CREDIT CONCENTRATION OF BRAZILIAN RURAL ACTIVITIES FROM 2000 TO 2007

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Abstract

This paper aims to analyze the degree of concentration of loans allocated to agricultural and livestock activities in Brazil for the period 2000-2007 and to assess the distribution pattern of credit among the states, analyzing the extent to which the volume of distributed credit is proportional to the states share of production and harvest areas, regarding agriculture, and the participation of each state in the total Brazilian livestock. The results suggest that rural credit still remains concentrated in states of the Southern and Southeastern regions, although there has been a credit decentralization during the current decade in favor of agricultural frontier in parts of Central and North regions of Brazil.

JEL classification: E51, G21, L11

Keywords: rural credit, concentration, distribution, Theil index.

1. INTRODUCTION

The creation of the National System of Rural Credit (NSRC) in 1965, according to Coelho (2001), was to mark the modernization of the Brazilian agriculture. At that time, following the creation of the NSRC, the Policy Guarantee of Minimum Prices (PGMP) was also created. Until the mid-1980s, the resources from National Treasury, plus the Resources Required[3], represented approximately 96% of the Brazilian rural credit system (Gasques et. al., 2000).

Hoffman and Kageyama (1987) found that the rural credit concentration,

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[3] The rural credit legislation requires that commercial banks allocate a percentage of the savings to finance the agricultural sector.

throughout the 1970s, favored some outputs, mainly in terms of export and/or industrialization, favoring the Southern and Southeastern states.

The '80s were characterized by the exhaustion of the Brazilian industrialization process via import substitution, the debt crisis and the consequent disruption of the flow of foreign investments. The capacity of the public sector to generate resources was exhausted and inflation rates reached levels politically unsustainable (Barros & Araújo, 1991). Then, the official credit supply declined dramatically and there was a need to search for financing alternatives, with priority for non-inflationary financing resources.

In the 1990s Brazilian agriculture financing had to adjust to changes in rural credit policy and cope with a new scenario faced by the market with the gradual removal of government. With the macroeconomic context further characterized by the exchange rate appreciation, there was a new ingredient represented by high interest rates in that decade. Furthermore, with the economic opening, there were still low import tariffs on some agricultural products. The compensatory variables were the increasing international prices from 1994 to 1997, the reduction[4] of input prices and the increase of the agricultural productivity through research and technology developed by universities and other research institutions and technology such as Embrapa (Brazilian Enterprise of Agricultural Research) (Homem de Melo, 1998).
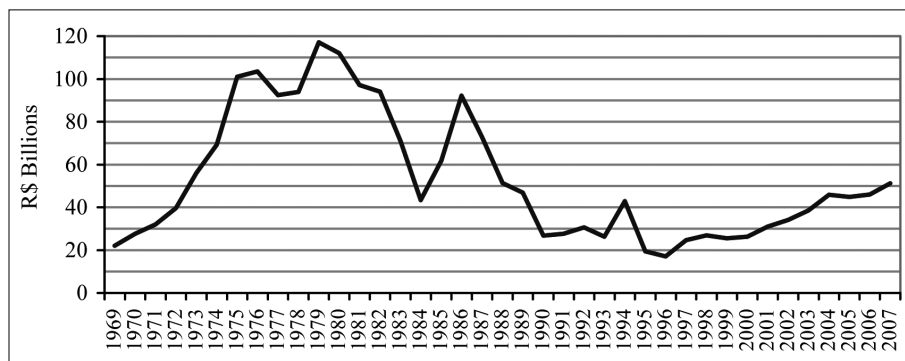

Figure 1: The Resources Evolution of the National System of Rural Credit (NSRC) - Agriculture and Livestock - Values in Reals[5] - from 1970 to 2007

Source: Central Bank (2008)

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[4] This reduction was caused by exchange rate appreciation and price reductions of pesticides, fertilizers and machinery.

[5] All information about rural credit system in Brazil, from the Central Bank, are in national currency (R$). In 2007, the nominal exchange rate was R$1.94 per US$.

Figure 1 shows that, over the recent decades, the amount of credit distributed by the NSRC has been reduced, and reached its lowest level between 1996 and 1997. The reasons for this reduction, the macroeconomic situation and the changes in funding sources, have been widely studied in the literature of agricultural policy in Brazil, such as studies of Coelho (2001) and Gasques et. al. (2000). However, the credit supplied by the NSRC still plays an important role as an instrument of agricultural policy although new instruments for financing agriculture and micro credit programs have been developed.

Since 2000, as observed in Figure 1, the amount of credit to agriculture has grown consistently, reaching in 2007 the amount of R$ 51 billion or so, which represented an increase of 94.8% between 2000 and 2007. This paper aims to verify if, despite the increase in rural credit amount, the pattern of the credit concentration, as observed in the 1970s and 1980s, has remained in the current decade.

2. LITERATURE REVIEW

The credit market is characterized by rationing, which is more severe in sectors where there are significant risks (in the case of rural sector), or that require long-term maturity (real estate mortgage). The solution to this problem, historically, has been the provision of credit for these operations by government programs and resources. The resources from the National System of Rural Credit (NSRC) at Banco do Brasil and the special financing line from the National Bank for Economic and Social Development (BNDES), the main sources of long-term loans, are examples of the structure of the credit market in Brazil.

The formal agricultural credit, supplied by the NSRC participating institutions, has a division between public and private bank activities[6]. Private banks work with a small number of borrowers at large volumes (i.e. high average value of contracts); while other institutions negotiate large number of contracts (low average). This indicates that resources from private banks may be limited to a few farmers and not to the agricultural sector as a whole (Lima, 2003).

The economic literature presents the hypothesis that rural credit could be an important determinant in adopting new technologies and in agricultural production growth, as demonstrated by Conceição (et al., 1998), Sperl &

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[6] This is a trend not only related to rural credit but to the whole financial market (Pequenos sem crédito, 2002).

Araújo (1995), Vicente (1999) and Kageyama (et al., 1990). The positive correlation between agricultural production and rural credit in Brazil is attributed to, according to these authors, the availability of credit to purchase machinery and modern inputs[7]. It is worth noting that there is no empirical evidence for this hypothesis, and, as Araújo (1983) states "even if certain raw materials related to gains in productivity have increased, the main variable to explain the agricultural production growth continues to be the intensified use of traditional factors."

Thus, during the 70s, expectations were created about a possible concentration of rural credit to produce exports to the detriment of the credit for food production. Contrary to what is expected, the commodities market had a slight increase in the participation of the total cost of credit, however it was enough to even out credit distribution in terms of the production value between agricultural export products and foods (Hoffmann & Kageyama, 1987). Among the explanations for this fact, the authors of the current study include:

a) on the supply side, the increase – with more access to credit – of capitalist enterprises for crops production, traditionally managed by family firms (as in the case of rice farms in the Midwest) and;

b) on the demand side, the increase in domestic consumption (mainly in urban areas) of processed food by income and substitution effects, led to an increasing share of agricultural production which was classified as tradable[8] to be effectively consumed in the domestic market.

Another feature of rural credit in Brazil is that access to resources has been quite restricted. According to the law of the Rural Credit System, this mechanism should guarantee the most resources availability to the agricultural sector (Melo, 1983). Additionally, it should be noted that only 15% of farms in the country received some type of financing from institutional credit sources, during the 1970s (Araújo, 1983).

Analyzing the period from 1970 to 1993, it is observed that the regional concentration of rural credit was strong. The sum of the resources supplied to the South, Southeast and Midwest amounted roughly to 90% of the total. To the North and Northeast, quantities with little significance to agricultural financing[9] were supplied (Sperl & Araújo, 1995). This situation can be explained partially by the commercial production distribution. Soon after the establish-

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[7] The fact that technical assistance was required from the rural credit borrowers, favoring the contact between technicians and producers, has also encouraged the use of modern inputs.

[8] Cotton, peanuts, cocoa, coffee, sugar cane and soybeans (Hoffmann & Kageyama, 1987).

[9] Even with the creation of the Northeast Constitutional Financing Fund (FNE) and North (NOF) in 1988, there was no change in the distributive pattern of rural credit in Brazil (Sperl & Araújo, 1995).

ment of NSRC there was greater concentration in the South and Southeast. Only from the late 70s on, with the displacement of the agricultural frontier, the volume of credit granted to the Midwest increased (Hoffmann and Kageyama, 1987). In addition, the regional credit concentration operations were affected by the following reasons: the small degree of internalization of the Brazilian banking system, the concentration of this network in more prosperous regions of the country, and the type of crops that predominate in the south (such as soybeans and wheat), which require more fertilizers and pesticides (Agro-analysis, 1979). Data from the Agricultural Census of 1995/96 show that only 5.3% of landowners borrowed loans for the development and expansion of their activities and only 4.1% demanded credit to finance the costs.

Lima and Campos (2001), as well as Almeida (et al., 2008), showed the reduction of the credit concentration in Brazil although the first authors have found a decline in the value of agricultural production and the rural activities in the Northeast, while the South showed increases in the two variables in between 1986 and 1997.

Almeida (et al., 2008) presented recent estimates on rural credit concentration, between 1999 and 2003. The authors focused their analysis only on the State of Bahia, and its regions but results indicated that there is uneven credit distribution between each geographic region of this state.

2.1 Credit Evolution for Agriculture from 2000 to 2007

The rural credit, supplied by the NRCS, is divided into two activities: agriculture and livestock. Table 1 shows the data regarding agricultural credit from 2000 to 2007 in which there were small changes in the distribution of agricultural credit among the Brazilian States. The states with the highest participation in NSRC were: Sao Paulo, Rio Grande do Sul, Parana and Minas Gerais.

Tables 2 and 3 show the share of each Brazilian state in the total agricultural production for temporary and permanent crops, also in the period from 2000 to 2007. Again, major changes are not observed along the time and states with greater participation in permanent crop production were: Sao Paulo, Minas Gerais, Bahia and Espirito Santo. In temporary crops, the states with the highest participation were: Sao Paulo, Rio de Janeiro Rio Grande do Sul and Mato Grosso.

A preliminary tabular analysis on the data suggests concentration of credit because some states like Bahia, Espírito Santo and Mato Grosso have a credit share, from NSRC, much lower than what their crops represent in the Brazilian agricultural production. Section 4 of this paper will present a more consistent analysis on credit concentration among the states.

Table 1: Percentage values of agricultural credit distributed among Brazilian States - 2000 to 2007

States	2000	2001	2002	2003	2004	2005	2006	2007
Acre	0.16	0.04	0.05	0.09	0.05	0.05	0.05	0.05
Amapá	0.02	0.02	0.02	0.01	0.02	0.01	0.01	0.00
Amazonas	0.12	0.37	0.10	0.10	0.09	0.13	0.07	0.14
Pará	0.78	0.41	0.31	0.64	0.68	0.53	0.52	0.42
Rondônia	0.90	0.34	0.23	0.36	0.35	0.37	0.26	0.21
Roraima	0.06	0.03	0.02	0.04	0.07	0.13	0.03	0.03
Tocantins	0.48	0.37	0.33	0.79	1.00	0.77	0.56	0.55
Alagoas	0.21	0.46	0.34	0.34	0.21	0.48	0.79	0.56
Bahia	2.02	1.93	2.25	2.54	2.89	3.42	3.25	3.27
Ceará	1.16	1.21	0.75	0.47	0.63	0.44	0.63	0.67
Maranhão	0.55	0.45	0.46	0.75	0.66	1.51	1.07	0.98
Paraíba	1.03	0.82	0.66	0.45	0.46	0.35	0.43	0.57
Pernambuco	0.23	0.20	0.13	0.31	0.50	0.57	0.74	0.78
Piauí	0.41	0.33	0.27	0.40	0.51	0.68	0.65	0.57
Rio Gde. do Norte	0.19	0.22	0.33	0.17	0.14	0.25	0.29	0.26
Sergipe	0.20	0.21	0.16	0.17	0.14	0.22	0.43	0.24
Espírito Santo	1.41	1.07	1.02	0.88	0.80	1.56	2.01	2.46
Minas Gerais	10.94	9.84	9.52	8.92	8.34	11.51	14.29	15.45
Rio de Janeiro	0.29	0.39	0.24	0.16	0.17	0.23	0.34	0.26
São Paulo	19.22	19.43	18.93	15.44	15.36	15.23	19.89	20.43
Paraná	18.09	18.42	19.14	19.12	19.57	18.90	16.13	17.36
Rio Gde do Sul	18.37	19.27	20.14	20.13	19.47	17.28	17.06	15.92
Santa Catarina	7.69	7.42	6.79	7.21	6.52	6.72	7.21	6.81
Distrito Federal	0.21	0.20	0.21	0.22	0.32	0.41	0.24	0.23
Goiás	6.90	6.44	7.10	7.20	8.11	7.08	5.04	4.56
Mato Grosso	5.76	7.16	7.34	8.89	8.77	7.52	5.19	4.38
Mato Grosso Sul	2.63	2.94	3.18	4.19	4.20	3.64	2.82	2.84
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: Central Bank (2008) and authors' elaboration

Table 2: States share in total agricultural production - permanent crop - 2000/2007

States	2000	2001	2002	2003	2004	2005	2006	2007
Rondônia	2.83	1.01	1.13	2.38	1.36	1.58	0.92	1.35
Acre	0.21	0.18	0.16	0.16	0.12	0.10	0.09	0.14
Amazonas	0.54	0.45	1.20	1.15	0.89	0.53	0.52	0.48
Roraima	0.06	0.07	0.05	0.07	0.07	0.08	0.06	0.07
Pará	4.67	4.22	4.85	3.56	2.83	3.02	3.01	3.70
Amapá	0.04	0.03	0.02	0.02	0.01	0.03	0.04	0.06
Tocantins	0.08	0.16	0.14	0.14	0.12	0.14	0.11	0.12
Maranhão	0.28	0.94	0.46	0.49	0.40	0.43	0.35	0.43
Piauí	0.44	0.28	0.20	0.27	0.32	0.22	0.23	0.16
Ceará	1.75	1.79	1.86	2.07	1.93	1.71	1.94	1.72
Rio Gde. do Norte	0.58	0.54	0.57	0.79	0.78	0.84	0.67	0.86
Paraíba	0.87	0.96	0.76	0.94	0.67	0.83	0.67	0.71
Pernambuco	2.29	3.02	2.31	2.72	2.61	3.13	2.86	2.99
Alagoas	0.30	0.31	0.34	0.24	0.21	0.21	0.18	0.18
Sergipe	1.09	1.06	1.25	1.40	1.02	1.22	1.30	1.23
Bahia	11.46	12.35	13.83	13.40	12.12	12.86	12.35	13.73
Minas Gerais	22.95	16.38	20.13	16.44	23.79	21.84	24.25	18.85
Espírito Santo	10.64	6.78	6.54	7.14	8.32	9.61	9.26	11.12
Rio de Janeiro	1.40	1.44	1.11	1.18	1.04	1.14	0.93	0.93
São Paulo	17.53	32.90	29.15	29.05	26.43	25.80	25.46	26.59
Paraná	6.91	3.47	3.55	4.49	3.85	3.52	4.01	3.38
Santa Catarina	3.51	2.41	2.50	2.96	2.43	2.55	2.90	2.93
Rio Gde. do Sul	6.90	6.56	6.05	6.96	6.71	6.38	5.99	6.33
Mato Grosso Sul	0.24	0.16	0.16	0.17	0.19	0.16	0.10	0.11
Mato Grosso	1.30	1.35	0.66	0.75	0.74	0.81	0.62	0.65
Goiás	1.01	1.02	0.90	0.94	0.93	1.15	1.06	1.05
Distrito Federal	0.12	0.14	0.13	0.13	0.11	0.10	0.11	0.11
Total	100	100	100	100	100	100	100	100

Source: IBGE (2009) and authors' elaboration

**Table 3: States share in total agricultural production -
temporary crop - 2000/2007**

States	2000	2001	2002	2003	2004	2005	2006	2007
Rondônia	0.39	0.29	0.37	0.37	0.41	0.51	0.54	0.52
Acre	0.34	0.22	0.20	0.19	0.14	0.21	0.17	0.18
Amazonas	0.59	0.63	0.41	0.26	0.22	0.44	0.47	0.37
Roraima	0.15	0.13	0.13	0.13	0.16	0.16	0.16	0.12
Pará	1.71	1.52	1.33	1.44	1.47	1.71	1.74	1.55
Amapá	0.06	0.07	0.08	0.03	0.05	0.07	0.09	0.10
Tocantins	0.53	0.56	0.51	0.81	0.84	0.97	0.76	0.75
Maranhão	1.50	1.40	1.42	1.49	1.54	1.75	1.62	1.44
Piauí	0.58	0.44	0.29	0.57	0.61	0.77	0.78	0.58
Ceará	1.35	0.80	1.09	1.08	0.82	0.93	1.41	1.01
Rio Gde. do Norte	0.49	0.35	0.59	0.56	0.57	0.59	0.76	0.53
Paraíba	0.93	0.71	0.69	0.68	0.63	0.70	0.92	0.61
Pernambuco	1.68	1.50	1.60	1.21	1.24	1.57	1.66	1.41
Alagoas	2.40	2.22	1.66	1.12	1.09	1.25	1.39	1.18
Sergipe	0.31	0.25	0.27	0.33	0.27	0.30	0.39	0.37
Bahia	5.95	4.67	6.49	4.72	5.56	5.30	4.98	5.93
Minas Gerais	8.41	7.45	7.42	7.02	7.24	8.72	7.88	7.89
Espírito Santo	0.53	0.44	0.47	0.41	0.41	0.51	0.48	0.39
Rio de Janeiro	0.86	0.68	0.57	0.43	0.55	0.59	0.61	0.42
São Paulo	16.46	17.76	17.29	13.75	12.66	15.32	19.20	17.11
Paraná	14.53	15.81	15.76	17.69	16.47	14.47	14.60	16.21
Santa Catarina	5.16	4.51	4.09	4.58	4.47	4.48	4.25	4.20
Rio Gde. do Sul	13.98	17.18	14.30	16.84	14.27	10.15	13.96	14.18
Mato Grosso do Sul	3.29	3.77	3.79	4.71	3.94	3.50	3.60	4.10
Mato Grosso	10.50	9.81	10.70	12.18	16.35	17.39	10.75	11.83
Goiás	7.05	6.60	8.21	7.11	7.80	7.36	6.55	6.74
Distrito Federal	0.28	0.23	0.27	0.27	0.24	0.30	0.27	0.27
Total	100	100	100	100	100	100	100	100

Source: IBGE (2009) and authors' elaboration

Rural credit is divided according to the following purposes: running expenses, investment and commercialization. Over the period from 2000 to 2007 the three credit purposes had the volume allocated for them increased, showing the trend to increase total credit supply shown in Figure 1. Running expenses received most credit, accounting for approximately 60% of the funds from the NSRC. Each of the other two purposes, investment and commercialization, has something around 20% of the official credit granted to the farmers and cooperatives through NSRC.

Figure 2 illustrates the share of the credit distribution by purpose of the intended investment.
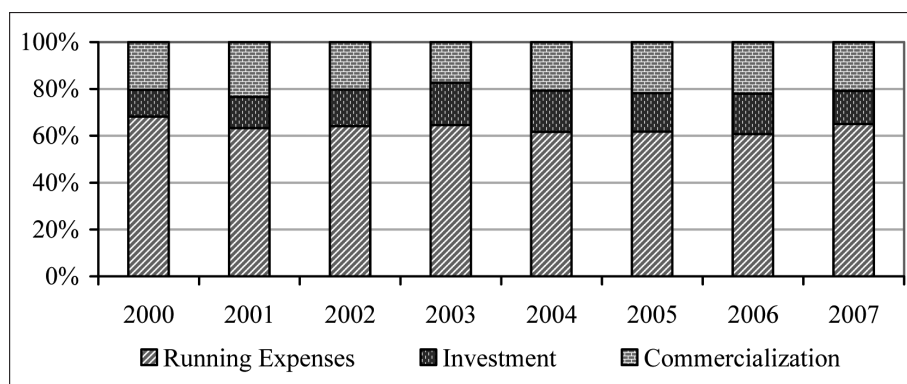
Figure 2: The Share of Agricultural Credit Purposes (Running expenses, Investment and Commercialization) - 2000 to 2007

Source: Central Bank (2008) and authors' elaboration

2.2 Credit Evolution for Livestock from 2000 to 2007

Table 4 shows the credit values for Brazilian livestock activity. The data suggest that in the period from 2000 to 2007 there were small changes in the distribution of credit among the States. The states with the highest participation in NSRC resources were: São Paulo, Minas Gerais, Rio Grande do Sul, Goias, Mato Grosso do Sul, Mato Grosso and Santa Catarina.

Running expenses have received most credit for livestock, representing approximately 60% of the funds from the NSRC. Each of the two other purposes, investment and marketing, holds something around 20% of the official credit granted to producers and cooperatives through NSRC. Figure 3 illustrates the percentage distribution of credit by purpose.

Table 4: Percentage values of livestock credit distributed among Brazilian States - 2000 / 2007

States	2000	2001	2002	2003	2004	2005	2006	2007
Acre	0.46	0.51	0.52	0.72	0.65	0.75	0.35	0.32
Amapá	0.02	0.02	0.03	0.02	0.07	0.09	0.05	0.03
Amazonas	1.23	1.36	0.38	0.28	0.34	0.38	0.32	0.42
Pará	5.97	2.97	2.91	4.20	4.51	3.76	4.32	3.34
Rondônia	2.12	1.68	2.14	3.61	4.21	3.24	1.59	1.70
Roraima	0.03	0.02	0.04	0.05	0.13	0.22	0.24	0.10
Tocantins	4.73	2.92	2.42	2.96	2.38	2.08	1.96	2.47
Alagoas	0.22	0.40	0.34	0.33	0.46	0.57	0.66	0.49
Bahia	1.99	2.31	2.74	2.53	3.83	3.43	3.52	2.96
Ceará	0.47	0.49	0.47	0.94	1.28	1.34	2.16	1.61
Maranhão	0.96	0.88	1.01	1.32	2.07	3.00	2.75	2.25
Paraíba	0.33	0.40	0.31	0.44	0.79	0.95	1.17	0.67
Pernambuco	1.20	0.61	0.48	0.62	0.93	1.09	1.91	1.68
Piauí	0.28	0.29	0.40	0.50	0.69	1.05	0.97	0.71
Rio Gde. do Norte	0.23	0.60	0.64	1.23	1.38	1.44	1.23	1.02
Sergipe	0.32	0.42	0.37	0.38	0.56	0.67	0.72	0.54
Espírito Santo	0.63	0.86	0.83	0.96	1.08	1.27	1.10	1.08
Minas Gerais	10.83	10.47	11.08	12.15	11.64	13.14	14.47	13.82
Rio de Janeiro	0.42	0.39	0.36	0.41	0.47	0.48	0.38	0.33
São Paulo	14.40	16.02	15.48	16.23	14.68	11.18	12.24	13.21
Paraná	6.94	8.79	8.28	8.51	6.78	7.49	8.37	9.27
Rio Gde do Sul	11.02	10.39	10.94	9.77	8.75	8.21	8.12	10.20
Santa Catarina	10.21	9.70	9.98	9.03	7.44	6.61	7.71	7.21
Distrito Federal	0.26	0.32	0.61	0.55	0.33	0.43	0.27	0.15
Goiás	10.47	11.21	10.80	8.25	9.99	12.48	10.37	9.89
Mato Grosso	6.30	7.83	8.43	7.03	6.72	6.79	6.19	7.15
Mato Grosso Sul	7.95	8.14	8.02	6.98	7.83	7.86	6.88	7.37
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

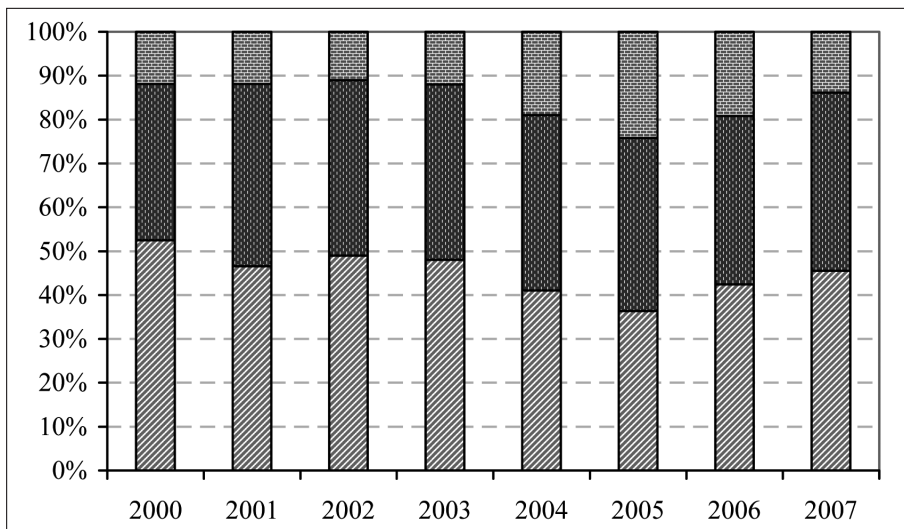Source: Central Bank (2008) and authors' elaboration

Figure 3: The Share of the Credit Purposes (Running expenses, Investment and Commercialization) in Livestock Loans - 2000 to 2007

Source: Central Bank (2008) and authors' elaboration

Table 5 lists percentage values of the state livestock production in domestic production in the period from 2000 to 2007. It is noted that production is concentrated mainly in the states: Minas Gerais, Sao Paulo, Rio Grande do Sul, Paraná and Goiás It should be noted that the proportions shown in Table 2 do not reflect the size of the each state herd because the percentages were calculated from production values for the type of products of animal origin, as announced by the Municipal Livestock Research (PPM).

3. METHODOLOGY

The research was conducted with secondary information sources and the period of analysis is restricted to the years between 2000 and 2007.

The data for the agricultural credit was collected from the Statistical Yearbook of Rural Credit published by the Brazilian Central Bank (BCB). In addition to the total amount of credit for the agricultural and livestock activities, it collected information on the credit purposes (running expenses, investment and commercialization) for Brazil as a whole and for the States.

Table 5: States share in total livestock production - 2000 / 2007

States	2000	2001	2002	2003	2004	2005	2006	2007
Acre	0.25	0.41	0.38	0.37	0.42	0.34	0.30	0.25
Amapá	0.02	0.02	0.02	0.01	0.01	0.02	0.02	0.03
Amazonas	0.55	0.55	0.61	0.54	0.51	0.55	0.60	0.41
Pará	2.14	2.03	2.26	2.06	2.09	2.38	2.48	2.27
Rondônia	1.12	1.06	1.18	1.44	1.63	1.66	1.48	1.64
Roraima	0.16	0.11	0.09	0.09	0.08	0.07	0.07	0.07
Tocantins	0.63	0.64	0.64	0.68	0.71	0.75	0.87	0.89
Alagoas	1.08	1.32	1.12	1.03	1.00	0.92	0.90	0.85
Bahia	4.22	4.28	3.95	4.15	4.01	4.00	4.18	4.01
Ceará	2.87	2.82	2.80	2.77	2.68	2.74	2.80	2.65
Maranhão	1.13	1.01	4.63	1.11	1.25	1.35	1.45	1.26
Paraíba	0.95	1.05	0.92	0.87	0.85	0.94	0.93	0.88
Pernambuco	2.78	2.89	2.83	2.50	2.44	2.95	3.37	3.34
Piauí	0.85	0.87	0.80	0.84	0.79	0.78	0.77	0.65
Rio Gde. do Norte	1.22	1.40	1.30	1.48	1.48	1.48	1.62	1.23
Sergipe	0.56	0.56	0.64	0.71	0.74	0.90	1.00	0.93
Espírito Santo	1.63	1.66	1.76	2.07	1.94	2.14	2.05	1.88
Minas Gerais	24.90	24.57	23.47	24.23	24.85	25.06	24.47	26.13
Rio de Janeiro	2.06	1.84	1.70	1.63	1.62	1.48	1.48	1.40
São Paulo	14.34	13.50	12.67	13.31	12.20	11.48	11.05	10.79
Paraná	8.83	8.92	8.86	9.24	9.70	9.95	9.78	9.46
Rio Gde do Sul	10.20	10.30	9.90	10.18	10.02	9.42	9.48	10.05
Santa Catarina	5.11	5.47	5.09	6.07	6.12	6.20	6.52	6.41
Distrito Federal	0.57	0.49	0.41	0.42	0.42	0.33	0.28	0.33
Goiás	8.13	8.30	8.34	8.51	8.47	8.28	8.40	8.49
Mato Grosso	2.07	2.25	1.99	2.09	2.30	2.40	2.29	2.31
Mato Grosso Sul	1.62	1.66	1.62	1.60	1.65	1.43	1.36	1.39
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: IBGE (Brazilian Institute of Geography and Statistics) and authors' elaboration

Data on gross production value (GPV) and planted area were collected from the Municipal Agricultural Production (PAM), the IBGE. The data expressed in monetary units have been deflated by the General Price Index - Internal Availability (IGP-DI), calculated by the Getúlio Vargas Foundation (FGV), whose base is 2007 (base = 100).

Finally, agricultural credit database was compared with agricultural production data and planted area (permanent and temporary crops); and data on credit for livestock were compared with data on livestock production (production of animal origin by the type of product expressed in thousands of Reals).

3.2 The Theil index[10]

To calculate the Theil index between agricultural credit and agricultural production values, and also the area planted, we used contemporaneous variables because the purpose of this work is only to measure the agricultural credit concentration in the current year. The livestock index of credit concentration was calculated from the value credit for the livestock and the value of livestock production.

There are, in the literature, some types of indexes to measure credit concentration or inequality; these concepts are often used as synonyms. According to Shirota (1988, p. 114), the most commonly used indexes are the Gini coefficient, the entropy index, and the Theil index. The Gini index is widely used to measure income concentration of the population. The index of entropy and Theil index are used in cases where the data are grouped by some criteria such as region, stratum area, among others. The concentration indexes provide important information for the analysis of credit distribution and its effectiveness as an instrument for rural development.

Lemos (et al., 1984) used the entropy index to study the rural credit concentration among products and among regions, however, as reported by Shirota (1988, p. 119) and Lima and Campos (2001), the entropy index measures the distribution of elements, while the Theil index provides a relationship of distribution between the variables studied, or strictly speaking, it determines the concentration in the distribution of the variables in relation to the distribution of another variable.

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[10] A methodological description in greater detail can be found in Hoffman and Kageyama (1987), Shirota (1988) and Hoffmann (1998). The Theil index, or redundancy, can be expressed in bits, when using the logarithm to the base 2 or nits, when using the natural logarithm, and 1 bit = 0.693 nit 1 and nit = 1.443 bit.

The Theil index decomposes the credit concentration into two components: the first consists of the concentration measured between regions[11] (inter-region) and the second refers to credit concentration in the regions (intraregions). According to Hoffmann (2006, p. 355), an analysis using the Gini index is more complex and difficult to interpret, so there is greater convenience using the Theil T index.

The total Theil index (T) can be described as follows:

$$T = \sum_{h=1}^{k} \sum_{i=1}^{n_h} \left[y_{hi} \cdot \log \left(\frac{y_{hi}}{\pi_{hi}} \right) \right] \tag{1}$$

Where:

k = is the number of regions;

n_h = is the number of states of the mth region;

y_{hi} = is the participation of the ith state of the mth region in agricultural or livestock credit value;

π_{hi} = is the participation of the ith state of the mth region in agricultural production or livestock production values (or planted area in the case of agricultural analysis).

As mentioned above, the total Theil index can be divided into the Theil index between regions (Te) and inside each region (Th). Thus, we have the Theil index between regions expressed by:

$$Te = \sum_{h=1}^{k} \left[y_h \cdot \log \left(\frac{y_h}{\pi_h} \right) \right] \tag{2}$$

Where:

y_h = is the participation of the hth-region in agricultural or livestock credit value;

π_h = is the participation of the mth-region in agricultural or livestock production value (or in the area planted in the case of agricultural analysis);

Redundancy intra groups (Regions) is expressed by:

$$Th = \sum_{i=1}^{n_h} \left\{ \left(\frac{y_{hi}}{y_h} \right) \cdot \log \left[\frac{(\pi_h \cdot y_{hi})}{(y_h \cdot \pi_{hi})} \right] \right\} \tag{3}$$

According to Theil (1967) apud Hoffmann and Kageyama (1987), "The to-

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[11] North, Northeast, Southeast, South and Midwest.

tal redundancy is the result of adding the redundancy between regions to a weighted average of redundancy within regions". According to Shirota (1988), the weighting factors are the relative shares of different groups in the variable in question. The redundancy, or total Theil index, can be expressed by:

$$T = Te + \sum_{h=1}^{k} (y_h.Th) \tag{4}$$

Following Hoffman and Kageyama (1987), it would not be reasonable to assume the absence of inequality in credit distribution when each region receives the same amount of credit. As an example, the authors considered the states of Minas Gerais and Sergipe arguing that if both received the same credit allocation there would be concentration in the state of Sergipe. A possibility of the inequality absence, argued by the authors, would be the rural credit distribution proportionally to the value of the agricultural production of the each region, but they do not defend this strategy, because in that case the Theil index would be zero and that is not necessarily the best situation. An uneven distribution of rural credit can be triggered by the government in a situation in which it wishes to develop a certain activity in a determined region in detriment to other activities in other regions.

According to the authors, lack of concentration is verified when the Theil index reaches its minimum value (zero). This situation would occur if each region received values of rural credit proportionally to their participation in the production value, ie ($y_{hi} = \pi_{hi}$). In contrast, the Theil index is maximum when all credit is targeted to the region with the lowest production value (planted area, in the case of agricultural credit) - the least productive region. In this situation, the Theil index would be {log[1/min(π_{hi})]}, where [min(π_{hi})] means the smallest share of the production value (or planted area). We use the same idea to designate the boundaries for the Theil index between regions.

Based on these arguments the Theil index can be considered, in this case, as an index of efficiency in the allocation of rural credit identifying regions more or less efficient regarding credit allocation.

4. RESULTS AND DISCUSSION

4.1 Credit Concentration for Agriculture

Figures 4 to 9 and Tables 6 to 9 show the results estimated in this work for agricultural credit concentration in Brazil.

As shown in Figure 4, given the increased volume of resources of NSRC, the increase of credit supply was not uniform among the Brazilian states, and even among the states in the same region. Over the period from 2000 to 2007 in the North, for example, the total credit distributed was constant among the states of Acre, Amapá, Amazonas, Roraima, Pará, while Tocantins obtained more resources in the same period. In Rondonia, after strong reduction in the first year (2000 to 2001), the volume of agricultural credit remained at around R$ 77 million.

In the Northeast, all states had an increase in agricultural credit granted in the period, with emphasis to the state of Bahia, which in 2000 received in real terms, R$ 0.4 billion in resources and in 2007 this figure was R$ 1.22 billion. A similar situation occurred in the South and Midwest. In the south, the states of Parana and Rio Grande do Sul received in 2000 around R$ 3.7 billion credit each, and in 2007 this value was approximately R$ 6.5 billion for the Paraná and R$ 5.9 billion to Rio Grande do Sul; Santa Catarina increased the credit from $ 1.5 billion to $ 2.5 billion. In the Midwestern Region, where, also, all states have increased the amount of credit received, the states of Goias and Mato Grosso had the highest amounts of credit in the region, obtaining in 2007 from R$1.7 billion and R$ 1.6 billion, respectively (the peak in the volume of resources occurred in 2004, when these states received, respectively, R$ 2.9 billion and R$ 3.1 billion).

The most significant amounts of credit received by the NSRC occurred in the Southeastern region, especially in the states of Sao Paulo and Minas Gerais. In Sao Paulo, in 2000, the total resources by NSRC were R$ 3.91 billion and in 2007, R$ 7.6 billion, which corresponded to a real increase of 95%. In Minas Gerais, in 2000, the volume of agricultural loans was R $ 2.23 billion, reached in 2007 the value of $ 5.78 billion, which represents an increase of 160% in the period.

Figures 5 and 7 illustrate the volume of agricultural credit for running expenses and commercialization, respectively, and they show a pattern quite similar in granted credit for each state, as seen in Figure 1. Regarding credit for running expenses, again, the states of Sao Paulo and Minas Gerais (followed by Rio Grande do Sul) were the States that increased resources in the period from 2000 to 2007 (Figure 5).

Considering the purpose of investment credit, as shown in Figure 6, an important aspect to highlight is that the states of the Northern region (Pará and Tocantins, prominently) and in the Northeast (Bahia, Maranhão, Pernambuco, Piauí) not only did they have a greater participation on this type of lending, but they also managed to increase the total annual credit received between 2000 and 2007.
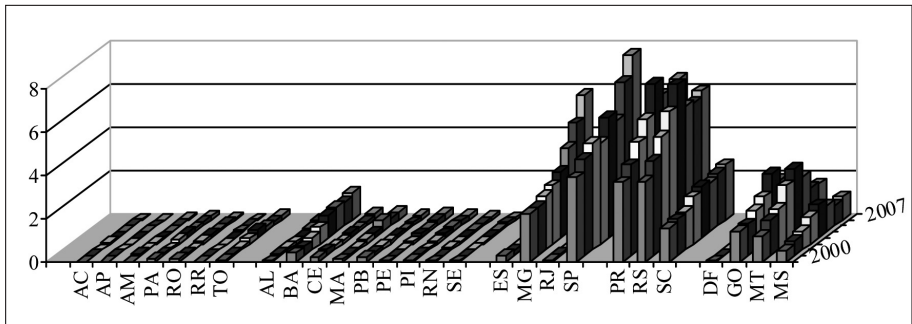
Figure 4: Brazil: Total credit distributed to agriculture, for States, period from 2000 to 2007 (R$ billion of 2007)

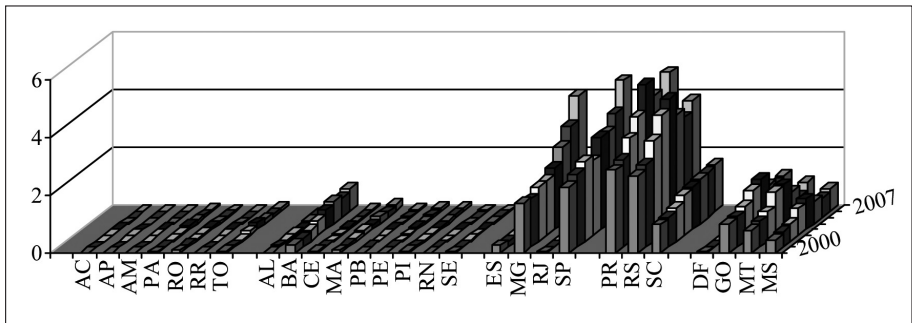Source: Central Bank (2008) and authors' elaboration

Figure 5: Brazil: Agricultural credit to running expenses, for States, period from 2000 to 2007 (R$ billions of 2007)

Source: Central Bank (2008) and authors' elaboration

From the values deflated by 2007 prices, the contracts average values in the period from 2000 to 2007 was computed, by State, for each purpose of credit in each of the years analyzed. From these results, the arithmetic mean values of the contracts from 2000 to 2007 was obtained. These values are shown in the Table 6. There is a wide range in values of contracts, ranging from R$ 380,43 (for investment in Paraiba state) to R$ 2.909.474,26 (for commercialization in the same state, Paraíba). Overall, the contracts average values in the Midwestern region are higher; while in the Northeast, averages are lower. Note that there is a weak correlation between the contracts average values and the production value of each state. The same is compared with the planted area.

Table 7 presents the results of the Theil index for the period 2000/2007, with calculations based on the production value and the planted area. It is
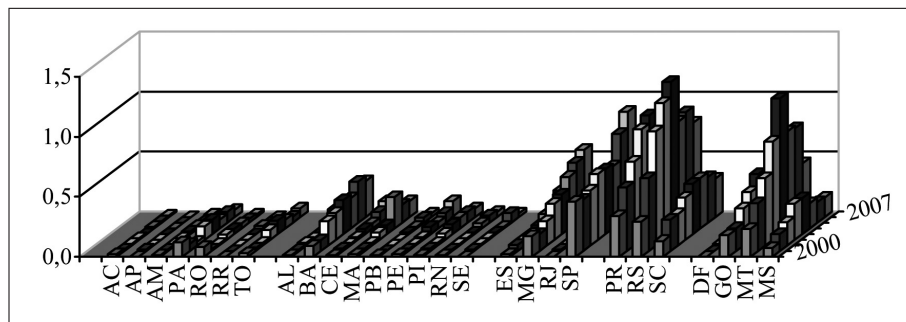
**Figure 6: Brazil: Agricultural credit to investments, for States,
period from 2000 to 2007(R$ billions of 2007)**

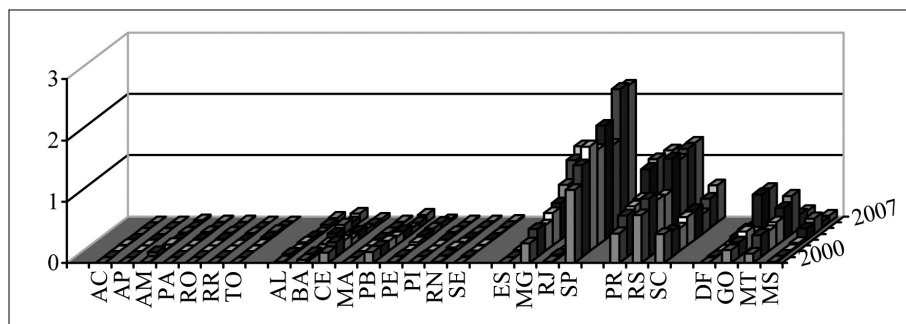Source: Central Bank (2008) and authors' elaboration

**Figure 7: Brazil: Agricultural credit to commercialization, for States,
period from 2000 to 2007 (R$ billions of 2007)**

Source: Central Bank (2008) and authors' elaboration

observed that the credit concentration evolution had different results according to the basis used, if we consider credit distribution based on production value. It is observed that there was devolution of credit in the period. Now, when the planted area is used as a basis concentration growth is observed. The exception occurs with the investment purpose in which there is strong devolution independently from the basis.

A possible explanation for this difference in the results is the proportional reduction in the credit previously supplied to the Southeastern and Southern regions. In both regions there is a predominance of small farms with high productivity. Thus, the credit may have migrated to regions with lower production (devolution of production) and predominance of large properties (concentration per area).

**Table 6: Brazil: Contracts average values for agricultural credit,
by purpose and State, for the period from 2000 to 2007**

States	Running Expenses	Investment	Commercialization	Total
Acre	2,605.00	2,090.41	160,360.48	2,460.64
Amapá	5,255.76	3,531.22	15,006.17	3,990.10
Amazonas	6,499.11	3,034.19	299,294.99	10,661.92
Pará	6,164.03	2,460.78	619,597.33	3,547.70
Rondonia	3,550.91	3,459.66	67,248.39	3,567.59
Roraima	59,176.37	6,499.76	160,114.90	16,831.84
Tocantins	17,836.33	3,886.49	672,406.39	8,931.26
Alagoas	6,876.41	1,323.08	402,016.05	3,794.30
Bahia	11,762.14	2,326.53	766,988.55	5,242.61
Ceará	2,244.54	648.90	1,143,143.89	3,604.03
Maranhão	4,928.07	1,816.63	149,055.02	2,786.05
Paraíba	4,958.50	380.43	2,909,474.26	6,247.82
Pernambuco	8,218.33	599.95	565,475.30	1,952.77
Piauí	3,267.87	1,167.29	431,159.21	1,879.33
Rio Gde do Norte	1,032.95	636.07	773,859.22	1,429.20
Sergipe	2,356.07	537.83	476,789.11	1,277.41
Espírito Santo	8,845.55	12,088.24	95,074.94	9,822.22
Minas Gerais	18,562.78	5,848.54	149,451.96	17,159.17
Rio de Janeiro	6,719.38	10,583.71	1,239,202.26	10,614.37
São Paulo	41,953.55	35,421.23	144,014.39	52,149.91
Paraná	18,137.75	18,307.45	231,237.39	21,158.21
Rio Gde do Sul	8,530.15	13,886.40	132,635.77	11,205.55
Santa Catarina	7,579.97	10,281.43	266,541.25	10,096.27
Distrito Federal	49,157.69	41,342.89	108,453.06	57,083.71
Goiás	32,975.21	25,455.87	165,435.06	35,625.80
Mato Grosso	57,168.13	43,090.60	174,823.31	55,038.51
Mato Gr. do Sul	39,319.05	26,983.23	31,360.46	35,444.81
Brazil	13,972.79	6,234.22	155,456.36	13,238.80

Source: Central Bank (2008) and authors' elaboration

Table 7: Brazil: agricultural credit concentration evolution, by States, measured by the Theil index, from 2000 to 2007

	2000	2001	2002	2003	2004	2005	2006	2007
Production Value								
Running expenses	0.150	0.131	0.162	0.102	0.125	0.163	0.125	0.112
Investment	0.115	0.130	0.152	0.090	0.105	0.114	0.081	0.050
Commercialization	0.293	0.197	0.239	0.195	0.161	0.1318	0.168	0.193
Total	*0.113*	*0.091*	*0.119*	*0.066*	*0.089*	*0.111*	*0.076*	*0.085*
Area								
Running expenses	0.206	0.200	0.212	0.172	0.170	0.192	0.232	0.229
Investment	0.169	0.149	0.136	0.119	0.104	0.076	0.056	0.094
Commercialization	0.369	0.307	0.365	0.331	0.238	0.172	0.389	0.390
Total	*0.175*	*0.163*	*0.175*	*0.140*	*0.133*	*0.132*	*0.185*	*0.208*

Source: The authors

The uneven distribution of credit can be analyzed by focusing on the regions (North-N, Northeast-NE, Southwest-SE, South-S and Midwest-CO) and on the concentration within each of these regions. Figures 8 and 9 present values that indicate the percentage contribution of inequality among the regions (Te index) in the total concentration index (T), based on the production value and planted area. Despite the basis of calculation, it appears that the distribution inequality among the regions is an important component in agricultural credit concentration in Brazil. Some exceptions have occurred occasionally. In 2007, inequality among regions was not relevant to the investment purpose, which can be explained by the reduction of loans for the Midwestern Region, which, in total, reduced its share from 22% (in 2006) to 16% (in 2007).

In Tables 8 and 9 are the results of credit concentration within their respective regions, according to the purpose of credit. Based on the production value (Table 6), the Th index shows that the running expenses purpose increased its concentration of credit in the Southeast, South and Midwest. In the investment purpose, the concentration decreased in the Southeast, unlike what occurred in the other regions (the Southern region showed an oscillation of the concentration in the period, but it reached in 2007 a value closed to that in 2000). In the commercialization purpose an increase of the concentration was observed only in the Northern region. In relation to the total credit volume in their respective regions there was concentration increase only in the South and Midwest, and still, at low intensity.
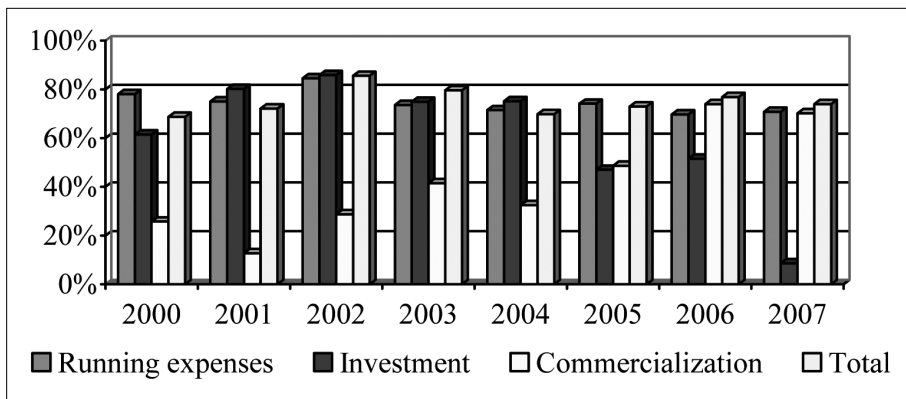
Figure 8: Percentage evolution of the Theil index among regions (Te) for agriculture, based on the production value
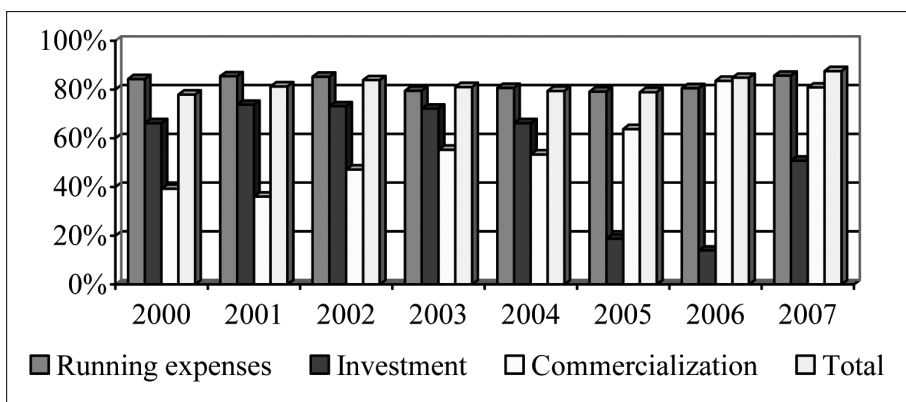
Source: The authors

Figure 9: Percentage evolution of the Theil index among regions (Te), based on the planted area

Source: The authors

Table 9 shows credit concentration measured by Th index based on planted area. Credit concentration of running expenses purpose increased in the Southeast, South and Midwest. As for investment purposes, only in the South there was an increase in the concentration of credit. Regarding the commercialization purpose, the concentration of credit was reduced in all regions.

Table 8: Evolution of the Theil index T inside each region (Th), based on the production value of agriculture

	2000	2001	2002	2003	2004	2005	2006	2007
Running expenses								
N	0.5968	0.8751	0.6569	0.3300	0.3230	0.3602	0.4537	0.3755
NE	0.2210	0.1623	0.2250	0.1809	0.0996	0.1329	0.1135	0.0683
SE	0.0199	0.0260	0.0175	0.0202	0.0183	0.0150	0.0241	0.0345
S	0.0006	0.0052	0.0007	0.0017	0.0000	0.0009	0.0054	0.0051
CO	0.0468	0.0329	0.0257	0.0355	0.0998	0.1456	0.1063	0.0699
Investment								
N	0.1334	0.0757	0.1111	0.0839	0.1001	0.1455	0.1026	0.1761
NE	0.0382	0.1789	0.1156	0.1852	0.1413	0.2724	0.0931	0.1059
SE	0.0892	0.0123	0.0042	0.0046	0.0116	0.0210	0.0102	0.0229
S	0.0019	0.0151	0.0136	0.0078	0.0153	0.0266	0.0305	0.0419
CO	0.0032	0.0137	0.0121	0.0046	0.0028	0.0050	0.0311	0.0030
Commercialization								
N	0.7530	1.2478	1.2054	0.6550	0.5367	0.2113	0.8094	0.9664
NE	0.9814	0.9614	1.3319	0.7745	0.5315	0.2460	0.2574	0.3934
SE	0.1798	0.0619	0.0820	0.0661	0.1065	0.0447	0.0338	0.0258
S	0.0634	0.0289	0.0195	0.0412	0.0093	0.0139	0.0102	0.0195
CO	0.1234	0.1017	0.0887	0.0667	0.1424	0.1270	0.0530	0.1078
Total								
N	0.2348	0.2848	0.3272	0.1596	0.2178	0.2121	0.2571	0.2210
NE	0.2248	0.2238	0.1571	0.0430	0.0511	0.0707	0.0450	0.0480
SE	0.0323	0.0106	0.0107	0.0141	0.0264	0.0120	0.0118	0.0198
S	0.0010	0.0067	0.0027	0.0049	0.0014	0.0031	0.0056	0.0060
CO	0.0343	0.0083	0.0057	0.0098	0.0545	0.0833	0.0254	0.0440

Source: The authors

Table 9: Evolution of the Theil index T inside each region (Th), based on planted area

	2000	2001	2002	2003	2004	2005	2006	2007
Running expenses								
N	0.6421	0.5391	0.3676	0.3422	0.2765	0.2685	0.2407	0.2041
NE	0.1326	0.1619	0.2564	0.2222	0.1511	0.1495	0.1015	0.0848
SE	0.0099	0.0138	0.0167	0.0132	0.0171	0.0078	0.0118	0.0128
S	0.0113	0.0112	0.0107	0.0164	0.0094	0.0207	0.0320	0.0217
CO	0.0496	0.0397	0.0459	0.0387	0.0556	0.0892	0.1356	0.0865
Investment								
N	0.1875	0.0657	0.0933	0.0795	0.0818	0.1382	0.0287	0.0791
NE	0.0690	0.0871	0.2170	0.1802	0.1181	0.1721	0.0645	0.0213
SE	0.0696	0.0530	0.0244	0.0142	0.0141	0.0241	0.0134	0.0423
S	0.0235	0.0412	0.0292	0.0306	0.0383	0.0672	0.0843	0.0854
CO	0.0168	0.0078	0.0011	0.0025	0.0089	0.0051	0.0222	0.0006
Commecialization								
N	0.8622	1.6450	1.5788	0.7691	0.5023	0.2226	0.6769	1.2430
NE	0.7590	0.7318	1.0568	0.7247	0.3898	0.2545	0.3418	0.4114
SE	0.1548	0.1303	0.1530	0.1139	0.1176	0.0383	0.0328	0.0173
S	0.1480	0.0700	0.0487	0.0834	0.0326	0.0051	0.0458	0.0570
CO	0.1778	0.1200	0.1296	0.0707	0.1426	0.1236	0.0967	0.1551
Total								
N	0.2856	0.2254	0.1596	0.1712	0.1825	0.1663	0.1037	0.1089
NE	0.1176	0.1103	0.1037	0.0525	0.0372	0.0505	0.0412	0.0327
SE	0.0177	0.0261	0.0320	0.0241	0.0290	0.0062	0.0045	0.0062
S	0.0268	0.0223	0.0167	0.0249	0.0154	0.0204	0.0380	0.0299
CO	0.0451	0.0145	0.0217	0.0118	0.0314	0.0534	0.0456	0.0608

Source: The authors

4.2 Concentration of Credit for Livestock

Figures 9 to 13 and Tables 10 to 12 exhibited the estimated results for credit concentration for livestock in Brazil.

In Figure 9, we observe that given the increase of resources from NSRC the credit supply increase was not uniform among the Brazilian states, and even among the states in the same region over the period from 2000 to 2007 in the North. For example, the total credit remained constant in the states of Acre, Amapá, Amazonas and Roraima, while Para and Tocantins had their resources increased in the period. In Rondonia, after a strong growth between 2003 and 2004, the volume of credit for livestock decreased and remained around R$ 235 million.

In the Northeast all states had an increase in credit for livestock especially the state of Maranhão where there was an increase of approximately R$ 250 million for the credit received in the period, rising from R$57 million in 2000 in real terms, to R$311 million in 2007. A similar situation occurred in the South and Midwest. In the South, the states of Santa Catarina and Rio Grande do Sul each received in 2000 a little more than R$ 60 million of credit, and in 2007 it was approximately $ 0.99 billion for Santa Catarina and R$ 1.41 billion for Rio Grande do Sul; Paraná increased the credit from R$ 867 million, jumping from R$0.41 billion in 2000 to R$ 1.28 billion in 2007. In the Midwestern Region, where all states also increased the amount of credit received, the states of Goias and Mato Grosso do Sul had the highest amounts of credit in the region, whose values in 2007 were R$1.36 billion and R$1.02 billion, respectively.

The most significant amounts of credit received from the NSRC occurred in the Southeast, specifically in the states of Sao Paulo and Minas Gerais. These two states accounted 27% of all credit for livestock in 2007. In Sao Paulo, in 2000, the total resources by NSRC was R$0.85 billion and, in 2007, R$1.82 billion, which corresponded to a real increase of 114%. In Minais Gerais, in 2000, the credit for livestock was R$0.64 billion, and in 2007 it reached the amount of R$1.91 billion, which represented an increase of 196% in the period.

Figures 10 to 12 illustrate the credit for the livestock sector by credit purposes (running expenses, investment and commercialization). The running expenses, investment and commercialization show different patterns in the distribution of credit for each state. The running expenses credit has a strong focus on the South and Southwest regions, especially the states of Sao Paulo, Minas Gerais and Rio Grande do Sul (Figure 10). The states of Northern and Northeastern regions showed strong growth in percentage terms over that period, but remained below the other regions in absolute volumes. In the Northern Region, Pará, Rondônia and Tocantins received 91% of resources
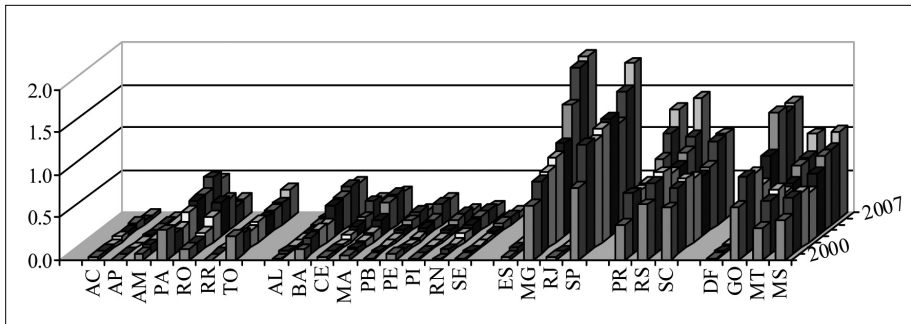
**Figure 9: Brazil: Total credit for livestock, for States,
period 2000 / 2007 (R$ billions of 2007)**
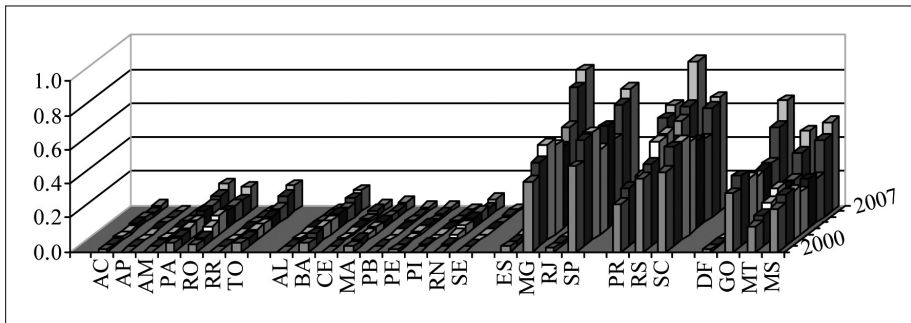
Source: Central Bank (2008) and the authors

**Figure 10: Brazil: Total running expenses credit for livestock, by States,
period 2000 / 2007 (R$ billions of 2007)**

Source: Central Bank (2008) and the authors

for running expenses. Bahia, Maranhão and Rio Grande do Norte were the main destinations of credit for the Northeast, representing 72% of the total.

The South, Southeast and Midwest showed increasing amounts of resources for running expenses in all states. In 2007, the three southern states accounted for 34.6% of total running expenses credit, percentage higher than that for the Midwest (26.3%) and Southeast (26.1%, concentrated in Minas Gerais and Sao Paulo).

As for investment credit, as shown in Figure 11, an important aspect to highlight is that the Northern states (Pará and Tocantins, prominently) and the Northeastern (Bahia, Maranhão, Pernambuco and Ceará) not only do they have a greater participation in this credit line but they also increased the total annual credit received between 2000 and 2007.
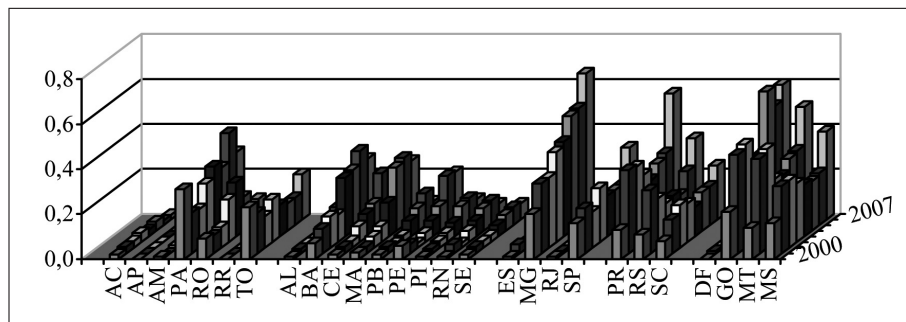
Figure 11: Brazil: Total credit for investment of livestock, by States, period 2000 / 2007 (R$ billions of 2007)
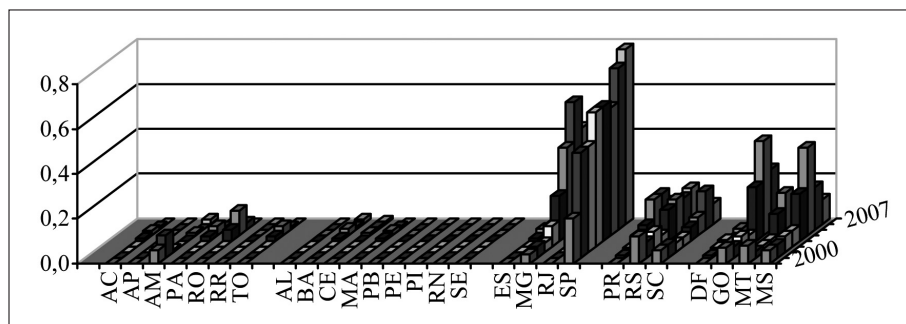
Source: Central Bank (2008) and the authors

Figure 12: Brazil: Total commercialization credit for livestock, by States, period 2000 / 2007 (R$ billions of 2007)

Source: Central Bank (2008) and the authors

Rural credit for livestock commercialization has been increasing in the Southeast, resulting in high concentration in 2007: 65% of the total credit for this mode is allocated to the Southeast. Sao Paulo received 41.7% of total loans, while Minas Gerais received 22.6%.

Following the same method applied in table 6, we calculated the average value of contracts in the period 2000 / 2007, by State, for each type of credit for livestock in each of the years analyzed, and these values are shown in Table 10. There is a wide range in values of contracts, ranging from R$ 1.213,84 (for investment in Paraiba state) to R$ 456.388,50 (for marketing in the Amazonas state). Overall, the average values of the contracts in the Midwest and the South are higher, while in the Northeast, there are the lowest averages.

**Table 10: Brazil: Contracts average values for livestock credit,
by purpose and State, for the period 2000 / 2007**

States	Running expenses	Investment	Commercialization	Total
Acre	63,673.10	9,352.69	85,167.81	15,568.93
Amapá	26,404.04	7,766.13	186,612.72	10,288.81
Amazonas	29,243.39	8,815.17	456,388.50	49,358.42
Pará	20,657.76	9,237.39	105,965.38	10,834.84
Rondonia	12,084.66	14,962.15	72,664.69	13,609.99
Roraima	28,991.24	6,951.23	123,638.25	8,214.11
Tocantins	28,821.96	11,212.51	61,342.19	14,296.61
Alagoas	11,792.72	1,387.86	67,539.85	1,883.88
Bahia	7,300.93	1,674.39	106,641.72	2,308.48
Ceará	6,598.86	1,324.59	94,905.57	1,504.11
Maranhão	13,134.18	2,625.80	304,143.79	3,576.27
Paraíba	6,602.46	1,129.67	38,104.55	1,213.84
Pernambuco	13,523.29	1,287.94	96,928.49	1,571.62
Piauí	6,316.69	1,092.64	7,723.02	1,235.66
Rio Gde do Norte	1,472.32	1,453.85	33,571.68	1,455.89
Sergipe	2,452.35	1,342.14	31,321.50	1,418.03
Espírito Santo	13,285.93	15,220.08	56,121.94	15,156.89
Minas Gerais	12,903.11	6,963.20	158,577.77	10,521.57
Rio de Janeiro	11,446.51	16,500.70	111,756.85	14,005.15
São Paulo	25,594.86	23,031.54	75,388.10	34,073.61
Paraná	33,160.81	18,200.38	323,701.18	25,858.93
Rio Gde do Sul	15,810.22	11,431.26	63,688.01	15,805.93
Santa Catarina	59,472.53	11,959.69	49,928.18	32,132.99
Distrito Federal	157,072.79	63,588.71	86,184.93	98,642.72
Goiás	16,916.17	34,950.21	100,735.34	25,414.07
Mato Grosso	25,117.61	23,622.66	36,792.67	24,973.24
Mato Gr. do Sul	38,319.83	40,428.46	51,209.86	41,336.59
Brasil	17,213.06	5,347.38	72,645.29	9,378.82

Source: Central Bank (2008) and the authors

Table 11 presents the results of the Theil index for the period 2000 / 2007, with calculations based on production value. It is observed that there was devolution in the period for the purposes of running expenses and commercialization. As for the investment credit for livestock, there was increase in concentration.

Table 11: Brazil: livestock credit concentration evolution, by States, measured by the Theil index, period 2000 / 2007

	2000	2001	2002	2003	2004	2005	2006	2007
Running expenses	0.291	0.275	0.279	0.233	0.230	0.204	0.244	0.255
Investment	0.139	0.200	0.207	0.222	0.218	0.201	0.170	0.226
Commercialization	0.815	0.970	0.886	0.847	0.514	0.477	0.343	0.483
Total	*0.313*	*0.265*	*0.282*	*0.214*	*0.204*	*0.194*	*0.142*	*0.170*

Source: The authors

Figure 13 presents the percentage indicating the contribution of inequality among the regions (Te index) to the total index (T) for the production value of livestock activity. It appears that the inequality distribution among regions is an important component in the concentration of livestock credit in Brazil, mainly for running expenses. Inequality among regions has not been relevant in the investment purpose, but it increased its importance over the period of analysis for the commercialization purpose.
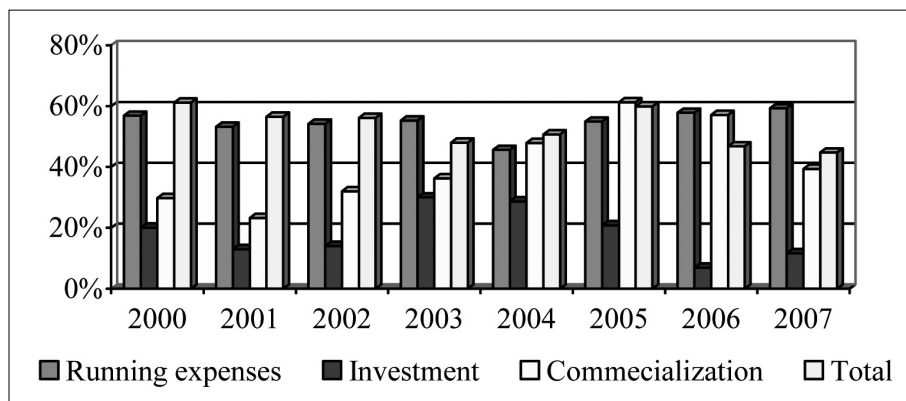

Figure 13: Percentual evolution of the Theil index among regions (Te) for livestock, based on the production value

Source: The authors

Table 12: Evolution of the Theil index T inside each region (Th), based on production value of livestock.

	2000	2001	2002	2003	2004	2005	2006	2007
Running expenses								
N	0.2470	0.2062	0.1612	0.0983	0.0568	0.0755	0.1244	0.0858
NE	0.4076	0.3970	0.2738	0.3468	0.2855	0.2389	0.1587	0.2439
SE	0.0786	0.0965	0.0777	0.0464	0.1187	0.0565	0.0588	0.0698
S	0.0958	0.0965	0.1092	0.0532	0.0678	0.0443	0.0219	0.0169
CO	0.1681	0.1590	0.1908	0.2053	0.2001	0.1809	0.2432	0.2300
Investment								
N	0.0400	0.1661	0.1568	0.1176	0.2515	0.1913	0.2029	0.2178
NE	0.1365	0.1685	0.2909	0.1198	0.1572	0.1479	0.1124	0.1705
SE	0.1135	0.2270	0.1919	0.1770	0.1399	0.1636	0.2025	0.2626
S	0.0124	0.0346	0.0307	0.0509	0.0418	0.0271	0.0436	0.0503
CO	0.2904	0.2794	0.2553	0.3533	0.3922	0.4133	0.3011	0.3339
Commercialization								
N	2.0697	2.1602	2.1363	2.0183	0.1824	0.2354	0.2103	1.5056
NE	2.5649	2.4828	0.4805	1.3796	0.4163	0.3672	0.3835	0.4358
SE	0.5781	0.7437	0.8093	0.6540	0.3958	0.1725	0.1588	0.3195
S	0.3553	0.2435	0.1319	0.0060	0.0381	0.0045	0.0282	0.0151
CO	0.2664	0.2455	0.3065	0.4362	0.2036	0.2455	0.1962	0.3776
Total								
N	0.1583	0.1292	0.1268	0.0997	0.0554	0.0517	0.0707	0.0670
NE	0.1133	0.1216	0.1601	0.1031	0.0951	0.1439	0.0687	0.0781
SE	0.1018	0.1391	0.1251	0.1091	0.1135	0.0492	0.0579	0.0927
S	0.0674	0.0341	0.0460	0.0221	0.0237	0.0094	0.0108	0.0015
CO	0.1839	0.1704	0.1936	0.2285	0.1815	0.1368	0.1678	0.2121

Source: The authors

In Table 12 are the results of credit concentration within their respective regions, according to the credit purpose. The Th index shows that the running expenses credit increased the credit concentration in the Midwestern Region. In other regions, especially North and Northeast, there was devolution. A similar situation occurred for commercialization credit. The investment credit increase is concetrated in all regions. In relation to the total credit in its respective regions, there was an increase of concentration only in the Midwest, and at lower intensity than devolution occurred in other areas.

5. CONCLUSIONS AND RECOMMENDATIONS

The results of this study show that, in absolute terms, the largest volume of agricultural credit remains for the states of Sao Paulo and Minas Gerais in southeastern Brazilian, and Parana and Rio Grande do Sul, in the South. This reflects the participation of the four states mentioned in crop (permanent or temporary) production: all these states together represent approximately 55% of each type of crop.

The credit for livestock, according to the results obtained in this research, is concentrated in the states of Sao Paulo and Minas Gerais in the Southeast. It reflects the relevance of these two states in the national livestock production value: 26.13% (Minas Gerais) and 10.79% (Sao Paulo). The states in the South and Midwest follow next, as important destinations of livestock credit.

Another issue raised in this study, which should be researched on in future works, is whether there is a causal link between the expansion of agricultural frontier and the demand for credit, as it is the case for the credit devolution in the North and Northeast. Possibly, the credit devolution in the mentioned regions results from the livestock activities expansion in these regions, previously unexplored, which have led to the increase of demand for credit, and, in addition, to the devolution of rural credit. The results suggest that transport and energy infra-structure promoted by local and national governments in favor of agricultural frontier in parts of Central and North regions of Rural Brazil over the past decades have been fundamental to expand the potential economic growth as well as the demand for rural credit in those regions. Some recent studies of Brazilian agriculture modernization show that the occupation of unexploited areas brought to Central and North regions new capital-intensive, labor-saving and human capital intensive technology. Actually, the rural credit supply has been sufficient to meet the demand; a different scenario from the decades of 1980 and 1990. In recent decades, Brazilian agricultural growth was important to meet the urban population demand for foods and

the international commodities markets. In addition to credit supply, the agricultural policy focus should be on the investments in R&D, to guarantee the increase in agricultural productivity and the production of the unexploited areas in the Center and North regions. The governmental investments in energy and transport infrastructure have been relevant on the agricultural frontier, to create conditions for the producers to develop their activities.

From the perspective of agricultural policy and regional economic development of the country, results are encouraging because there has been a credit decentralization during the current decade in favor of agricultural frontier in parts of the Central and North regions. Access to credit and the agricultural activities development will allow income growth and, consequently, greater opportunities for the economic development in these regions.

References

Agroanalysis, 1979, Rio de Janeiro, Vol. 3, No. 6.

Almeida P.N.A., R.A.S. Lima, V.C. Santos, A.F.C. Almeida and R. Shirota, *Concentração do Crédito Rural no Estado da Bahia no Período de 1999 a 2003*, in Congresso Brasileiro de Economia e Sociologia Rural, Rio Branco-AC, Anais, Brasília: SOBER, 2008.

Araujo P.F.C., 1983, "Agricultura Brasileira sem Subsídio", *Revista de Economia Rural*, Vol. 21, No. 3, pp. 295-303.

Central Bank - Banco Central do Brasil, 2008, *Anuário Estatístico do Crédito Rural 2007*, Brasília.

Barros G.S.C., 1991, "A Agricultura e o Ajuste Fiscal", *Revista Brasileira de Economia*, Vol. 45 (espec.), pp. 318-328.

Barros G.S.C. and Araujo P.F.C. de, 1991, "Oferta e Demanda de Crédito Rural no Brasil: Algumas Evidências Empíricas sobre seus Determinantes. Piracicaba: CEPEA/FEALQ", *Relatório de Resultados*, No. 9.

Coelho C.N., 2001, "70 Anos de Política Agrícola no Brasil", *Revista de Política Agrícola*, Secretaria de Política Agrícola, Ano X.

Conceição J.C.P.R., J.G. Gasques, A. Carvalho and P.H.Z. Conceição, 1998, "Relação entre PIB Agrícola e Crédito Rural no Brasil: Aplicação do Teste de Causalidade de Granger", Piracicaba: ESALQ, DESR, (Série Seminário, 5) /Apresentado ao Congresso Brasileiro de Economia e Sociologia Rural, 36., Poços de Caldas.

Gasques J.G., J.C.P.R. Conceição and R.I. Rodrigues, 2000, *Financiamento da Agricultura: Experiências e Propostas*, Brasília: IPEA, (Projeto BRA 97/013).

Hoffmann R. and A. Kageyama, 1987, "Crédito Rural no Brasil: Concentração Regional e por Cultura", *Revista de Economia Rural*, Vol. 25, No. 1, pp. 31-50.

Hoffmann R., 1998, *Distribuição de Renda: Medidas de Desigualdade e Pobreza*, São Paulo: Edusp.

Hoffmann R., 2006, *Estatística para Economistas*, 4ed., São Paulo: Thomson.

Homem de Melo F.B., 1998, "Agricultura Brasileira nos Anos 90: O Real e o Futuro", *Economia Aplicada*, Vol. 2, No. 1, pp. 163-182.

Ibge - Instituto Brasileiro de Geografia e Estatìstica, Disponível em: <http://www.ibge.gov.br>, Acesso em: março de 2009.

Kageyama A., A.M. Buainain, B.P. Reydon, J.G. Silva, J.M. Silverira, MG.D. Fonseca, P. Ramos, R.B. Fonseca and W. Belik, 1990, "O Novo Padrão Agrícola Brasileiro: do Complexo Rural aos Complexos Agroindustriais", in G.C. Delgado, J.G. Gasques, C.M.V. Verde (Ed.s), *Agricultura e Políticas públicas*, Brasília: IPEA, Cap. 2, pp. 113-223.

Lemos J. de J.S., A.J. Fernandes, L.A. Stock, 1985, "Análise da Concentração de Crédito Rural no Brasil", *Revista de Economia Rural*, Brasília, Vol. 22, No. 2, pp. 231-240, abr./jun. 1984.

Lima R.A.S., 2003, "Informação, Capital Social e Mercado de Crédito Rural", Piracicaba, Tese (Doutorado) - Escola Superior de Agricultura Luiz de Queiroz, Universidade de São Paulo.

Lima M.F. and R.T. Campos, 2001, "Distribuição do Crédito Rural nas Grandes Regiões Brasileiras", in Congresso Brasileiro de Economia e Sociologia Rural, Recife-PE, Anais, Brasília: SOBER.

Melo F.H., 1983, "A Agricultura e a Política Econômica em 1983", *Reforma Agrária*, Vol. 13, No. 3, pp. 8-23.

Pequenos sem crédito, *O Estado de São Paulo*, São Paulo, 20 fev. 2002. p. A-3.

Shirota R., 1988, *Crédito Rural no Brasil: Subsídio, Distribuição e Fatores Associados à Oferta*, Piracicaba, Dissertação (M.S.) - Escola Superior de Agricultura "Luiz de Queiroz", Universidade de São Paulo.

Sperl E. and P.F.C. Araujo, 1995, *Crédito Rural no Brasil: Distribuição Regional e Produtividade*, Piracicaba: ESALQ, DESR, Relatório final de projeto.

Vicente J.R., 1999, "Eficiência na Produção Agrícola Paulista e seus Determinantes", *Economia Aplicada*, Vol. 3, No. 2, pp. 263-287.

Résumé

Cet article vise à étudier la concentration des prêts destinés à l'agriculture et à l´élevage par états au Brésil au cours de la période 2000-2007. Par ailleurs, ce travail présente une analyse sur le montant des crédits par état en vue d´évaluer si leur part correspond à la participation de ces états en termes de productions et de récoltes agricoles et en termes de dimension du cheptel. Les résultats montrent que le crédit agricole reste concentré dans certains états du Sud et Sud-est, bien qu'on puisse noter un processus de décentralisation.