Credit and Economic Growth: Evidence from a Panel of Regional Data from the Brazilian Economy in the 2000

ABSTRACT

In this article the relationship between credit and economic growth is approached from a regional point of view. As credit is very unevenly distributed among regions of the country, we will use a simple econometric model to investigate the relationship between credit and GDP, and credit and labor productivity in the 2000s. It is confirmed that the credit for the Southern and Southeastern regions has a greater effect on GDP growth and the growth of labor productivity than for other regions. These effects are also estimated considering the credit via the National Bank for Economic and Social Development (BNDES) and the Constitutional Funds.

KEY WORDS

Credit. Investment. Regional Economic Growth.

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1 – INTRODUCTION

There is a vast empirical literature that associates more credit and financing with higher rates of economic growth. Thus, any process of growth leverage should also record an increase in the activity of financial intermediation in the country or region. In Brazil, the share of total credit to GDP is relatively low, despite showing an increasing trend in recent years. Moreover, given the country's continental dimensions, this participation is relatively low and also very uneven in terms of geographical regions.

Although more recently discussed, the relationship between finance and regional development is still a controversial issue. Until the mid-1970s this was a neglected subject, largely due to the influence of neoclassical growth theory on the studies of regional economy. This theory assumes that capital, labor and flow of information move freely and without costs between regions, so that there would not be expected that the money supply had an important role in the regional development plan. Rodriguez-Fuentes (1996), as Myrdal (1968) and Kaldor (1970) had already highlighted, explains that as the regional units do not have their own monetary authorities, it is assumed that the financial system could only have a direct impact on the regional development by promoting the development of the country as a whole.

The changes in the international financial system since the 1970s have generated more interest in aspects of financial development of the regions. As of the late 1980s, various studies were conducted that focused on such topics as the impact of different interest rates over the regions, inter-regional flows of funds and the regional availability of credit. Studies, mostly with post-Keynesian character (CHICK, 1996, DOW, 1982, 1990, RODRÍGUEZ-FUENTES, 1996), argue that, under imperfect capital mobility, the local banks influence regional development when they affect the local availability of credit. Therefore, the finances would work also indirectly on regional development. Amado (1997) presents an analysis of Keynesian nature of the relationship between financial development and regional development, where the idea that economic development promotes the development of finance seems to overlap.

In terms of Brazil, some studies linking financial development and regional development have been made recently. Castro (2002) found the concentration of financial activity in areas of greater economic development. He studied five metropolitan regions of Brazil (Sao Paulo, Rio de Janeiro, Belo Horizonte, Salvador and Curitiba) during the period 1988-2000, and concluded that the greater the economic dynamism and average labor productivity in the region, the greater its ability to retain deposits and lower preference for liquidity. That would explain why most economically developed regions concentrate most of the financial activity in Brazil.

Reichstul and Lima (2006) analyzed the relationship between bank credit and the level of economic activity in the Metropolitan Region of São Paulo in the period 1992-2003 and found a bi-directional causality. Alexander, Biderman and Lima (2009) evaluated which credit indicators in the states are more positively related to the state growth rate and income convergence among the federal units. The results showed that some credit variables increase the convergence speed. They conclude that the credit variable that best fits this profile is the volume of loans and bills discounted in relation to the total income of the state. According to the authors, the fact that it is possible to find at least one credit variable that influences both growth rate and convergence suggests that a more egalitarian regional credit distribution can improve the regional distribution of income in Brazil.

The purpose of this paper is recognizing the importance of credit in the process of economic growth to provide an empirical analysis and an econometric study on the evolution of credit in terms of geographical regions in the 2000s. The text message is to reinforce the idea that the growth potential of the country and regions could be magnified if the credit conditions, such as volume, distribution and cost were more favorable. Besides this introduction, this article is divided into the following sections: Section 2 presents two interpretations present in the literature on the causality relationship between access to credit and finance and economic growth. Section 3 analyzes empirically the regional and sectoral distribution of credit in Brazil in the 2000s, especially the credit for investment.

In section 4 an econometric analysis is made using panel data to quantify the relationship between credit growth and GDP growth and credit growth and change in labor productivity. The results are presented for each geographic region compared. Finally, there are closing remarks.

2 – THE RELATIONSHIP BETWEEN CREDIT AND GROWTH IN CONTEMPORARY THEORETICAL LITERATURE: TWO ALTERNATIVE APPROACHES

Despite empirical evidence that credit expansion favors economic development, which in turn favors the development of financial sector, growth models in general have in common the low importance given to the conditions of funding as an important factor to trigger the economic growth. One of the first great authors who understood the importance of the financial system in economic development was Schumpeter (1928) by studying the process of innovation. Myrdal (1968), in turn, when describing the process of cumulative circular causation to explain the divergence in the process of economic growth of countries and regions, also recognized the important role that banks have in the development process. For him, banks could exert both a negative role, widening inequalities by transferring savings from poorer regions to wealthier ones, as could also extend the effects of the economic expansion of the more developed center for other regions.

Thus, a central issue in the debate on the role of credit and financial institutions in the process of economic development is to investigate how the relationship between credit expansion and economic growth occurs. Economic growth models are unanimous in pointing out the investment process as a source of expansion of the productive potential over time, for example. (PAGANO,1993). But how does the process begin? From a saving in advance that is made available to investors, or from a savings that is generated during the economic expansion that starts by the action of the investment of entrepreneurs, moved by "animal spirits"? The theoretical arguments to explain how the investment process originates divide much of the literature on the explanation of how access to credit and financing are related to economic growth.

In Keynes' tradition (1964), economic decisions are guided by expectations based on uncertainty and therefore it is reasonable to assume that economic agents increase their preference for liquidity in times of high uncertainty about the future, and vice versa. In this theoretical context, according to post-Keynesians, banks hold the "key" to sustain the growth of market economies, because they can provide the liquidity necessary to carry out investment plans, which by having a long time to mature involve more uncertain expectations. It is assumed, then, that the financial sector plays a crucial role in explaining the operation of monetary production economies, because they can advance funds to the investment process.

In the logic of Keynes (1964), savings, i.e., the supply of resources, differently from what conventional theory assumes, would not have the power to limit the investment process, which in a closed monetary economy would be financed by commercial banks. By definition, investment, once made, generates a volume of savings in return, which ex-post, is equal to investment.

In analytical terms, the theory of Keynes (1964) develops the circuit "finance-investment-saving-funding" to explain how the process unfolds for financing the investment process in a money economy[1]. It is assumed that the initial resources for the investment stem from money creation by banks. So the banks, not savers are critical in determining the supply of resources to finance investment. When making the investment, the multiplier process of demand generates the expansion of income and therefore the aggregate savings. This expansion of savings should ideally be channeled into the financial sector, restoring the liquidity that was anticipated to give impetus to the beginning of the investment. The "finance-investment-saving-funding" mechanism describes thus how the initial loan that boosts investment, the 'finance', becomes 'funding'. However, this transformation of 'finance' in 'funding' is not automatic and depends on the compatibility of periods and interest rates by banks, creating a risk for borrowers and lenders. (STUDART, 1993). A schematic of the circuit finance funding can be seen in Figure 1.

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1 The term monetary economy refers to an economy where money is not neutral both in the short and long term
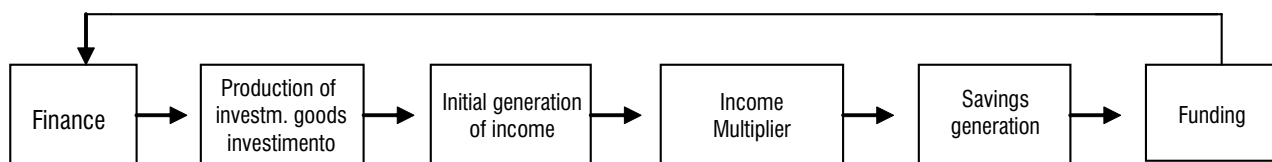
Figure 1 – Circuit Finance-Funding
Source: Prepared by the authors from Resende (2007).

Accepting the operation of the circuit 'finance-funding' and the secondary role of savings in the economic development process involves placing emphasis on the degree of financial market development to explain the dynamics of growth. A more appropriate financial sector to the placement of long-term bonds will reduce the financial vulnerability of investors and provide, in aggregate terms, a more favorable environment for economic development. The less developed the financial markets, the greater the uncertainty regarding the long-term investment, thus affecting the growth potential of economies.

Under this interpretation, one could argue that the increase of liquidity in poorer areas can help reduce economic disparities. Amado (1997) shows that the cumulative process of economic inequality can be broken through the acting of government policies on the financial structure of the regions. According to the author, in areas of less economic dynamism, with a poorly developed financial sector, there is greater liquidity preference. One consequence of this increased preference for relative liquidity is that banks located in less dynamic areas lose more reserves than banks that are located in the most dynamic areas. So they lend less and at a higher interest rate, which inhibits investment in fixed capital and makes the economy less dynamic, reinforcing the cycle of increased preference for liquidity and low growth.[2] Following this line of reasoning, the availability of credit and economic growth is directly related, and the more developed the financial system, the greater must be the potential impact of credit on growth.[3]

On the other hand, assuming the existence of saving in advance as a funding source for investment implies assigning banks a passive role in the growth process, i.e., a mere intermediary role of savings past and present. Chick (1996) characterizes this view as associated with a primitive monetary system, where the distinction between the act of saving and investing theory is not relevant and therefore the financing of investment is directly attributed to individual savings.

The contributions of Gurley and Shaw (1960) offered a new approach to understanding the role of the financial system in economic development, even considering the need for saving in advance to make the investment. For these authors, in addition to the need for saving in advance, is also incorporated the justification for the need for development of financial markets to accelerate economic growth. Basically, the model developed by the authors assumes that the economic system is composed of surplus and deficit agents. Agents have a deficit because they consume more income than they have or because they invest more than they save. As the mobilization of savings among the agents through the mechanism of supply and demand incurs high costs, the model of Gurley and Shaw (1960) suggests the financial intermediation to reduce these costs. From a macroeconomic standpoint, the idea behind this argument is that, through techniques of financial intermediation, it would be possible to increase the levels of aggregate savings and investment, more efficiently allocating scarce resources of capital. In this regard, it is assumed that the economic growth requires and needs the development of the financial system. (DUTRA, FEIJÓ, 2009).

More recently, the development of 'endogenous growth theory' allowed the establishment of an

2 See also Dow (1982), and Dow (1990).

3 Growth models based on the theoretical framework of the neoclassical mainstream, by starting from the assumption of neutrality of money, leave out the study and analysis of the functioning of the financial system, particularly at regional level. In this particular case, it is assumed that the regional systems and financial flows are mere reflections of unequal levels of development between regions. Moreover, in the mainstream tradition, in

addition to little or no relevance to financing conditions, aggregate demand is not considered as an important factor in explaining economic growth.

economic mechanism through which financial development could positively affect the long-term economic growth. This can occur either by increasing the mobilization of savings or by increasing the efficiency of resource allocation. (PAGANO, 1993).

Following Pagano, considering the simple model of endogenous growth AK we have:

$$Y_t = AK_t \tag{2.1}$$

In equation (2.1) Y is real output, A is the average productivity of capital and K is the stock of capital in the economy into consideration. Assuming that the population is constant and that the economy produces a single good that can be consumed or invested and the depreciation rate is δ, gross investment (I) is given by:

$$I_t = K_t + 1 - (1-\delta)\, K_t \tag{2.2}$$

Assuming a closed economy without government in which a fraction of the savings (S) equal to (1-φ) is lost in the financial intermediation process, we have:

$$\varphi S_t = I_t \tag{2.3}$$

The rate of product growth in the long-term balance is given by:

$$g = A(\,I/Y) - \delta = A\varphi s - \delta \tag{2.4}$$

From equation (2.4) it is possible to evaluate the role of financial markets in long-term growth. According to this approach, financial development can positively affect growth, increasing the proportion of savings that are channeled into investment, social productivity of capital and the actual savings rate.

Regarding the mechanism of channeling savings, it should be noted that during the transformation process of savings into investment, the financial markets and intermediaries absorb resources such that a unit saved generates less than one unit invested. A fraction of the savings goes to commercial banks in the form of spread between borrowing rates and loan rates, or to brokerage firms and investment banks in the form of commission on underwriting of shares. This absorption of resources by the financial sector may either reflect the inefficiency of financial institutions or be the result of its market power. Thus, financial development may act to increase

the long-term growth as it corrects the inefficiency of financial institutions and / or to encourage greater competition between these institutions in the process of allocation of resources for investment.

Financial institutions may also act to increase the efficiency in allocating capital. This increased efficiency is given in two ways: (a) through the collection of information for evaluation of alternative investment projects, which contributes to a better selection of projects, (b) through the inducement to invest in riskier but more productive technologies.

Pagano, however, concludes that in a first approach, the relationship between financial development and economic growth tends to be ambiguous from the purely theoretical point of view. Greater access and lower cost of credit reduces the liquidity constraint which part of families undergo, which stimulates consumption, leading to a possible fall in the savings rate. However, a greater financial development can increase efficiency in the allocation of resources for investment, which has a positive impact on long-term growth.

If the development of the financial system can affect the social productivity of capital via credit, then labor productivity is also affected, since a higher level of average productivity of capital makes workers more productive. Therefore, it is possible to establish a relationship between credit growth and increased productivity, which would be a positive externality of credit.

It is inferred from literature that there is a strong and positive correlation between growth and financial development. However, the causality relationship between these elements is controversial. However, regardless of the causality relationship assuming between savings and investment, or financial development and economic growth, there is a consensus in the economic literature that access to credit and the degree of development of the financial system can play a major role in the process of economic development of a country or region. This role is explained both because it is the financial system that provides the necessary funds to finance investment and stimulate consumption, via the investment multiplier (Keynes view), and because the financial system as an intermediary of accumulated savings, helps to improve

the allocation of financial resources of the economy and thereby contributes to raising the productivity of capital (mainstream view).

Following this line of reasoning, the availability of credit and economic growth are directly related, and the more developed the financial system, the greater must be the potential impact of credit growth. As we will see next, when we analyze credit with a regional focus, we still see the Brazilian financial system barely able to boost economic development in less developed regions of the country.

3 – EVOLUTION AND DISTRIBUTION OF CREDIT IN BRAZIL IN THE 2000

The evolution of credit as a percentage of GDP in Brazil can be seen in Figure 1. The credit operations to the public and private sector ranged from 23.8% in March 2003, the lowest percentage in the series, to 45.0% in December 2009, the highest level of the analysis period.

Despite the upward trend, this percentage is still considered low compared with some developed and developing countries, where this percentage reaches 200%.[4] The high real interest rates in Brazil can be considered one of the main causes of low proportion of credit in the country's GDP. Studies show that the liquidity preference of financial institutions is also high concentrating lending in the short term, see, e.g., Romero and Jaime (2010). This implies a greater retention of resources, reduced availability of credit by banks, and lower spending and investment by the public and entrepreneurs. When the liquidity preference is low, less retention of resources generates more liquid assets, higher level of credit, investment and dynamism.[5]

With credit growth in recent years, all sectors of activity increased their amount of credit against the GDP. However, the segment of credit to individuals had an outstanding performance in the sense of having been the most expanded. Torres (2010b) shows that the balance

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[4] It exceeded 200% in the U.S. and 100% in China. (WORLD BANK, 2010).

[5] One should also remember that in Brazil there is one more problem, which is the low access to credit. There is a large contingent of people who are excluded from the market economy and financial system, either because of the low level of education, or by exclusion from the formal labor market.

of loans to individuals increased from 5.6% of GDP in March 2004 to 14.9% at the end of 2009. This means that during this period, credit to individuals responded alone for nearly half of the total increase in bank credit in Brazil. In industry, one of the most dynamic sectors, credit growth was not as impressive. Between 2004 and 2009, the industrial credit rose from 6.2% to 9.8% of GDP. The credit for housing was a very small share, from 1.4% to 1.9% of GDP between March 2004 and September 2008. One factor alone that contributed to credit growth in recent years has been the fall in interest rates: by the end of 2007 the annual interest rates charged showed a strong downward trend, from 45% per year between 2004 and 2006 to less than 35% per year, in late 2007. However, this trend was reversed in 2008, when rates rose again, ending the year above 40% per year, to fall back after the international financial crisis. (CENTRAL BANK OF BRAZIL, 2010).

The expansion of credit to individuals was due to higher payroll credit, directed primarily to public employees and beneficiaries of Social Security. In addition to easier access to credit by the population, the average term of loans to individuals and also to legal entities increased. The average term of loans to both individuals and for corporations in January 2004 was 222 calendar days and in December 2008 it went to 379 days.
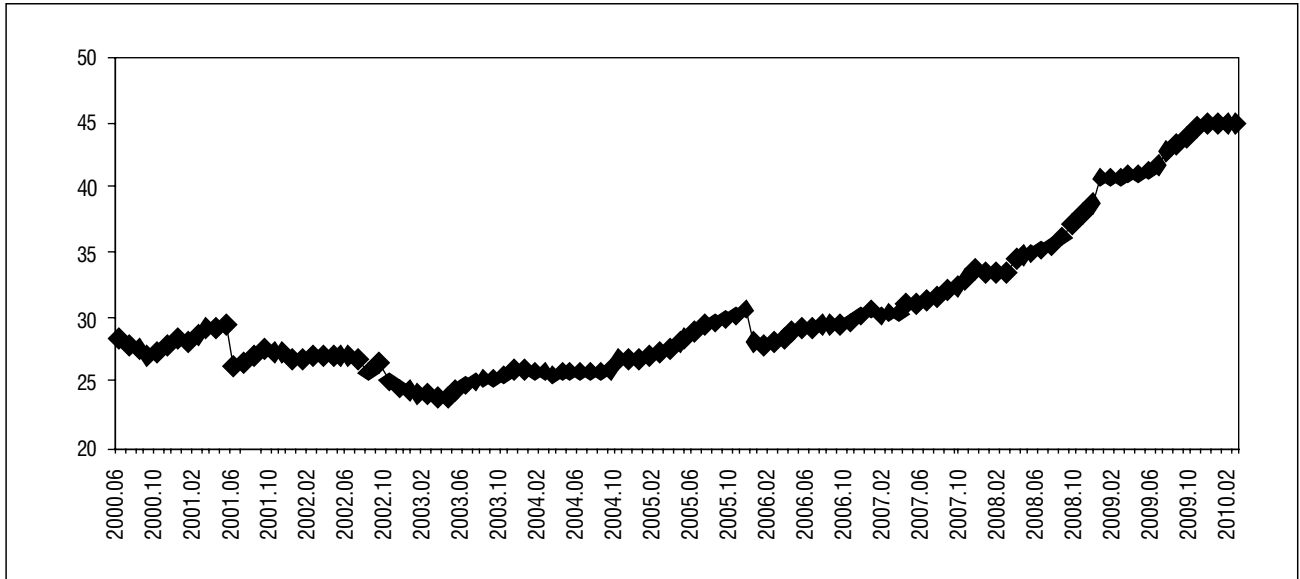
Table 1 shows the evolution of the participation of sectors in total credit operations. The share of lending to individuals has almost doubled. The sectors of industry and housing lost share in the credit, while the rural sectors and trade kept their share. Credit to the public sector follows a downward trend, with their participation falling from 4.8% in 2000 to 1.9% in 2008.

Figure 2 shows the distribution of credit as a percentage of GDP in the regions, as from 2004 when the Central Bank of Brazil began to publish the data series of the balances of loans at the regional level. The northern region has the lowest percentage, being in 2008 equal to 21.6%, followed by the Northeast with 24.2%. Interestingly, the Southeast region, with 32.1% of total credit in the country in 2008, appears below the Midwest and South with 32.9% and 36.6% respectively.

Table 2 shows the involvement of regions in the balance of credit operations of the National Financial

Graph 1 – Credit Operations (% of GDP) – 2000-2009

Source: Prepared by the authors themselves based on IPEA data (2010).

System from January 2004 to December 2009, illustrating the uneven dynamics evolution of credit between regions of the country. There is little variation in total between the participation of the regions and the large increase in the participation of individuals in total credit, as already noted in Table 1. Thus, while the total expansion in nominal terms, from January 2004 to December 2009 was 251.6%, the expansion of credit to individuals stood at 361.8% and 202.9% for legal entities.

The balance of loans from legal entities had its share reduced from 69.3% in Jan/2004 to 59.7% in Dec/2009. The biggest falls in the share of credit to legal entities in total were in the Southeast and South, with a loss of 6.9% and 1.7% respectively. The Northeast region was the only one that managed to keep virtually the same credit share for legal entities during the period.

Figure 3 shows the Theil entropy index (ET)[6] of the balance of loans from states to individuals (PF) and legal entity (PJ). This indicator measures regional inequality for these two types of borrowers. The indicator varies between 0 and 3.3 (in our case). The closer to 0, the higher the concentration. Thus, if the

indicator is increased, it means an improvement in the distribution of credit between regions.[7]

Although the index presents trend of high for legal entities and individuals, indicating decreased concentration, comparing the index for Individuals (PF) and Corporate (PJ), we note that the index for legal entities (PJ) is lower, indicating that the credit for legal entities (PJ) is much more concentrated, confirming that the distribution of credit to business is more concentrated. It was also noted that until the first half of 2008, Theil Entropy (ET) for legal entities was little changed, with further growth thereafter.

3.1 – Credit for Investment: BNDES – National Bank for Economic and Social Development – and Constitutional Funds

The public sector participation in the structure of the financial system in providing long-term resources is quite significant in the Brazilian case. This participation is in part explained by the chronic inflationary process experienced by the Brazilian economy since the post-war until the mid-1990s, which inhibited the supply of long-term domestic private credit in the country. Thus, the National Bank for Economic and Social

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6 The Theil entropy index is given by $ET = \sum_{i}^{n} S_i \ln S_i$, where Si is the share of each region i in total loans, and n is the number of regions. ET varies between 0 and ln (n). In this study, n is equal to 27 federal units [ln (27) = 3.3, thus ET varies between 0 and 3.3].

7 The ET indicator was chosen, instead of the index most widely used Herfindahl-Hirschman Index (HHI), to correct the tendency to overestimate the concentration present in the HHI index.

Table 1 – % Participation of Sectors in Value of SFN – National Financial System – Loans, 2000–2009

Sectors	Public	Private					
Year		Industry	Housing	Rural	Trade	Individuals	Others
2000	4,8	27,3	19,2	8,8	9,5	16,7	13,7
2001	3,3	28,9	10,8	7,9	10,6	22,0	16,5
2002	3,0	30,4	6,8	8,1	10,7	23,1	17,9
2003	3,7	29,4	6,3	10,1	10,5	22,6	17,5
2004	4,0	26,3	5,5	11,2	10,8	25,4	16,8
2005	3,6	23,8	5,0	11	10,8	30,0	15,8
2006	3,0	22,2	4,9	10,7	10,7	32,3	16,3
2007	2,3	22,4	5,0	10,1	10,3	33,6	16,4
2008	1,9	23,3	5,0	9,1	10,3	33,2	17,2
2009	3,2	22,9	5,9	8,3	9,6	32,9	17,2

Source: Prepared by the authors using data from the Central Bank of Brazil (2010).
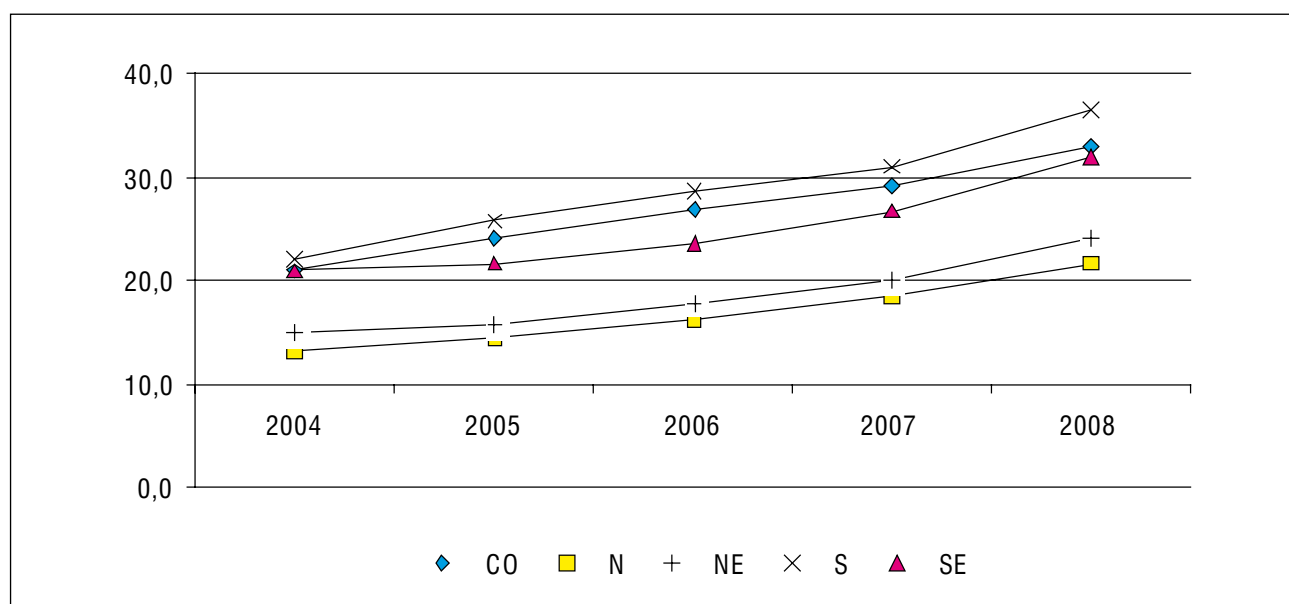
Graph 2 – Credit Operations of the Regions (% of GDP) – 2004–2008
Source: Prepared by the authors using data from the Brazilian Institute of Geography and Statistics (IBGE) and the Central Bank of Brazil (2010).

Development - BNDES, created in the 1950s in order to meet the needs of long-term financing of companies of any size and sector, is today the main source of domestic financing of investment in fixed capital.

The values in Table 3 show the distribution of disbursement of funds from the BNDES, which includes its subsidiaries: the BNDES Participações SA a subsidiary company of the National Bank for Economic and Social Development (BNDESPAR) and the Special Agency for Industrial Financing (FINAME), by regions.

The ordering in the distribution of BNDES funds follows a similar pattern of distribution of total credit of the National Financial System for the regions. (Table 2). However, it is clear that over the decade the North and Northeast regions had a significant increase in participation, reaching 8.2 and 16.2% of BNDES credit respectively. In terms of industries, the top recipients of BNDES resources were the sectors of industry (45.9%) and infrastructure (34.8%). (Table 4).

The BNDES also plays a prominent social role as a major provider of funds for micro, small and medium

Table 2 – % Participation and Value in R$. Million of Balance of Credit Operations of SFN – the National Financial System, SFN, 2004-2009

	NE	N	S	CO	SE	% TOTAL	R$ TOTAL
Jan/04	9,6	3,2	18,9	9,2	59,1	100	357.186
Jan/07	9,9	3,5	19,8	9,9	57	100	626.330
Dec/09	11,6	3,6	18,3	9,3	57,2	100	1.255.824
	NE	**N**	**S**	**CO**	**SE**	**% Legal Entity**	**R$ Legal Entity**
Jan/04	6,5	2,3	11,7	4,6	44,3	69,3	247.678
Jan/07	5,4	1,9	11	4,1	38	60,4	378.493
Dec/09	**6,4**	**1,8**	**10**	**4,2**	**37,4**	**59,7**	**750.107**
	NE	**N**	**S**	**CO**	**SE**	**% Individuals**	**R$ Individuals**
Jan/04	3,1	1	7,2	4,6	14,8	30,7	109.509
Jan/07	4,4	1,6	8,7	5,8	19	39,6	247.836
Dec/09	5,1	1,8	8,3	5,2	19,8	40,3	505.717

Source: Prepared by the authors based on data from the Central Bank of Brazil (2010).
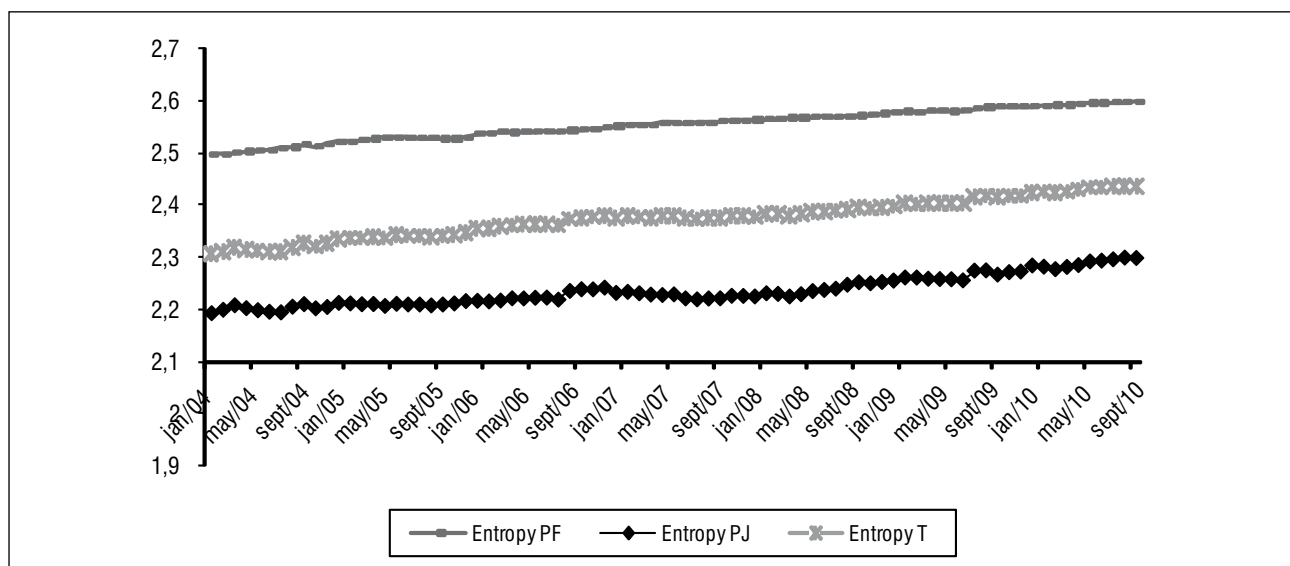
Graph 3 – Evolution of Indicator Concentration of Credit (ET) – 2004–2009
Source: Prepared by the authors from data of the Central Bank of Brazil (2010).

enterprises. According to data from the BNDES (2010), the average distribution of resources by size of the company during the period 2000 to 2009 was 24% for micro, small and medium enterprises and 76% for large companies. Public banks are transfer agents of BNDES funds, especially for micro, small and medium enterprises. Among public sector banks, the Bank of Brazil was the development agent that received the most funds of BNDES for micro, small and medium enterprises. In the Northeast, the BNB and Desenbahia are the most active development agencies. In 2000 the BNB was the second agency in amount of funds received from the BNDES leaving behind only the Bank of Brazil. However, in subsequent years the amounts of disbursements for the BNB have been decreasing year by year especially after 2003. This may be due to substitution of resources from BNDES by resources from the Constitutional Funds[8], which offer lower interest rate than that charged by BNDES. As the BNB is the manager

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8) The Finance Constitional Founds are in North, Center-West and Northeast Region: FNO, FCO end FNE.

of the Constitutional Fund in the Northeast (FNE), then it is assumed that this fund was predominant in BNB in recent years for that size of company.

Table 3 – % Participation in annual BNDES Disbursement by Region and Total in R $ million – 2000–2009

Region/ Year	NE	N	S	CO	SE	TOTAL R$ million
2000	12,1	4	18,5	9	56,4	23.045,80
2001	13,2	3,4	19,1	6,8	57,5	25.216,50
2002	10,1	5	16,3	6,9	61,7	37.419,30
2003	9,3	2,1	20,4	8,4	59,7	33.533,60
2004	6,9	4,9	21,8	13	53,5	39.833,90
2005	8,1	3,4	20,3	7	61,2	46.980,20
2006	9,4	3,2	19,1	7,1	61,2	51.318,00
2007	8,2	5,3	19,7	8,9	57,9	64.891,80
2008	8,4	5,4	19,2	10,9	56,1	90.877,90
2009	16,2	8,2	15,2	7,9	52,6	136.356,40

Source: BNDES (2010).

Table 4 – Average % Participation of Sectors in the BNDES Disbursements, 2000–2009

Sector/	Farming and Cattle-raising	Industry	Trade and Services	Infrastructure
Average	9,6	45,9	9,8	34,8

Source: BNDES (2010).

The Regional Development Bank of Southern Region (BRDE), active in southern Brazil had a significant increase in resources devoted to micro, small and medium enterprises. These resources increased from 81.3 million in 2000 to 663.2 million in 2009. With this the BRDE moved into second place among the funding agencies that received the most funds from the BNDES for this group of companies, behind only the Bank of Brazil. The Southern region also has the Caixa RS, Banco do Estado do Rio Grande do Sul (Banrisul) RS, Development Agency of the State of Santa Catarina (SC BADESC) and Development Agency of Paraná (AFParaná) to foster development in the region. With all these agencies, micro, small and medium enterprises in the South were the one that most received funds from the BNDES through public bank agents.

In summary, the data show that the distribution of credit among regions is very uneven, but that through institutions such as BNDES, the picture is softened. It may be noted that in recent years the North and Northeast have been increasing their share in total credit provided by BNDES.

Another important source of funds for investment are the Constitutional Funds - Constitutional Financing Fund of North (FNO), Constitutional Financing Fund of the Midwest (FCO) and the Constitutional Fund for Financing the Northeast (FNE) – for the North, Midwest and Northeast respectively. These funds were created in 1988 and are formed by a fraction of 3% of the amount of the Tax on Industrialized Products (IPI) and the Income Tax of Legal Entities (IRPJ) collected each year. Of this total, 60% goes to states in the Northeast (and part of Minas Gerais and Espírito Santo), and the remaining 40% is divided equally between the North and Midwest.[9]

Table 5 shows the amount of loans by the Constitutional Funds. Although a considerable amount of resources, these resources do not reach 2% of GDP in each of these regions. A positive point is that the Fund resources are more evenly distributed between the companies regarding size, with an average from 2000 to 2008 equal to 56.8% for micro, small and 43.2% for large companies.

It is important to verify the participation of sectors in the Constitutional Fund resources to know the type of investment that is financed. In Figure 4 we can see that most of the funds went to agriculture despite a downward trend observed.

In the second position, the Funds finance most industry and agribusiness, and in the third position, trade, services and tourism, the latter being those with the highest uptrend. Resources for infrastructure, although a smaller portion, also show an upward trend. It should be noted that the resources for investment in export constant in Figure 4 from 2002 to 2005

9 The administration of funds is made by Superintendencies of regional development currently developing agencies: in the Northeast (ADENE) and in Amazon (ADA) and government financial institutions in the regions, in the Northeast, the Banco do Nordeste do Brasil (BNB), in the Amazon the Bank of Amazônia (BASA), and in the Midwest, the Bank of Brazil (BB). These funds represent an important source for the activation of regional investment.
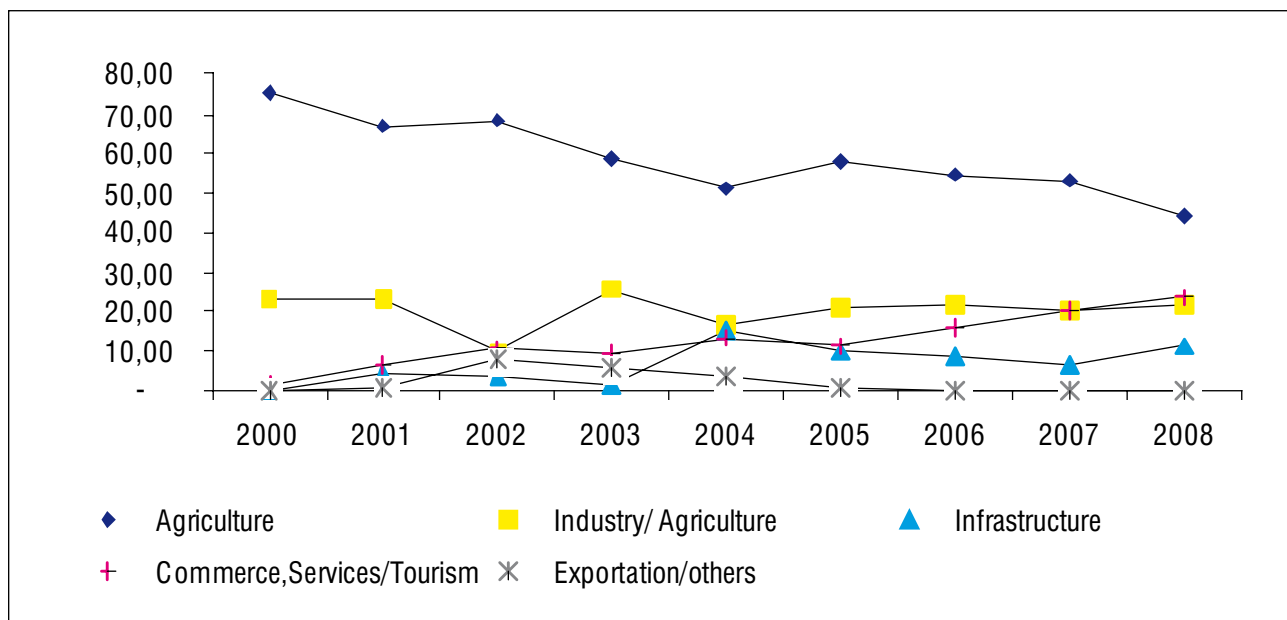
Graph 4 – % Participation of Sectors in Loans made by the Constitutional Funds, 2000–2008
Source: Prepared by authors from Brazil Reports (2010).

were only the FNO funds, and in 2002 19.1% of NOF resources were for exports in the North.[10]

Table 5 – % Participation and Total in R $ Thousand of Regions in Volume of Loans made by the Constitutional Funds, 2000–2008

Year/ Fund	FCO-CO	FNO-N	FNE-NE	FNE-SE*	Total R$ thousand
2000	22,81	43,62	30,46	3,11	1.264.134
2001	56,28	26,21	15,49	2,02	1.753.673
2002	62,61	26,32	9,67	1,40	2.298.738
2003	30,52	35,67	32,47	1,34	3.014.113
2004	20,56	23,17	54,40	1,87	5.702.116
2005	22,18	14,75	58,39	4,67	6.618.338
2006	20,58	14,05	62,11	3,26	7.018.789
2007	26,93	15,14	54,27	3,66	7.330.292
2008	26,30	15,57	54,62	3,51	3.192.225

Source: Prepared by the authors from reports from Brazil (2010).

Note: * In the Southeast FNE only covers the municipalities of ES and MG included in the operating area of the Northeast Development Superintendence (Sudene) and the South region is not receiving any funds cited.

When adding the volume of credit offered through the Constitutional Funds FNO, FNE and FCO with the volume of credit offered by BNDES we have the largest amount of total public credit for investment in the regions.

Table 6 – % Participation in Credit of GDP by Region, 2000–2008

	BNDES Credit					BNDES Credit + Constitutional Funds				
	NE	N	S	CO	SE	NE	N	S	CO	SE
Average	1,7	2,0	2,6	2,3	2,4	2,5	3,0	2,6	3,2	2,4

Source: Prepared by authors from SIG-reports of BNDES from 2000 to 2008 (2010).

Considering BNDES credit alone, we note that the North and Northeast regions have a credit average as a percentage of GDP below the other regions. This average for the period 2000 to 2008 was 1.7% and 2.0% of GDP for the Northeast and North regions, respectively, while for South and Southeast regions was 2.6% and 2.4% respectively. When the credits Funds are added to BNDES credits, the averages pass to 2.5% and 3.0% of GDP for the Northeast and North regions respectively. The highest average was found in the Midwest, 3.2% of

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10 In the case of FNO in other years, and in the case of the FCO and FNE for all years, the resources for export are grouped in their respective sectors.

GDP. The Constitutional Funds enabled the North, Northeast and Midwest to have a volume of credit for investment as a percentage of GDP from public institutions close to that observed in South and Southeast regions.

4 – EXPANSION OF CREDIT AND THE IMPACT ON ECONOMIC GROWTH AND LABOUR PRODUCTIVITY IN REGIONS IN THE YEAR 2000: AN ECONOMETRIC EXERCISE

As discussed in the previous section, the performance of financial institutions in lending influences the pace of economic growth, either directly, as suggested by the theory of Keynes, whether through increased productivity, as suggested by mainstream theory. This section presents an econometric analysis in order to quantify the relationship between credit and economic growth, credit and growth of labor productivity, being the analysis based on data from the federal units. The goal is simply to compare the different regression coefficients across geographic regions, with the aim of showing how the impact of credit on the GDP of each region and on the productivity of each region is different, as a result of unequal distribution of credit in the national territory.

4.1 – Equations to Be Estimated

First, it was observed that the increase in production in each region is associated with an increase of loans in each region using the following specification:

$$Yit = c + \beta Crit + \varepsilon it \qquad (4.1)$$

In equation (4.1) Y is the GDP of each state, c is a constant, Cr is the average balance of loans, β is the parameter to be estimated, ε is the error term.

The specification (4.2) was used to observe if the increase in labor productivity[11] is associated with the

increase in the average balance of loans, Cr. In this specification, R is the labor productivity and α is the parameter to be estimated.

$$Rit= c + \alpha Crit + \varepsilon it \qquad (4.2)$$

4.2 – Presentation of Data and Estimation Method

The estimation method used was regression with panel data, which are estimates that combine data in time series with cross-section. The regressions were performed by generalized least squares (cross-section Weights), which takes into account the heterocedasticity between the cross-section[12]. The matrix of coefficients of variance was estimated with the robust version of the presence of heteroscedasticity across periods.

A well-known problem in estimates of data in cross-section is the possible bias and inclusion of outliers, i.e., in our case, the states with standards that deviate from the other states in the sample. If these states are included in the same regression, it can lead to conclusions that are not actually valid for most states in our sample. Therefore, we present the regressions by region, because it minimizes the problem of outliers among the different regions.

Following Morettin and Toloi (2004) first were made the necessary changes in the series and then use them. We used the Log of the variables to minimize the variance. The unit[13] root test indicated the presence of the same in all series and was used the method of the first difference. To test the above equations for Brazil in the period 2004 to 2008, we used the following set of data related to 27 federal units:

Each equation was estimated to two data sets. The first data set refers to the total credit of the National Financial System, data from each of 27 federal units.

- Y is log of GDP of each state in R$ of 2000, taken from Ipeadata IPEA – The Institute for Applied Economic Research (2010);

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11 An exercise to investigate the effects of the credit over the work productivity was realized by Ottaviano and Sousa (2008). A first specification revealed a positive association between the productivity of companies benefited and the BNDES loans, being the coefficient equal to 0.06 withouth control, and 0.47 with control. A second specification showed that, with the introduction of a "dummy" variable that identifies all companies receiving loans, productivity

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continues to grow positively after the loan; however, a less accelerated pace, where the coefficients vary between 0.13 and 0.05. .

12 For more details on panel data models see Greene (1997).

13 The "Unit Root" test, as well as the other tests mentioned in the table of results, can be provided upon request of the autors.

- CR is the log of the average balance of loans in R$ of 2000 in each state;

- R is the log of labor productivity, calculated from the GDP in R$ of 2000 and the number of workers employed in each state, data from Ipeadata and IBGE;

In the second data set was used BNDES credit added to the Credit Constitutional Funds, data from each of the regions. The variables Y and R are the same, but in this case they were used at regional level. The use of data in the region level in this set is because of BNDES data are only available by region. The variable credit has been defined as follows:

- Funds + bndes is the log of the values of loans Constitutional Funds (FCO, FNE and FNO) together with those of BNDES in R$ of the 2000 in each region.

4.3 – Results[14]

The effect on GDP in the same period in which the credit was granted is the effect via the impact on aggregate demand (consumption and investment), since the observed effect in subsequent periods captures more the impact on investment. In the case of regression with labor productivity as the dependent variable, the observed effect should express the impact of credit on labor productivity, mainly through investment.

4.3.1 – Effect of credit on GDP

Table 7 presents the results of equation (4.1). The coefficient that measures the effect of credit growth on GDP growth was positive and significant at 5% in all regions. This coefficient was more significant in the Southeast, where it presented a coefficient greater than 1, indicating that a 1% increase in credit results in an increase greater than 1% of GDP in this region. This result expresses the effect of credit on GDP, more specifically, via the impact on aggregate demand. In the South this coefficient was close to 0.6 and in the other regions was very low, near 0.15. This result indicates that the North, Northeast and Midwest require a lot more credit to boost growth in their respective regional

GDPs. It is also worth mentioning the coefficient R2, with far greater explanatory power in the Southeast and South, than in other regions.

Table 8 shows the results of equation (4.2) in order to quantify the relationship between credit and labor productivity. The results are as expected, and all coefficients are insignificant for credit. Again the North and Northeast regions appear with the lowest coefficients among regions, indicating that the return to labor productivity due to increased credit is less in these regions in relation to others. The explanatory power of credit on productivity, measured by the coefficient of R2 is shown lower in case of Table 8 than in the regression with regional GDP presented in Table 7.

We reproduced in Tables 9 and 10 the previous exercises with credit data considering the data of the Constitutional Funds Loans (FCO, FNO, FNE) described in Table 5, plus the volume of BNDES credit described in Table 3. For Brazil regressions were performed using panel data at the regional level. For regions regressions were performed using time series of each region.

The results of the regression coefficients indicate that the credit from public institutions for investment to the South, Midwest and Southeast has a much greater effect both on the growth of GDP (Table 9) and on the growth of labor productivity. (Table 10). This result confirms those seen in previous regressions. It is noteworthy that the South is not receiving any funds cited and presented the highest coefficient (0.196) between the regions. In the Northeast the coefficient of credit for investment was not significant in the short term, and R2 of 0.06 indicates that the immediate effect on GDP and labor productivity is zero. Although the credit coefficient to the North is low compared to South and Southeast, the explanatory power of credit on GDP and productivity, measured by the coefficient R2 was larger in the North when we evaluate the equation using the BNDES credit and Funds.

As seen, the Constitutional Funds enabled the North, Northeast and Midwest to have a volume of credit for investment as a percentage of GDP close to that observed in South and Southeast regions. One would expect a positive effect on GDP and productivity in the

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14* Significant at 5%. **Significant at 10%. ***Significant at 20%.

(a) Likely not to reject the null hypothesis of normality.

(b) Likely not to reject the null hypothesis of no autocorrelation.

Table 7 – Regression Results of Equation (4.1), 2004–2008[15]

Variable	Brazil	NE	N	S	CO	SE
C	**0,030**	**0,037**	**0,029**	**-0,056**	**0,037**	**-0,040**
	(10,529)*	(6,097)*	(2,576)*	(-4,595)*	(4,185)*	(-12,031)*
CR	**0,160**	**0,136**	**0,178**	**0,599**	**0,147**	**1,202**
	(19,454)*	(6,302)*	(3,692)*	(8,276)*	(2,372)*	(12,989)*
R2	0,55	0,54	0,41	0,85	0,51	0,90
N	108	36	28	12	16	16
SSR	0,172	0,022	0,037	0,016	0,070	0,005
Norm. [a]	0,069	0,588	0,334	0,621	0,295	0,854
DW	2,109	2,577	2,190	2,719	1,406	2,370
LM Aut.(AR1) [b]	0,704	0,018	0,969	0,412	0,490	0,263
(AR2)	0,335	0,243	0,934	0,032	0,276	0,228

Source: Prepared by the authors using data from the Central Bank of Brazil (2010) and IBGE (2011).

Notes: log of GDP is the dependent variable.

Table 8 – Regression Results of Equation (4.2), 2004–2008

Variable	Brazil	NE	N	S	CO	SE
C	**0,011**	**0,022**	**-0,009**	**-0,056**	**-0,039**	**0,103**
	(2,740)*	(3,383)*	(-0,831)	(-4,924)*	(-2,517)*	(7,749)*
CR	**0,114**	**0,146**	**0,150**	**0,527**	**0,362**	**1,304**
	(8,748)*	(4,108)*	(1,925)**	(12,110)*	(6,051)*	(4,598)*
R2	0,23	0,48	0,10	0,80	0,39	0,66
N	108	36	28	12	16	16
SSR	0,258	0,046	0,105	0,012	0,045	0,089
Norm.[a]	0,072	0,399	0,480	0,597	0,555	0,720
DW	2,282	2,159	2,849	2,544	1,696	0,975
LM Aut.(AR1) [b]	0,425	0,888	0,324	0,557	0,943	0,070
(AR2)	0,101	0,415	0,123	0,179	0,370	0,362

Source: Prepared by the authors using data from the Central Bank of Brazil (2010) and IBGE (2011).

Notes: log of Productivity is the dependent variable.

North, Northeast and Midwest closer to that found for the South and Southeast regions. However, the regression coefficients found for the less developed regions are very far from those observed in more developed regions, indicating that the volume of credit to these regions is still insufficient to drive a positive effect on GDP and labor productivity as observed in South and Southeast regions.

5 – FINAL CONSIDERATIONS

The aim of this paper was to explore with the available statistics, the relationship between credit expansion and GDP growth and labor productivity,

15 Although the understanding of the data contained in the above table is simple, it is a test reading of Table 7 in order to provide guidance for other tables of results. The R2s range from 0.41 in the North and 0.90 in the South East are considered good. The Durbin Watson (DW) test to detect first-order autocorrelation remained in the area indicating the absence of first-order autocorrelation for all regions. The LM test of autocorrelation of higher order AR (2) for regions has not rejected the null hypothesis of no autocorrelation, considering a significance level of 5%, with the exception of the South. The normality test of Jarque-Bera waste (JB) does not reject the null hypothesis of normality, considering a significance level of 5% for all regions.

Table 9 – Regression Results of Equation (4.1), 2000–2008

Variable	Brazil	NE	N	S	CO	SE
C	**0,039**	**0,042**	**0,053**	**0,021**	**0,061**	**0,030**
	(8,572)*	(2,060)**	(17,833)*	(1,275)	(2,577)*	(2,922)*
funds+bndes	**0,078**	**0,049**	**0,059**	**0,196**	**0,156**	**0,141**
	(5,953)*	(0,686)	(7,366)*	(1,803)***	(2,178)**	(4,105)*
R2	0,62	0,06	0,89	0,36	0,25	0,54
SSR	0,067	0,008	0,001	0,005	0,049	0,005
Norm. (a)	0,709	0,861	0,746	0,823	0,034	0,701
DW	2,204	2,994	2,383	2,040	2,091	2,217
LM Aut.(AR2) (b)	0,988	0,314	0,815	0,029	0,915	0,692

Source: Prepared by the authors using data from the Ministry of Integration; BNDES and IBGE (2011).

Notes: log of GDP is the dependent variable. For Brazil n= 40, for the regions n=8.

Table 10 – Regression Results of Equation (4.2), 2000–2008

Variable/Region	Brasil	NE	N	S	CO	SE
C	**0,013**		**0,004**	**0,004**	**0,036**	**0,007**
	(7,534)*		(0,454)	(0,281)	(1,485)***	(0,614)
funds+bndes	**0,059**		**0,058**	**0,159**	**0,115**	**0,112**
	(9,851)*		(4,544)*	(1,510)***	(1,579)***	(2,739)*
R2	0,27		0,60	0,27	0,15	0,39
SSR	0,070		0,003	0,005	0,050	0,005
Norm.	0,275		0,921	0,742	0,048	0,726
DW	1,942		1,560	2,050	2,090	2,173
LM Aut.(AR2)	0,194		0,803	0,156	0,868	0,624

Source: Prepared by the authors using data from the Ministry of Integration, BNDES and IBGE (2011).

Notes: log of productivity is the dependent variable. For Brazil n=40, for the regions n=8.

with regional detail in the 2000s. Comparing the different coefficients of regressions between different geographical regions was possible to show how the impact of credit on the regional GDP and productivity of each region is different, reflecting the uneven distribution of credit in the country.

From the theoretical point of view it was assumed that the availability of credit is an important driver of economic growth as it maintains aggregate demand, and through productive investment it favors an increase in productivity of the economy. An environment favorable to economic growth should provide stability for the performance of banks and firms towards increasing production and investment in fixed assets. The more developed regions should have less preference for

liquidity and better investment opportunities and therefore expansion. Likewise, the more efficient allocation of credit should increase the productivity of the economy, and thus another important relationship is observed between credit supply and economic growth.

The empirical analysis in Section 3 highlighted the great inequality in the distribution of credit in terms of regions. The results of the econometric estimates in section 4 showed that the credit for the South and Southeast regions have a greater effect on both GDP growth and on the growth of labor productivity compared to other regions.

Considering the credits from the Constitutional Funds and BNDES, which are clearly more resources for investment, it is noted that the volume of credit

as a percentage of GDP in the North, Northeast and Midwest are very close to those observed in the South and Southeast. Even considering such resources in the econometric estimates, the coefficients found for the less developed regions are very far from those observed in more developed regions, indicating that the volume of credit to these regions is still insufficient to boost GDP growth and labor productivity as observed in South and Southeast regions.

In regional terms, it is worth noting that even in the North, Northeast and Midwest, credit aimed at investment is concentrated in the agricultural sector, being characterized therefore as shorter-term credits.

It was seen that the credit for individuals was the fastest growing in the period, and that it is important to increase consumer demand. However, the evidence from this paper suggests that there should be more incentive to increase credit (supply at lower cost) for infrastructure and industries to increase their level of investment, improving productivity of the economy. Thus, it is considered that policies to increase credit in recent years were important to heat trade and to sustain aggregate demand, however, they were not designed to significantly reduce regional inequalities.

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