Determinants of contractual arrangements in agricultural credit transactions

Luciana Florêncio de Almeida
Decio Zylbersztajn
Peter G. Klein

RESUMO

Determinantes dos arranjos contratuais nas transações de crédito agrícola

Com a redução da oferta do crédito subsidiado no financiamento da agricultura brasileira, os agentes econômicos ao longo dos sistemas agroindustriais organizam-se para associar crédito a suas transações de compra e venda com agricultores. Diferentes arranjos contratuais caracterizam-se por distintas estruturas de financiamento. No presente estudo, objetivou-se verificar a relação causal entre o tipo de financiamento adotado pelos produtores de soja no Brasil e seus possíveis determinantes. Dois arranjos foram escolhidos para análise: obtenção de crédito com bancos e por meio de transações com agentes da cadeia agroindustrial. As variáveis explicativas utilizadas foram: tamanho da propriedade, colateral acessório ao contrato e reputação medida em termos do tempo de relacionamento. Como previsto na teoria, os resultados demonstraram que o tamanho da propriedade é um elemento determinante nas transações de crédito entre agricultores e agentes da cadeia agroindustrial. Entretanto, o relacionamento com banco público e os colaterais não se mostraram elementos relevantes na análise dos determinantes da escolha dos arranjos contratuais para financiamento da soja com agentes do Sistema Agroindustrial (SAG).

Palavras-chave: contratos, crédito rural, agronegócio.

Luciana Florêncio de Almeida, Doutora em Administração pela Faculdade de Economia, Administração e Contabilidade da Universidade de São Paulo, é Professora da Escola Superior de Propaganda e Marketing (CEP 04018-010 – São Paulo/SP, Brasil) e Pesquisadora Associada do PENSA – Programa de Estudos dos Negócios do Sistema Agroindustrial da Fundação Instituto de Administração.
E-mail: lflorencio@espm.br
Endereço:
Escola Superior de Propaganda e Marketing
Rua Dr. Alvaro Alvim, 123
04018-010 – São Paulo – SP

Decio Zylbersztajn, Engenheiro Agrônomo e Mestre em Economia Agrária pela Escola Superior de Agricultura "Luiz de Queiroz" da Universidade de São Paulo, Ph.D. em Economia pela *North Carolina State University*, Estados Unidos, é Professor Titular do Departamento de Administração da Faculdade de Economia, Administração e Contabilidade da Universidade de São Paulo (CEP 05508-010 – São Paulo/SP, Brasil).
E-mail: dezylber@usp.br

Peter G. Klein é Professor Associado na *Division of Applied Social Sciences* da *University of Missouri* (Columbia, MO 65211 – USA) e Diretor Associado do *Contracting and Organizations Research Institute* (CORI).
E-mail: pklein@missouri.edu

1. INTRODUCTION

The credit market in general and the agricultural credit in particular, in Brazil, are characterized by the scarcity reflected in high interest rates as compared to the current interest rates of other countries. This is due to the macroeconomic fiscal and monetary policies that have been adopted in this country in the1980s aiming at the adjustment of public accounts and the need to restrict the expenses of the public sector (SAYAD, 1978; SPOLADOR, 2001; BANCO MUNDIAL, 2005)[1].

The market crisis, which started more abruptly in late 2008, increased the access to credit on the part of producers. New strategies have emerged in response to macro environmental factors. However, it has been observed – between boom and bust cycles – that the institutional problems make up the transactions background. In the specific case of agricultural credit, there is the lack of a fully developed insurance market able to reduce uncertainties (OSAKI, 2005), and the judicial system slowdown leads to a legal uncertainty in Brazil (PINHEIRO, 2003).

In response to the rules in force in the Brazilian agricultural credit market since the late 1980s, trading companies, agricultural input industries, crushing companies, grain exporters and unions started playing a key role in the coordination of the agro-industrial systems (*Sistemas Agroindustriais* – SAGs) through different contractual arrangements adapted to the conditions of each region. One of the strategies adopted by these companies was to associate credit facilities for producers with the sale of their products or the purchase of commodities (ALMEIDA, 1994; GONÇALVES *et al.*, 2005). Complex transaction forms were expanded in the agro-industrial chain and began to prevail as contractual arrangements, supposedly as reducers of transaction costs (NEVES, 2003; WATANABE, 2007).

Overall, agricultural credit transactions for financing production can be found in two forms: formal credit from financial institutions or credit from nontraditional credit market agents (trade credit)[2]. In each of these transaction groups, there are several possible contractual arrangements.

In the first case, the producers are able to contract farm credit with banks and credit unions. In Brazil, there is a subsidized credit modality for family farming through the National Family Farming Program (*Programa Nacional da Agricultura Familiar* – Pronaf) and there is also the restricted credit with preferential rates provided to farmers who do not fit into family farming by the banks associated with the National Farm Credit System (*Sistema Nacional de Crédito Rural* – SNCR).

The credit from SAG agents indicates a higher variability in the contracting forms and will depend on the structure of the agro-industrial system. In the specific case of soybeans, producers perform short-term credit operations mainly with credit unions, input industries, trading companies and crushing and processing industries. In these cases, there are credit transactions at free rates, as well as the transfer of credit through credit unions and such union's transactions with input industries. The trade credit transaction may generate positive results for trading companies, as they have access to credit in the international market and transfer them at higher rates to producers in Brazil (ALMEIDA, 2008).

The share of non-traditional agents in the flow of financial resources to producers also appears to be a trend in other countries. Specifically in the United States, commercial banks have represented the greatest financial power in the agricultural market. However, in recent years, the agents of the chain, known as non-traditional lenders, have been gaining a greater share in the flow of financial resources for agriculture (CHADDAD and LAZZARINI, 2003).

In agricultural credit transactions, the credit cannot be understood as a single transaction in the flow of information and resources throughout the agro-industrial system. There is a set of characteristics indicating that contractual arrangements for farm loans fall within the group of hybrid contracts or even complex contracts. As pointed out by Ménard (2004), there are bonds connecting the agents in hybrid relationships, that is, there is a certain degree of dependence. In the contractual relationships of SAG, credit agents are interconnected with producers, either by the specificity of existing assets in the production process of the negotiated product, by the frequency of transactions, or even by the environment uncertainty.

Also according to Ménard (2004), uncertainties can be derived from the inputs to the transaction (ex ante), from final products (ex post) or even from environmental factors. In credit transactions, the uncertainty arises from the informational asymmetry (ex ante opportunism) and the moral risk (ex post opportunism), in addition to issues directly involving agricultural production, that is, the risk of irregularities that could jeopardize the crop and prevent the borrower to honor his debts.

It can be concluded that in the agricultural credit market, the options to finance production are many and complex. However, each one of them contains features that will affect the farmers' decisions regarding the most appropriate arrangement to finance their crops.

The key question of this study is: What are the determinants of the contractual arrangements for financing the agricultural production in Brazil that differentiate traditional agents from trade credit agents? In other words, this study aims to evidence determinants and differentiating elements regarding the type of financing to fund the crop.

To answer this question, we opted for a multiple regression model that tests the existence of a relationship between the credit volume obtained either by traditional agents, or trade credit agents, and potentially determining factors: farm size, association of collateral with the credit agreement and the reputational aspect measured by the relationship of rural producers with financial agents. These relationships allow testing the hypotheses formulated in the light of the theoretical contribution regarding the reduction of transaction costs and the literature on capital structure determinants. The data was collected from 115 soybean producers from the main producing regions of Brazil.

The decision-making to finance every new crop reflects the incentives to which creditors and borrowers are submitted. For many years, the institutional environment appeared to be limited for the development of a complete agricultural credit market in Brazil. Ultimately, this study aims to contribute to the discussion of practices that encourage the reduction of trans-

action costs, improving credit markets in order to reduce the spreads charged, by enhancing the allocation and provision of rates appropriate to the reality of agricultural markets.

This article is divided into six sections, including this introduction. In the next section, we present the theoretical reference that focuses on the works of Titmam and Wessels (1988), Williamson (1988), Balakrishnan and Fox (1993) and Petersen and Rajan (1997). In this set of studies, we identified the hypothesis concerning the determinants of contractual arrangements to finance production. The third section presents the data collection methods and statistical tools used in this research. The fourth and fifth sections presents the results derived from the tests of hypotheses and, lastly, the conclusions will close this article.

2. THEORETICAL FRAMEWORK

Agricultural credit instruments and the contractual arrangement instruments differ from each other depending on the creditor, which may be traditional credit agents – such as banks and credit unions – and credit agents from non-traditional sources, herein called trade credit – such as trading companies, production cooperatives and industrial inputs.

Banks and credit unions – agents specialized in credit extensions – offer credit for financing, fulfilling their role as pure financial agents. In this transaction, in addition to bank credit, there is a contractual form based on funds controlled by the government with preferential rates. The offer of subsidized credit is limited as it comes from the Nation's budget through the equalization system[3]. It is natural that there may be allocation mechanisms based on politically defined criteria. By having transaction costs and shortage in the official credit supply of lower cost, it seems natural that the phenomenon of queues (BARZEL, 1982) happen as a way to allocate the scarce resource. In addition, there is a limit on the volume granted to each borrower, who must meet specific criteria based on the scale of operations and the agricultural activity modality. In summary, the fully subsidized credit is directed to family farming through Pronaf. Therefore, producers in the agribusiness – focus of this research – end up having to compose their financing needs with alternative ways, presenting market rates ranging from 11% to 30% per annum.

Trade credit agents, in turn, associate credit with their marketing strategies, such as input industries, and their origination strategies, which is the case of trading and processing companies. The strategy of associating the products flow with the financial flow is interesting for trade credit agents as it increases the chances of access to the producing market in the case of buyers, and increases the sales volume in the case of sellers. Moreover, the frequency with which the transactions occur allows companies to obtain information on the payment ability of their customers, to which banks do not have access (PETERSEN and RAJAN, 1997).

Processors and traders in the agro-industrial chain use advance contracts in the form of inputs and financial resources. Such transactions are backed by formalized contracts, such as rural producer notes (*Cédulas do Produtor Rural* – CPR), green soybean contracts or even by informal CPRs, also called off--the-record agreements, since they are not registered (SPOLADOR, 2001). Such contractual arrangements are characterized by high interest rates compared to restricted credit, which are based on the compensation of public bonds (Selic rate) plus other costs (GONÇALVES *et al.*, 2005).

Since the 1970s, the significant presence of economic agents replacing the role of financial institutions became common in agribusiness as a way to strengthen the relationship with their customers, increase sales and ensure the sustainability of their business in the long term.

According to Petersen and Rajan (1997), in the trade credit transactions, the creditors of the companies would have privileged access to the borrowers' information in contrast to financial institutions, given that the sellers or buyers of these companies frequently visit borrowers, or have greater knowledge on the business conditions due to their applications. There is also the privileged condition of control over the borrower, given the business relationship with the seller or buyer agent. Thus, the companies would also offer credits to firms with current financial problems but that indicate growth rates, because they believe that by investing in the relationship with these firms, in the future, such supplier would benefit from the upcoming profits. In other words, the loan to any type of borrower guarantees the permanence of the creditor in the market. Therefore, in conditions of high competition, the trade credit strategy would be compensatory.

The authors also claim that firms use trade credit when they cannot be eligible for the credit offered by banking institutions. In this case, creditors may attract high-risk customers, but they will also be able to implement a higher (spread) price in their operations (PETERSEN and RAJAN, 1997).

The situations mentioned by the authors can be observed in the relationships between agricultural producers and retailers of agricultural inputs, trading companies and processing companies, as there is an interdependence relationship between the various links of the agro-industrial system. Both buyers and sellers are interested in offering credit to rural producers, which is part of the competitive strategy, providing the basis for the sustainability of the agricultural activity and, therefore, for their own business. In both cases, agents that have relationships with the producers are the key elements in informational terms, since they visit the farms and establish a close and intense contact with the producer. Every time the supply has a strategic role for the trading company or for the agro-industry, more complex extra-market mechanisms become relevant.

The access to credit is determined by factors related to the firm size and its ability to offer tangible collaterals to its creditors (TITMAN and WESSELS, 1988; JIMENEZ and SAURINA,

2003). Moreover, other aspects may determine the relationship between creditors and borrowers, such as the information (STIGLITZ and WEISS, 1981; BARRY, STEVEN and LAJILI, 1992) available to the creditor concerning the rural producer. This information may include its debt level, as well as the frequency with which transactions are carried out, as they become relational contracts supported by the future value of continuous transactions between the agents (BAKER, GIBBONS and MURPHY, 2002). This set of information is relevant for the risk analysis in the absence of a public registration system that includes the registration of collaterals and other information about the borrower.

Based on the studies on the financing structure determinants of a firm, the following hypotheses are presented to explain the relationship between farmers and creditors. Three aspects were chosen for the establishment of causal relationships: firm size, use of collaterals and length of the relationship between borrowers and creditors.

2.1. Firm size

Titman and Wessels (1988) found that the leverage of a firm is positively related to its size. In other words, the higher the variables indicating the scales, the greater the interest of creditors in offering credit to these firms. Moreover, small enterprises face higher transaction costs to make use of long--term financial instruments and, therefore, the leverage becomes unfavorable to these borrowers.

Taking the agricultural credit scenario in Brazil, there is a scarcity of resources given the high demand on the part of the producers. Regarding the mandatory percentage allocation of on-demand deposits for the farm credit activity, as occurs in Brazil, it is expected for financial agents to only limit the supply for those with better payment conditions, either by having a larger scale, which leads to a smaller number of contracts, or by the increased capacity to ensure payment through collaterals in case of default. Thus, small farmers have less access to these funds. Whereas banks (traditional agents) are the key factors for the allocation of controlled resource and by considering the phenomenon of queues, it is possible to conclude that these institutions will assign it to customers with greater payment capacity and lower operating costs, that is, to medium and large landowners.

Regarding the performance of traditional credit agents, Néri and Giovanini (2005) state that these agents concern about ensuring loans to large enterprises, due to their ability to better contribute to the profitability of banks, rejecting low volume transactions, given the fixed costs of administrative and informational nature involved in the process.

Hypothesis 1 – Thus, it can be concluded that leverage through **traditional agents** is positively related to farm size.

Petersen and Rajan (1997) investigated trade credit transactions to assess their determinants. Among the findings, the authors concluded that the trade credit increases due to the company size and this occurs because the size can be an indication for the continuity of trade relations and also of the existence of higher value allocated as collateral. The results showed that the trade credit practice with these companies demonstrates the interdependence between buyers and sellers. Thus, selling to buyers of large volumes indicates the survival of the business.

In view of these findings, it can be concluded that the size of rural enterprises is positively related to the leverage through trade credit, since the greater the potential transaction volume and the larger the farms sizes, the greater the interest of private agents credit to associate credit with their business transactions. In other words, the causes of down-to-scale gains may be: to save on transaction costs, because each transaction has a bureaucratic cost, and the existence of higher collaterals.

Hypothesis 4 – Thus, it can be concluded that the leverage through **trade credit** is positively related to farm size.

2.2. Collaterals

Regarding the reduction of transaction costs (*Economia dos Custos de Transação* – ECT), Williamson (1988) presented his contribution to questions concerning the capital structure formation, associating it with the governance concept. The author assures that the financial leverage decisions of a firm are more related to strategic and control aspects than exclusively to financial factors. Thus, Williamson (1988) introduces the concept of dequity and establishes causal relationships between the decision to use the equity or to perform a financial leverage through the use of redeployable assets by the firm.

In general, the author certifies that this choice will rely on the asset's redemployment degree or on the second-use value of such asset in an activity other than the one to which the asset was built. Thus, the leverage of a firm is negatively related to the use of assets with increasing degrees of specificity, which are also used as collaterals for credit transactions. The greater the asset redeployability, the higher the probability of loans, on which these assets will be taken as collaterals. On the other hand, for those firms with higher degree of asset specificity, there will be a greater probability of using their own resources instead of third-party resources.

Based on the concepts developed by Williamson (1988), Balakrishnan and Fox (1993), empirical tests were conducted, which results indicated that the leverage of a firm is positively related to the potential redeployability of their existing assets. This implies that, in case of bankruptcy or execution of collateral, creditors will have greater difficulty with the specific assets that will lose their value as compared to non-specific assets easily sold to market agents.

In the agricultural credit market, there can be observed a practice implemented by creditors through which they take the future crop of producers as collateral, in addition to other collaterals, such as mortgages, guarantors and pledge. However, depending on the type of creditor, such collaterals will have greater or lesser degree of redeployability. In the case of banks and credit unions, traditional credit agents, it is expected for their greatest interest to be the acquirement of collaterals, such as mortgages and pledges, since the financial institution has the experience and structure to accomplish the liquidation of assets. Differently, the sale of the future crop requires specific skills and relationships, which in general, do not fall under the financial institutions competences.

Hypothesis 2 – Thus, it can be concluded that the use of the future crop as a collateral for credit transactions is negatively related to leverage by means of the traditional agents.

The agents in the agro-industrial system – such as trading companies, unions and input industries – incur in coordinate relationships, which facilitates the acceptance of the crop as collateral, in addition to collaterals, such as mortgages and guarantors. Petersen and Rajan (1997) concluded that the higher the possibility of using the products traded by the creditor (redeployment), the greater the credit supply. The possibility to redeem sold or purchased goods that could be reused in other transactions appears as an advantage on financial institutions. That is, it is expected for credit to primarily flow into markets where there is product liquidity, as is the case of commodities, which markets, spot and futures, are structured.

Hypothesis 5 – Thus, it can be concluded that the use of the future crop as a collateral for credit transactions is positively related to the leverage through trade credit.

2.3. Reputation

The reputational aspect assumes a crucial role in the preparation of institutional arrangements (BAKER, GIBBONS and MURPHY, 2002). In trade and credit relations between private agents and farmers, it is no different. However, given the difficulty of access to accurate information regarding the payment capacity of borrowers, private agents use strategies to minimize risk such as analyzing the relationship between the borrower and traditional agents.

Petersen and Rajan (1997) affirm that the trade credit may increase depending on the borrower's relationship with financial institutions. The premise behind this action indicates that the longer the relationship, the greater the probability for the borrower to be a good payer, given the strict selection of traditional creditors. In the case of agricultural credit market,

producers primarily access the restricted credit through banks. The banks, in turn, either by risk management or by the limited credit availability at preferential rates, apply selection systems. For trade credit agents, this selection becomes a guarantee for their relationship with the farmer. Therefore, it can be concluded that, if such farmer acquired access to restricted credit, there will be more chances this farmer is a good payer as compared to those who have failed the selection procedure of banks.

The literature on trade credit states that, in the absence of reliable information concerning the borrower, the agents take as a presumption in favor of the borrower, the fact such borrower maintains a relationship with a bank, as this traditional agent tends to investigate the payment capacity of the borrower. Thus, for trade credit agents, if the borrower obtains credit in the bank, it means that its risk profile is lower than the one who does not take a bank loan (PETERSEN and RAJAN, 1997).

Hypothesis 3 – Thus, it can be concluded that the leverage through traditional agents is positively related to the history of transactions between farmers and banks.

As a proxy for reputation, the frequency of transactions between creditors and borrowers is used. Baker, Gibbons and Murphy (2002) consider this repetition as part of the so-called relational contract, which is based on observable, but not contractible, behaviors. For transactions between producers and traditional agents, the reputation – measured by the length of the relationship between borrowers and creditors – emerges as a key element, so that transactions can continually endure. Thus, it is expected for relationships with a long history of transactions between banks and farmers to be positively related to the leverage with these institutions.

Hypothesis 6 – Thus, it can be concluded that the leverage through trade credit is positively related to the length of relationship between farmers and traditional agents.

3. METHODS AND STATISTICAL TREATMENT

The research conducted to answer the objectives proposed was based on a questionnaire applied to soybean producers located in the producing states in Brazil. The sample used was induced and non-random, due to the impossibility of access to a database with information regarding the universe of rural producers in Brazil, which according to the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística* – IBGE, 2007), totals 5,2 million. It was based on a database with 4,600 farmers, arising from several sources, including private companies of the productive chain of soybean and government statistical agencies. Randomly, 500 farmers

were chosen for the research and out of this total, 115 farmers[4] volunteered to answer the questionnaire by telephone, out of these, 107 cases were considered valid, which generated a response rate of 22%.

The sample stratification was based on the participation of every state in the national production, as shown in Chart 1.

We observed a relatively homogeneous distribution between farm sizes, with the large areas representing a greater share (34%), which indicate between 500 to 2,000 hectares, reflecting the reality of soybean production in the country. The largest farms, with 5,700 hectares on average, are located in Mato Grosso, and the smallest ones are located in Rio Grande do Sul, with 570 hectares on average.

By phone, structured questionnaires were applied during September and October 2005. Two statistical treatments were used to analyze the information: descriptive statistics analysis, exploring the tools of frequency, histograms and averages; econometric model based on multiple-regression equations to analyze the relationships on the determinants of the financing with third parties.

To facilitate the implementation of econometric tests, we chose to group the hypotheses in the following models:
- Model A – dependent variable is the financing volume with traditional agents.
- Model B – dependent variable is the financing volume with trade credit agents.

A third model was generated (Model AB) as a control group, whose dependent variable is the total financing volume with third parties, that is, the sum of the financing volumes with traditional agents and trade credit agents.

The equation adopted for **Model A** was:

$$\gamma = b_o + b_1 V_1 + b_2 V_2 + b_3 V_3 + e \qquad [1]$$

where:

γ = credit volume (expressed in monetary values – Real) obtained from financial institutions;

b_o = constant;

V_1 = farm size (hectares);

V_2 = future crop[5] as collateral (dummy variable);

V_3 = length of relationship between the farmer and the official and private bank (in years).

The hypotheses of **Model A** are:

H1: $V_1 > 0$ – The leverage through traditional agents is positively related to the farm size.

H2: $V_2 < 0$ – The use of future crop as a collateral for credit transactions is negatively related to the leverage through traditional agents.

H3: $V_3 > 0$ – The leverage through traditional agents is positively related to the history of transactions between farmers and traditional agents.

The equation adopted for **Model B** was:

$$\gamma = b_o + b_4 V_4 + b_5 V_5 + b_6 V_6 + b_7 V_{7+} e \qquad [2]$$

where:

γ = credit volume (expressed in monetary values – Real) obtained from trade credit agents[6];
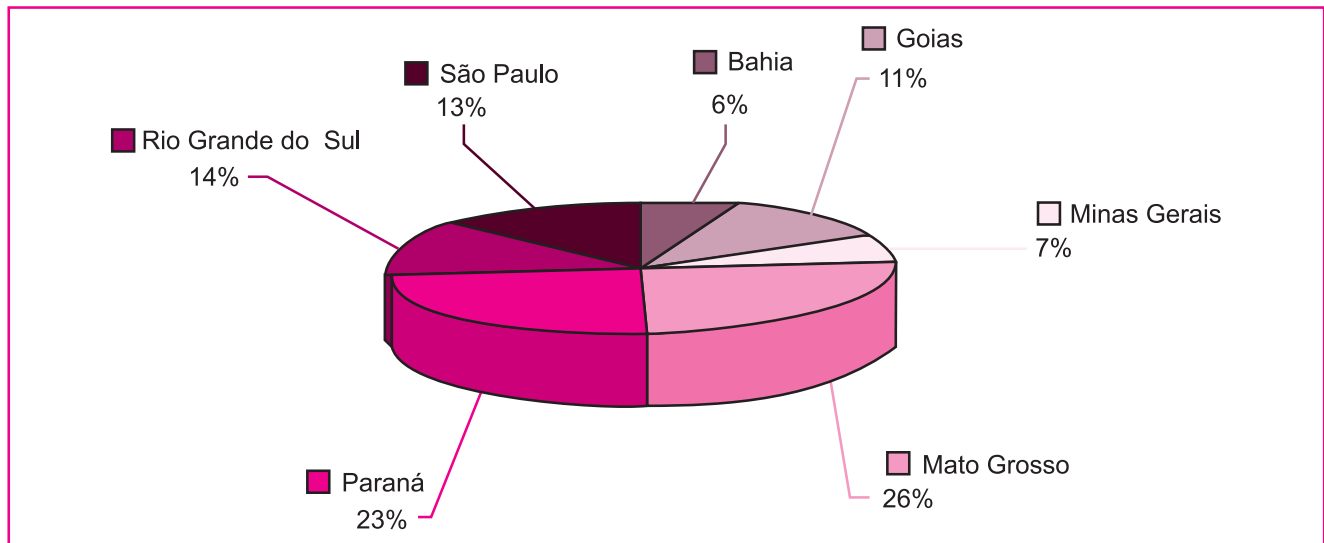
b_o = constant;

Chart 1: Source of Questionnaires as per Brazilian State

V_4 = farm size (hectares);
V_5 = future crop as collateral (dummy variable);
V_7 = length of relationship between the farmer and the official bank (in years).

The hypotheses of **Model B** are:

H4: $V_4 > 0$ – The leverage through traditional agents is positively related to the farm size.

H5: $V_5 > 0$ – The use of future crop as a collateral is positively related to the leverage through the trade credit.

H6: $V_6 > 0$ – The leverage through trade credit is positively related to the history of transactions between farmers and banks.

Table 1 shows descriptive statistics concerning the variables. There was no significant correlation between the variables tested. However, the heteroscedasticity phenomenon was found in the variables of the models. Thus, the results were corrected by using White's Test.

4. ANALYSIS AND RESULTS

In this section, the survey analyses are presented in two parts: the first one presents descriptive statistics on the financing structure of soybean producers, the second presents the statistical tests of the hypotheses concerning the capital structure determinants of soybean producers.

4.1. Production description and financing structure of soybean producers

Overall, in the sample, the leverage of funds to finance the needs of short-term capital for 2004/2005 crop primarily comes from the set of trade credit sources (47%), followed by the producers' resources (35%) and, lastly, from SNCR's controlled resources (18%), as shown in Chart 2. It was found that, out of the 107 respondents, 94% underwent operations with restricted resources; 64%, with trade credit associated with the restricted resources; 73% with producers resources associated with some type of financing. Only two producers financed crop costs exclusively with their own funds, both of them were large producers.

The survey indicated dispersion between the actual amounts spent by soybean producers in 2004/2005 crop. This dispersion is due to the occurrence of a few very large producers. By observing the histogram regarding amounts under R\$ 10 million, it can be seen that the concentration of expenses occurs at amounts under R\$ 200.000,00, which relates to farm sizes in the sample, since 73% of respondents have properties under 2,000 hectares. Larger farms require high investment volumes, which was demonstrated in the study, with amounts reaching up to R\$ 50 million.

By verifying the percentage of such expenses financed by restricted funds, the dispersion decreases. It can be seen that
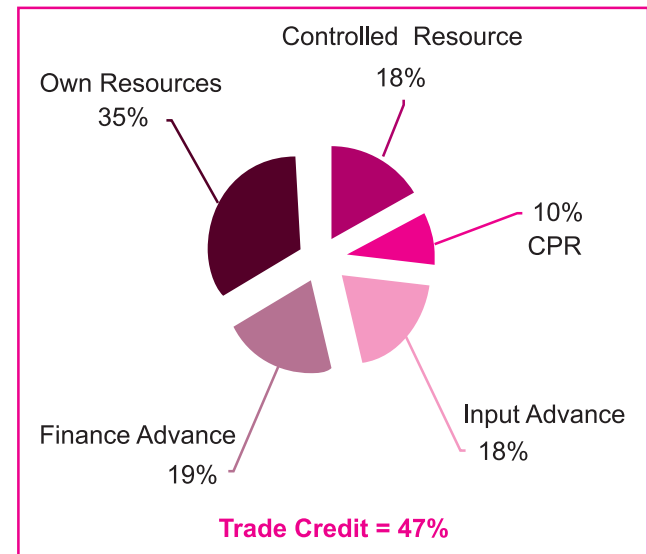
Chart 2: Financing Structure of 2004/2005 Crop

Table 1

Descriptive Statistics of Variables

Variables	Mean	Standard Deviation	Number of Observations
Area	1,699.40 hectares	4,227.72 hectares	107
Amount with Banks	R\$ 355.155,66	R\$ 471.011,28	101
Total Trade Credit Amount	R\$ 911.370,33	R\$ 3.112.846,89	71
Total Amount – Third Parties	R\$ 1.263.206,80	R\$ 3.213.381,50	105
Official Bank – Years	20 years	11 years	107
Private Bank - Years	3 years	7 years	107

most producers will fund up to 60% of their crop with rural notes.

Focusing the analysis on collaterals of farm credit agreements, there are basically five types: rural property mortgage; urban real estate mortgages; future crop; guarantors and pledge (farm machinery and tools). Every soybean producer that was interviewed was required to provide some type of collateral to enter into the restricted credit agreement with the financial institutions and the results suggest that, for some cases, more than one collateral has been required. It can be seen that 74% of borrowers offered the future crop, 35% were required to present a guarantor, 30% mortgaged some kind of rural property, and lastly, 7% offered machinery and/or tools as pledge.

4.2. Statistical test of the contractual arrangement determinants

This section presents the results of the statistical tests for the hypotheses on the financing structure determinants of agricultural production focusing on farm size, collaterals and reputation. The Table 2 summarizes the tests previously carried out with standard errors consistent with heteroscedasticity.

Model A aimed to analyze the leverage determinants with traditional agents, considering size, collateral and relationship as the variables: In this model, we have used two variables to represent the relationship between financial institutions and farmers: length of the relationship with the public bank and length of the relationship with the private bank. For the collateral, we used the future crop variable. The coefficient of determination appeared to have a low explanatory ratio ($R^2 = 0.209$), which indicates that the model has a predictive power of 21% over the causal relationship as compared to the analysis of the mean. However, the F ratio of Model B appeared to be above the sum of squared errors, indicating that, given the sample used for estimation, the model can explain 6% more than the observation of the mean.

In one of the complementary tests for Model A, only the variable length of relationship with public bank was used to represent the relationship, and in this case, the determination coefficient dropped to 0.0698, indicating that the share of other variables has contributed to the predictive power of the model. In another test, variables such as rural mortgage and urban mortgage were included to represent the collateral variable. It is worth to point out that they are all dummy variables and not

Table 2

Estimates of Regression Parameters

Dependent Variable		Traditional Agents Financial (A)		Trade Credit Financial (B)	Third Parties Financing (A + B)
Independent Variable	**Expected Signal**		**Expected Signal**		
Size	+	24.640 (24.98117)	+	707.890* (54.88071)	734.715* (30.31578)
Collateral	–	58,644.62 (101,323.2)	+	-70,280.53 (109,317.3)	2,527.31 (102,721.3)
Relationship	+	24,829.87#** (11,538.97)	+	1,409.44@ (5,747.303)	2,006.58@ (5,941.248)
Model		A		B	AB
Constant		137,274.0 (101,421.5)		-268,475.8 (120,898.5)	-5,218.463 (116,632.0)
R^2		0.209		0.921	0.938
F Ratio		6.0398		361.58	468.37
Number of Observations *		96		96	96

Notes: . The table reports the coefficients and standard deviation (in parentheses).
   * Significant at 1%.
  ** Significant at 10%.
  # The result refers to the variable "length of the relationship with the private bank".
  @ The result refers to the variable "length of the relationship with the public bank".
  *** The number of observations was reduced due to the number of observations of the variable **crop**.

mutually dependent. In other words, the respondent could choose all of them or at least one. In this case, the coefficient of determination reached 0.225, indicating that additional variables help explain the relationship, although the predictive power is low (F = 4.114; sig. = 0.001).

Model B examined the correlation between the leverage with trade credit agents and variables such as size, relationship (length of the relationship with the official bank) and collateral. The model appeared with the determination coefficient of $R^2 = 0.9218$, indicating a high explanatory power.

Two variables were added to the model regarding other collaterals used as guarantees in agriculture credit contracts: rural mortgage and urban mortgage. The model remained predictive with the addition of these variables and the *F* ratio was higher than the sum of the squares ($R^2 = 0.925$; F = 175.476).

Model A+B sought to analyze the effect of variables in the decision of the producer's total funding, which jointly reflected the leverage with traditional agents and trade credit agents. Model A+B proved to be as predictive as Model B. Area, crop and length of relationship with the bank official were used as variables.

5. RESULTS

Model A indicated reduced eloquence based on *F* measures and the significance of explanatory variables. However, the variable length of relationship with private banks seemed to be relevant to explain the financing with traditional agents as provided for in hypothesis 3. The variable relationship with the official bank, however, has not indicated the same behavior. Given that the official banks are the largest providers of restricted credit and that, in several regions, the only option

for farmers to access this credit, they tend to attract the best customers and, therefore, there would be an adverse selection in private banks. In this situation, the length of relationship becomes an important variable in the analysis of the borrower's reputation by private banks. Thus, the higher the relationship, the higher the probability for the farmer to renew the credit agreement with the private bank (relational contract).

On the other hand, models B and AB appeared to be appropriate for explaining the causal relationship between the variables. In model B, the farm size variable appears to be relevant when explaining the financing with trade credit agents and supports hypothesis 4. The same effect occurs for the Model AB. The other variables – length of relationship with the public bank and crop – are not statistically significant to explain the financing with trade credit agents.

Table 3 summarizes the signals obtained for each hypothesis. The signal consistency was observed in size and relationship variables (positively) for models A and B. Meanwhile, the signals from the collateral variable, both for financing with trade credit and with traditional agents, were not consistent with the results expected by hypotheses 2 and 5.

The next section presents the final discussions on the results and objectives proposed by this research.

6. CONCLUSIONS

This study aimed to verify the existence of determinants of the financing structure regarding the production and existing contractual arrangements. The arrangements were organized into two groups: traditional agents (public banks and private banks) and trade credit agents (non-traditional agents, private companies in the SAG).

Table 3

Results Analysis

Hypotheses	Expected Signal	Signal Obtained
Model A		
H1: The leverage through traditional agents is positively related to the farm size.	+	+
H2: The use of the future crop as a collateral for credit transactions is negatively related to the leverage through traditional agents.	−	+
H3: The leverage through traditional agents is positively related to the history of transactions between farmers and traditional agents.	+	+
Model B		
H4: The leverage through trade credit is positively related to the farm size.	+	+
H5: The use of future crop as a collateral is positively related to the leverage through trade credit.	+	−
H6: The leverage through trade credit is positively related to the history of transactions between farmers and banks.	+	+

Overall, the forms of financing via trade credit are determined as alternative arrangements to the scarcity of restricted credit to producers and as supply and marketing strategies for companies in the SAG. On the other hand, it is observed that the credit obtained from financial institutions continues to be an important source for financing agricultural production.

The hypotheses of this study were formulated in the light of the theory on the economy of transaction costs and studies on determinants of the capital structure. Farm size, length of relationship with traditional creditors, participation in the securitization program and the use of future crop as contractual collateral were analyzed as determinants.

The results showed that the ability of soybean producers to finance their agricultural production with trade credit agents is directly related to the size of their productive operation. However, the reputation with the financial agents and the future crop granted as collateral are not relevant to explain this relationship.

Regarding the confirmation of the hypothesis on the importance of firm size for trade credit agents, the results support the works of Petersen and Rajan (1996). The results indicated that this option is held to a greater degree by producers with higher production volume, confirming the authors' precept stating that the trade credit increases according to the company size.

It was not possible to affirm that there was a positive correlation between funding from traditional agents and farm size, as previously expected. The scarcity of funds, preferential rates and increased indebtedness of farmers with past debts, which led to the securitization process in the 1990s, led banks to conduct rigorous selection procedures. Thus, other variables such as credit score and the financing amount on the assets should have a greater impact on the creditors' decisions. Given that banks use models to estimate the borrower's risk, the set of variables tested here, when associated with others, may better characterize the borrower and, hence, determine the contractual arrangement. On the other hand, trade credit agents that have no competence to conduct more rigorous selection procedures are based on observable variables such as size.

As for the reputational aspects, it was found that the length of the relationship with financial institutions was not a relevant variable to explain both arrangements. Only the variable length of relationship with private banks seemed to be relevant to explain the arrangement with banks. This can be explained by the necessity of private banks to base upon relational contracts (frequency and reputation) in order to reduce adverse selection, since official banks have more favorable conditions to attract the best customers.

While the reputational aspect did not appear to be relevant in the models, one can reckon that it may be measured in different ways other than just the length of the relationship with banks. With respect to trade credit agents, the reputation can be measured by the proximity with the borrower, which allows monitoring the business profitability. On the other hand, banks must use other information accessed through social networking, such as timely payments of suppliers in relationships brokered by the bank. Alternatively, the reputation exclusively refers to the borrower's credit score and the aspects regarding the borrower's behavior with other creditors are irrelevant.

The propositions of Balakrishnann and Fox (1993) and Williamson (1988), regarding the relationship between redeployable assets and the leverage by third parties, were not corroborated. Both banks and trade credit agents require the future crop as collateral in credit agreements. It can be noted in the sample that 74% of borrowers offered the future crop. This result may indicate the increasing interrelationship between financial institutions and trade credit agents, on which by accepting the crop, financial institutions can sell them to these companies, forming triangular trade relationships. These operations have been leaded by the intensive use of CPRs, which associate the anticipation of funds with the future crop delivery. In addition, since they are located in agricultural regions, these financial agents specialize in the agricultural credit supply, creating social and business networks that enable them establishing transactions shared with agents of the agro-industrial chain. As provided in the theory on hybrid forms (MÉNARD, 2004), credit agreements show the interdependence between the agents as a way to reduce the uncertainties and transaction costs.

Considering the 2008/2009 crisis scenario in the global markets, the Brazilian agribusiness has been mainly affected concerning the access to credit, further aggravating the situation of the aforementioned producers, as shown in this study, and institutional elements related to the transaction that narrow the access to credit at appropriate rates as per the agricultural production financing.

The results indicate the complex relationships that determine the financing, depending on the creditor. In the absence of a fully developed insurance market for both credit and crop, and given the results obtained in this research, we suggest the government authorities and creditors to enter into an alliance in order to reduce the adverse effects of credit scarcity and of high interest rates on the sustainability of agribusiness. Initiatives, such as the sharing of risk between traditional and nontraditional agents, the development of a positive reference file for borrowers and the performance of transactions backed by agribusiness receivables are welcomed by the market and should be stimulated by the government, as a way to reduce transaction and mitigation costs of uncertainties and risks associated with the agricultural activity.

By looking at the current and future contractual relationships in the agro-industrial chain in Brazil and the importance of credit to support them, the results of this study lead to a research agenda with three central vertices: the overall study on the credit market regulation and specifically the agricultural

market, considering the drop of interest rates; the impacts of trade credit as an important business strategy based on relational aspects; studies on crop insurance, since it is an important instrument to reduce uncertainties and may provide a new institutional path to the agricultural credit scenario in Brazil. ◆

NOTES

(1) According to Sayad (1978) the agricultural credit policy has exhausted its possibilities in the late 1970s. The author outlines three central issues: the unequal distribution of subsidized credit among the producers categories, for only 20% of the total have access to the funding and most of them are large landowners; the credit increase not followed by the production increase; the operation of the rural credit system had an impact on the monetary policy, thus, generating inflation.

(2) Trade credit in Portuguese means, credit transaction. According to Ferris (1981), it is a mechanism that separates the exchange of money for the actual uncertainty in the exchange of goods. In other words, it indicates the purchase of goods or services with deferred payment to the supplier or the sale of goods or services with collection adjorment or anticipation.

(3) The rate at the time of the study was 8.75% per annum. In 2008, such rate went down to 6.75% per annum. The Selic rate for December/2008 was 13% per annum. The equalization system of interest rates is equivalent to the payment of the difference between the interest rates charged by the financial market and those paid by farmers. This equivalence is made by the National Treasury. In the Brazilian farm-credit market, the interest rate applied in the official farm credit is lower than the one in force in the market, and according to Barzel (1982), it is reasonable to expect that mechanisms emerge to allocate the excess demand. Such a mechanism, represented by the phenomenon of queues, can be seen as being formed by access costs, which in practice could be priced indicating higher real interest rates.

(4) In this sample, we did not include family farmers who have access to other forms of agricultural credit, not addressed in this research.

(5) Future crop corresponds to the crop to be harvested after contracting the credit to finance production.

(6) This amount represents the sum related to the agreements with CPR carried out with private agents, agreements of advance procurement of inputs and advance financing agreements.

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ABSTRACT

Determinants of contractual arrangements in agricultural credit transactions

Because of a reduction in the supply of subsidized agricultural credit in Brazil, the economic agents in the agro-industrial systems organized themselves to tie in credit and their buying and selling transactions with farmers. Different types of agreements appeared, characterized by different finance structures. In this study, the authors aimed at verifying the causal relation between the type of financing used by soy producers in Brazil and their possible determinants. Two arrangements were chosen for analysis: getting bank loans and getting loans tied to transactions with agro-industrial chain agents. The explanatory variables used were property size, guarantees provided and reputation, measured in terms of how long the relationship had existed for. As foreseen in the theory, results showed that property size is one of the determinants of credit transactions between farmers and agro-industrial chain agents. However, the relation with government banks and the guarantees did not turn out to be relevant elements for the analysis of the determinants in the choice of contractual arrangements for soy financing with agents of the agro-industrial system.

Keywords: contracts, rural credit, agribusiness.

RESUMEN

Determinantes de los arreglos contractuales en las operaciones de crédito agrícola

Con la reducción de la oferta de créditos subsidiados en el financiamiento de la agricultura brasileña, los agentes económicos en los sistemas agroindustriales se organizan para vincular crédito a sus operaciones de compra y venta con agricultores. Distintos arreglos contractuales se caracterizan por diferentes estructuras de financiamiento. El objetivo de este estudio fue verificar la relación causal entre el tipo de financiamiento utilizado por los productores de soja en Brasil y sus posibles factores determinantes. Dos arreglos fueron elegidos para análisis: la obtención de crédito con los bancos y por medio de las transacciones con agentes de la cadena agroindustrial. Las variables explicativas utilizadas fueron: tamaño de la propiedad, colateral o garantía del contrato y reputación medida en términos de duración de la relación. Como se afirma en la teoría, los resultados demostraron que el tamaño de la propiedad es un factor determinante en las operaciones de crédito entre agricultores y agentes de la cadena agroindustrial. Sin embargo, la relación con el banco público y los colaterales no se mostraron relevantes en el análisis de los factores determinantes de los arreglos contractuales para financiamiento de la soja con agentes del sistema agroindustrial.

Palabras clave: contratos, crédito rural, agroindustria.