

The Global Financial Cycle and the Brazilian Credit Market: the differences between private and State-owned banks during the Great Recession

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Resumo: O presente estudo tem por objetivo principal analisar a evolução do mercado de crédito do Brasil no período que compreende a estabilização monetária (Plano Real) e a “Grande Recessão”. Busca-se identificar o padrão de atuação dos bancos públicos e dos bancos privados, de modo a verificar se os primeiros foram capazes de contra-arrestar o suposto movimento pró-cíclico dos primeiros, especialmente no contexto da Crise Financeira Global e seus desdobramentos posteriores. Para tanto, aplicamos a metodologia dos modelos VEC para dois períodos distintos: 1996-2014 e 2008-2014. Tal divisão permite especular sobre a dinâmica do período de crise e, adicionalmente, testar a hipótese de que não necessariamente os bancos públicos atuam contracíclicamente em todos os momentos. Assim, espera-se contribuir com a literatura prévia.

Palavras-chave: Bancos públicos; Crédito; Políticas contracíclicas; Brasil.

Abstract: This study aims at analyzing the credit market in Brazil from the Real Plan to the Great Recession. We contrast the behavior of the State-owned banks (SOB) and private banks, in order to check if former showed counter-cyclical characteristics, while the later behaved in a procyclical manner. In order to do this, we used VEC models for two different periods: 1996-2014 and 2008-2014. We hope to contribute to the previous literature by offer fresh evidence on this topic.

Keywords: State-owned banks; Credit; Counter-cyclical policies; Brazil.

JEL: G28; E5; E32

1. Introduction

The debate concerning the role of the State in a market-economy is part of *Economics* since its origins. This broad matter holds particular attention when it refers to financial intermediation. It is basically accepted that monetary authorities should have a monopoly of monetary emission and regulate financial markets (Arestis and Sawyer, 2007; World Bank, 2012; Davidson, 2015; Unctad, 2016). The specific level of regulation and financial supervision may vary in time and space, and it is contingent to the evolution of financial markets themselves. New mechanisms and private strategies, especially when they result in financial crises, induce the update of state intervention parameters (Minsky, 1986; Goodhart, 2013). Thus, regulatory activism can vary between high and low, be it in the domestic or in the international sphere. More controversial is the question of credit supply through controlled institutions by the State, namely, state-owned banks (SOB).⁵

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⁵ For the purposes of this article, we will deal with SOB in general, without the worry of specifying whether they are institutions specializing in long-term credit supply, such as development banks. Thus, SOB are public financial institutions whose controlling interest belongs to the State (central government or local governments). For more conceptual details see, among others, Jayme Jr. and Crocco (2010), World Bank (2012) and Unctad (2016).

From a historical perspective, the dissemination of regulatory practices restraining the full freedom of private finance was established after the 1929 crisis. In the following decades, this trend was augmented by the creation or expansion of financial intermediaries controlled by the local or national governments⁶, responsible for direct credit supply (Jayme Jr. and Crocco, 2012; Luna-Martínez e Vicente, 2012; World Bank, 2012 and 2015; Ollioqui, 2013; Unctad, 2016). This process was so intense that when several advanced and emerging and developing countries tried to revert it, through an intense phase of financial deregulation and bank privatizations, especially in the 1980s and 1990s, they were not able to give up some of their SOB. In 2002, in more than 40 emerging countries, including Brazil, Russia, India and China, assets from these banks constituted more than 25% of the total banking system assets (Hanson, 2004). More recent estimates suggest that the SOB assets in the total financial system assets is 22% for emerging countries – proportion that, in the case of advanced economies, would reach 10% (World Bank, 2012).

The concern with the role of State financial institutions was renewed in the aftermath of the GFC, triggered in 2007-2008 by the liquidity and solvency problems in the American mortgage market. What seemed as just a localized problem, soon revealed itself to be a systemic rupture that affected every financial market sector in the world with additional negative effects on the real economy. After such a grave episode, which rapidly came to be called as “The Great Recession” (Arestis et al. 2011; Cynamon et al. 2013), a restored concern about the desirable degree of state activism in financial intermediation was reestablished. Emerging and advanced countries used their SOB to minimize the shortage of private credit. Even the World Bank (World Bank, 2012) recognized the positive results this action had on their economies. Thus, the countercyclical role of SOB contrasted with the typical procyclical private sector behavior (Borio et al. 2001; Borio, 2012; BIS, 2014). As argued by the World Bank (2012) “... the global financial crisis underscored the potential countercyclical role of state-owned banks in offsetting the contraction of credit from private banks, leading to arguments that this is an important function that can perhaps better justify their existence”(p. 11).⁷

In this context, the goal of this study is to evaluate the hypothesis that SOB can play a positive role in stabilizing aggregate credit in a downturn. In other words, we have verified the countercyclical characteristics SOB’s credit, confirming the views, among others, of Micco e Panizza (2006), Bertay et al. (2012), Thibaut (2012), Cull and Martínez Pería (2012), World Bank (2012), Mazzucato and Penna (2015) and Unctad (2016). We contribute to this literature by using new evidence arising from the recent Brazilian experience. Previous studies relied on descriptive analysis of credit aggregates and suggest that there is evidence that Brazilian SOB would have acted countercyclically in response to GFC (Correa *et al.*, 2010, Lourenço, 2013; Unctad, 2016).

Our contribution lies in applying MS-DR (Markov-Switching Dynamic Regression) and VEC (Vector Error Correction) models to verify credit behavior (total, private banks’ credit, state-owned banks’ credit) in Brazil from 1996 to 2014. The evidence we reach confirms that SOB’s credit acted in a countercyclical way after the Global Financial Crisis, despite its pro-cyclical behavior during the complete period. On

⁶ In addition, of course, of multilateral and regional banks, controlled by several countries. Examples in this regard are: The World Bank, regional development banks in Asia, Latin America, Africa and so on.

⁷The same study states that: “The Brazilian government actively used its state infrastructure bank to engineer the rapid countercyclical response to mitigate the contagion effects from the global financial crisis” (World Bank, 2012, p. 106).

the other hand, the private bank's credit moved pro-cyclically in both exercises. This chapter continues as follows: section 2 presents a short review of the literature on the matter and our theoretical framework, inspired mainly in the Post-Keynesian tradition; section 3 describes credit market in Brazil, the methodology and the results of our study; section 4 presents our conclusions.

2. State and Financial Intermediation: Literature Review

Post-Keynesian theory sustains that the State should have the responsibility to manage the economy as to avoid falling into depression and large unemployment. Keynesian *economic policy*, be it fiscal, monetary, financial or any other is a powerful theoretical contribution in assisting governments to maintain levels of effective demand and mitigate involuntary unemployment, particularly during recessions⁸. It is because markets, if left to work completely by themselves – that is, in an uncoordinated manner – enlarge the main problems of monetary production economies, that Keynes affirmed that the State should use its power to steer the economic system⁹. The importance of countercyclical credit policy according to Keynes is that by sustaining business confidence, it helps to avoid a fall in the investment level (Arestis and Sawyer, 2007; Lavoie, 2014; Davidson, 2015). Here we focus, in particular, in analyzing if credit policies and SOB was used countercyclically to mitigate the negative effects of the GR on the Brazilian economy.

Conventional literature suggests that there are mainly two reasons¹⁰ that would justify the presence of State's institutions in the direct role of supplying credit: to mitigate market failures and/or to promote economic development (World Bank, 2012 and 2015; Unctad, 2016). The existence of market failures or imperfections, such as incomplete information, externalities, information asymmetry and imperfect competition obstruct and may prevent many activities and sectors to access to resources available in the market (Čihák *et al.*, 2012; Anginer *et al.*, 2012; Demirgüç-Kunt *et al.*, 2012). SOB may provide these necessary resources to enable long-term maturation projects. They can also grant credit to entrepreneurs that operate with higher levels of risk that the private sector prefer to avoid. In this conventional perspective, some

⁸ Keynesian macroeconomic policy coordination would focus mainly in (i) designing fiscal policies with the aim of expanding effective demand, (ii) making monetary policy more flexible looking to stimulate consumption and investment and (iii) coordinating and regulating financial and foreign-exchange markets in order to stabilize capital flows and exchange rates. In short, taking up how Minsky (1986) stated this problematic, a modern capitalist monetary economy needs a Big Government and a Big Bank that intervenes and regulates through its economic policies and assure that they evolve smoothly over time.

⁹In the General Theory, Keynes (1936 [1962]) proposed some economic policies, such as fiscal, monetary and income, in order to address the fact that “[t]he outstanding faults of the economic society in which we live are its failure to provide for full employment and its arbitrary and inequitable distribution of wealth and incomes” (p. 372).

¹⁰ These are split into four visions (i) the social view suggests that SOB should be used to offset market failures, as long as the benefits of its existence outweigh the costs arising from those imperfections; (ii) the ‘development vision’ suggests that the low degree of sophistication and depth of financial markets, which characterize the very condition of ‘delay’, would force the state to act in the credit supply to compensate for the lack of funds from private sector; thus the State would take the economic development promoter function (iii) in direct opposition to such a perspective there is the ‘political vision’ to which SOB are channeling sources of income by those in power to their political allies; with this, the state credit would not only distort markets as would be systemic inefficiency and corruption; and (iv) the ‘vision of the agency’, shares the social/developmental perspective that the state can complete markets and resolve flaws, but simultaneously points to the risks arising from state action. More details on Jayme Jr. and Crocco (2010), Gutiérrez *et al.* (2011), World Bank (2012), Luna-Martinez and Vicente (2012) and Ollioqui (2013).

authors are concerned with SOB efficiency, reasoning that, despite of its development intentions, the use of political criteria in credit allocation would generate distortions that are socially not desirable (Kornai 1979; Shleifer and Vishny, 1998; World Bank, 2012; Unctad, 2016).

Theoretical traditions that diverge from the mainstream view and are inspired, among others, in the seminal works of Schumpeter (1911 [1983]), Keynes (1936 [1962]), Gerschenkron (1962) and Minsky (1986), acknowledge the centrality of credit in modern market economies (Arestis and Sawyer, 2007; Davidson, 2015). Beyond the correction of ‘market imperfections’, it is assumed that the advancement of purchase power by financial institutions, particularly commercial banks (or universal banks with a commercial branch), is key to enable investment decisions that produce strong economies. These decisions, however, are taken under uncertainty conditions. Thus for economic agents liquid assets, including State money, become an attractive alternative to store wealth. This attraction grows as the state of confidence deteriorates. When entrepreneurs are optimistic about their investment’s returns, they expand their liabilities, so that they can enlarge their assets. On the other hand, when pessimism prevails, they search to reduce their debts, avoiding new investments in illiquid assets. As argued by Mazzucato and Penna (2015), SOB, particularly the development banks, should play a structural role by shaping markets and by “... promoting strategic investments for economic development” (p.16).

Financial intermediaries, on their part, are also capitalist agents that seek profits and establish strategies of accumulation. Thus, their behavior can sanction or not the non-financial sector’s credit demand. Even more, if they fall into a more pessimistic state, they could revise their plans and restrict their credit offer. Therefore, if the banks’ optimism drives and reassure the general optimism, their pessimism may represent the interruption of an ascendant phase of a dynamic cycle. In view of this cyclical pattern, non-mainstream authors tend to suggest that it should be up to the State, as monetary authority and through SOB, to stabilize the money supply, mostly the credit, and fulfill the structural role mentioned above. This role should not be just an occasional, but a permanent feature of the modern financial system (Paula, 2010; Ocampo et al., 2007; Lavoie, 2014; Davidson, 2015; Mazzucato and Penna, 2015; Unctad, 2016).

The GFC represented an important watershed in this debate. Up to the early 2000s, the conventional wisdom considered that direct State intervention in providing financial services should be avoided, because it was thought to generate inefficiencies. Thus, it fell to the State only to act as a market-friendly regulator. This changed after 2008. Different views emerged, such as: (i) State regulation of financial markets must be reinforced, especially its macro prudential dimension; and (ii) the countercyclical behavior of SOB began to be perceived as essential to reactivate the credit channels and to increase the effectiveness of monetary policy.

Contemporary research supports these views. For instance, Gutierrez *et al.* (2011) argue that SOB, particularly development banks, are essential to mitigate problems arising from the behavior of private banks: in times of crisis, private banks individually have incentives to restrict credit, but, in this way, they hinder the recovery of the economy as a whole. Consequently, borrowers’ liquidity might deteriorate, and lead to solvency problems. Such market failure could be mitigated by loans coming from SOB. Additionally, their credit boosts countercyclical monetary policy (Gutiérrez *et al.*, 2011). Bertay et al. (2012), Cull and Martinez Peria (2012), Cihak et al. (2013), Morck et al. (2013), Mazzucato and Penna (2015), Coleman and Feler (2015) and Unctad (2016) offer similar results and conclusions.

It should be noted that this stabilizing role through credit supply is now offered as a source of justification for maintaining SOB. Based on the studies by the Conference Board of Canada, Gutiérrez *et al.* (2011) suggest, in an analogy to the existence of armed forces to provide national security, that development banks should be kept continuously in operation, even in ‘peacetime’, that is, when the market is not under stress. Therefore, they would keep tuned-in their organizational skills when mobilized in times of crises, where the role of countercyclical credit supply proves to be essential. Cihak *et al.* (2013) also point out evidence showing that credit provided by SOB is less procyclical or, even better, it is countercyclical. Concerning the Brazilian experience, Oliveira (2010), Lundberg (2011), Araújo (2012), Mendonça and Sachsida (2013), among others, assess the conditions of credit supply and demand in Brazil, obtaining inconclusive results regarding to the role SOB and the procyclical nature (or not) of the private and SOB credit. Hermann (2010), Oliveira (2010), Araújo *et al.* (2011a, 2011b), Araújo and Cintra (2011), Lundberg (2011), Araújo (2012), Rezende (2015), Costa (2015), Unctad (2016) among others, are examples of works that seek to identify: (i) the profile of the Brazilian SOB’s credit supply; and (ii) their ability to promote development.

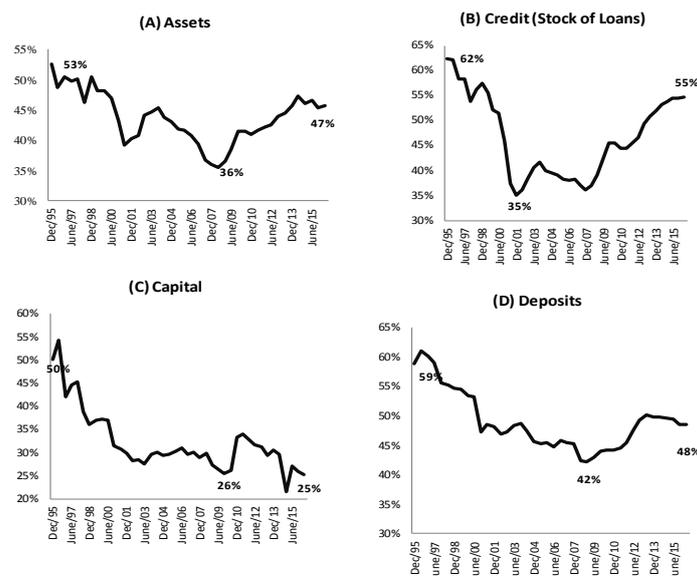
In the next section, we present our main contribution, as we think it has not been done before, which is to apply MS-DR and VEC models to investigate if private banks and SOB were able to stabilize the credit supply in Brazil during the GR. In this sense, we would be following Keynesian theory by assessing if the policy of augmenting SOB’s loans managed to keep up the general level of credit in the Brazilian economy during the GR.

3. Credit Behavior in Brazil in the 1990s and the 2000s

3.1 Stylized Facts, Methodology and Data

State-owned banks (SOB) have always played a pivotal role in the Brazilian Financial Sector (BFS), responding for most of the long-term funds directed to strategic economic sectors, from agriculture to infrastructure, and granting access to financial services to sectors, regions and segments of the society under-serviced by private banks, due to their higher risks and lower profitability prospects (Jayme Jr. and Crocco, 2010; Paula, 2011; Rezende, 2015 and Unctad, 2016). Consequently, and despite the privatization process of the 1990s and early 2000s, which reduced its share in the BFS, SOB still represent today half of the financial sector’s credit, assets and deposits (Figure 1).

Figure 1 – SOB in the Brazilian Financial System, 1995-2016 (% of total)



Source: prepared by authors, based on data from Central Bank of Brazil (“50 Maiores” and “IF Data” datasets, access in 20/02/2017)

It is possible to argue that Brazilian State-owned banks represent a complex and heterogeneous system, which includes commercial banks, development banks and other financial institutions. At the end of June 2016, there were 28 SOB in Brazil (Table 1).

Table 1 - State-owned banks in Brazil at end June 2016 (%)

Institution	Capital Control	History and Main Mission	Market-Share in Brazilian Financial System***		
			Assets	Credit	Deposits
Banco do Brasil (BB)	Federal Government	Founded in 1808 - Multiple bank with developmental tasks	17.7	20.0	21.5
Caixa Econômica Federal (Caixa)	Federal Government	Founded in 1861 - Savings and Loans Institution	14.5	20.8	22.5
Banco Nacional de Desenvolvimento Econômico e Social (BNDES)	Federal Government	Founded in 1952 - Development Bank	11.2	11,3	0.7
Banrisul	State of Rio Grande do Sul	Founded in 1928 - Multiple bank with developmental tasks	0.8	0.9	1.9
Banco do Nordeste	Federal Government	Founded in 1958 - Multiple bank with developmental tasks	0.9	0.4	0.5
Banestes	State of Espírito Santo	Founded in 1937 - Multiple bank with developmental tasks	0.2	0.1	0.5
Banco Regional de Desenvolvimento do Extremo Sul (BRDE)	States Rio Grande do Sul, Santa Catarina e Paraná	Founded in 1961 - Development Bank	0.2	0.4	0.0
Banco de Brasília (BRB)	Brasília - Federal District	Founded in 1964 - Multiple bank with developmental tasks	0.2	0.3	0.4
Banco da Amazônia (BASA)	Federal Government	Founded in 1942 - Multiple bank with developmental tasks	0.2	0.1	0.1
Banco de Desenvolvimento de Minas Gerais (BDMG)	State of Minas Gerais	Founded in 1962 - Development Bank	0.1	0.2	0.0
Others*			0.3	0.4	0.3
System of SOB			45.8	54.8	48.6
Top 10 Private Institutions			44.1	35.7	39.9
Others private institutions			10.1	9.5	11.6

Source: Authors' elaboration based on Banco Central do Brasil "IF.Data" dataset, access in 20/02/2017).

(*) Banpara, Badesul, Banco do Estado de Sergipe, AF Paraná, Bades, Desenvolve SP, Desenhahia, AF Santa Catarina, AF Rio de Janeiro, Afeam, AF Goiás, AFRN, APPE, Afal, AFMT, AAFTO, AFAP, Piauí Fomento, AFRR.

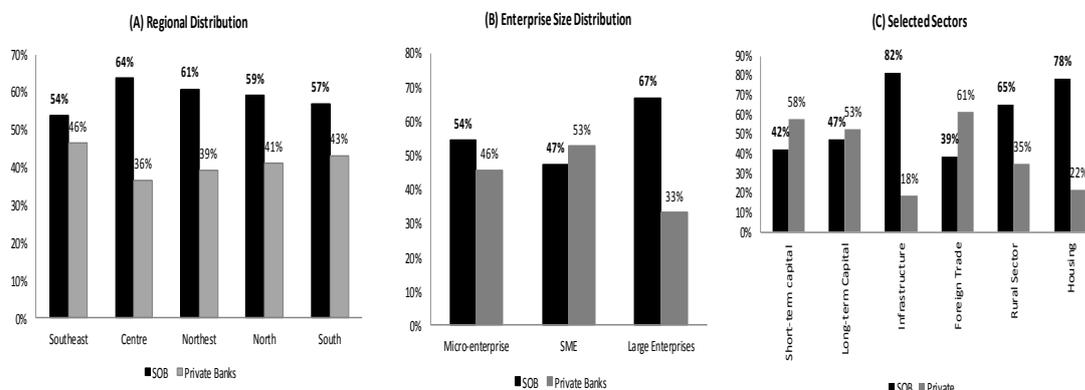
(**) Itaú, Bradesco, Santander, BTG Pactual, HSBC, Safra, Votorantim, Citibank, Credit Suisse, BNP Paribas

(***) At end June 2016: Total Assets = R\$ 8,380 billion (USD 2,265 billion); Credit (Stock of Loans) = R\$ 3,274 billion (USD 1,005 billion); Deposits = R\$ 2,056 billion (USD 555,7 billion)

Some SOBs belong to the central (or federal) government, in part or totally, while others are controlled by the States that constitute the Brazilian Federation. For instance large federal banks such as *Banco do Brasil (BB)* and *Caixa Econômica Federal (CEF)* lead most segments of the BFS alongside with large private banks like *Itaú*, *Unibanco* and *Bradesco*. In addition, BNDES (the national development bank), other federal banks (like Banco do Nordeste and BASA) and state banks perform an important role in credit markets, filling the gap left by private banks that are unwilling to act vigorously because they prefer short-term operations. Figure 2 shows that SOB are responsible for most of the credit supplied to sectors and regions characterized by higher risks and lower returns' prospects, such as: (i) poorer regions in Brazil – Northeast and North; (ii) micro-enterprises; and (iii) sectors that depend on long-term finance – Infrastructure, Housing and Rural. BNDES, the national development bank,

also funds, directly (first floor) or indirectly (second floor), most of the long-term finance to investment projects, in the non-financial private sector¹¹ (World Bank, 2015; Unctad, 2016).

Figure 2 – Stock of Loans in Selected Sectors – Brazil, June 2016 (%)



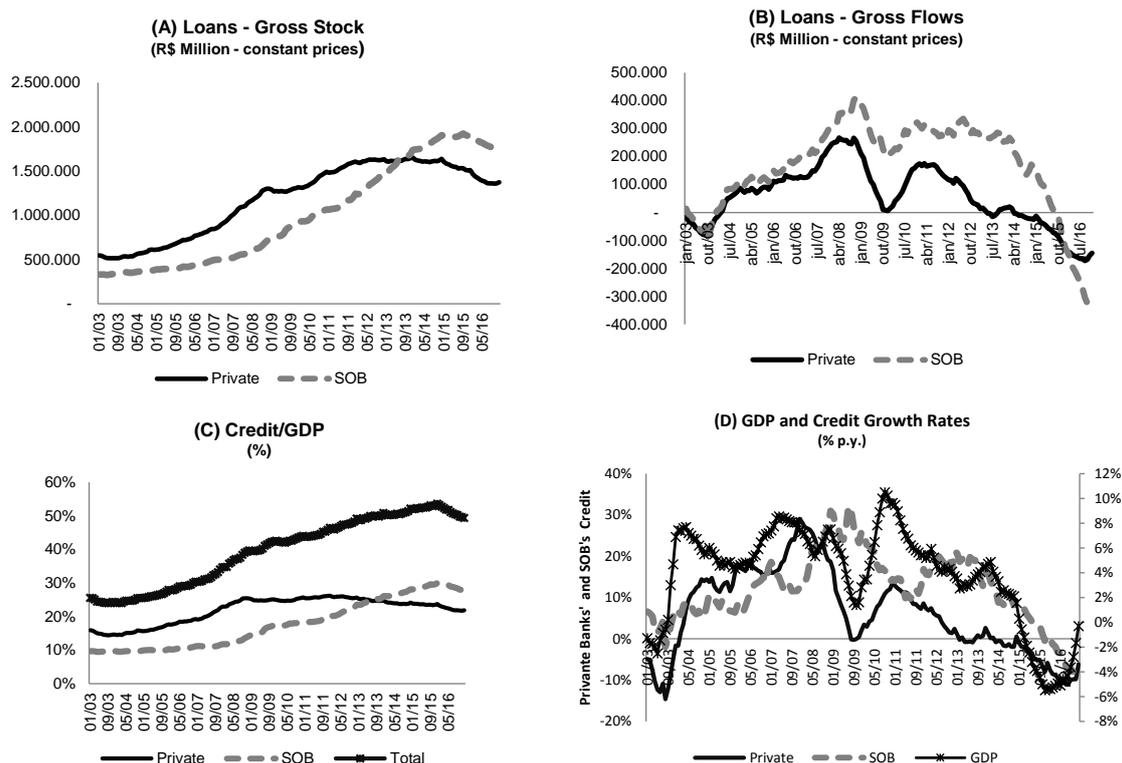
Source: prepared by authors, based on data from Central Bank of Brazil (“IF Data” dataset, access in 20/02/2017).

The evolution of the Brazilian credit supply in the recent years gives the impression that private financial institutions and SOB followed markedly different paths in the aftermath of the GFC.¹² As it can be seen from Figures 1 and 3, while private banks’ credit flow waned, SOB sustained the trend of total loans supply. Thus, the relative shares of private credit and SOB in the total credit supply changed. If in 2003 62% of total loans was originated in private institutions (domestic and foreign), in 2016 this share fell to 45%. Consequently, by the end of this period, the SOB credit had become predominant. It should be noted that this recovery occurred in a period of strong credit expansion: in 2003, the credit/GDP ratio was 21.4%; in 2015, it reached its peak, 54.0%; later to drop to 50.0% in 2016.

Figure 3 –Credit Market and GDP in Brazil, 2003-2016 (%)

¹¹ The World Bank (2015) states that “Brazil’s development bank BNDES has historically played a major role in providing long-term finance through directed lending ... (it) has provided extensive financing for large-scale investments in physical and social infrastructure whose social returns may not be fully internalized by private investors” (p. 36). There is more relevant evidence, and discussion, in Rezende (2015) and Unctad (2016).

¹² “While private sector banks in Brazil and elsewhere contracted lending and loan maturities in the aftermath of the financial crisis, Brazil used its government banks, including BNDES, to play a countercyclical role. The share of credit extended by Brazil’s government banks rose from 13 to 18 percent of gross domestic product between September 2008 and 2009. Thanks to a generous capital injection by the government (R\$100 billion in 2009), BNDES was able to extend special credit facilities with maturities of more than one year at substantially discounted interest rates and increased lending, from R\$160 billion (at 2005 prices) in Q4 2008 to R\$277 billion in Q4 2009. The reference interest rate for long-term loans was set at 6 percent, which was 7.5 percentage points below the market rate” (World Bank, 2015, p. 36).



Source: prepared by authors, based on data from Central Bank of Brazil and IBGE, access in 10/03/2017.

Recent literature (Micco and Panizza, 2006; Demirgüç-Kunt and Huizinga, 2012; Thibaut, 2012; Cull and Martinez Peria, 2012; World Bank, 2012; Ollioqui, 2013; Unctad, 2016) points out that although employing different empirical methodologies, the SOB's credit has the potential to act countercyclically, enhancing the monetary policy by the Central Bank. Oliveira (2010, 2014), Correa *et al.* (2010), Araújo (2012), World Bank (2012), Lawrence (2013), Bonomo *et al.* (2015), Coleman and Feler (2015) and Rezende (2015) have studied the stabilizing role of SOB in Brazil. Usually, this literature¹³ employs descriptive statistics, as expressed in Figures 1 and 3, to compare variations in credit supply (SOB and private) and activity level. Therefore, further research to seek additional evidence, exploring different econometric methodologies, as in this chapter, can be of help.

3.2 Evidence from the Markovian-Switching Dynamic Regression

To test the hypothesis that the SOB's credit can, indeed, act countercyclically and, thereby, mitigate the recessionary impact of a financial crisis, we applied MS-DR (Markovian-Switching Dynamic Regression) and VEC (Vector Error Correction) models. The first one focuses on the endogenous structural breaks suffered by time series in their average and variance, being useful to deal with parameters' non-linearity, identifying breakpoints and regime switching as well as permanence period and transition probability (Quandt, 1972; Goldfeld and Quandt, 1973; Doornik, 2013).

¹³ Exceptions in this regard are Oliveira (2010, 2014) and Bonomo *et al.* (2014). These studies apply different econometric techniques to assess the impact of SOB's credit in non-financial firms' investment decisions. The countercyclical role and the comparison between the private banks' and SOB's credit do not represent their main research goal. On the other hand, Coleman and Feler (2015) found econometric evidence that SOB acted countercyclically. They suggested that SOB's credit created inefficiencies in the economy.

We have also estimated two vector error correction models (VEC) to evaluate the interactions of co-integrated variables, keeping all of them endogenous and without imposing a priori definitions about causality order. On one hand, the conclusions of the VEC model show a more structural character than the MS-DR. On the other hand, there is an opportunity cost: the information about regimes is lost.

According to Doornik (2013), the number of regimes in each model is arbitrary, nevertheless, any simple switching regime model should have:

$$y_t = \mu(0) + \rho y_{t-1} + \epsilon_t \quad (1)$$

$$y_t = \mu(1) + \rho y_{t-1} + \epsilon_t \quad (2)$$

Where: $\epsilon_t \sim N[0, \sigma^2]$, being (1) Regime 0, and (2) Regime 1. Hamilton (1994) specifies the MS-DR model follows:

$$y_t = \mu_{st} + \epsilon_t, \quad \epsilon_t \sim IID(0; \sigma^2) \quad (3)$$

Equation (3) demonstrates that the data generating process of the MS-DR model is influenced by the intercept μ , which changes due to the regime. The model allows an endogenous estimation of the transition probabilities between the “S” non-observed regimes that follow a Markov chain. The probability of reaching regime S_t depends only of the past regime, i. e., S_{t-1} (Doornik, 2013).

On our first exercise, we estimated MS-DR models for the accumulated variation in a 12-month period for the credit supplied by the private and by State-owned banks. Following Doornik (2013), we opted to work with this class of MS models due to the volatile character of the series and because of our rather large sample size. Following Hamilton’s (1990) suggestion to choose the number of regimes by visually observing the movement of a variable, we considered best to employ two or three regimes to conserve an adequate economic explanation. We also estimated a MS-DR model for the Volatility Index (VIX) as it is the most common proxy variable for the global financial cycle (Nier et al., 2014; Rey, 2013).

In our exercise, the MS-DR estimation perform a similar role to descriptive statistics by showing the co-movement between private and by State-owned banks’ credit flows and the relationship of each one with the global financial cycle – using a monthly sample from 1996 to 2014.¹⁴ Each series suffered monotonic transformation by natural logarithm and seasonal adjustment. In the following table, we expose the description of the three variables.

Table 2 – Description of the Variables

Variable	Name	Description
Global Financial Cycle	VIX	Volatility Index – Monthly average.
Private Credit Supply* (flows)	PRIV	Twelve months accumulated variation from credit operations to private sector by private banks.
State-owned banks Credit* Supply (flows)	SOB	Twelve months accumulated variation from credit operations to private sector by State-owned banks
Source: Central bank of Brazil (BCB); Chicago Board Options Exchange Market (CBOE), access in 15/01/2017). (*) Figure 2 depicts the evolution of the original time series: stock of loans from private and SOB (panel A); while panel B is the twelve months accumulated flows of loans, being this calculated from the monthly variation of the stock of loans.		

We selected the models by the non-rejection of the null hypothesis of homoscedasticity and autocorrelation criteria, as well as the minimization of the

¹⁴ The selection of the time sample is explained by the needs of the VEC model estimation, exposed in the next section. The beginning of the sample was chosen because of the availability of the data about credit supply. We did not employ the data since 2015 because the unstable behavior of Brazilian economy generates residuals that do not fit conditions such as homoscedasticity, normality and absence of autocorrelation.

information criteria. In addition, we opted for estimations with less non-significant parameters, adding them only if this decision was able to improve the quality of the residuals. Regarding the number of regimes, the estimation of the global financial cycle and of private banks' credit supply MS-DR models pointed out three regimes, while the estimation of the State-owned banks' showed two regimes. The selected estimations rejected the null hypothesis of linearity, considering 95% of confidence.

The table below presents the transition matrices for each estimated model. We show, in the first place, that each estimated regime is persistent. Secondly, VIX's higher volatility implies its regimes are less persistent than those of SOB and PRIV.

Table 3 – Transition Matrices of the MS-DR - VIX, SOB and PRIV – 1996-2014

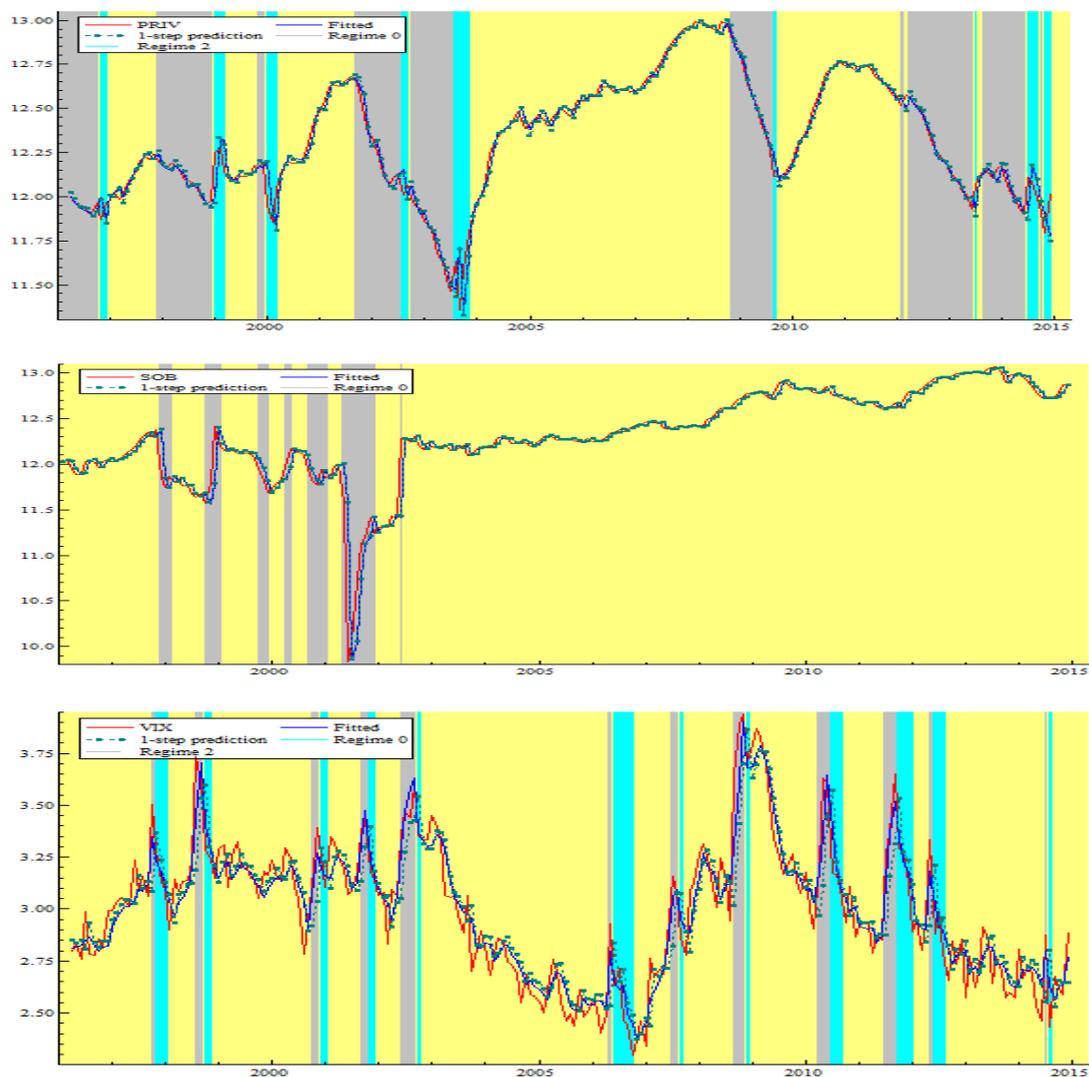
PRIV - MS(3)-DR(3)	Regime 0, t	Regime 1, t	Regime 2, t
Regime 0, t+1 (Low)	86,09%	5,18%	17,91%
Regime 1, t+1 (High)	0,00%	94,82%	21,27%
Regime 2, t+1 (Medium)	13,92%	0,00%	60,81%
SOB - MS(2)-DR(1)	Regime 0, t	Regime 1, t	
Regime 0, t+1 (Low)	74,88%	2,26%	
Regime 1, t+1 (High)	25,12%	97,75%	
VIX - MS(3)-DR(3)	Regime 0, t	Regime 1, t	Regime 2, t
Regime 0, t+1 (Medium)	58,11%	0,00%	50,40%
Regime 1, t+1 (High)	41,89%	89,59%	0,00%
Regime 2, t+1 (Low)	0,00%	10,41%	49,60%

Source: Own construction.

First, table 3 shows that the global financial cycle presents the less persistence in the low regime in comparison with Brazilian credit supply. We interpret this outcome as a result of the strong resistance in Brazil, particularly from private banks, to offer credit, even in periods of larger global liquidity. Additionally, the credit supply data shows a difference between the State-owned Banks' and the private sector. Thus, the larger persistence of the State-owned banks' credit supply in the high regime can be associated with its counter-cyclical behavior and its growth during the period.

Regarding the regimes' composition, it is important to note the acceleration of the credit market was a trend in Brazil and in the rest of the world. Thus, the three variables are in the high regime during most of the period. In Brazil, on the other hand, the private banks' credit supply presents the high regime of shorter participation in comparison with the other series. If, on one side, it could be argued that this means that Brazilian financial system had little exposition to the negative consequences of the 2007/08 GFC; on the other side, in turn, it can be said that it implies that the Brazilian private banks resist offering credit even when there is great global liquidity. In addition, the State-owned banks' credit supply shows a strong growth trend since the end of 2002, keeping its position in the high regime during the Great Recession, which explains its counter-cyclical behavior during this period. Figure 4 shows the regimes for each variable.

Figure 4 – Adjustment of MS(3)-DR model to regimes - VIX, SOB and PRIV – 2004-2015



Source: Own construction.

We can see that private banks present a pro-cyclical behavior during the observed period. Thus, the private banks' credit supply switches to low regimes almost in the same time of the reversal of global financial cycle, characterized here by the transition to a low regime. Regarding the State-owned banks' credit supply, we need discuss its evolution in two different periods: (i) in the complete period, from 1996 to 2014, SOB acted pro-cyclically, keeping its position in high regime even before the GFC; (ii) however, after the GFC, State-owned banks' credit supply presents a counter-cyclical behavior as the private credit supply fell.

The persistence of high SOB's regime is usually seen from two opposing perspectives. One praises it as a countercyclical action against the fall of the private credit supply; the other criticizes it as excessive activism aimed at sustaining artificially the pace of growth achieved with the commodities' boom. In between, there is a third view that considers the greater amount of public credit offered as a result of a market dispute between federal commercial banks (such as Banco do Brasil and Caixa Federal) in a context of credit rationing by private banks.

3.3 Further evidence from the VEC model

In this section, we complement our previous exercise by estimating two vector error correction models (VEC) to evaluate the interactions of co-integrated variables, keeping all the variables as endogenous and without imposing a priori definitions about causality order. Considering the VEC model with more than two variables, it is presented the VEC general formulation for “n” variables:

$$\Delta y_t = \beta_0 + \sum_{i=1}^n \beta_i \Delta y_{t-1} + \alpha \theta^1 y_t + u_t \quad (4)$$

Where y_t is the variables vector, β_0 the intercept vector, β_i the parameters vectors associated to the models' variables, α the error correction vector, $\theta^1 y_t$ the cointegration vector, and u_t the residuals vector. In this sense, the equation above combines short (autoregressive vectors) and long-term (cointegration vector) relationships. The stability of the model can be observed through the inverse roots of the autoregressive polynomial. The model is considered stable when it does not present roots out of the unitary circle.

Here, we employed the same data sample from last section, but with some changes: the twelve months accumulated gross domestic product (GDP) and the benchmark interest rate (SELIC)¹⁵ are added; in addition, we estimated STAMP univariate structural models to control the level breaks and outliers of each variable. The selected period in the second model is based on the level breakpoints of the global financial cycle's proxy variable (VIX), which presented one level break in September 2008.

As we mentioned in the Introduction, we are interested in the behavior of private banks' and SOBs' credit supply in relation to domestic economic activity, being the global financial cycle and the benchmark interest rate included as control variable. Our estimations will be presented in two ways, using, respectively, the private banks' and the SOBs' credit supply as dependent variable. A positive sign from GDP means that the type of credit is behaving procyclically, while a negative sign implies a countercyclical behavior. Since the high level of the VIX is a proxy to the declining period of the global financial cycle, its sign in relation to the credit supply has the inverse meaning that is: positive means countercyclical behavior, and negative a procyclical one.

The first VEC model comprises the monthly period from 1996 to 2014, while the second one starts at 2008 September due the breakpoint level of the global financial cycle's proxy. These exercises are able to show how each type of credit supply behaves in the long period as well whether this behavior changed after the Global Financial Crisis.

Starting with the identification of the first VEC model, we tested the existence of unit root for our five variables. Using EViews and Stata, ADF (Augmented Dickey-Fuller), KPSS (Kwiatkowski-Phillips-Schmidt-Shin), PP (Phillips-Perron) tests, as well as other centered on breakpoints tests such as ADF (breakpoint version) and ZA (Zivot-Andrews) were applied. Most of the series had unit root in at least one test, considering 95% degree of confidence. Thus, this allowed us to model the variables in an econometric structure based on VEC model (Johansen and Juselius, 1990). Nevertheless, even having any stationary series, according to Campbell and Perron (1991), when a co-integrated process between two non-stationary series is attained,

¹⁵ These series were extracted from the Time Series Database of the Central Bank of Brazil (BCB), access in 15/05/2017.

adding a stationary series in the VEC model does not lead to significant changes in the robustness of the regression.¹⁶

Table 4 – Information Criteria, residual autocorrelation and heteroskedasticity test – 1996-2014

Lag	2		3		4		5	
	AIC	SBC	AIC	SBC	AIC	SBC	AIC	SBC
	-16,9107	-15,9086	-16,8355	-15,4495	-16,7727	-15,0004	-16,6965	-14,53535

LM Autocorrelation Test								
Lag	LM-Stat	p-value	LM-Stat	p-value	LM-Stat	p-value	LM-Stat	p-value
1	28,7348	0,2752	27,9432	0,3105	29,1679	0,2570	24,1385	0,5114
2	29,7094	0,2354	28,8252	0,2713	35,5082	0,0794	22,1864	0,6250
3	29,4803	0,2443	33,3283	0,1231	19,8519	0,7546	25,6691	0,4254
4	25,8739	0,4144	27,3764	0,3373	28,9475	0,2661	33,3840	0,1217
5	34,8286	0,0914	27,9379	0,3107	32,6112	0,1411	24,7806	0,4747
6	17,9430	0,8448	17,1178	0,8775	18,0622	0,8397	14,6417	0,9494

White Heteroskedasticity Test				
Lag	2	3	4	5
	0,0002	0,0095	0,1819	0,1473

Source: own construction.

Next, we determine the appropriate lag structure, i.e. the number of lags required to capture the dynamic interrelations in the VEC model. Here attention is given to the information criteria of Akaike (AIC) and Schwarz (SBC), as well as to the behavior of residues. We started from a minimum number of lags equal to 2, since it is the minimum quantity to reach complex roots in this system of equations.

The table 4 results showed, first, that regarding the information criteria, the SBC and the AIC presented the estimation structure with two lags as being most adequate. However, the estimation based on two lags had residual heteroscedasticity, considering a degree of confidence at 95%. To correct this, we estimated a VEC (4), which presented white noise residuals, considering a degree of confidence at 95%. The Johansen test is estimated to delimitate the existence and the number of co-integrated equations.

Table 5 - Johansen Cointegration Test - VEC (4) – 2008-2014

Number of Equations	Trace Statistic	Critical Value - 5%	Maximum-Eigenvalue Statistic	Critical Value - 5%
None	112,7111	88,8038	51,0958	38,3310
At most 1	61,6154	63,8761	39,0523	32,1183
At most 2	22,5631	42,9153	10,8461	25,8232
At most 3	11,7170	25,8721	7,4482	19,3870

¹⁶ Campbell and Perron (1991) discuss the concept of co-integrated vector and sustain that: “Second, definition 1 does not require that each of the individual series be integrated of order one; some or all series can be trend-stationary. In this respect definition 1 differs from the definition given in Engle and Granger (1987)” (p. 165). In addition, according to Johansen (1988), a vector X_t with k elements is considered as $I(1)$ if this vector X_t is non-stationary and ΔX_t is stationary. Thus, if the linear combination $\beta'X_t$ is stationary, the system is co-integrated. This definition contains the co-integration concept of Engle-Granger, but establishes the possibility of some elements of X_t being defined as $I(0)$.

At most 4	4,2688	12,5180	4,2688	12,5180
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Obs: When the calculated statistic is higher than the critical value, we reject the null hypothesis of absence of cointegration.

Source: own construction

VEC (4) model presents at least one or two co-integration equation by the trace and maximum-eigenvalue criteria respectively, considering a confidence level at 95%. According to Dickey et al. (2007), if there are relations of co-integration between the variables, the system of equations becomes more stable; therefore, the estimated system is stationary in a set of possible directions. From that conclusion, we decide to estimate a VEC (4) with one co-integration vector. Based on the estimated co-integration vector, it is possible to write the long-run equilibrium equation and interpret each of the parameters X_i from the following tables:

Table 6 - Co-integrated Vector – Reparameterized Equation - 1996-2014

Dependent Variable: State-Owned Banks' Credit Supply (SOB)		
Variable	Coefficient	t-Statistics
PIB*	0,193645	-5,04290
SELIC*	-0,521728	2,60165
PRIV*	-0,593841	4,94909
VIX	0,130927	-1,29494
Trend*	-0,018672	3,61812
C	-7,932218	

Source: Own estimation. * Statistically significant at 5% level.

Table 7 - Co-integrated Vector – Reparameterized Equation - 1996-2014

Dependent Variable: Private Banks' Credit Supply (PRIV)		
Variable	Coefficient	t-Statistics
PIB*	0,32609	-4,64559
SELIC*	-0,87857	2,5371
SOB*	-1,68395	5,60100
VIX	0,22048	-1,3956
Trend*	-0,03144	3,6259
C	-13,3575	

Source: Own estimation. * Statistically significant at 5% level.

In the tables 6 and 7, we can see, first, that, except for the global financial cycle, all the variables are statistically significant, considering a 95% degree of confidence. The benchmark interest rate, as expected, showed a negative sign in face of both types of credit supply. In addition, private banks' and SOB's credit supply presented a pro-cyclical behavior. One interesting result is the mutually positive sign presented by both kinds of credit supply that can be understood as a crowding-out effect of SOB's credit supply over the private banks. On the other hand, it is also possible that SOB's credit supply must increase to mitigate a reduction in private banks' credit supply.

Passing to the second VEC model, we executed the same unit roots tests and verified that most of the series had unit root in at least one test, considering 95% degree of confidence. Next, we determined the number of lags by the information criteria of

Akaike (AIC) and Schwarz (SBC) as well as the behavior of residues. As presented by table 8, the VEC (2) is the most adequate according to the SBC and the AIC criteria. In addition, this structure showed white noise residuals, considering a degree of confidence at 95%.

Table 8 – Information Criteria, residual autocorrelation and heteroskedasticity test – 2008-2014

Lag	2		3		4		5	
	AIC	SBC	AIC	SBC	AIC	SBC	AIC	SBC
	-18,2998	-16,276	-18,3853	-15,5946	-18,0482	-14,4907	-17,8488	-13,5246

LM Autocorrelation Test								
Lag	LM-Stat	p-value	LM-Stat	p-value	LM-Stat	p-value	LM-Stat	p-value
1	21,98195	0,6368	14,06232	0,9606	19,20250	0,7873	26,68701	0,3717
2	32,20101	0,1523	15,68896	0,9238	19,24293	0,7853	13,82391	0,9647
3	35,10069	0,0864	30,05371	0,2223	23,92040	0,5240	23,29257	0,5605
4	22,66557	0,5971	15,03741	0,9405	34,26412	0,1024	54,39704	0,0006
5	18,62591	0,8147	18,13374	0,8367	15,62626	0,9255	51,06870	0,0016
6	22,76936	0,591	16,47639	0,8999	17,80963	0,8504	15,34064	0,9331

White Heteroskedasticity Test				
Lag	2	3	4	5
	0,1569	0,0257	0,1677	0,4027

Source: own construction.

According to the Johansen test, showed in table 9, VEC (2) model presents at least two or one co-integration equation by the trace and maximum-eigenvalue criteria respectively, considering a confidence level at 95%. From that conclusion, we decide to estimate a VEC (2) with one co-integration vector.

Table 9 - Johansen Cointegration Test - VEC (2) – 2008-2014

Number of Equations	Trace Statistic	Critical Value - 5%	Maximum-Eigenvalue Statistic	Critical Value - 5%
None	102,8680	88,8038	38,9681	38,3310
At most 1	63,8999	63,8761	23,6874	32,1183
At most 2	40,2125	42,9153	21,5138	25,8232
At most 3	18,6987	25,8721	15,1393	19,3870
At most 4	3,5594	12,5180	3,5594	12,5180

Obs: When the calculated statistic is higher than the critical value, we reject the null hypothesis of absence of cointegration.

Source: own construction

In the tables 10 and 11, we can observe that all the variables are statistically significant, considering a 95% degree of confidence. In the case of the State-owned banks, there is a change of the behavior in face of the GDP. Thus, after the Global Financial Crisis, SOB's credit supply started to act counter-cyclically. Regarding the private credit supply, the sign of the GDP is opposed to State-owned banks' credit, presenting the same procyclical behavior of the first VEC model. Additionally, both kinds of credit supply present a mutually positive sign, which could be implied as

meaning that the increase of the State-owned banks' supply tended to boost greater credit offer from the private sector.

The signs of global financial cycle's proxy are counter-intuitive, with the SOB's credit supply presenting a pro-cyclical behavior, and the private banks showing a counter-cyclical. However, this result is very sensitive to changes in the VEC estimation, being the opposite in case of different treatments to the series or if the estimation starts one month after. The same problem was observed in the benchmark interest rate, presenting a negative sign, as expected, in face of the SOB's credit supply, and a counter-intuitive sign to the private banks. In this case, it can be explained by the context of credit rationing by private banks, which were resisting the reduction of the central bank's interest rate between 2012 and 2014.

Table 10 - Co-integrated Vector – Reparameterized Equation - 2008-2014

Dependent Variable: State-Owned Banks' Credit Supply (SOB)			
Variable	Coefficient	t-Statistics	
PIB*	-3,109963	4,87886	
SELIC*	-1,310424	4,39660	
PRIV*	1,972780	-3,95067	
VIX*	-0,678393	2,51732	
Trend*	0,35043	-4,63579	
C	436,523		

Source: Own estimation. * Statistically significant at 5% level.

Table 11 - Co-integrated Vector – Reparameterized Equation - 2008-2014

Dependent Variable: Private Banks' Credit Supply (PRIV)			
Variable	Coefficient	t-Statistics	
PIB*	1,57644	-10,2927	
SELIC*	0,66425	-3,3231	
SOB*	0,50690	-2,0284	
VIX*	0,34388	-2,0257	
Trend*	-0,17763	13,2110	
C	-221,2733		

Source: Own estimation. * Statistically significant at 5% level.

Regarding the relationship with the activity level after the Global Financial Crisis, the result confirms what was advanced by Correa *et al.* (2010), World Bank (2012), Lourenço (2013), Costa (2015), Rezende (2015) and Unctad (2016). These studies, using descriptive statistics, already signaled the countercyclical behavior of the credit provided by the Brazilian SOB in the recent past. Thus, it is possible to stress that SOB's credit was less sensitive to business cycles (Thibaut, 2012). Furthermore, as it is possible to verify, as in Table 10, that the SOBs' credit supply behaves countercyclically in the period after the GFC. An outcome pushed forward conscientiously by the central government (World Bank, 2012; Ministério da Fazenda, 2014; Ferrari Filho *et al.*, 2014, Banco Central do Brasil, 2014). Thus, it can be stressed rather firmly that SOB's credit was used as an instrument to stabilize the business cycle, since it helped to smooth the volatility of the economy.

Literature not focused only on the Brazilian case, for instance, Micco and Panizza (2006), Bertay et al. (2012), Thibaut (2012), and Cull et al. (2012), also reached similar conclusions to ours, mainly that private banks and SOB followed different paths during financial crises. Particularly, along the GR, when while private banks in Brazil were trying to reduce their risk exposure, becoming more selective when granting credit, SOB adopted less safe positions. In this way, they ended up sustaining the growth of total credit. In other words, SOB's credit in Brazil did not fall with the outburst of the crisis of 2008, as was the case with private credit (Micco and Panizza, 2006).

4. Concluding Remarks

This article has the main objective of evaluating if SOB acted with the focus of stabilizing credit supply in Brazil during the GR. According to the literature reviewed, private banks act in a procyclical manner. This kind of behavior intensifies real and financial euphoria, but it can also aggravate a fall in the level of output and employment. Furthermore, it can abruptly pass from one to the other. This is why non-mainstream views, particularly post-Keynesians, affirm that State should have the responsibility to act countercyclically through its fiscal, monetary, financial and other tools (Minsky, 1986; Arestis and Sawyer, 2007; Lavoie, 2014; Davidson, 2015).

Regarding SOB, the subject of this study, non-orthodox views make particular emphasis that the financial sector should not be left to itself, especially amid a financial crisis. Some mainstream researchers have recently also acknowledged this conception (Borio, 2012; BIS, 2014). Their work suggests that SOB, besides resolving market failure setbacks, should also act in a countercyclical manner. This is because SOB credit has the capacity of boosting countercyclical monetary policies. In this way, they can compensate a fall in private banks' credit supply (Micco and Panizza, 2006; Bertay et al., 2012; Thibaut, 2012; Cull and Martínez Pería, 2012; World Bank, 2012; Ollioqui, 2013; Unctad, 2016).

In the Brazilian case, Correa *et al.* (2010), Araújo (2012), World Bank (2012), Lourenço (2013), Rezende (2015), among others, evaluated SOB's capacity to stabilize credit supply, paying particular attention to the experience after 2008. In general, these authors employ descriptive statistics, which consists of comparisons of the variation rate in credit supply (both SOB and private banks' credit) in relation to the level of economic activity. In our contribution we apply MS-DR and VEC models to investigate, using monthly data, the behavior of private banks' credit and SOB's credit. We produce evidence that, in fact, SOB's credit behaved in a countercyclical manner during the crisis, whereas private banks' credit predominantly behaved in line with the cycle.

In order to reach our conclusion we have developed two groups of exercises. In the first one, we have estimated MS-DR models for each one of three variables: state-owned banks' credit supply (SOB); private credit supply (PRIV); and global financial cycle (VIX). We find that State-owned and private banks had different behaviors in terms of regime transition, composition and adjustment. The private banks' credit supply switches to low regimes almost in the same time of the reversal of global financial cycle, presenting the high regime of shorter participation in comparison with the other series. Otherwise, the State-owned banks' credit supply shows a strong growth trend, being in the high regime since the end of 2002, keeping the same behavior after the Global Financial Crisis.

To reach more robust conclusions, we have performed a final exercise by estimating two VEC models: the first one considers the full period, from 1996 to 2014;

the second estimation focuses on post-GFC period, starting at the end of 2008. In this case, results converged to the MS-DR model. More specifically we have found that: (i) SOB's credit supply acted countercyclically after the GFC, in spite of its procyclical behavior during the complete period; and (ii) private credit supply moves procyclically in both exercises. Additionally, during the post-GFC period, we have found a positive relationship between SOB's and private banks' credit supply, which suggests that State-owned banks can perform an important role to stimulate private disposition to lend. Our conclusions converge with those presented in recent literature on this topic.

The study of the impact of SOB credit on the economy is a broad, complex and controversial subject. There are still many areas to be researched, particularly those regarding its capacity to promote development and financial stability. Additionally, it also includes the discussion of other crucial issues such as the efficiency of State intervention¹⁷. In this chapter we have just focused on the recent experience of SOB's credit in Brazil during the GFC. We hope to have helped in the understanding of this important matter.

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¹⁷ Regarding the outlines of this debate and evidence that emphasizes the Brazilian case, see, among others, Hermann (2010), Modenesi *et al.* (2012), Oliveira (2014), Bonomo *et al.* (2014), Rezende (2015), World Bank (2012, 2015), Coleman and Feler (2015) and Unctad (2016).

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