Texto para Discussão 009 | 2013
Discussion Paper 009 | 2013

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JUNHO, 2013

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Abstract

Investment is one of the key drivers of effective demand and plays a pivotal role in determining long-term growth of monetary economies. Heterodox theory stresses several factors which contribute to define investment dynamics, especially uncertainty and the availability of financial resources (debt and its cost). This present paper aims at analyzing empirically the behavior of investments and their determinants in the period from 2003 to 2012 in Brazil, using the Keynesian-Kaleckian theoretical framework as a reference to our discussion and to offers insights to our econometric model. More specifically, we were interested in assessing whether the 2008-9's global financial crisis changed the balance between the determinants of investments or not.

Keywords: Investment, Uncertainty, Debt, Crisis, Brazil.
JEL Codes: E22, E32, G31.

* Draft version. Comments and suggestions are welcomed. The views expressed in this paper do not necessarily reflect the views of institutions with which the authors are related.

Resumo

O investimento é um dos principais determinantes da demanda efetiva e exerce um papel fundamental na determinação do crescimento de longo prazo nas economias monetárias de produção. Teorias heterodoxas destacam diversos fatores que contribuem para definir a dinâmica dos investimentos, em especial a incerteza e a disponibilidade de recursos financeiros (dívida e seus custos). O presente artigo tem por objetivo analisar empiricamente o comportamento do investimento e de seus determinantes no Brasil, no período de 2003 a 2012, utilizando os arcabouços teóricos de Keynes e Kalecki como referência para nossa discussão e especificação do modelo econométrico. Mais especificamente, avalia-se se a crise financeira global de 2008-9 mudou o balanço entre os determinantes do investimento no Brasil no período analisado.

Palavras chave: Investimento, Incerteza, Dívida, Crise, Brasil.

JEL Codes: E22, E32, G31.

Introduction

Investment is one of the key drivers of effective demand and plays a pivotal role in determining long-term growth of monetary economies, which are characterized by the uncertainty that surrounds economic decisions (Carvalho, 1992: Chapter 3; Davidson, 2002: Chapter 4).

While Keynes (2008: Chapters 11 and 12) highlighted the interaction between the marginal efficiency of capital and the money interest rate in determining aggregated investments and the role of uncertainty and conventions, Kalecki (1954; 1956) developed a dynamic model in which investments are function of the current level of economic activity and its changes and an autonomous component (Possas, 1999: 32-3). These theories were further developed by post-Keynesians and neo-Kaleckians, which extended the set of investment determinants to a broader range of elements.

According to these heterodox approaches, several factors contribute to the determination of investment dynamics. Economic activity (through the behavior of output and capacity utilization), availability of financial resources, interest rates, uncertainty etc. are all variables which affect investments.

In Brazil, several works analyzed the behavior of investments, however, without referring to these theories (see, for instance, Melo and Rodrigues, 1998; Ribeiro and Teixeira, 2001; Santos and Pires, 2007; Luporini and Alves, 2010). Effectively, these works adopted an empirical approach based on orthodox grounds and, thus, treated the factors mentioned above in an oblique or shallow manner, especially the role of uncertainty and debt in investments.

This failure in accounting for these factors is of particular relevance in the context of a crisis. This affirmative is justifiable because in a crisis we witness a particular behavior of these factors: the market for new debt freezes and debt costs rise while uncertainty overcomes all other factors when influencing investments. In other words, in a context of crisis both finance availability and uncertainty contribute to affect negatively the investment. As the models referred above do not properly take into account these elements, they may describe the behavior of investment in a misleading way.

In this context, the present paper aims at analyzing empirically the behavior of *investments* and their determinants in the period from 2003 to 2012 in Brazil, using the Keynesian-Kaleckian theoretical framework as a reference to our discussion and to construct our econometric model. More specifically, we were interested in assessing whether the 2008-9's global financial crisis changed the balance between the determinants of investments or not.

For this purpose, this article counts with 3 sections beyond this introduction and our final remarks. In the first section we make a brief review of heterodox theory of investment, focused on the works of Keynes and Kalecki. In the second section we review the main empirical works that treat of investment in Brazil, purpose our alternative model, and describe the data we used. The third section discusses the results – we estimated several models based on OLS and VAR methods. Our final remarks summarize the main points raised in the article.

Finally, it is relevant to notice that this is an ongoing research, at its initial stage. We did not codify all results and discussions in the present paper and we are still working in the reviews of the investment theories and of the empirical evidence to Brazil. We also work in an effort, together with the Brazilian Institute of Geography and Statics (IBGE), to improve the data used in our preliminary estimations. In this context, any comments and suggestions are welcomed.

1 INVESTMENT: a brief review of orthodox and heterodox theories

The purpose of this section is to summarize the main contributions of heterodox economists to the theory of investment in order to identify the main variables that will be used to estimate our model to the Brazilian economy in the period 2003-12. We acknowledge that there is a really broad literature on the determinants of investment - mainly produced by orthodox economists - however conduct a deep review on this topic will certainly surpass the boundaries of the present paper. For our intentions we will make a briefly review of the main orthodox theories and focus on Keynes' and Kalecki's works in this first moment.

1.1 Orthodox theories of investment

In the orthodox theory, investment was treated basically in three different perspectives. The first – and certainly oldest – of them is related to the Acceleration Principle that states that investments are directly linked with the current behavior of economic activity – namely, changes in current output. Early works on this topic were published in the beginning of the 20th century, as recognized in the survey conducted by Knox (1952), being the paper of Clark (1917), entitled "Business acceleration and the law of demand: a technical factor in economic cycles" and published at the Journal of Political Economy, the most referred one.

In spite of the simplicity of the Acceleration Principle, Sachs and Larrain (2000: 146) stress the ability of these models in predicting the behavior of investment, even if we compare to the more complex models – such as the multiplier acceleration – which were developed in the 1970's (Clark, 1979; Blanchard, 1981).

The second perspective is called the neoclassical approach, which relates the investment decision to an intertemporal problem of utility – or profit – optimization in the basic neoclassical model of the representative agent (Eisner and Stroz, 1963; Lucas, 1967; for a brief presentation, consult Sachs and Larrain, 2000: 133-9). An alternative form of viewing this approach is referring to capital stocks, with investment depending on the level of output and the user cost of capital (Jorgenson, 1967; Hall and Jorgenson, 1971).

The third orthodox view on investment is based on the Tobin's *q* theory, basically developed on Tobin's (1969) article entitled "A general equilibrium approach to monetary theory". This theory establishes a relationship, the *q* ratio, between the market value of the firm (numerator) and the replacement costs (denominator), with a $q > 1$ indicating that the market value of the firm exceeds the replacement cost and thus the firm has incentives to issue equity and invest, generating profits without changing the costs of physical assets (replacement costs).

In addition to these three approaches, there is a fourth one, based on the constraining effects that credit availability may impose to investment, namely the credit rationing approach of Stiglitz and Weiss (1981). According to the duo, the inability of banks in assessing creditworthiness of borrowers properly – basically due to information asymmetries – tends to generate a sub-optimum equilibrium in which interest rates and credit supply are set below the optimal level, thus reducing the credit available to induce investment.

Of course that several other theories were developed, especially in considering financial aspects of investment and making neoclassical models more 'Keynesian', so to speak (adding rigidities). But these are not our focus here. Serven and Solimano (1992) summarize some of these developments, highlighting the theories of investment under uncertainty (in the neoclassical sense), the 'Keynesian' disequilibrium approach and the financial determinants of investment.

More recently, no works re-analyzed the topic from a theoretical viewpoint. As the macroeconomic discussion turned to dynamic stochastic general equilibrium (DSGE) models, and since these models incorporate investment in the neoclassical fashion, the theoretical discussion on investment was left on the corner by the orthodoxy. However, several developments took place in heterodox approaches, to which we turn our focus right now.

1.2 Heterodox theories of investment: a focus on Keynes and Kalecki

Heterodox theories have as their starting points the treatment of investment offered by Keynes (1936) and Kalecki (1954). We will focus on these two authors in the present paper as our review of more recent developments on heterodox investment theories is still ongoing. We know that we will miss some rich insights on the theme – for instance,

see Minsky (1986) – but at this initial stage of research we opted to work only with the well-known Keynesian and Kaleckian frameworks. In a further update of this article, we will certainly include and discuss the works of post-Keynesian and neo-Kaleckians adequately.

The heterodox tradition on approaching investments has its basis fixed in the roots of modern macroeconomic theories. Although the different theoretical background upon which both Keynes and Kalecki built their economic ideas, one common point is the pivotal role played by the investment in the effective demand. They would argue that to understand the behavior of investment is necessary to control both the current state of the economy and the dynamics investment assumes. Nonetheless, when it comes to the understanding of investment itself, i.e., its theoretical determinants, important differences between the two authors arise, and we shall see these in more detail.

The decision of investment in the Keynesian theory pertains to a broader analysis of a theory of a choice of assets, which states that every kind of asset has an "own-interest rate", or an own marginal efficiency. Each asset yields a nominal return to its owner, based on four different attributes: a physical yield, liquidity, carrying cost and expected appreciation (Keynes, 1936: Chapter 17). In order to make the investor indifferent between the different kinds of assets, their returns should be equal, and that is the ultimate reason why the *marginal efficiency of capital* (or the return on capital goods), which is basically determined by physical yield, has to be equal to the interest rate (or the return on treasury bills), determined basically by the liquidity premium. Thus, we determine the amount of money expend in purchasing capital goods and, as a consequence, the amount of investment.

Specifically, the *marginal efficiency of capital* is the rate that discount the future incomes yielded by a capital good such that to make them equal to the current offer price of the capital good (or replacement cost). It is a nominal variable, which permits the comparison to the nominal interest rate. The level of investment affects the *marginal efficiency of capital* in two ways: first, it raises the offer price of investment goods, as this industry is characterized by diminishing returns to scale (or, conversely, increasing marginal costs); second, investment is negatively related to expected yields in future, since the more abundant is capital, the lesser is the return it yields. In the long run, as there is no sense in assuming diminishing returns to scale, it is the second relation

which prevails. Thus, the important feature to retain is that the marginal efficiency of capital is inversely related to the quantity of current investment.

There is, however, the influence of the so-called long run expectations. If, in one hand, they can be assumed constant in the short run and left aside of investment analysis, in the other hand they can undergo sudden modifications and thus affect investment.

Long-term expectations "does not solely depend, therefore, on the most probable forecast we can make. It also depends on the confidence with which we make this forecast […]" (Keynes, 1936 [2007]:148), and are influenced strongly by conventions, that is to say, the fact that, influenced by recent past, we grow confident about the future and we start to give present factors more importance that they truly have. It must be stressed that the projection of future yields remains unaltered – what changes is the degree in confidence in these projection. Another influence is the "state of confidence" of investors, related to the inherent uncertainty of the decision to invest. This is highly influenced by the "animal spirits" and the development of stock exchange market, which renders liquid investments previously illiquid.

There is, moreover, another class of determinants of the level of investment, which act through their influence in the interest rates rather than in the marginal efficiency of capital. However, the determination of the interest rate is to be found in a different market, the monetary market, where money is exchanged for treasury bills, and what is not of our primary interest. It is sufficient to notice that a lower interest rate will, *ceteris paribus*, permit a higher investment on capital goods: as Keynes (1936 [2007]: 228) states: "When there is no asset of which the marginal efficiency reaches the rate of interest, the further production of capital-assets will come to a standstill."

Kalecki's approach to investment starts in recognizing the relevance of investment to the behavior of aggregate demand. In other words, the importance of investment to the determination of the level of output can be seen in the following expression, drawn from the basic model of a three-department economy, in which capitalists earn what they expend, and workers expend what they earn:

$$Y_\tau = \left(\frac{1}{(1-w)}\right).(I_\tau + C_{c\tau})$$

The multiplier is determined by the fraction of the output paid to workers as wages (w), and the autonomous expenditures are given by the sum of investments and capitalist's consumption. As Kalecki assumes that the fraction of the revenue consumed by capitalists is constant, it is the investment that is the true variable that will induce the economy into cycles along time. In the last instance, the determinants of the inducement to investment will be the same of determinants of the output cycles.

Investment is demand today but it is an increase in capacity of production tomorrow. That is to say, investment impacts offer price of capital goods, as Keynes pointed out, but also the demand price of capital goods, as investment level alters the profitability of capital through changes in capacity utilization; and this is what was often overseen by economists, even Keynes. Therefore, there is a long run problem of equilibrium level of investment, which generates, because of the difficultness of its solution, economic cycles through time.

As for the theoretical determinants of investment, Kalecki's analysis often separated investment in two different types – in fixed capital and in inventories –, total investment being the sum of them.

Investment in fixed capital has three determinants. First of all, there is the accumulated profits of enterprises (S_τ), which is a proxy for own resources. This influences the level of investment because, in the first place, "there will be a tendency to employ these savings in investments […]" and, secondly, gross savings of firms "expands the limits imposed to investment planning by capital's market constraints and by the rising risk factor" (Kalecki, 1954: 80).

This second reason is best known as the "principle of increasing risks", which tries to capture the doubled-faced phenomena of increasing marginal risk in respect of the amount of investment made. One reason is that the greater the ratio investment/wealth, the riskier the decision, because of the impact of a possible setback in the business. Secondly, there is the risk of illiquidity associated with investment that obliges the entrepreneur to raise money in the credit market, paying a higher interest rate, in the case of a sudden need of capital. In sum, the "principle of increasing risks" limits the amount of investment made, and it is softened by a greater firm's gross accumulated saving.

The second determinant is the variation of profits (P_τ), since "a rise in the profits from the start to the end of the considered period will render attractive certain projects which were previously considered unprofitable […]" (ibid. 80).

Finally, there is the variation of capital stock (K_τ), which is negative, since "a rise in the volume of capital in equipment – if the profits remain constant – means a fall in the rate of profit" (ibid., 80). It should be stressed that using profits and capital stock as determinants is nothing but the linearized form the rate of profit ($\frac{P_\tau}{K_\tau}$), so it is the rate of profits that is the determinant of investment in the last instance. As for the investment in inventories, Kalecki does not get into it a lot and only points out that it is a positive function of the change in the level of output (ΔO_τ). The result is the following expression:

$$I_{\tau+\theta} = \frac{a}{1+c}.S_\tau + b.\frac{\Delta P_\tau}{\Delta t} + e.\frac{\Delta O_\tau}{\Delta t} + d$$

This is the basic framework used by Kalecki to understand investment and, above all, investment changes along the cycle. Here, we see clearly the dependence of the level of investment on investment's past performance, incorporated both in the retained profits of enterprises and in the variation of profits.

1.3 The differences between orthodoxy and heterodoxy: the role of long-term expectations and debt

As we tried to point out in the previous section, a basic difference between heterodox and orthodox theories of investment is the role played by uncertainty, and the correlated importance of the long-term expectations. Even though some orthodox models allow for imperfect foresight, this is usually treated as a quantifiable uncertainty (risk), under the form of a probability distribution of some possible events.

In the opposite approach, the uncertainty is a fundamental one, upon which one cannot build a probability distribution. In Keynes's theory, this is captured by sudden movements of the IS and LM curves, which render the outcome of economic behavior impossible to determine. One can also find a parallel with Kalecki's "increasing risk principle", which limits the investment process because of a fear of illiquidity, even

though the author's theory is not based on fundamental uncertainty, as Keynes's is. Be that as it may, as a consequence of the importance of long-term expectations, we expect that uncertainty will be highly significant in determining the behavior of investments.

The availability of financial resources seems also to be a relevant variable for the determination of investment[1]. One reason is the referred "principle of increasing risk"; also, there is the effect of the cost of debt in refraining the investment process. Finally Keynes (1937a, 1937b) finance-funding circuit also suggests this behavior.

This failure in accounting for these factors is of particular relevance in the context of a crisis. This affirmative is justifiable because in a crisis we witness a particular behavior of these factors: uncertainty freezes investments as well as the market for new debts – debt costs also rise. In other words, both factors contribute to affect negatively investment. As the models referred above do not properly take into account these elements, they can describe the behavior of investment in a misleading way.

So, an effective description of investment behavior needs to explicitly consider these factors. With this is mind, we turn to our empirical research, with the focus on the Brazilian case in the period 2003-12.

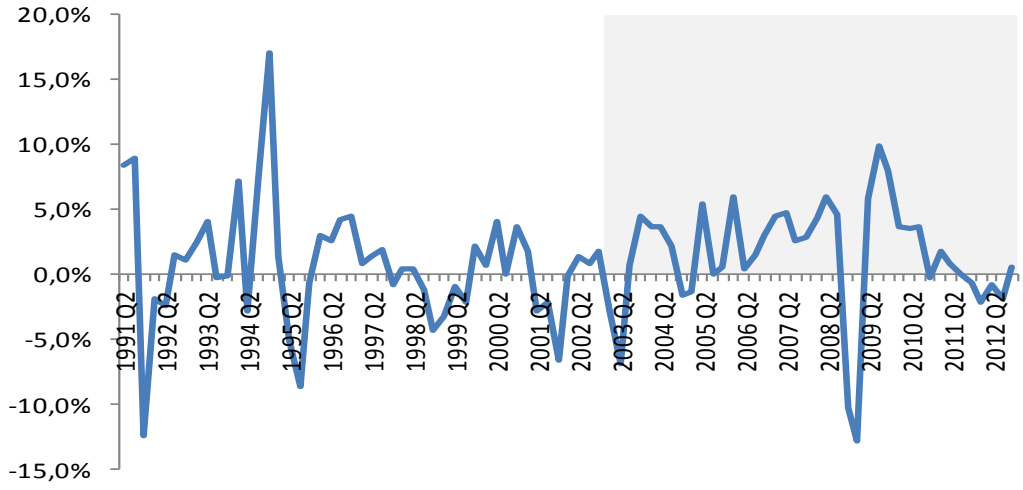
[1] Although it is one of the strands by which some orthodox economists 'become more heterodox', the role of finance for these authors is quite different from the one played in heterodoxy. See Serven and Solimano (1992: 99).

2 DEBT, INVENTORIES AND INVESTMENT: the case of Brazil in the period 2003-2012

The year of 2003 is characterized by a recovery of investments in Brazil, after several years – approximately since the 1980's – of instability, in which investments presented an erratic path or a stop-and-go trajectory (see Graph 1). More precisely, investments started to recover in the third quarter of 2003 and then inaugurated a period of sustainable expansion till the 2008-9's global financial crisis. Since then there was a slowdown of investments. Our aim is to investigate the determinants of investment in the whole period from 2003 to 2012, with special interest in analyzing if there is significant change in the balance between these determinants in the aftermath of the crisis.

Before we turn to our empirical research, we will review some of the empirical evidence for investment in Brazil, in order to get some insights on the treatment of this variable in econometric models.

Graph 1: Fixed capital formation (seasonally adjusted) – Q_t/Q_{t-1} (%)



Source: Ipeadata.

2.1 A brief review of empirical evidence for investment in Brazil

Several papers tried to investigate the determinants of investment in Brazil and their behavior and influence over time. Most of them looked to investment from a particular theoretical framework, usually the neoclassical one, while only a few papers provide a broad empirical investigation. It is worth to mention Dailami (1987) as he is one of the pioneers in investigating the behavior of private investment in Brazil: the study found that aggregate demand and real wages have a positive effect on private investments, while the cost of capital and economic instability (volatility of the stock exchange) negatively affect the capital formation.

Instead of describing accurately each of the contributions we found in our research, we have chosen to summarize in a table the main variables used by each author, as well as the model implemented in each paper. Therefore Table 1, inspired by Luporini and Alves (2010: 474), gathers that information.

Table 1: Empirical works on investment in Brazil

	AD	CU	PF	C	PI	EI	EC	Model
Dailami (1987)	x		X			x		OLS
Ronci (1991)	x		X		x			OLS
Studart (1992)		x		x	x	x		OLS
Rocha and Teixeira (1996)	x		x		x			VEC
Jacinto and Ribeiro (1998)		x		x	x	x		OLS
Melo and Rodrigues Júnior (1998)	x		x		x	x		VEC
Cruz and Teixeira (1999)	x		x		x			VEC
Reis et al. (1999)		x	x					OLS
Ribeiro and Texeira (2001)	x			x	x	x	x	VEC
Muinhos and Alves (2003)	x		x					OLS
Falls and Natke (2007)	x			x				Panel (Fix.E)
Santos and Pires (2009)	x		x		x			VEC
Luporini and Alves (2010)	x	x		x	x	x	x	OLS

Source: Luporini and Alves (2010: 474) and authors elaboration.

AD: Aggregate demand or output; CU: Capacity utilization; PF: Price of factors; C: Credit; PI: Public investment; EI: Economic instability; EC: External conditions.

From this set of works, we highlight the results of Melo and Rodrigues Júnior (1998), which argue that "macroeconomic instability has an adverse impact on private investments and so do the public investment (crowding-out effect)", in line with conventional orthodox theories. Conversely, Ribeiro and Teixeira (2001) pointed out that the findings "reveal the positive impact of the output, public investment and financial credit variables and the negative effect of the exchange rate" on private investment.

It is also worth to mention Luporini and Alves (2010). They developed the broader study of the ones we surveyed, covering the period from 1970 to 2005 and carefully

describing investment theories and the empirical research on investment in Brazil. Its main findings are that:

> "The results indicate that increases in income and economic activity have positively influenced private sector investment in Brazil. The reduction in credit volume and the existence of political and economic instabilities are shown as being harmful to private investment in the analyzed period." (Luporini and Alves, 2010: 449)

Finally, there is also the paper authored by Falls and Natke (2007), the single one that refers to Keynes and Kalecki explicitly in developing its model. However, unlike others studies based on macro-variables, they opted to conduct an analysis based on micro-panel data. The main conclusion is that 'the Keynesian investment theory will not accurately predict firm behavior in chaotic economic and financial conditions, such as the ones we witnessed in Brazil in the middle of the 1970's' (Falls and Natke, 2007: 501).

We take the opportunity to argue that, in contrast to what Falls and Natke seem to suggest, this result fits perfectly with the Keynesian theory: as uncertainty is the main element in determining long-term expectations, such a chaotic environment as they argued is the one in force in Brazil in that period will make prediction a Herculean task and thus will make investments unpredictable. We now turn to our model, based, in last instance, on the heterodox theories of investment that we described in Section 1.

2.2 Equations

We used a modified Kaleckian equation to estimate our model, in order to incorporate some specificities of Keynes' theory. We have chosen to emphasize both the role of debts in financing (banking credit)/funding (capital markets) investments and of own resources in line with Kalecki's proposition. So we switched the variable S_τ by D_τ, which represents the flow of new debt in the economy, capturing both short- and long-term debts assumed by agents.

The role of the current state of economic activity (O_τ) is captured by two variables: output (Y_τ) and capacity utilization (CU_τ). This approach allows us to adjust the level of

capacity utilization by the current output which is effectively produced (by using a ratio between these two variables).

So, the equation

$$I_{\tau+\theta} = \frac{a}{1+c}.S_\tau + b.\frac{\Delta P_\tau}{\Delta t} + e.\frac{\Delta O_\tau}{\Delta t} + d$$

was replaced by:

$$I_{\tau+\theta} = \frac{a}{1+c}.D_\tau + b.\frac{\Delta P_\tau}{\Delta t} + e.\frac{CU}{Y}_\tau \Big/ \Delta t + d$$

We then applied the logarithmic function as we are interested in the weight of each determinant on investments and replaced the profit rate $\frac{\Delta P_\tau}{\Delta t}$ by the interest rate, using it as a proxy. We changed the nomenclature of variables and coefficients and, finally, achieved the following equation:

$$i_{t+\theta} = \beta_0 + \beta_1.capu_t + \beta_2.outp_t + \beta_3.debt_t + \beta_4.intr_t + \varepsilon_t$$

This equation will describe the dynamics of investment and their determinants in our hypothetical economy.

2.3 Data description

Our sample is based on quarterly observations that range from the first quarter of 2003 to the fourth quarter of 2012 – i.e., 40 observations. Besides the variables mentioned above, we inserted a *dummy* to capture the effect of the 2008-9's global financial crisis: from 2008.Q3 to 2012.Q4 our dummy assumes the value 1, otherwise 0.

Variable $\mathbf{i_t}$ represents *investment* and was obtained from Brazilian national accounts, released by the Brazilian Institute of Geography and Statics (IBGE) in a quarterly basis. It refers to the seasonally adjusted and chained index for fixed capital formation. Although our initial plan was to treat both the capital formation and inventories in our model, the statistical characteristics of changes in inventories led us to choose in considering only capital formation. Inventories are obtained as residuals from the aggregate demand equation when calculating national accounts and it may generate relevant noise in our final estimations. Moreover, each of these categories may present different dynamics.

Variable $\mathbf{capu_t}$ represents the *level of capacity utilization*, provided by the Getulio Vargas Foundation (FGV), in a monthly basis. We took the average between the three months of each quarter to build our series. We proceeded to the X-12 ARIMA analysis, which accused seasonality, and thus adjusted the series.

Variable $\mathbf{outp_t}$ reflects output and was released in a quarterly basis by IBGE. It accounts for the gross domestic product, measured by the seasonally adjusted chained index.

Variable $\mathbf{debt_t}$ represents the *aggregate flow of debt* in Brazil, accounting for the sum of loans freely advanced by banks and BNDES, provided by the Central Bank of Brazil (BCB) and the Brazilian Development Bank (BNDES), respectively, in a monthly basis, and corporate debt issues, provided by the Brazilian Securities Commission (CVM), in the same basis. To generate a quarterly series we just added the 3 months of each quarter. We proceeded to the X-12 ARIMA analysis and then adjusted the series for seasonality.

Variable $\mathbf{intr_t}$ stands for *interest rate*, used as proxy for the profit rate. We used the Brazilian prime rate (Selic), provided by BCB, in a monthly basis. Our series was constructed by multiplying the monthly factors of each of three months of every quarter, annualizing these results and, finally, converting these numbers to quarterly annualized rates of interest.

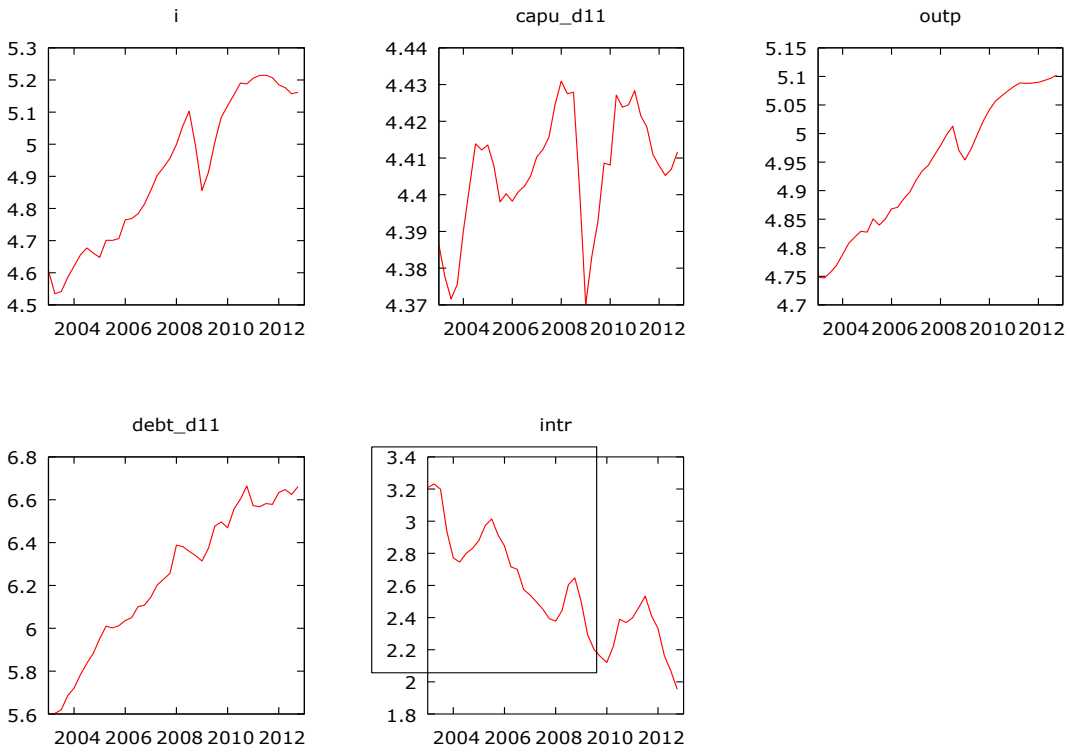
Graph 2 shows the series after the above-mentioned adjustments. One should notice that, only by taking a look at the graph, series *i*, *outp*, *debt* and *intr* might not pass in the unit root tests. We proceeded to unit root tests and in fact the tests we have made indicate that we cannot reject the hypothesis of unit roots at the usual confidence levels

for all the four variables mentioned[2]. All of them are integrated of order one (I(1)). Only *capu* does not present unit root and is I(0).

Taking these results into account we have opted to apply the first difference to all series, in order to avoid spurious estimations. We included also *capu* in our adjustments in order to keep the consistency between variables' meanings. So, all variables here refer to the *growth rate* of original series. The new set of series is illustrated in Graph 3. Now, all unit root tests indicate that we can reject the unit root hypothesis at the usual levels of confidence. All series now are integrated of order zero. We call for attention to one aspect: the effect that the 2008-9's crisis has had on all series, specially *investment* and *output*[3].

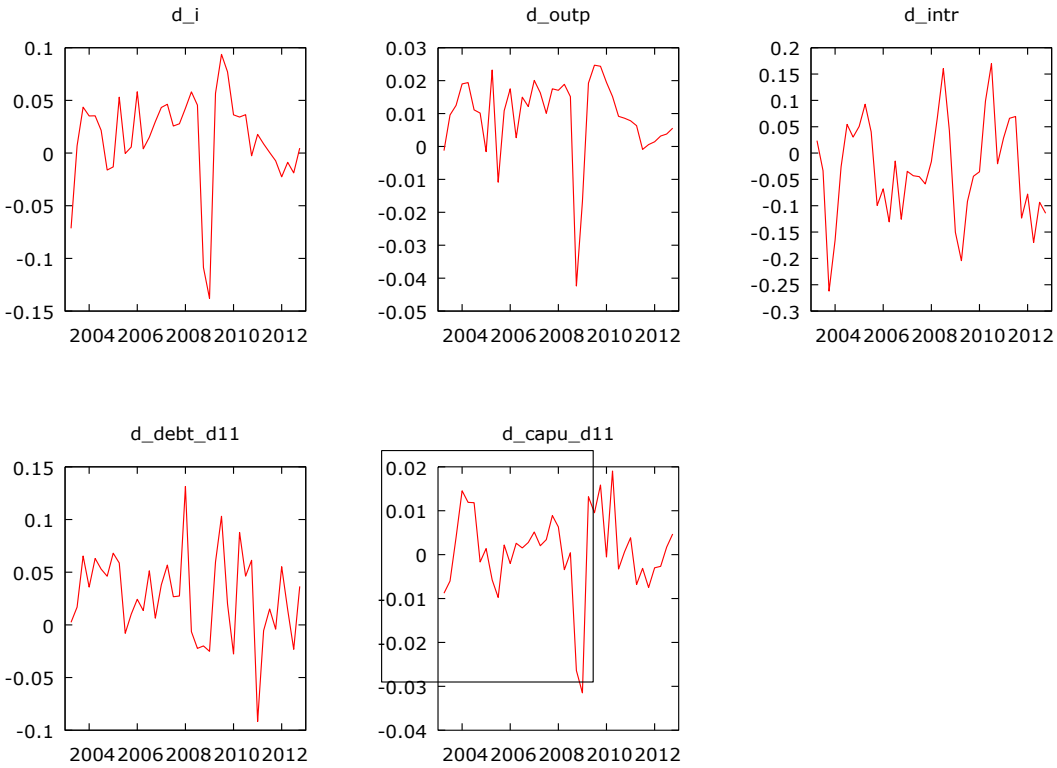
[2] For the case of *investment*, if we make the ADF test with a trend and an intercept we can reject this hypothesis at the 5% level of confidence. In the other cases, we cannot reject this hypothesis anyway.
[3] We are planning to treat this structural break in a more adequate way in a further revision of this paper.

Graph 2: Variables *i*, *capu*, *outp*, *debt*, *intr*



Source: Authors' elaboration.

Graph 3: Variables *i*, *capu*, *outp*, *debt*, *intr* in their first differences



Source: Authors' elaboration.

3 MODEL SPECIFICATION AND RESULTS

We divided our empirical exercise in three parts. First of all, we will estimate the weight of each explanatory variable – *capacity utilization*, *output*, *deb*) and *interest rates* – in determining *investments* in Brazil from 2003 to 2012. So we will start estimating, through Ordinary Least Squares, a model with all variables in the same period and without the *dummy* (Model I); we then will introduce the *dummy* (Model II); further we will use the variable *debt* lagged in 1 period, keeping *dummy* outside the model (Model III); and thus, finally, we keep *debt* lagged (*t-1*) and put the *dummy* inside the equation again (Model IV). In every model residuals seems not to present serial correlation (see Durbin Watson statistic for a proxy; as a rule of thumb, if $d \sim 2$ there is no evidence of serial correlation). The average R^2 is around 80%. Table 2 summarizes our results:

Model III seems to be the one which better fits to our sample. The *constant* term, *capacity utilization* and *output* are significant to explain the behavior of *investment*. Output is most significant one. There are no great differences in these determinants before and after the crisis, as *dummy* is far from significant. The flow of resources from the financial to the industrial circulation (*debt*) also does not appear to have influence on investments as well as the *interest rate*.

Now we will proceed to our second exercise. We broke our sample in the pre- and post-crisis periods, from 2003.Q1 to 2008.Q2 and from 2008.Q3 to 2012.Q4, respectively. In spite of the small number of observations in each sample, we will try to investigate if there are some relevant changes in the significance and weight of each determinant of investment.

Table 2: Models estimated by OLS (full sample) – p-values

	Model I		Model II		Model III		Model IV	
const	0,18572		0,24809		0,08632	*	0,20309	
d_capu_d11	0,05988	*	0,06924	*	0,03739	**	0,04069	**
d_outp	<0,00001	***	<0,00001	***	<0,00001	***	<0,00001	***
d_debt_d11	0,96855		0,94615		0,21911		0,23568	
d_intr	0,2106		0,21325		0,26713		0,27549	
dummy			0,83626				0,98975	
R^2	0,7949		0,795172		0,817877		0,817878	
Durbin Watson	2,01896		2,025788		2,159433		2,15933	
F-Statistic	32,9437		25,62209		37,04904		28,74125	

Source: Authors' elaboration.
*Significant at α = 10%; ** Significant at α = 5%; *** Significant at α = 1%.

Table 3 summarizes our main results. The models V and VII use *debt* in the same period as investments (*t*), while models VI and VIII use *debt* in *t-1*. *Output* still the main variable explaining investments in both periods, but after the crisis investments started to react to monetary stimulus, as our model suggests that *interest rates* might have some influence on them. However the coefficient presents the opposite signal to what we expected: it is positive. It means that cuts on *interest rates* not only do not stimulate *investments* but contribute to its slowdown. This could be a problem of specification and, as in any case *debt* stills not impacting *investments* we started to search for other possibilities to our model.

Keeping the two samples apart, we then raised the hypothesis that some greater lag between *debt* and *investment* may exist. So we tested several specifications and found that in the pre-crisis period the OLS model which better fits to our data is the one which considers the influence of *capacity utilization* delayed in 1 period and of *debt* delayed in 2. In this case, *debt* is statistically significant at the 5% level – in any case, *output* remains the main determinant of *investment*. However, this is not the case in the post-crisis period: *debt* losses its statistical relevance. The same occurs if we restore our full sample – see Table 4.

Table 3: Models estimated by OLS (2 samples) – p-values

	Before the crisis		After the crisis	
	Model V	**Model VI**	**Model VII**	**Model VIII**
const	0,23026	0,21249	0,57452	0,56369
d_capu_d11	0,8384	0,2131	0,07751 *	0,0478 **
d_outp	0,00112 ***	0,00017 ***	0,00359 ***	0,00497 ***
d_debt_d11	0,8609	0,11699	0,73745	0,43086
d_intr	0,49613	0,14264	0,09995 *	0,09754 *
R^2	0,577821	0,662967	0,895377	0,89954
Durbin Watson	1,699766	2,40528	2,531085	2,386449
F-Statistic	5,474652	7,376506	27,81381	29,10127

Source: Authors' elaboration.
*Significant at α = 10%; ** Significant at α = 5%; *** Significant at α = 1%.

Table 4: Models estimated by OLS (3 samples) – p-values

	Pre-crisis	**Post-crisis**	**Full period**
	Model IX	**Model X**	**Model XI**
Const	0,077 *	0,1958	0,16656
d_capu_d11_1	0,30217	0,14674	0,2693
d_outp	0,00067 ***	<0,00001 ***	<0,00001 ***
d_debt_d11_2	0,03245 **	0,16416	0,14857
d_intr	0,25202	0,26528	0,29756
R^2	0,70953	0,895318	0,812299
Durbin Watson	1,83061	2,727543	2,359125
F-Statistic	8,54941	29,93454	34,62103

Source: Authors' elaboration.
*Significant at α = 10%; ** Significant at α = 5%; *** Significant at α = 1%.

Possible explanations to this behavior are that in the post-crisis period *debt* (i) was scarcer and (ii) was channeled to other uses than investment, for instance to fill some short-term liquidity needs or for helping in restructuring financial obligations in the right-hand size of firms' balance sheets. So, in any case, there is evidence that the *link between the behavior of debt and investment*, even in the case of some lagging effect, *was broken by the crisis*.

Finally, we will turn to our third and last empirical effort. It is perfectly possible that lagged and feedback effects between *investment* and the other variables exist, especially between investment and debt, and between investment and capacity utilization. As all variables we are working with are integrated of order zero, we then estimated a Vector Auto-Regression (VAR) model to try to capture the effects we mentioned. We tried two specifications: the first one which gathers *capacity utilization*, *output*, *debt* and *interest rates* however without the *dummy* variable (Model XII); and the second one is merely the Model XII with the *dummy* (Model XIII). In both cases we used our full sample – we already have a small sample (40 observations) so if we split it our VAR will be meaningless.

To estimate the Model XII we start by selecting the lags of our model. There is mixed evidence with the Schwarz (Bayesian) Information Criterion (BIC) indicating that we should use only 1 lag. We choose to use BIC as reference in spite of the other criterions.

Table 6 present our results for the VAR (1). We advance that all roots are outside the unit circle or, conversely, all inverse roots are inside the unit circle.

Table 5: Lag Selection in VAR

lags	log.L	AIC	BIC	HQC
1	465,82332	-24,90419	-23,571034*	-24,443985
2	508,78261	-25,930435	-23,486317	-25,086726*
3	536,63185	-26,093248	-22,538167	-24,866035
4	567,48902	-26,427944*	-21,7619	-24,817226

Source: Authors' elaboration.

Table 6: VAR (1) Model XII – coefficients

	d_i	d_capu_d11	d_outp	d_debt_d11	d_intr
const	-0,0118735	-0,00535214***	0,00527882*	0,0206741*	-0,0293682
d_i_1	-0,316391	-0,0551846	-0,0536331	-0,439951	-0,554193
d_capu_d11_1	-0,0461395	-0,122355	0,312794	1,12292	4,49901**
d_outp_1	2,48009**	0,54557**	0,139478	1,22467	2,6118
d_debt_d11_1	0,203378	0,0163551	0,0583193	-0,0332868	-0,202958
d_intr_1	-0,159292***	-0,0557618***	-0,0607619***	-0,0873307	0,570795***

Source: Authors' elaboration.

In the Model XII, our evidence suggests that *investment* is explained mainly by *output* and *interest rates*. Both variables present the expected signals, positive and negative, respectively. The main difference from our OLS estimations is that VAR indicates that *investment* is quite sensible to *interest rates*, and now in the right way. Moreover, *capacity utilization* now seems to influence *investment* through reinforcing the effect of *interest rates* (see column d_intr).

The impulse-response functions indicate that *investment* reacts to *capacity utilization* in a mixed way (see Graph 4 – quadrant I), though the initial impact is positive (in spite of the negative coefficient). Impact of *output* is highly positive in initial periods – first 2 quarters – and then you have some negative effect. One can interpret this result in the sense that aggregate demand influence is very relevant in the short-term and in the long-term conventions prevail. *Debt* presents a behavior which is similar to *output* but with smooth impacts on investment. Finally, *interest rate* has a huge negative impact on *investment* in the short-term, especially in the first three quarters after a shock.

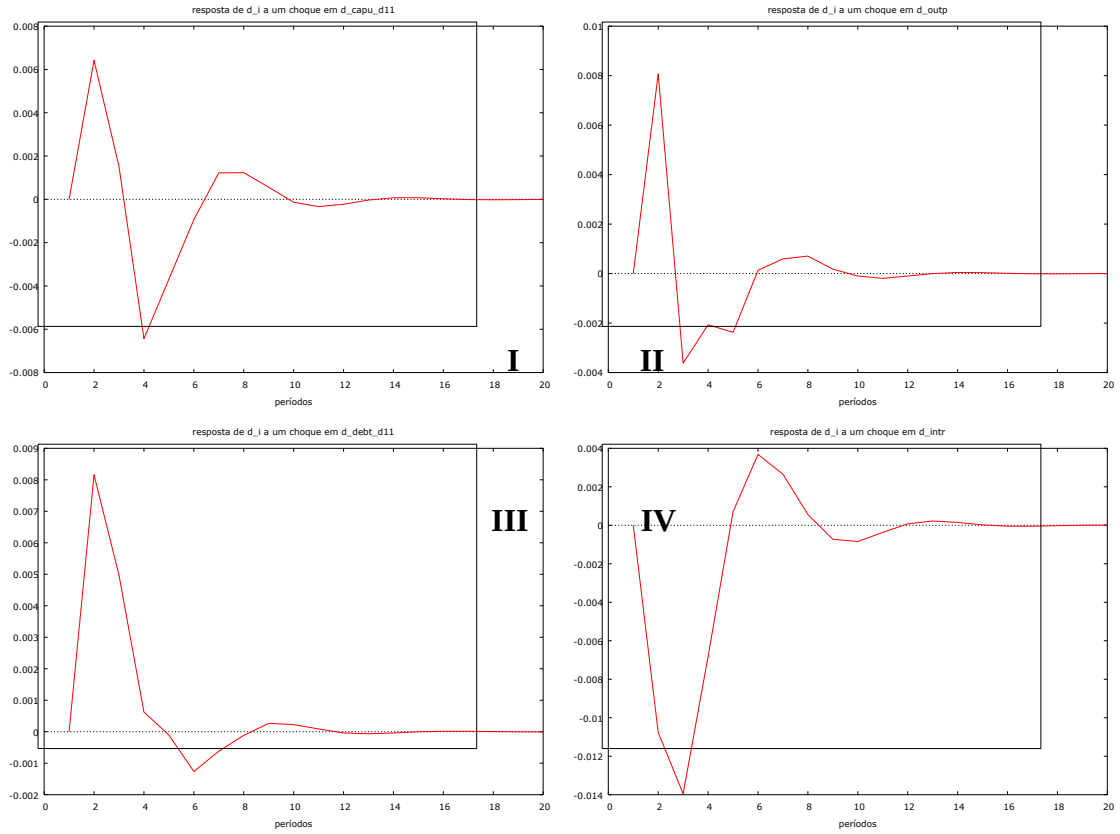
To complement our analysis we looked to the variance decomposition of our model. In short, the variance decomposition indicates the amount of information each variable contributes to the other variables in the VAR. In other words, it measures how the variability of one variable influences the variability of each other. Table 7 shows our results and indicates that the variability of *interest rates* is the most relevant to explain the variability of *investment*: after 4 quarters, around 20% of *investment* variability is related with *interest rate* variability. *Debt* and *capacity utilization* have a small capacity

of explanation as well as *output* – a curious result as *output* is statistically significant in the model.

Some highlights of other variance decomposition estimations: *capacity utilization* variability is largely explained by *investment* variability (26,4% after 4 quarters) and *interest rate* also (29,9% a4Q); the same applies to *output* (54,3% *investment* and 22,3% *interest rate* a4Q); *debt* has its own dynamics (74,0% of its variability is explained by its own variability a4Q); *interest rates* too but there is some influence of *investment* (12,1%, a4Q) and *capacity utilization* (12,7%, a4Q) on it.

To summarize the main findings of Model XII we stress that in our VAR (1) model *interest rates seem to have a significant influence on investment*, opposed to what literature usually finds for the Brazilian economy (Luporini and Alves, 2010: 454-5). Now we ask: has the crisis changed anything?

Graph 4: VAR (1) Impulse-Response Functions



Source: Authors' elaboration. I: *i* response to *capu* impulse; II: *i* response to *outp* impulse; III: *i* response to *debt* impulse; IV: *i* response to *intr* impulse.

Table 7: VAR (1) Model XII – variance decomposition of *investment*

period	sd-dev	d_i	d_capu_d11	d_outp	d_debt_d11	d_intr
1	0,030319	100	0	0	0	0
2	0,036947	78,847	3,019	4,772	4,8733	8,4891
3	0,04045	68,003	2,6594	4,783	5,5793	18,975
4	0,041911	64,93	4,8354	4,699	5,2192	20,316
5	0,042345	64,542	5,4969	4,918	5,1135	19,93
6	0,042534	63,969	5,4967	4,876	5,1562	20,503
7	0,042664	63,678	5,5458	4,865	5,1459	20,766
8	0,042712	63,632	5,6162	4,882	5,135	20,736
9	0,042725	63,602	5,6301	4,88	5,1358	20,752
10	0,042735	63,575	5,6285	4,879	5,1362	20,782
11	0,04274	63,568	5,6333	4,88	5,1354	20,784
12	0,042741	63,566	5,6358	4,88	5,1352	20,783
13	0,042742	63,564	5,6357	4,88	5,1353	20,785
14	0,042742	63,563	5,6358	4,88	5,1352	20,786
15	0,042742	63,563	5,6361	4,88	5,1352	20,786
16	0,042742	63,563	5,6361	4,88	5,1352	20,786
17	0,042742	63,563	5,6361	4,88	5,1352	20,786
18	0,042742	63,563	5,6361	4,88	5,1352	20,786
19	0,042742	63,563	5,6361	4,88	5,1352	20,786
20	0,042742	63,563	5,6361	4,88	5,1352	20,786

Source: Authors' elaboration.

We inserted the *dummy* variable as an exogenous variable to control to the crisis. As we argued above, if we split our sample there will be a quite small number of observations to run VARs. Our hope is that *dummy* will have the ability to capture some of the effects of the crisis in other variables, altering the weight of each component in determining investments. We made the lag selection and now evidence suggested that we should work with 2 lags, or a VAR (2):

Table 8: Lag Selection in VAR

lags	log.L	AIC	BIC	HQC
1	469,25527	-24,814587	-23,259239	-24,277681
2	514,01579	-25,943759	-23,277448*	-25,023349*
3	540,08506	-26,004861	-22,227587	-24,700946
4	573,29365	-26,473923*	-21,585686	-24,786504

Source: Authors' elaboration.

Our estimations are summarized in Table 9 – again, all inverse roots of our model are situated inside the unit circle. The variable *dummy* is not statistically significant in all equations, at the usual levels of confidence – however its p-value in the equation which has *debt* as the explained variable is 13,0%, suggesting that the crisis may had some negative influence on credit and capital markets.

Table 9: VAR (2) Model XIII – coefficients

	d_i	d_capu_d11	d_outp	d_debt_d11	d_intr
Const	0,00549509	-0,00885179	0,0111564	0,0608916**	-0,0759897
d_i_1	-0,039513	-0,132472	0,0255653	-0,180918	-1,45688
d_i_2	-0,120575	-0,0614901	-0,0408564	-0,625163*	0,0386918
d_capu_d11_1	0,605873	-0,226896	0,523732	1,82288	4,02208
d_capu_d11_2	-0,330116	0,176922	0,324161	2,52015*	0,42453
d_outp_1	1,38739	0,709147*	-0,305601	-0,0666144	5,59119
d_outp_2	-0,751859	0,277616	-0,284881	0,13714	2,25303
d_debt_d11_1	0,16548	0,0154821	0,0399747	-0,229127	-0,142701
d_debt_d11_2	0,147652	0,0276203	0,074098	-0,319422	0,133901
d_intr_1	-0,0915366	-0,0635171***	-0,058292**	-0,0784693	0,357088*
d_intr_2	-0,0143608	-0,00557958	-0,00238131	-0,0142566	0,217409
dummy	-0,010147	0,00119867	-0,00383766	-0,0238359	0,0143732

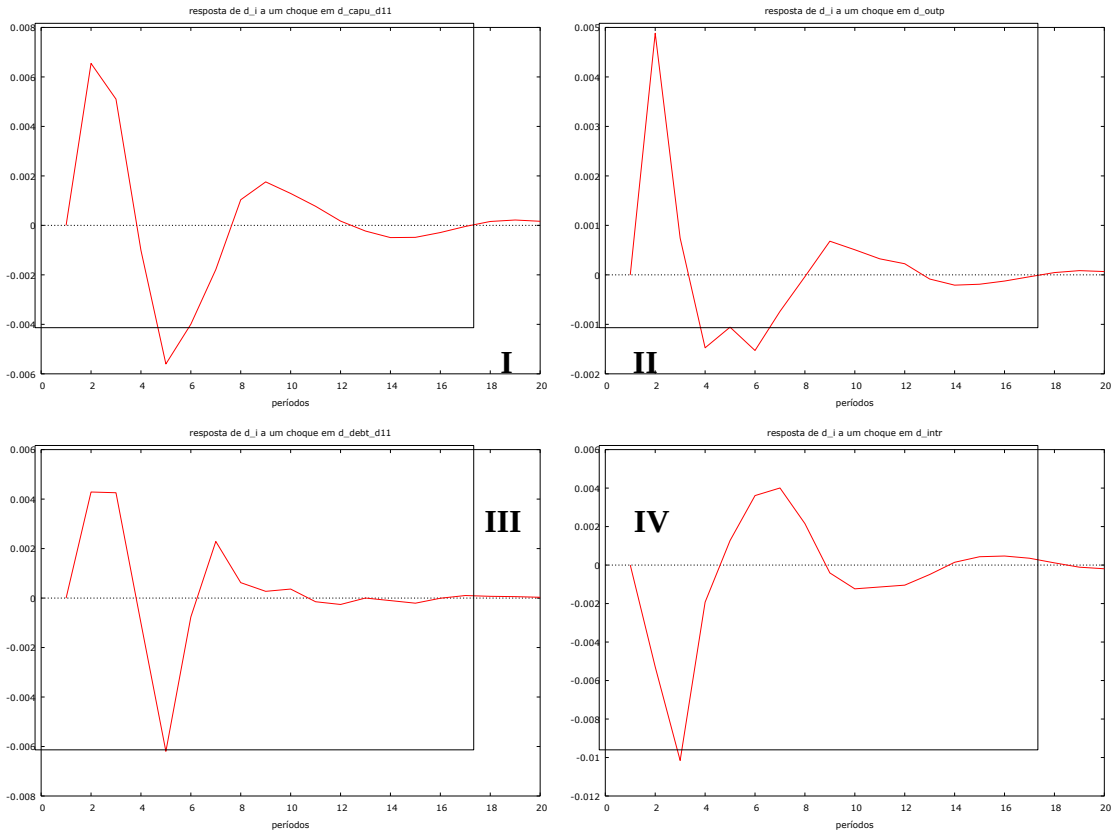
Source: Authors' elaboration.

The *investment* equation does not present any statistically significant explanatory variable: in fact, the lowest p-value is *0,2891* for *d_intr_1* and there is a poor adjustment of the equation (adjusted R^2 = 0,382664). We interpret this result in a Keynesian sense:

although many variables could be used as proxy for explaining and determining investments, the relationship with the main determinant of investment, long-term expectations, are, at least, blurred. The behavior of variables in the short-term can affect the long-term expectations and the state of confidence on them, but these effects depend on conventions – that could be long-lasting but are unstable by definition – which give to agents more comfort in an environment surrounded by uncertainty.

Graph 5 illustrates the result of impulse-response functions. The figures show a behavior which is similar of the one presented in Graph 4 for our VAR (1) model and the analysis is correspondingly similar.

Graph 5: VAR (2) (with dummy) Impulse-Response Functions



Source: Authors' elaboration. I: *i* response to *capu* impulse; II: *i* response to *outp* impulse; III: *i* response to *debt* impulse; IV: *i* response to *intr* impulse.

The variance decomposition analysis only reinforces the results we find above: the variability of investment, when we control for the crisis, is highly explained by its own variability; even if we take a 5 years horizon, ¾ of investments' variability is not related with the variability of other variables (Table 10).

Again, we provide some highlights of other variance decomposition estimations: *capacity utilization* variability is still explained largely by *investment* variability (34,6%, after 4 quarters) and *interest rate* (26,6%, a4Q); *output* keeps suffering a major influence of *investment* (66,4%, a4Q) and now both *capacity utilization* (10,5%, a4Q) and *interest rate* exert some influence (14,4%, a4Q); *debt* now relies less on its own dynamics (61,3%, a4Q) and investment's and capacity utilization's variability help in explaining it (17,8% and 13,2%, respectively, a4Q); *interest rates* keeps influenced by *investment* (20,5%, 4Q) and *capacity utilization* (17,1%, *idem*) on it.

To sum up, when we control for the crisis, *investments* do not seem to be affected by other variables. It has an autonomous character, in line with the Keynesian theory. Uncertainty and conventions vary over a period of time and so the short-term behavior of economic variables loses their ability in influencing the behavior of *investments*.

But one last question remains. Why there is such a discrepancy between the two VAR specifications? If we control for the crisis there is no effect of *interest rates* on *investments* while if we do not control this effect is highly significant. We suggest an interpretation that during and mainly *after the crisis*, *a nexus between monetary policy and investments was established* – this link was not significant before but the expansionary monetary policy in response to the crisis started to build it.

In other words, through the decrease in *interest rate* (Selic), which alleviated the costs of obligations that firms already assumed in the pre-crisis period, the BCB started to stimulate *investments.* One should notice that, conversely to our OLS estimations, in the VAR model the coefficient of *interest rate* presents the right signal (negative).

Table 10: VAR (2) Model XIII – variance decomposition of *investment*

período	sd-dev	d_i	d_capu_d11	d_outp	d_debt_d11	d_intr
1	0,028261	100	0	0	0	0
2	0,033023	89,634	3,9302	2,186	1,6851	2,5647
3	0,037741	81,684	4,8372	1,713	2,563	9,2036
4	0,039256	82,556	4,537	1,724	2,4351	8,7483
5	0,040412	79,102	6,2018	1,695	4,6471	8,354
6	0,040823	77,606	7,0351	1,801	4,589	8,969
7	0,041475	76,85	7,0007	1,777	4,7501	9,6223
8	0,041705	76,753	6,9857	1,757	4,7203	9,7842
9	0,04175	76,586	7,1477	1,78	4,7143	9,7724
10	0,041798	76,434	7,2267	1,791	4,711	9,8373
11	0,041823	76,347	7,2523	1,795	4,7067	9,8998
12	0,041842	76,298	7,2472	1,796	4,7062	9,9528
13	0,041853	76,293	7,2466	1,795	4,7038	9,9615
14	0,041858	76,281	7,2586	1,797	4,7032	9,9602
15	0,041864	76,259	7,2699	1,799	4,7043	9,968
16	0,041869	76,246	7,2731	1,799	4,7033	9,9787
17	0,041872	76,242	7,272	1,799	4,7031	9,9842
18	0,041874	76,241	7,2729	1,799	4,703	9,9841
19	0,041875	76,238	7,2752	1,799	4,703	9,9844
20	0,041876	76,235	7,2765	1,8	4,7029	9,9861

Source: Authors' elaboration.

FINAL REMARKS

The purpose of this paper was to analyze the behavior of *investments* and their determinants in the period from 2003 to 2012 in Brazil, using the Keynesian-Kaleckian theoretical framework as a reference to our discussion and to build our model. More specifically, we were interested in assessing whether the 2008-9's global financial crisis changed the balance between the determinants of investments or not.

It is always relevant to notice that econometric models have serious limitations in describing and predicting the behavior of economic variables. Models are fragile. But their use is still valuable to offer some insights to researchers and provide some evidence on certain issues. So we should use them, but be aware of its limits.

Our empirical exercise here was divided in three tasks. First of all, we tried to estimate the weight of each explanatory variable – *capacity utilization*, *economic activity*, *availability of financial resources* (*debt*) and *interest rates* – in determining *investments* in our case. Our first estimations (OLS) suggested that variables *capacity utilization* and *economic activity* are the main responsible for explaining the behavior of *investment* in the full period from 2003 to 2012. However, *debt* and *interest rates* seem not to have a major influence on the behavior of *investments*.

We then proceeded to our second exercise. We broke our sample in the pre- and post-crisis periods and started to investigate if there are some relevant changes in the significance and weight of each determinant of investment. After some adjustments, we found that *debt* is a relevant variable to explain the path followed by investments in the pre-crisis period, although with some delay (namely, 2 quarters). This evidence seems to support our theoretical assumptions.

What happened when the crisis erupted? Our OLS estimations point to the fact that the crisis implied some changes in the picture. In our first specifications, *interest rates* started to have some influence on *investments* but in a weird manner (positive coefficient). The only possibility we raised is that lower *interest rates* means lower profits, de-stimulating *investments*, but is it is more probable that our model specification was not appropriate.

After trying some different specifications, we found that in the post-crisis period *debt* was not a significant variable anymore. Our interpretation is that the crisis made *debt* scarcer and firms changed its end-uses: financial resources were channeled to other uses than *investment*, for instance to fill some short-term liquidity needs and to turn over the production or for improving the structure of financial obligations; so *debt* and *investment* lost the link they usually have.

Finally, we estimated a VAR model to assess the weight of each component for another angle, taking into accounting more properly some feedback and lagged effects that one variable has in each other. We estimated two specifications: (i) a VAR (1) which contemplates *capacity utilization*, *economic activity*, *debt* and *interest rates*, and (ii) a VAR (2) which uses the same variables plus a *dummy* to control for the crisis (2008.Q3-2012.Q4 = 1; else = 0).

In the first model, the evidence suggests that *interest rate seems to have a significant influence on investment*, contrarily to what literature usually finds for the Brazilian economy (Luporini and Alves, 2010: 454-5). In the second model, *investments do not present any statistically significant relationship with any explanatory variable*. We interpreted this result in a Keynesian sense: although many variables could be used as proxy for explaining investments, their relationship with the main determinant of investment, long-term expectations, is, at least, blurred. The short-term behavior of variables can affect the long-term expectations and the state of confidence on them, but these effects depend on conventions and uncertainty.

Finally we started to investigate why such a discrepancy between the two VAR specifications. We suggested an interpretation that during and, mainly, *after the crisis, a nexus between monetary policy and investments was established* (this link was not significant before). Through the decrease on *interest rate* (Selic), which alleviated the costs of obligations that firms already assumed in the pre-crisis period, the BCB started to stimulate *investments* – now, in the VAR model, the coefficient presents the right signal –, however, they did not reach the 2003-8's path yet.

So, *if, at one hand, the crisis broke the link between investments and the flow of resources channeled from the financial to the industrial circulation (debt), at the other*

hand, it resulted in the establishment of some nexus between investments and monetary policy (interest rate).

Our models also suggested that the short-term behavior of variables can affect the main determinants of investment, but, in last instance, these effects will depend on conventions and *uncertainty*[4].

[4] We would like to finish our paper reminding that our research is ongoing and this paper is a first draft of our initial findings. We acknowledge that several parts of the paper could (and need to) be ameliorated and we are working on it. And this task is easier with the contributions of our colleagues, so any suggestions and contributions will be really welcomed.

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Annex I: Data

obs	i	outp	intr	debt_d11	capu_d11
2003 Q2	4,53476	4,74718	3,23238	5,602914	4,377632
2003 Q3	4,54163	4,75675	3,19884	5,619742	4,371621
2003 Q4	4,58519	4,76923	2,93682	5,685103	4,375552
2004 Q1	4,62041	4,78824	2,77151	5,720956	4,390103
2004 Q2	4,65576	4,80765	2,74547	5,783997	4,402014
2004 Q3	4,67732	4,81876	2,79989	5,836965	4,413852
2004 Q4	4,66119	4,8289	2,8302	5,883131	4,412176
2005 Q1	4,64805	4,82733	2,88082	5,951172	4,413565
2005 Q2	4,70111	4,85056	2,97356	6,009941	4,4078
2005 Q3	4,7007	4,83971	3,01381	6,001955	4,398052
2005 Q4	4,70641	4,85058	2,91429	6,012116	4,400255
2006 Q1	4,7646	4,86809	2,84642	6,036384	4,398235
2006 Q2	4,76862	4,87074	2,71573	6,050023	4,400826
2006 Q3	4,78366	4,88572	2,70058	6,101315	4,402351
2006 Q4	4,8135	4,89784	2,57486	6,10768	4,405119
2007 Q1	4,85675	4,91792	2,54018	6,145651	4,410277
2007 Q2	4,90307	4,93422	2,49716	6,202473	4,412301
2007 Q3	4,92872	4,94428	2,45235	6,229171	4,415716
2007 Q4	4,95653	4,96179	2,39372	6,256543	4,424623
2008 Q1	4,99904	4,97885	2,37753	6,387972	4,430935
2008 Q2	5,05711	4,99774	2,44474	6,381525	4,4275
2008 Q3	5,10259	5,01288	2,60515	6,359201	4,42792
2008 Q4	4,99401	4,9705	2,64749	6,339224	4,401518
2009 Q1	4,85606	4,95376	2,49714	6,314146	4,370032
2009 Q2	4,91275	4,97302	2,29282	6,373832	4,38322
2009 Q3	5,00648	4,99771	2,20096	6,476921	4,392752
2009 Q4	5,08353	5,02207	2,15694	6,496726	4,408615
2010 Q1	5,11979	5,04155	2,12138	6,469082	4,408081
2010 Q2	5,15398	5,05672	2,21996	6,556849	4,427132
2010 Q3	5,19041	5,06589	2,38971	6,603095	4,42385
2010 Q4	5,18777	5,07448	2,36935	6,664404	4,424491
2011 Q1	5,20548	5,08229	2,39774	6,572703	4,42834
2011 Q2	5,21419	5,0886	2,46374	6,567227	4,421524
2011 Q3	5,21475	5,08771	2,53315	6,582363	4,418406
2011 Q4	5,2074	5,08829	2,40968	6,578291	4,410915
2012 Q1	5,18484	5,08972	2,33175	6,633542	4,407914
2012 Q2	5,17601	5,0929	2,16192	6,64782	4,405249
2012 Q3	5,15716	5,09668	2,06851	6,624643	4,406959
2012 Q4	5,1619	5,10223	1,95423	6,661173	4,41166

Source: Authors' elaboration.