial assets have to reflect what happens to the real variables behind them. But these expectations also influence decisions about real variables like output and investment. This means that there is a strong link between fundamentals and financial variables, which is explored in literature, e.g. SOARES, PINTO, and MOREIRA (2010), and TELES and LEME (2010).

3. Data, context, and descriptive statistics

It seems that real and financial variables in the Brazilian economy were behaving normally at the beginning of the crisis, with obvious links to the external scenario and influences from domestic economic policy. Things changed noticeably in the fourth quarter of 2008. GDP dropped and investments fell even more. Brazilian policy makers reacted through fiscal incentives in selected sectors and an ease on monetary policy. As a consequence, in the first quarter of 2009 Brazil's interest rate was reduced to its lowest level in history.

In the fourth quarter of 2008, Brazilian GDP fell 3.3% and investment fell 9.7% in comparison to the all-time peak observed in the third quarter. In the first quarter of 2009, the declines were another 1.5% and 12%. Recovery began in the second quarter of 2009. The relation of these shortfalls to the international crisis is not straightforward. Unlike previous crises that impacted Brazil, when the recent financial crisis became stronger and spread

around the world, Brazil's external accounts situation was comfortable. By the end of September, 2008, the country had accumulated a bulk of 224 billion dollars in reserves, more than the total of the then 211 billion dollar external debt. The current account deficit was around 25 billion dollars in the 12 months prior to September, 2008, or about 1.6% of GDP. This deficit was easily financed by the FDI and FPI. This could mean that the impact of the crisis would be small in countries like Brazil, as believed by politicians like Brazil's then President Lula. As the data demonstrates, the crisis hit Brazil strongly and the channel for this effect is an interesting field of research.

Balance of payments data disaggregate FPI in four types of investments: equity traded in the country, equity traded abroad, fixed income traded in the country, and fixed income traded outside the country. As assets traded in Brazil have to be denominated in local currency, trading in the country or outside the country means that investors are exposed to different risks. Beyond the usual market risk, from the international investor's standpoint, assets traded in Brazil also incur the Brazilian currency exchange rate risk. There would be also the convertibility risk, given the possibility that the conversion of local assets in foreign exchange could be restricted or even prohibited. During the time span analyzed in this paper there has not been any restriction of this kind. Rather, it has been the other way around; in times of strong inflows taxes were imposed on inflows in order to try to reduce the flows. This difference in risks is one of the reasons for separating flows traded inside and outside the country. The other is that while flows related to trades inside the country can come from both primary and secondary markets, in the case of trades abroad only primary market operations are registered in the balance of payments. This means that only the first sale of equity or bonds and their repayments have an impact on the balance of payments. All the secondary market trades do not have a direct impact on Brazilian foreign assets and liabilities. One difference that arises between flows in the country and abroad is that the latter are subject to demand and supply shocks, which can lead to situations in which no operations are carried out at all. Secondary market operations can occur at any time, only by adjusting prices, while primary market operations are evaluated by issuers and buyers over the adequacy of the prices for the issuance to take place or not. The disaggregation of the flows between equity and fixed income follows the traditional classification of financial market assets.

Because the flows related to securities traded abroad are the primary issues or repayments of these securities and depend on the decisions of the Brazilian private sector or government to do so, only the flows related to trades inside Brazil are analyzed. In this way, the decisions of market participants to buy or sell Brazilian securities are feasible at any moment, because of the existence of a secondary market for equity and fixed income securities in Brazil.

It is expected that the behavior of the different flows will show differences between them, but they also should have similarities, due to the common underlying fundamentals of the Brazilian economy.

The data employed in this paper is described in Table 1. An L at the beginning of the name of the variable means it is expressed in logarithms and D means it is the first difference of the series. Data are quarterly, from 1995 to 2009.

Table 1 – Data employed – Quarterly series - 1995 to 2009

Variable	Description	Source	Remarks
FC	Fixed Income Foreign Portfolio Investment, net flow, traded in the country	Brazilian Central Bank	In billions of US dollars, at prices of the last quarter of 2009, employing the CPI as deflator
EC	Equity Foreign Portfolio Investment, net flow, traded in the country	Brazilian Central Bank	In billions of US dollars, at prices of the last quarter of 2009, employing the CPI as deflator
LGDP	Log of real GDP index	Ipeadata	Log of the seasonally adjusted index, basis 1995 = 100
DLGDP	First difference of LGDP		
LINV	Log of the investment index	Ipeadata	Log of the seasonally adjusted index, basis 1995 = 100
DLINV	First difference of LINV		
LER	Log of the real effective Exchange rate, consumer price deflated	Brazilian Central Bank	Log of the index, basis June 1994 = 100
DLER	First difference of LER		
SELIC	Selic Interest rate, the monetary policy interest rate	Brazilian Central Bank	Average of monthly rates
RISK	Brazilian EMBI+ spread over US Treasury bonds	Datastream	In basis points (100 basis points = 1%). Average of daily spreads
DRISK	First difference of RISK		

The total value of FPI flows in comparison to GDP and current accounts is significant. The net values of FPI grew from values near to zero prior to 1990 to peaks near to 50 billion dollars in 2007 and 2009 with outflows higher than 5 billion dollars in 2002 and 2004, the only years with outflows since 1991. For the period of 1995 to 2009, the average net inflow was 13.5 billion dollars. These figures represent 48% of the financial account balance from 1995 to 2009. On average, FPI represented 89% of the FDI value. For the total amount of flows, FPI was 66% of the value of FDI from 1995 to 2009. As a proportion of GDP, FPI ranged from -1% in 2002 to 3.5% in 2007.

Figure 1 shows the quarterly net flows (inflows minus outflows) of FPI traded inside the country from 1995 to 2009. Flows of FPI traded in the country have become more important in both equity and fixed income from 2005 onwards. These flows show strong inflows and outflows in several quarters. In the last quarter of 2008 EC was negative (8.8 billion dollars), but there was also a strong outflow over the whole third quarter (7.2 billion dollars), the same value that entered the country in the second quarter. The crisis may have generated the fourth quarter outflow, but outflows do not occur only in times of crisis. FC shows outflows of US$ 1.6 and 1.7 billion in the last quarter of 2008 and the first quarter of 2009, contrasting with a net inflow of US$ 16.9 billion over the first three quarters of 2008. In the last three quarters of 2009, Brazil again attracted FPI.

Figure 1 – Brazil - Net Foreign Portfolio Investment, in billions of dollars of 2009

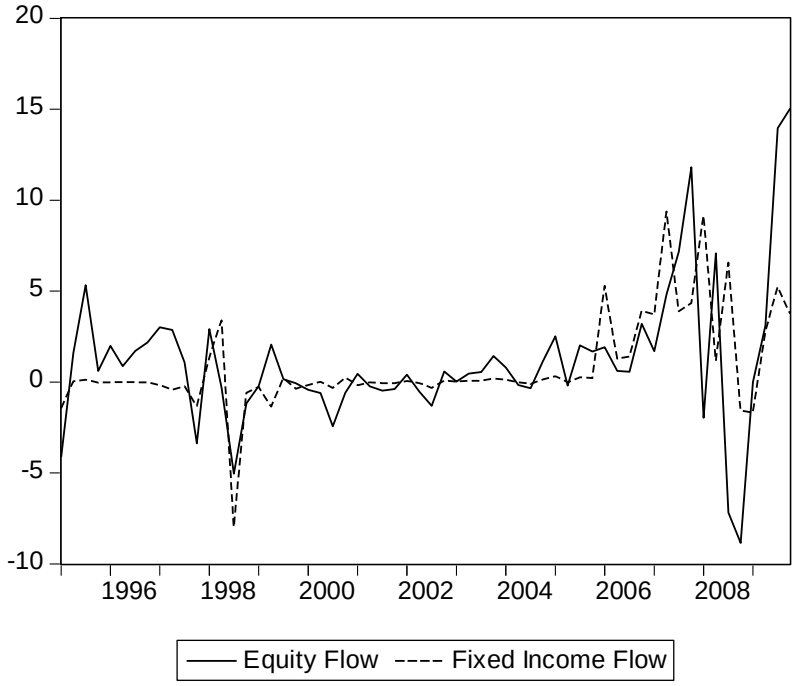


Figure 2 shows real and financial variables that are linked to the flows. GDP shows steady growth beginning in 2004, but prior to this its growth rate was unstable. GDP fell 3.5% in the fourth quarter of 2008 and another 0.9% in the first quarter of 2009. Investment stagnated since the beginning of the period, but shows growth from 2004 onwards. During the crisis investment was more strongly hit. GDP began to recover in the second quarter of 2009 and at the end of the year its level was 0.6% above that prior to the crisis. Investment also began to recover in the second quarter of 2009, but in the last quarter of 2009 was still 7% below its pre-crisis level. The policy interest rate, dubbed SELIC, changed according to its main objective of controlling the exchange rate from 1995 to 1998. Since then the main purpose of monetary policy has been to control inflation through formal inflation targeting. Immediately before the crisis in September of 2008, the interest rate had been raised due to fears of inflation, given expanded demand and a high level of utilization of capacity in industry. The rate was reduced from January to April, 2009, then reaching historically low levels.

The Brazilian currency suffered a strong depreciation in 1999, forcing a change to a floating exchange rate. Since then the currency has remained sensitive to local and international environments, like the Argentinean crisis in 2001 and the fear of Lula winning the Presidential election in 2002. The exchange rate continuously appreciated from 2003 until the third quarter of 2008. With the crisis, in the fourth quarter of 2008 the Brazilian currency depreciated, but after that appreciated again. Risk was at historically low level at the beginning of the crisis.

The local currency depreciated during the beginning of the crisis, and turned to appreciation in 2009, almost the same behavior of the EMBI+ spread, a measure of risk which peaked in October of 2008. It is clear that the financial crisis had strong effects on real and financial

variables. The possibility of a "decoupling" of the emerging market economies, like the Brazilian, soon would be ruled out. The situation of fiscal and external accounts does not explain the strong fall in output and investments, unlike the other crises which had plagued the Brazilian economy in previous times.

Figure 2 – Brazil – GDP index, Investment index, Interest rate, Real Effective Exchange Rate and EMBI+ Risk – 1995Q1 to 2009Q4

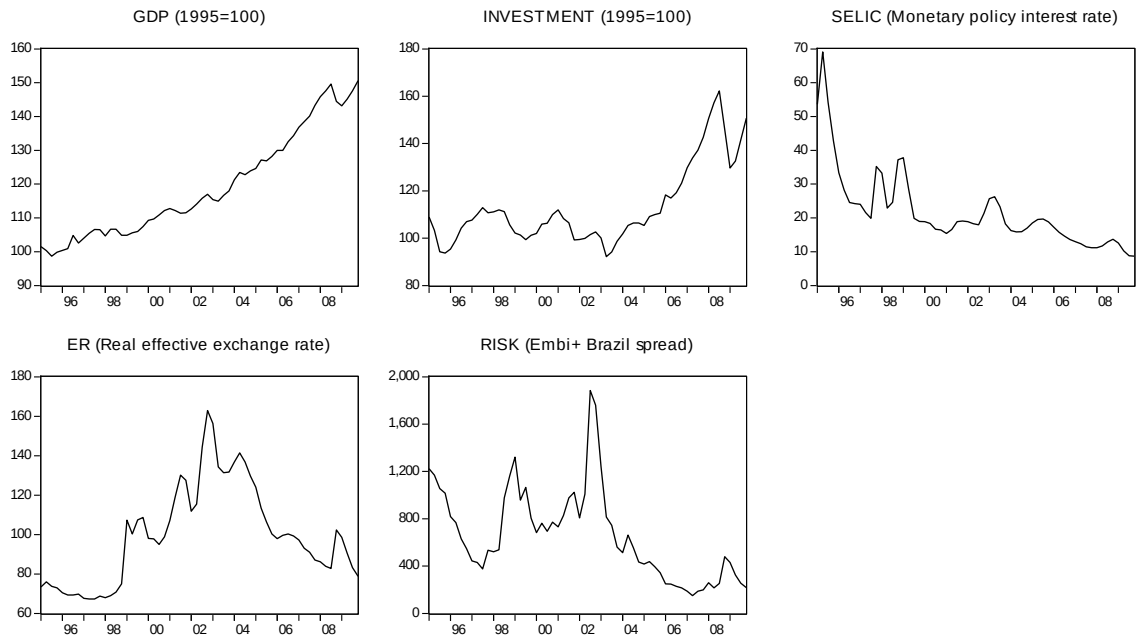


Table 2 shows the descriptive statistics of the variables. Flows related to assets traded in the country have a similar pattern, with positive and negative values, and their coefficient of variation (standard deviation divided by average) is above three.

Table 2 - Descriptive statistics of the variables – 1995Q1 to 2009Q4

	FC (billion dollar)	EC (billion dollar)	DLGDP (≅ % Change)	DLINV (≅ % Change)	SELIC (%)	ER (index June 1994=100)	RISK (basis points)
Average	0.829	1.154	0.007	0.006	21.736	99.570	658.364
Maximum	9.380	15.049	0.038	0.067	69.120	162.883	1884.643
Mínimum	-7.983	-8.849	-0.035	-0.118	8.650	67.237	149.809
St.Dev.	2.631	3.958	0.013	0.040	11.418	25.014	386.427
Coef.Var.	3.175	3.429	1.973	7.158	0.525	0.251	0.587
N > 0	32	37	44	41	60	60	60

For the real variables GDP and investment growth the results are also as expected, with greater stability in GDP in comparison to investment. The financial variables interest rate, exchange rate, and risk show high volatility. The interest rate has a maximum of 69.1% and a minimum of 8.7%, with a high average of 21.7%. The highest exchange rate is 2.4 times the value of the lowest. These values are already smoothed by the average in the quarter and because nominal changes in prices are taken into account by calculating the real effective

rate. Risk shows high variability because of the structural change in Brazilian foreign accounts and volatility in international financial markets.

Table 3 shows the unit root test results for the variables. These tests are carried out in order to avoid spurious results in the regressions. Log of GDP, log of investment, log of real effective exchange rate, and risk are stationary in first differences. The SELIC rate is level stationary. The equity flow is stationary, but the fixed income flow is not. An examination of the behavior of this flow, Figure 1, shows that there seems to be a structural break in 2006Q1. Without enough observations to undergo the whole procedure suggested in PERRON (1989, 1990), PERRON's (1989) suggestion of estimating two regressions with one autoregressive term for the period before and after the break is followed. A Wald test rejects the null hypothesis that the autoregressive coefficient is equal to one for each equation. This means that the variable is stationary with a structural break in 2006Q1. The reason for this break is the exemption of foreign investors from income tax on earnings from public debt securities from February, which leads to a hike in inflows.

Table 3 - ADF tests results 1995Q1 to 2009Q4
(tests include intercept)

Variable	t-ADF	Prob	Lags
FC	-1.843	0.3566	0
EC	-4.804	0.0001	3
LGDP	1.125	0. 9973	0
DLGDP	-7.7592	0.0000	0
LINV	-0.1873	0.9339	2
DLINV	-6.8748	0.0000	1
SELIC	-6.010	0.0000	3
LER	-1.333	0.6088	0
DLER	-6.338	0.0000	0
RISK	-1.879	0.3399	0
DRISK	-6.574	0.0000	0

4. Results and analysis

This section will attempt to explain the behavior of the GDP and investment change variables. The models were estimated employing equity and fixed income flows through a VAR and a parsimonious model. An advantage of the VAR estimation is that it does not include contemporaneous relationships, avoiding the endogeneity issue. The impulse-response functions were estimated with data for the whole period from 1995 to 2009. In the parsimonious models contemporaneous interaction is allowed for and was estimated for the whole period and for the subsample 1995Q1 to 2008Q3. The last estimation results were employed to evaluate the out of sample forecast capability of the models. Broadly speaking, the models tested are of the form:

DLGDP = f(DLINV, SELIC, DLER, FLOW, DRISK)

DLINV = f(DLGDP, SELIC, DLER, FLOW, DRISK)

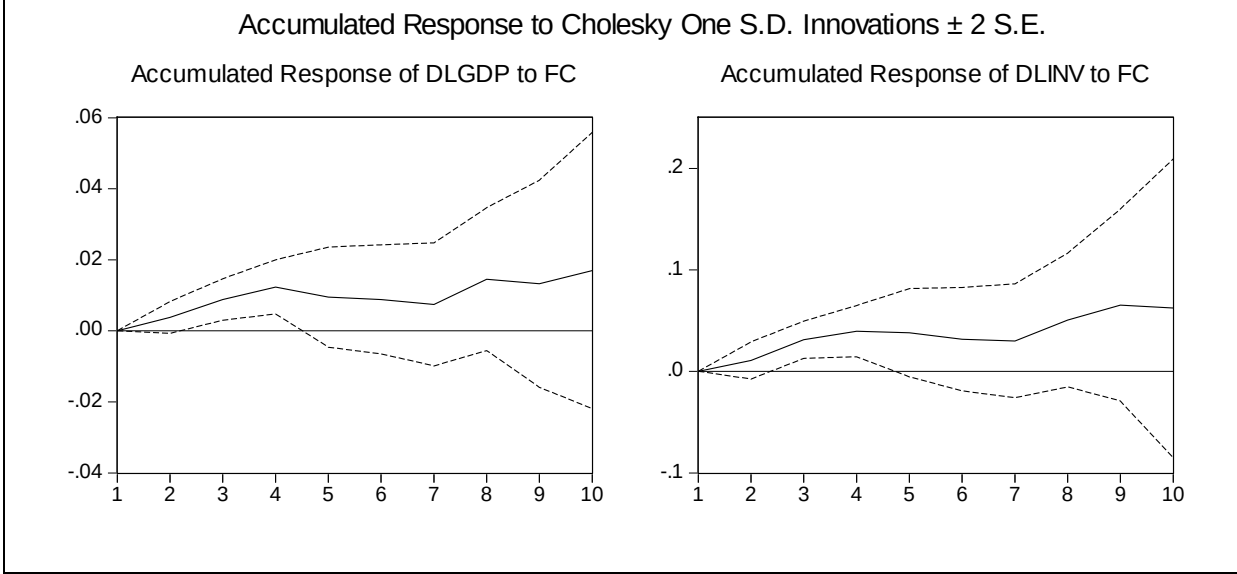
The Cholesky decomposition is employed for the impulse-response functions, which raises the question of ordering the variables in the VAR. The chosen order is: GDP-Investment-Interest Rate-Exchange Rate-Flow-Country Risk. The change in GDP will be considered the most exogenous variable in the sense that it is the least prone to be influenced

contemporaneously by the others, especially the financial variables. The economic explanation is that output decisions demand time until implemented. Financial asset prices, on the other hand, can change instantaneously. Investment changes also do not change instantaneously, but as this is a more restricted aggregate than GDP, the reaction can be faster than in GDP as a whole. The policy interest rate, SELIC, is defined in scheduled meetings of the Monetary Policy Committee of the Brazilian Central Bank. There is the possibility for exceptional committee meetings, but they are rare, representing only three out of the 147 total meetings in its history. This gives some rigidity to the interest rate. As a financial price variable, the interest rate changes instantaneously, but central banks are known to smooth the path of their interest rates. It is more likely that contemporaneous GDP and investment influence the interest rate than the other way around. The relation between interest rates and exchange rates is well established, as is the determinant role of expectations. As expectations can change quickly, exchange rates can also adjust quickly to expectations. This means that in a floating regime the changes in exchange rates can happen over time with more flexibility than interest rates. Exchange rates and FPI flows tend to have a feedback relation, because exchange rates will influence the relative price of assets as well as the supply and demand of foreign exchange. Beyond FPI, exchange rates will result from the balance of payments aggregate flows. As the current account transactions tend to react slower than financial flows to the economic environment, the exchange rate will react slower than flows, which means that flows are more endogenous at a given point of time. But, as current account expectations are already priced in the current exchange rates, changes in flows could also influence the exchange rate. As a robustness check the impulse-response functions were also run with flows before exchange rates in the Cholesky ordering, but generated almost identical results. Risk is based on bond market prices and will incorporate all the available information at any moment, being the most endogenous of the variables analyzed.

The impulse-response results reported below are generated by a VAR with seven lags, selecting the longest lag according to AIC, SC, or HQ criteria. Choosing the longest lag allows for real variables to react to financial variables.

The impulse-response results in Figure 3 show that there is a positive response in changes in GDP and investment to a shock in the flow of fixed income traded in the country. In absolute terms, the change of investment is higher. This result may be important in explaining the response of economic activity to changes in flows. For equity flows the relation is positive in the first six quarters, becomes negative, and is close to zero after 10 quarters. This pattern is consistent with how flows to the stock market anticipate the behavior of the economy and even overreact, with a net effect close to zero in the long run. For both flows the influence on GDP and investment changes follows the same pattern, with higher values for investment. This may indicate that there is a relationship between the flows and domestic real variables through investment, and indirectly to GDP.

Figure 3
Impulse-Response results - Responses of changes in GDP (DLGDP) and Investment (DLINV) to an impulse in Fixed Income Flows (FC) and Equity Flows (EC)



Impulse-Response results in a VAR with EC flows

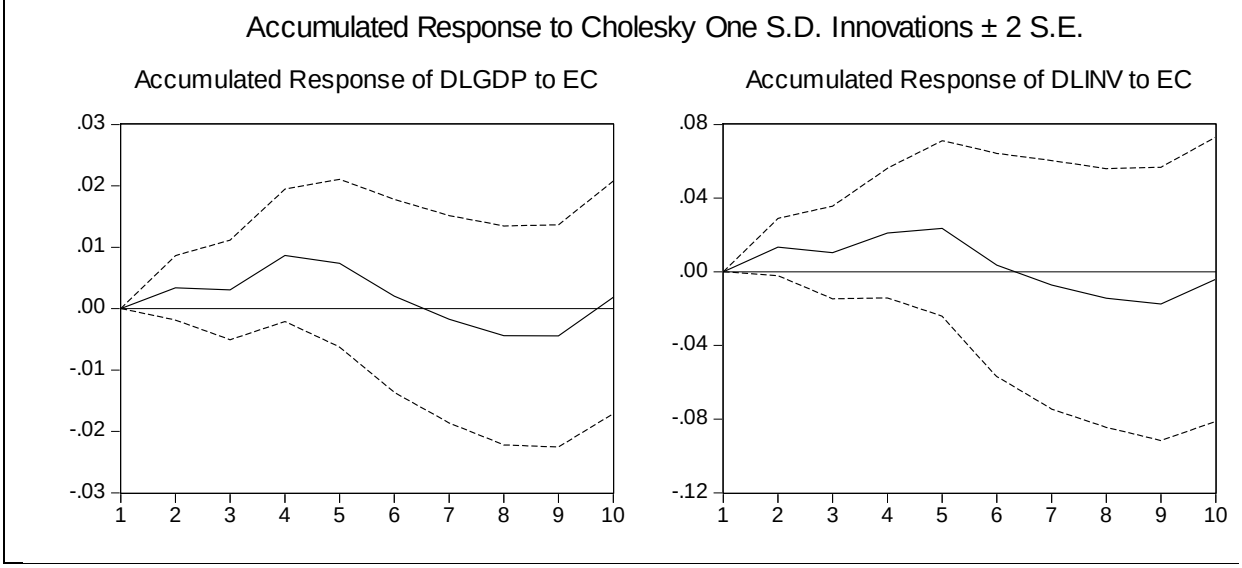


Table 4 shows the results of a parsimonious model for DLGDP and DLINV employing FC and EC flows, estimated with all the explanatory variables, following the general-to-specific strategy (HENDRY, 2001), with only the variables significant at the 5% level left in the model. The model was estimated for the entire 1995-2009 period and then reestimated with the data up to the third quarter of 2008. Beyond the out of sample forecasts, this additional estimation was also useful as a robustness check of the results during the crisis period.

For the changes in GDP, columns 1 and 2, the FPI flows are not significant in the final model. This does not mean that the flow does not influence growth. The effect can be captured by other variables which are influenced by the flow, like interest rates or investment, both present in the model. A possible explanation coherent with this result is that the higher

positive inflows allow interest rates to be lower, leading to higher investment, which has a positive relation with GDP growth. The autoregressive term of LGDP is negative, probably due to adjusments in GDP growth, correcting for growth that is too fast or too slow. The influence of the interest rate on GDP occurs with a lag, as expected, but the second lag is positive, which could be due to an overreaction of the GDP to changes in the interest rates or the effect of other lagged effects that also influence the GDP.

Table 4 – Parsimonious models for DLGDP and DLINV 1995 (1) to 2009 (4) (probabilities in brackets)

	(1) DLGDP (1995Q1 to 2009Q4)	**(2) DLGDP (1995Q1 to 2008Q3)**	**(3) FCDLINV (1995Q1 to 2009Q4) FC Flow**	**(4) FCDLINV (1995Q1 to 2008Q3) – FC Flow**	**(5) FCDLINV (1995Q1 to 2009Q4) EC Flow**	**(6) FCDLINV (1995Q1 to 2008Q3) EC Flow**
Constant	0.0117 [0.000]	0.0143 [0.000]	-0.0178 [0.000]	-0.0152 [0.000]	-0.0192 [0.000]	-0.0161 [0.000]
dlgdp			1.8934 [0.000]	1.6056 [0.000]	1.9434 [0.000]	1.7367 [0.000]
dlgdp_1	-0.5049 [0.000]	-0.5315 [0.000]	1.5092 [0.000]	1.4494 [0.000]	1.5328 [0.000]	1.4678 [0.000]
Fc			0.0032 [0.006]	0.0025 [0.041]		
fc_2			-0.0022 [0.048]	-0.0011 [0.413]		
EC					0.0016 [0.026]	0.0009 [0.359]
dlinv	0.2822 [0.000]	0.2596 [0.000]				
selic_1	-0.0006 [0.013]	-0.0007 [0.007]				
selic_2	0.0004 [0.042]	0.0005 [0.032]				
R^2	0.6747	0.5937	0.7818	0.6928	0.7722	0.6849
F	27.49 [0.000]	17.54 [0.000]	47.48 [0.000]	27.06 [0.000]	62.15 [0.000]	36.23 [0.000]
DW	2.31	2.3	2.32	2.32	2.31	2.26
AR 1-4 F test	0.7074 [0.5908]	0.8505 [0.5010]	0.7434 [0.5671]	0.7917 [0.5369]	0.5671 [0.6876]	0.3467 [0.8450]
ARCH 1-4 F test	1.5066 [0.2163]	1.6408 [0.1829]	0.48163 [0.7490]	0.3789 [0.8223]	0.8579 [0.4962]	0.3985 [0.8086]
Normality $Chi^2(2)$ test	1.8522 [0.3961]	1.7578 [0.4152]	0.55954 [0.7560]	1.4654 [0.4806]	1.0074 [0.6043]	1.3204 [0.5167]
Hetero F test	2.1262 [0.0533]	1.6421 [0.1444]	1.9470 [0.0766];	1.8137 [0.1038]	1.6515 [0.1537]	1.4145 [0.2312]
RESET F test	0.0569 [0.8124]	2.0149 [0.1624]	5.7325 [0.0203]	4.7801 [0.0338]	10.898 [0.0024]	3.5302 [0.0662]

For DLINV, columns 3 to 6 in Table 4, the models show a strong positive relationship between changes in investment and changes in GDP, contemporaneous and with one lag. The contemporaneous effect is obvious because investment is part of GDP. The lagged effect of GDP on investment, on the other hand, means that GDP growth is an important determinant of investment. As the Brazilian economy is a relatively closed economy, with exports plus imports averaging 21.5% of the GDP from 1995 to 2009, this result indicates how important the development of the domestic economy is for investment. Both FC and EC flows have a contemporanous positive relation with the changes in investment. In the case of FC there is also a negative relation with two lags. This negative relation could be due to the negative relation with the first lag of GDP changes. The net effect of the the FC flows on DLINV is close to the value of the coefficient for the EC equation, meaning that a 1 billion dollar expansion in inflows is associated to an 1.5% expansion in GDP. The explanation for this positive effect is possible through various channels: 1) The foreign portfolio investment is the funding for the investments that are being made at each period; 2) Foreign investment inflows are related to appreciation in the local currency, and this appreciation makes importing investment goods cheaper, fostering investment; 3) Foreign portfolio investments and domestic changes in investment are both driven by the same expectations about future economic performance; 4) Investment and flows are both influenced by the same expectations about growth and risk. The positive relationship between flows and investment, based on investment funding, exchange rate channel, and expectations seem to be robust in this way.

It is interesting to note that the coefficient for the contemporaneous flow in the FC equation is smaller in the estimation containing the sample up to 2008Q3 (column 4), while the second lag is not significant. In the case of the EC equation (column 6), the contemporaneous coefficient is not statistically significant. This means that the relation between investment and growth became stronger during the crisis period, from the last quarter of 2008 to the fourth quarter of 2009. The negative flows at the end of 2008 and the beginning of 2009, when investment also had a strong downturn, may explain the stronger relation between the flow series and investment when the crisis period is included in the sample. This also gives support to the hypothesis that the flows are not directly responsible for investment changes, but that the expectations behind FPI flows and domestic investment during the crisis were similar.

The out of sample forecasts were generated with the observed figures of the explanatory variables, including the lagged values of changes in GDP (column 2 in Table 4) and investment (columns 4 and 6 in Table 4), with the equation estimated using data up to 2008Q3. In this way, forecast errors in one period are not carried over into subsequent periods. The observed and forecasted values with the two standard error interval are plotted in Figure 4.

Results for the out of sample forecasts, Figure 4, show that for DLGDP the model (column 2 in Table 4) actually predicted a fall in GDP in the fourth quarter of 2008, but this reduction in output was stronger than predicted. The forecast of a fall in output is due to the presence of the contemporaneous investment change in the DLGDP change equation. But it is unrealistic to think that the fall in investment was predictable. This is corroborated by the bad forecasts

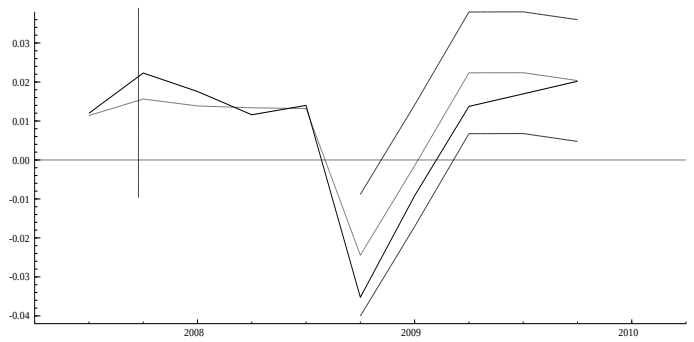
for the last quarter of 2008 and first quarter of 2009 in DLINV. Even considering that an outflow of fixed income portfolio investment occured in the fourth quarter of 2008 and would impact investment, the downturn was much stronger than estimated.

Both DLGDP and DLINV modeled forecasts improve from the first quarter of 2009. It seems that the positive relationship between the flows and investment is strong during the crisis period, not only in the downturn. The good fit in the investment equation is also reflected in the DLGDP equation through the contemporaneous effect between both real variables. This means that expectations, which are not directly observable, must have changed suddenly and affected investment even more than the financial flows. The fall in investment was transmitted to GDP because it is a component of GDP, but also because other items of GDP may have been hit through the same kind of negative expectations or risk aversion.

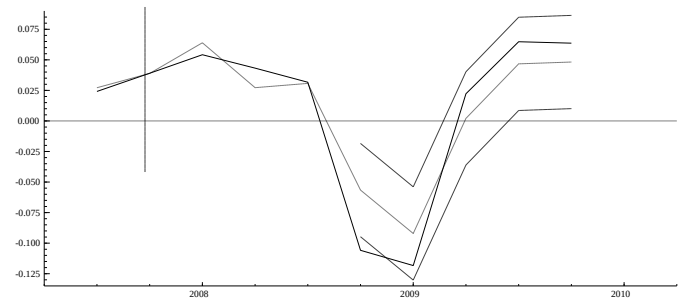
The forecast results for both GDP and investment change show that investment was a key factor in explaining poor GDP performance. The assumption of a correct forecast for investment, which would justify the forecast of GDP employing the contemporaneous observed value of investment change, certainly is difficult to accept for the fourth quarter of 2008. The forecasts for GDP changes would be even worse if true expectations and not observed values of the change in investment in the fourth quarter of 2008 were employed. In other words, the importance of investment seems to be one of the main variables in explaining the fall of GDP at the end of 2008.

Figure 4 - DLGDP and DLINV - Observed (solid line) and Forecasted (dotted line, with 2 std error interval) - (2008Q4 to 2009Q4)

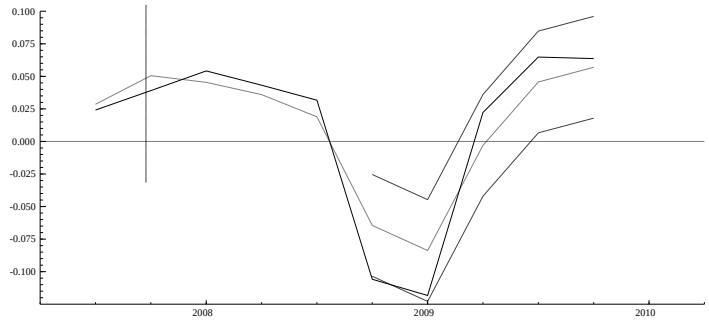
GDP Change



Investment Change (FC flow)



Investment Change (EC flow)



Results employing FC and EC render similar results in the forecasts because both react to all available information about the Brazilian economy, although FC is influenced by the structurally high Brazilian interest rates, which allow for carry trade operations even when interest rates in the rest of the world rise, given the high absolute difference between domestic and foreign interest rates.

The results for investment signify that a change occurred in this variable's behavior in relation to the previous period. Other factors beyond the variables included in the models are driving investment, most likely expectations and risk aversion. In-country investment and FPI flows can be influenced by the same expectations, but the reaction to investment was even stronger than the response in FPI.

Beyond exchange rates and interest rates, the transmission mechanism behind the relationship between flows and real variables includes unobservable variables such as expectations and risk aversion. Results of further impulse-response functions (not included, but available on request) show that a positive shock in FC is related to domestic currency appreciation and lower interest rates. For a shock in EC flows, the interest rate reacts as it would to an FC shock, while a clear relation with the exchange rate does not appear.

The relationship between the financial flows and real variables and the importance of expectations for both of them ends in highlighting that economic fundamentals and the expectations about them have strong roles in the behavior of the economy, confirming previous results in literature like SOARES, PINTO, and MOREIRA (2010) and TELES and LEME (2010). The stronger fundamentals of the Brazilian economy during the crisis of 2008 in comparison to previous crises allowed for a faster recovery, based on domestic demand.

5. Conclusion

The financial crisis of the last quarter of 2008 triggered a generalized fall in output throughout the world. Even fast-growing economies slowed their growth rates as a result. The recession was triggered in the financial sector and spread to the worldwide economy. In the case of emerging economies, there were mixed feelings. On the one hand, there was the traditional fear that with every crisis these economies would suffer because of their inherent higher risk. On the other hand, as the crisis originated in developed countries and the

economic fundamentals of the emerging economies were better than in previous crisis episodes, there could be a “decoupling” of the emerging economies. Soon it was realized that the decoupling was not to happen.

As in other crises, the FPI flows went from countries and markets considered risky to safer assets, the flight to quality. The case of developing countries’ flights to quality is not only related to flows from more risky stocks to less risky bonds, as in BAUR and LUCEY (2009), but also to outflows from a broader set of assets to developed countries. If emerging markets were dependent on the inflow of resources to finance their economic growth, the reversal of the flows would hamper the growth capabilities of these economies. In this case, there would be a link between the financial flows and growth. In fact, the FPI flows were negative in Brazil in the fourth quarter of 2008 and the first quarter of 2009.

The results of the impulse-response functions in this paper show that there is a positive relationship in the short run between fixed income flows and GDP changes and investment in Brazil. For equity flows this relationship is positive in the short run, turns negative, and then disappears after 10 quarters. This means that flows anticipate the behavior of the real variables. When allowing for contemporaneous relations between the flows and investment, the positive relationship is stronger when the crisis period is included in estimations instead of in the period preceding the crisis. This means that investment and flows are reacting to the same kind of expectations.

With more solid fundamentals concerning Brazilian fiscal and external accounts when the 2008 crisis erupted, FPI outflows were less intense in comparison to previous crises. It also allowed that broader economic policy measures could be adopted, due to greater degrees of freedom in government actions. The fundamentals and perspectives of the economy resulted in positive FPI flows by the second quarter of 2009. Beyond the theoretical explanations of the influences of FPI on the financial system, sound macroeconomic policies also affect the flows and the real economy through their effect on expectations. GDP growth was concentrated in domestic demand factors, namely consumption, and investment and flows followed this positive trend.

Further research will be necessary to explain the operation of the relations between FPI flows and growth. But it is clear from the results in this paper that the financial link is significant in explaining the behavior of growth and investment in the Brazilian economy, as are internal and external expectations, as well as the transmission mechanism behind it. Interest rates and exchange rates seem to have a role in this sense, meaning the effects of the flows have to be considered when economic policy decisions are made concerning interest rates or factors that may limit capital flows.

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