

Daruge, Fernando Perrini; De Souza Lima, Roberto Arruda

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## SOCIAL CAPITAL AND ITS INFLUENCE ON RURAL CREDIT MARKET

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**Paper to be presented in the 50th European Regional  
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**Social Capital and its Influence on Rural Credit Market**

FERNANDO PERRINI DARUGE

Degree in Economics Science at “Luiz de Queiroz” College of Agriculture – University of  
São Paulo – Brazil.

Address: Rua do Trabalho, 166.  
13418-220 – Piracicaba, Estado de São Paulo  
Brazil

Phone: 55 19 9753 7757

E-mail: [fpdaruge@gmail.com](mailto:fpdaruge@gmail.com)

*Roberto Arruda de Souza Lima*

Professor of Economics at “Luiz de Queiroz” College of Agriculture – University of São  
Paulo – Brazil.

Address: Avenida Padua Dias, 11 caixa postal 09  
13418-900 – Piracicaba, Estado de São Paulo  
Brazil

Phone: 55 19 3429 4444 r.8718 Fax 55 19 3434 5186

E-mail: [raslima@esalq.usp.br](mailto:raslima@esalq.usp.br)

**Abstract:** This study analyses the relationship between social capital accumulation and the amount of rural credit market contracts of the State of São Paulo, Brazil. The most important definitions of social capital found on literature and the main ways of creation and measure this variable were reported. It discusses the connection between social capital and information and how this relation contributes to the reduction of financial intermediation’s transaction costs, that results on rural credit volume increasing. It was used the same logit regression model that have been created and used by LIMA (2003), to empirically test the effect of social capital on the volume of rural credit. The data, from the municipalities of the State of São Paulo, are from 2007/2008 official statistics (Farm Census, LUPA and SEADE’s data basis). The results indicate that the level of social capital is positively-correlated with the amount of rural credit. That shows the governmental incentives to further increase and maintain social capital would result on rural sector’s development.

JEL classification: Z13, Q14, G14, L14, H81

Key words: social capital, rural credit, logit.

## **Social Capital and its Influence on Rural Credit Market**

### **1. Introduction**

The main role of financial markets for the rural sector is to provide resources to remedy lack of capital for producers, thus, allowing them to perform their activities. To do so, there is a liaison between fund providers and fund recipients, operation known as financial intermediation. Being credit supply tied to levels of investment, which is, in turn, linked to development, it is expected that inefficiency of financial intermediation results in constraints to the rural sector.

There are several factors that discourage financiers from funding activities in this sector. One of them is the interest rate for rural credit fixed below the breakeven point by the government – as is the case in Brazil. Moreover, credit supply to agriculture is extremely costly, especially due to geographic dispersion, information asymmetry and risks inherent to the activity. The outcome is the inefficiency of financial intermediation, which results in credit rationing (LIMA, 2003).

This work analyzes the influence of levels of social capital on the amount of funds provided to rural credit, based on the hypothesis that accumulation of social capital can reduce costs of financial intermediation and contribute to its efficiency. This is because the variable of social capital levels can boost confidence of creditors in the results of their operations, enhancing the volume of business generated.

### **2. Objectives**

The overall objective of this study is to empirically examine the influence of social capital on the volume of rural credit in the State of Sao Paulo, Brazil. Specifically, the objectives are: (i) to assess the financial system and financing activity to the rural sector, (ii) to analyze the importance of social capital to mitigate transaction costs, and (iii) to econometrically verify the influence of capital on provision of rural credit.

Additionally, it is expected that results present relevant issues to formulate policies for rural development and to help future academic studies on financial intermediation in the rural sector.

### 3. Literature review

Rural credit in Brazil was institutionalized with the creation of the National System of Rural Credit (SNCR) in 1965, although the Bank of Brazil started granting such credit in the late 1930s (SHIROTA, 1988; LIMA, 2003; BACHA, 2004). This type of credit significantly expanded by the late 1970s, driven by strong presence of the public sector and compulsory application of banks (LIMA, 2003). Due, mainly, to high transaction costs and limited levels of interest rates prevailing in Brazil, the private sector was not attracted to spontaneously operate in the rural credit market. Provision of resources to the rural sector was also supported by funds from foreign financiers available at relatively low cost (VELLUTINI, 1991). The 1980s was marked by a significant reduction in the provision of rural credit, largely as a result of depletion of public sector savings, triggering an increase of the private sector participation in providing rural credit (BIASOTO JUNIOR; MAGALHÃES JUNIOR, 1998). Data from the latest Census of Agriculture for the year 2006 indicate that only 7.7% of landowners borrowed funds for investment and 9.54% for running expenses (IBGE, 2008).

The financial system reduces transaction costs and risks of intertemporal trade of goods and services. One contribution of the financial system for the economic development is to turn the process of lending and applying resources less costly and less risky. The neoclassical model of competitive balance, which would lead to Pareto<sup>1</sup> solution, only occurs if there are no transaction costs and if markets run perfectly. However, in practice, transaction costs are not null, resulting in rationing the amount of credit offered (SHIROTA, 1996). Similarly, reduction of transaction costs implies a greater volume of credit offered at lower interest rates.

In a market where interest rate is fixed at a level below the breakeven point of a competitive market balance, as seen in rural credit operations in Brazil, the amount of credit has been reduced even more. In this scenario, reduction of transaction costs would imply a lesser rationing, i.e., a greater supply of credit (LIMA, 2003). In short, banks provide funds primarily based on interest rates and risk levels, once they will have a direct influence on their expected return.

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<sup>1</sup>An allocation of resources for Pareto is efficient if you cannot find a way to improve the situation of an agent without worsening that of another (NICHOLSON, 2005).

It is assumed that, *Coeteris Paribus*, higher interest rates imply a greater expected return by the creditor. However, interest rate affects risk level through adverse selection<sup>2</sup>, which affects the moves of decision-makers.

### 3.1 Costs of financial intermediation and their implications

It was previously presented that efficiency of financial intermediation is directly affected by its costs. Being cost equals, by definition, to the difference between the rate that remunerates the lender and the loan fee paid by the borrower deducting the profit margin. Cost is composed mainly by administrative costs (and other operating costs), regulatory costs (compulsory, cross subsidies, etc.), by fiscal costs (direct and indirect taxes) and by default costs (associated with risks) (KOYAMA; NAKANE, 2002). The analysis of this work will focus on administrative costs and risk-related costs.

Risk-related costs arise, mostly, from asymmetry of information (COSTA; NAKANE, 2004). Thus, among mechanisms to mitigate risk-related costs is information gathering, which can be divided into two phases. The first is prior to granting the loan, in which the bank will analyze the borrower profile and collaterals they will use, in addition to the expected return and risks of investment (ARAÚJO, 1996). The second is after granting the loan, in which the financiers should monitor allocation of resources by borrowers.

The stage prior loan granting is crucial to prevent resources from being allocated to borrowers who cannot honor their debts, whatever the reason that may lead them to default. As a result, some intermediaries prefer to avoid small borrowers, given the greater difficulty to obtain accurate information about them and lack of collaterals. The importance of the monitoring phase, after granting the loan, is due to moral hazard<sup>3</sup> and information asymmetry. Once the loan is granted, the borrower may make an opportunistic behavior, because the

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<sup>2</sup>Borrowers who accept higher interest rates are generally higher risk borrowers (STIGLITZ; WEISS, 1981). Thus, high interest rates jeopardize projects with lower expected return, but with less risk.

<sup>3</sup>The basic premise of moral hazard is that individuals do not have the same incentive to take care of properties belonging to others with the same zeal with which they care for their own interests, i.e., there is less incentive to zeal for the borrowed capital than for their own resources (FRY, 1995).

money is fungible<sup>4</sup> and decisions regarding the use of borrowed capital affect their ability to discharge the debt (LAZZARINI; CHADDAD, 2000).

Moral hazard is accentuated when, for the borrower, default cost is lower than that to settle the debt or when a possible renegotiation implies benefits to the debtor (COSTA; NAKANE, 2004). On the other hand, when they are being monitored by the lender, borrowers become more cautious with respect to borrowed capital (Braga, 2000).

These factors underscore the importance of information, to reduce intermediation costs. However, gathering information involves costs, which can be quite high – especially in the rural sector – favoring the action of *free riders*<sup>5</sup>. This is because information is non-rival, once consumption by one individual does not reduce the amount to be consumed by others, and non-exclusionary, since it is virtually impossible to avoid that others benefit from the information produced (RANDALL, 1987). These features discourage lenders from investing their resources in gathering information, once other agents may benefit from it free of charge.

In short, loan high costs not only cause restrictions on credit volumes, but also issues concerning moral hazards and adverse selection, which can ultimately impose additional restrictions to the credit market, which reflect on the market balance (COSTA; NAKANE, 2004).

Marginal cost of administration is declining – particularly in rural credit – favoring market concentration, which justifies the approach of the financial market structure in later sections of this study. Risk is primarily reflected by default rate, detailed as follows.

Default is construed as breach of contractual obligations by the debtor, whether financial or not. Clients complying with their contractual obligations are referred to as non-defaulting (ORTOLANI, 2000). The cost of borrowing funds for borrowers, under the assumption of 100% of contract compliance, equals the sum of the cost the lender has to obtain funds and other operating costs (acquisition of information, pre and post contract transactions) (LIMA, 2003).

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<sup>4</sup>It means the possibility to exchange of currency units. That is, the borrowed capital can be easily exchanged or assigned for other means.

<sup>5</sup>*Free riders* are those who benefit from effort of others, and reap benefits without having to pay. In private production (and sale of information), *free riders* appear because they can mimic the behavior of those who paid for the use or generation of information to improve the quality of their investments (HILLBRECHT, 1999).

If part of the credit granted is not paid off, the borrower will not be paying off part of operating and fund-raising costs. Thus, default results in losses of not only the principal, but also of fund-raising and operating costs (ARAÚJO, 1996). Given the uncertainty as to pay off the loan, the lender incorporates a risk prize to interest rates. LIMA (2003) shows that marginal reduction of default is higher than reduction of any other components of loan costs. This highlights the importance of understanding peculiarities of default in order to plan effective actions to reduce intermediation costs and, therefore, increase the volume of credit offered.

It should also be considered among default costs, those related to settling the debt. The lender should assess (or reassess) collaterals the borrower uses which may be forfeited to discharge the debt and charge them in court (LIMA, 2003). This underscores the importance of the judiciary system for the efficiency of financial activity.

Default has especial important effect on rural credit, since rationing is adopted by financial institutions as a protection, once interest rates are legally limited to a maximum level (BOURNE, GRAHAM, 1984).

### **3.2. Information**

In the credit market, information is a production factor, as the financier must necessarily spend resources to gather information on borrowers (LIMA, 2003). In some cases, information has characteristic of non-rivalry, which means that consumption by one individual does not reduce the amount available to others (RANDALL, 1987). Furthermore, many times it is not possible to maintain exclusivity of information, i.e., once produced, it is difficult to prevent individuals from benefiting from it.

The cost of information gathering occurs before the end of its generation and is not recovered in case of failure to close the transaction (VARIAN, 1998). In addition, information has a high production cost and low cost of reproduction. Thus, one can assume that it should be produced once and multiplied with no charge. Nevertheless, in the credit market, agents who gather information make efforts to ensure that it is not shared, since they could not charge information use and would benefit their competitors for free.

This inefficiency is due to the aforementioned non-exclusivity, which jeopardizes the price operation system – no one would pay for something they can obtain for free. Often, the result is the coexistence of different agents incurring the same costs to produce the same

information that was produced by another agent. Other times, there is underinvestment in the production of this resource (LIMA, 2003). In both cases the inefficiency is evident.

### **3.3. Social capital and access to credit**

Traditionally, economic theories usually consider society as a set of independent individuals, each attempting to individually achieve their goals. The functioning of the society would correspond to all actions of each of these individuals aiming to maximize their utility (LIMA, 2003). However, recently, the concept of social capital has expanded, which aims to characterize networks of relationships among individuals. This concept extends and complements the neoclassical theory (PERES, 2000).

Social capital can be understood as a set of entities providing benefits to individuals of a particular social structure. It would be the result of horizontal associations among people who cooperate for mutual benefit of the community, and of vertical relationships, characterized by hierarchical relations and distribution of power. It should also extend the concept to institutions that shape society, such as the political regime, the judiciary system, among others. Social capital is productive and enables the achievement of goals that would not be attainable otherwise. It is not a completely fungible feature and it feeds itself with its use (DURSTON, 2002). Being connected with obligations and with agents expectations, this feature is strongly related to the integrity of the social environment, which, in turn, depends on the mechanisms of reinforcement and punishment aimed to discipline individuals to follow prevailing standards.

Social capital is a public asset, i.e., agents that create social capital, generally use only a small part of its benefits, which leads to underinvestment in this resource (LIMA, 2003). Discussions arise as for the role of the public sector in fostering social networks. Some scholars maintain that there can be an important synergy between the institutionalization of social capital and the State (EVANS, 1996 apud DURSTON, 2002). The State can help create and seize the benefits of social capital, due to a strong personal commitment that is created among members of the local community (TENDLER, 1997). Above all, stimulus placed on individuals association reduces long-term barriers of fear and mistrust and strengthens the habits of cooperation.



Important to highlight that the living in a social structure generates information about individuals. In general, social relations are maintained for other purposes, but ultimately result in reducing the burden of information asymmetry. Therefore, relationships observed in a context can guide actions of another different context. In a social structure, when rules exist and are effective, then it constitutes a powerful form of social capital. Not only does it facilitate certain actions, it restricts undesirable ones as well (LIMA, 2003).

Societies, whose individuals do not maintain strong ties with one another, become vulnerable to mandatory actions of individuals and face obstacles to curb negative externalities. Social capital facilitates collective sanctions, making rules more effective, and creating an environment of integrity.

Measuring variables of social sciences constitutes a major challenge for researchers. It is not different for the social capital variable, since there is no consensus on which indicator (s) best predicts the relationship between social capital and the object of study (BEBBINGTON, 1999). Different definitions and applications of the social capital concept allow each researcher to use their own ad hoc method (HJØLLUND & SVENDSEN, 2000). There are two main approaches: survey or behavior observation. However, both have limitations and the most appropriate method should be analyzed within the object of study.

Several authors have used data from the World Values Survey to measure social capital. These data are focused on confidence (trust) and membership in various types of associations (NARAYAN & CASSID, 2001) In general, two characteristics have predominated in measuring social capital: trust (trust) and affiliation (membership) to voluntary organizations (HJØLLUND & SVENDSEN, 2000). GROOTAERT; VAN BASTELAER (2001) warn that there is a dangerous tendency to consider social capital all that is not classified in conventional categories of capital. A very broad concept implies the risk of not explaining anything. It should be identified in the context of the research, a pertinent indicator of social capital and established an empirical correlation with indicators of benefits (DURSTON, 2002).

Indicators of social capital differ both geographically and sectorally. The *proxy* choice in case studies should consider specific manifestations of social capital in the field of study, or specific means through which social capital is acquired (LIMA, 2003). Important to remember that a particular form of social capital that is valuable as a facilitator of certain actions may be useless or even harmful to others (COLEMAN, 1990).

Credit agreements provide an intertemporal financial transition based on different expectations among agents. The lender waives a sum of money today to receive a larger amount in the future. On the other hand, the borrower pays a premium to the lender to obtain credit today. This relationship should be solidified on trust between agents.

Confidence required by the creditor will be, mainly, based on factors such as efficiency and burden to chase payments, availability of information on the borrower and collaterals. Nevertheless, aspects that will guide the conduct of borrowers are, mainly, penalties resulting from default. In this sense, social capital has been used in the credit market, both in stipulating guarantees and as an alternative to reduce costs for lenders in face of imperfect information (LIMA, 2003).

Several mechanisms are to use the capital in favor of the financial system. It is usual, in credit agreements, to require cosigners to endorse the granting of funds. This is because over time, coexistence of individuals generates an accumulation of information about other members of society. Overall, an individual will not endorse another, unless he is trustworthy. Thus, we can understand financial intermediaries such as *free-riders* (gathering information from society members, without having to incur many costs to gather it). Moreover, guarantors enhance the security for banks.

On the other hand, when an individual is endorsed by another, he tends to honor it, once breaching it could compromise their reputation with members of society. In this case, community pressures the individual, reducing monitoring costs for banks. Tainted reputation due to default can be construed as cost for defaulting. This cost will vary in different societies and from individual to individual.

Local moneylender and commercial credit systems also benefit from the extensive knowledge built through coexistence. Microfinance programs based on groups also establish their guarantees on social capital of the community and its relations of trust, reciprocity and participation (BARONE et al., 2002). In these systems, there is a mechanism of self-selection and self-monitoring within the group, which tends to mitigate problems of moral hazard and adverse selection, as well as management costs for banks (BRAGA; TONETO JUNIOR, 2000).

It is known that high differences in actual interest rates observed between countries are based primarily on an argument of trust. COSTA; NAKANE (2004) showed that risk is the most important component to compose banking spread in Brazil. It is clear, therefore, the potential contribution that the variable social capital may generate in the credit market.

## 4. Methodology

In the rural credit market changes in the amount supplied cannot be explained by the interest rate, since it is fixed. The amount of resources will depend on expected returns by lenders, which will result from the economic scenario, behavior of borrowers and their transaction costs. This paper aims to analyze the effect of changes in variables that affect the expected returns by financial intermediaries on the amount of rural credit offered.

Important to emphasize that limiting interest rates causes lenders to maximize economic profits by reducing costs. As shown previously, transaction costs associated with defaults, including those related to its prevention, stand out in the activity of credit. Considering the influence of social capital level on default rate, social capital is expected to be one determinant of credit amount to be offered.

### 4.1 Effect of Social Capital

This paper empirically examines the influence of social capital level on the volume of rural credit available in the market. As in LIMA (2003), the model for this analysis will be based on four assumptions:

- a) Environment is exogenous: There are no institutional changes (e.g., efficiency of the judiciary system is the same in all operations) and occurrence of unexpected natural phenomena, which could compromise offer, are not considered;
- b) Additional information, such as data on climate and agricultural zoning, is known by lenders. Cost already incurred will be the same (i.e., no additional cost) regardless of the level of use of such information;
- c) The higher social capital, the greater likelihood for the success of a credit transaction; and,
- d) Relationship between this probability and capital is not linear. That is, for low social capital level, access to credit is unlikely, also at a certain level of social capital, it would no longer be a limit to credit access.

It is postulated that the occurrence of credit transaction ( $V$ ) can be expressed by the following function:

$$V = f(G, K, W) \quad (1)$$

where:

$V$  = occurrence of credit transaction, assuming value 1 (occurred) or 0 (not occurred);

$G$  = guarantees offered;

$K$  = Capital, and

$W$  = Other variables. This term will seek to attract other sources that might influence the volume of credit, such as presence of bank branches in the city, easy access, size of contract, among others. In particular, it is considered factors that favor the emergence of economies of scale and the scope in the use of information

It is noteworthy that default rate significantly affects transaction costs, therefore, volume of rural credit transactions. However, disaggregated data on this variable were not found, given its confidentiality. But, the model considers data ( $W$ ) reflecting the interest of financial institutions operating in the region, presumably affected by default.

The econometric model chosen to perform empirical investigation of the relationship between the amount of rural credit offered and the social capital was developed and tested in LIMA (2003). Likewise, the logit model will be used, as in equation (2).

$$Y_j = \ln(P_j/Q_j) = \mathbf{x}_j' \boldsymbol{\beta} = \beta_0 + \beta_1 x_{1j} + \dots + \beta_k x_{kj} \quad (2)$$

where  $P_j$  is the probability of obtaining favorable response, given vector  $\mathbf{x}_j$  with values of explanatory variables in the  $j$ -th observation. Considered a favorable response the number of APUs<sup>6</sup> that received rural credit. Coefficient  $\beta_i$  is the marginal effect of  $X_i$  on the logit  $Y$

## 4.2 Variables used in the model

The analysis was restricted to the State of São Paulo (Brazil) – to avoid interference of regional variables such as efficiency of the judiciary system. Thus, index  $j$  of eq. (2)

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<sup>6</sup>Agricultural Production Unity (APU) is the rural estate (not considering estates used for leisure), understood as a set of contiguous properties belonging to the same landowner (s) (São Paulo, 2006).

represents each municipality of the São Paulo state. Percentage of Agricultural Production Units (APU) which received credit in each municipality served as a *proxy* of credit traded [variable  $V$  of eq. (1)]. In eq. (2),  $Y_j$  is the percentage value for each municipality  $j$ , obtained from the Survey on Agricultural Production Units (SAPU), referring to the São Paulo State, crop year 2007/2008, prepared by the Coordination of Integral Technical Assistance - CATI.

We used seven explanatory variables [vector  $\mathbf{x}_j$ , presented in eq. (2)] - LPROD, CAPSOC, ICMS, OPCRED, AGBCO, AREA and CRIMES - for each municipality  $j$ , defined in (Table 1). This table also shows the definition of variables UPA and CREDRUR necessary to obtain values of  $Y_j$ .

Once assumed that the higher the production, the greater the guarantees offered by the borrower, and that guarantees affect the likelihood of obtaining credit, it was adopted the production size as variable *proxy*. Therefore, we will adopt as *proxy* of variable  $G$  of eq. (1), revenue amounts (in logarithmic form) of livestock and crop production, by municipality.

Table 1. Variables that compose the model.

Name	Description	Source	Expected outcome
$APU_j$	Number of Agricultural Production Units present in the municipality $j$ in 2007.	São Paulo (2008)	—
$CREDRUR_j$	Number of APU receiving credit in the municipality $j$ .	São Paulo (2008)	—
$LPROD_j$	Revenue amount, in its logarithmic form, of livestock and crop production in the 2006/2007 harvest (in thousands of Reais).	IBGE (2008)	Positive
$CAPSOC_j$	Maximum value among percentage of APUs in the municipality $j$ , whose producer was member of cooperatives, associations or producers syndicates in the 2007/2008 harvest.	São Paulo (2008)	Positive
$ICMS_j$	Percentage of municipality $j$ participation in generating ICMS (VAT, in Brazil) in São Paulo state, in 2008.	SEADE (2009)	Positive
$OPCRED_j$	Value of loans, in its logarithmic form, in financial institutions in the municipality $j$ in 2008.	SEADE (2009)	Positive
$AGBCO_j$	Number of bank branches in the municipality $j$ in 2008, per thousand inhabitants.	SEADE (2009)	Positive
$AREA_j$	Area of APUs in the municipality $j$ (in thousands of hectares) in December 2007.	São Paulo (2008)	Negative
$CRIMES_j$	Total occurrences of crimes against property in the municipality $j$ , per inhabitant (in 2008).	SEADE (2009)	Negative

As LIMA (2003), to measure the level of social capital in a given municipality, we used the percentage of APUs that are part of cooperatives, associations or producers syndicates [variable  $K$  of eq. (1)]. To avoid double counting, we opted to use only the highest percentage among the three above. Variable CAPSOC served as *proxy* for social capital.

Other variables, described in Table 1, were introduced to the model to capture the interest of the financial institution to operate in the municipality, reflecting differences in market conditions, economies of scale and scope. Thus, we included variables related to the financial share of the municipality (percentage of participation of municipalities in the ICMS (VAT)) and to the volume of credit operations. The number of bank branches per thousand inhabitants was introduced to the model to capture competition and attractiveness of the local financial market (not only rural credit). We also considered areas used by APUs, per municipality, assuming that monitoring cost is a function of the area to be studied. As seen in the literature review, the decision to supply credit is also based on levels of risk associated with production, which may prevent producers from discharging their debts. To measure the safety of lenders regarding this topic, we have included an explanatory variable that indicates incidence in percentage of crimes against property, recorded in the municipality, for each inhabitant.

### **4.3 Treatment of data**

The State of Sao Paulo is currently comprised of 645 municipalities. From which, 42 municipalities were not included in the Census of Agriculture and, therefore, not considered. The participation in agriculture of the city of São Paulo (Capital) is clearly marginal. However, its expression in quantitative variables related to ICMS (VAT) and funds transfer is highly significant. In order to prevent influence of São Paulo City on results, not relevant to the topic discussed, this municipality was also removed from the sample. 67 municipalities present in SAPU and SEADE database showed inconsistent or incomplete statistical data and, therefore, were excluded from this study. In the end, 535 observations remained, i.e., a reduction of 17.1% in the sample.

## 5. Results

Values of variable social capital (calculated by the percentage of landowners belonging to associations, cooperatives and syndicates) varied widely among the municipalities analyzed, ranging from 1% to 98.1%. This variable showed an average of 38.76%, and its standard deviation of 22.42. Average of percentage of APUs receiving rural credit per municipality reached 16%, being the amplitude equal to 89% (ranged from 0% to 89%) and standard deviation was equal to 0.14. The municipality of Pedrinhas Paulista presented the highest percentage of APUs that obtained rural credit (89%). Important to emphasize that this municipality holds the third place among municipalities with the highest levels of social capital (97.1%).

To estimate the model parameters, we used the computer package SAS for data regression. The likelihood ratio obtained was equal to 6,332,7608 with seven degrees of freedom, which is highly significant, with  $p < 0.0001$ . So, at least one of the coefficients is not null. In logit models, when the coefficient value is high, the Wald statistics may lead to type II errors, i.e. false negative – considering the effect not significant when, in fact, it is (HAUCK, DONNER, 1977). In the case of the model tested, this occurred in variables AREA and CRIMES and the rest of the coefficients were all significant with  $p < 0.01$  (Table 2). This justifies the model restriction, with the exclusion of variables that are not significant (AREA and CRIMES), to prevent occurrence of the errors abovementioned.

Table 2. Analysis of maximum likelihood estimation

	GL	Estimation	Standard deviation	Wald Qui-square	Value -p
Intercepto	1	-3.0957	0.0726	1,818.4109	<0.0001
LPROD	1	0.1514	0.00538	792,6413	<0.0001
CAPSOC	1	0.0116	0.000247	2,196,8081	<0.0001
ICMS	1	-0.6782	0.0368	338,9066	<0.0001
OPCRED	1	-0.0494	0.00448	121,5796	<0.0001
AGBCO	1	1.4709	0.0610	581,3354	<0.0001
AREA	1	-1.66E-7	1.827E-7	0.8282	0.3628
CRIMES	1	0.00041	0.000729	0.3121	0.5764

Source: Research results

Next, we present results recalculated for the restricted model (Table 3). In this new model, the likelihood ratio obtained was equal to 6,331,6793 now five degrees of freedom, which is highly significant, with  $p < 0.0001$ .

Table 3. Analysis of maximum likelihood estimation for the restricted model

	GL	Estimation	Standard deviation	Wald Qui-square	Value-p
Intercepto	1	-3.0861	0.0696	1964,37	<0.0001
LPROD	1	0.1497	0.00498	904,8373	<0.0001
CAPSOC	1	0.0116	0.000242	2282,4594	<0.0001
ICMS	1	-0.6747	0.0366	339,4572	<0.0001
OPCRED	1	-0.0491	0.00418	137,6747	<0.0001
AGBCO	1	1.4769	0.0583	642,4517	<0.0001

Source: Research results

According to estimation obtained from parameters, the logit model is:

$$Y = -3.0861 + 0.1497 \text{ LPROD} + 0.0116 \text{ CAPSOC} - 0.6747 \text{ ICMS} - 0.0491 \text{ OPCRED} + 1.4769 \text{ AGBCO}$$

The coefficients represent the marginal effect of each variable on the logit model. Coefficients showed expected outcomes, except those related to variables ICMS (VAT) and OPCRED. We will discuss outcome changes in detail at the end of this section. Odds ratios are shown in Table 4. The highest values of variables LPROD, CAPSOC and AGBCO imply a higher likelihood of rural credit occurrence in the event of an increase of one unit of these variables.



Table 4. Estimates of odds ratios.

Effect	Estimates	Trust gap (limits)	
		Inferior	Superior
LPROD	1.161	1.150	1.173
CAPSOC	1.012	1.011	1.012
ICMS	0.509	0.474	0.547
OPCRED	0.952	0.944	0.960
AGBCO	4.379	3.907	4.909

Source: Research results

To assess adjust quality of the model (*goodness of fit*) we use measures that indicate the accuracy with which the model approaches the observed data. When the dependent variable is qualitative, accuracy can be evaluated in terms of adjust between calculated probabilities and frequencies of responses observed (MADDALA, 1990). The sample assessed corresponded to 305,172 APUs (denominated “observations” in logit model), distributed in 535 municipalities. From these APUs, 46.313,7 received rural credit, while 258,858.3 never obtained such resources. Table 5 shows the distribution of associations among observed responses and the estimated probabilities.

Table 5. Associations among observed responses and estimated probabilities

Concordance Percentage	60.4
Discordant Percentage	38.3
Even Percentage	1.3

Source: Research results

From this information, we generated statistics that assess adjust quality of the model listed in Table 6. The four statistics indicate that the adjust quality of the model is desirable.

Table 6. Statistics on the associations among responses observed and estimated probabilities

Somers' D	0.222
Gamma	0.225
Tau-a	0.057
C	0.611

Source: Research results

In this study, we elucidate the existence of two coefficients that showed different outcomes from what was expected (OPCRED and ICMS). This might be due to the fact that they are rich municipalities with diversified economy, and have notable presence in the industrial sector which would exert strong influence on coefficients of variables ICMS and OPCRED, which may explain a different outcome than what was expected in the regression analysis.

In this respect, there is one important limitation of the model. Variables ICMS and OPCRED were introduced to the model to capture the interest of financial institutions to operate in the municipalities. However, the share of primary sector in the economy varies from municipality to municipality. Thus, the influence of industrialized municipalities (and with small rural areas), which generally have higher values for variable ICMS (VAT) and higher volumes of credit operations (loans are more abundant to sectors other than rural) occur in reverse to what is expected. That is, high values of variables ICMS and OPCRED indicate heavy industrialization in these municipalities and low values in the logit model.

A limitation of the logistic regression is that the model does not capture the difference in exposure time to the variable, which can alter the likelihood of credit granting (HALLI & RAO). For example, the time that an individual participates in a cooperative, association or syndicate may influence the likelihood of their obtaining credit. According to LIMA (2003), the presence of agricultural industries that exert strong influence on APUs, ensuring agricultural trades can influence access to credit. However, none of the variables present in the model capture the presence or influence of agro-industries in the municipalities analyzed.

## 6. Conclusions

This work evidenced the existence of barriers of several kinds that undermine the ability of financial intermediaries (especially in rural credit) to reduce their costs in this activity and therefore provide plentiful and inexpensive credit.

One solution is to use social capital to reduce the information asymmetry and transaction costs – especially those tied to opportunistic behavior and, therefore, with selecting, monitoring and contracts enforcement. In a scenario of lower costs and risks, the result will be more resources offered to credit.

Empirical results obtained in this work, as in LIMA (2003), show that the volume of rural credit in the State of Sao Paulo is positively affected by the level of social capital. Thus, highlighting the import role this variable plays for the development of the rural sector.

We emphasize to academics the existence of a vast research field of relations between social capital and financial system. Moreover, studies that aim to improve or create new measurement techniques of social capital will bring notable contribution to this research field.

Other variables can be included to the work in order to direct it to a particular field of interest. In addition, once demonstrated the influence of social capital on rural credit, we can investigate the influence of these credits on the total level of investment in agriculture in order to measure the contribution of social capital to the development of agriculture.

Furthermore, we emphasize that other factors may have significant effect on reducing inefficiencies in the financing system for agriculture, and can be analyzed more precisely in later works, such as efficiency of the judiciary system and existence of legislations and institutional policies that benefit borrowers who breach contracts, once default burden will be ultimately paid by non-defaulting borrowers.

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