Assessing public policy impacts: one application of Cooperatives Participating of Agricultural Cooperatives Capitalization Program (Procap-Agro) in Brazil

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In this paper we proposed an instrumental framework for assessing impacts of credit public policies applied to agricultural cooperatives in Brazil. Considering whether cooperatives that received funding of the Agricultural Cooperatives Capitalization Program (PROCAP-AGRO) have undergone changes related to operating efficiency and financial structure. For this, was used financial ratios and econometric approach. Results indicating improvements in the cooperatives after the PROCAP-AGRO on certain financial ratios and distinct effects on the technical efficiency, as a result of the varied use of program resources. Finally, we conclude about the potential of the proposed assessment methodology.

1. Introduction

According to Cook (1995), there are some problems provided by vaguely defined property rights, which affect both members incentives to invest in organization and overall ability of cooperative to expand your net worth. Moreover, Chaddad, Cook and Heckelei (2005) states that financially constrained firms only invest when they generate sufficient cash flow arising from its operations, while firms not constrained are able to acquire venture capital from external sources.

Authors such as Parliament and Lerman (1993) and Moller, Featherstone and Barton (1996) already indicated the occurrence of financial constraint in United States cooperatives, with small and large ones affected differently: while in the smaller, main difficulty was the low returns of its operating assets, in the largest, were the high level of debt and high interest rates charged on bank loans.

In the 2000s, Brazilian government began to partly provide the demand for external equity financing of these cooperatives, introducing, under the agricultural cooperative, programs like RECOOP[1], PRODECOOP[2] and the Capitalization Program of Agricultural Cooperatives (PROCAP-AGRO)[3], to enable the cooperatives to make investments, to mitigate financial constrains and to business reorganization of their financial structures.

The purpose of this study is to evaluate a Brazilian experience to improve financial structure of agricultural cooperatives, the Agricultural Cooperatives Capitalization Program (PROCAP-AGRO), presenting a methodology that enables to check whether the cooperatives that received funding have undergone any change in their operational efficiency, in their degree of indebtedness and hence in their financial structure.

As results of the econometric approach in this study, it is observed virtuous potential of proposed assessment methodology, with the results indicating improvements after the PROCAP-AGRO on certain financial ratios and distinct effects on the technical efficiency of cooperatives, as a result of the varied use of program resources, influenced, among other issues, by the cooperative size.

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[1] Revitalization Program of the Brazilian Agricultural Cooperatives.
[2] Cooperative Development Program for Adding Value to Agricultural Production.
[3] Aimed at promoting financial reorganization and formation of capital by individual stations exclusively for agriculture, agribusiness, and aquaculture or fisheries resources through the National Bank for Economic and Social Development.

The paper is structured in three other sections besides this introduction. In the second section was described the methodology and data used. In third section it's presented the results and, finally, the fourth section presents the conclusions.

2. Methodology

In the literature regarding the assessment of government programs, the usage of models related to Estimation of Treatment Effects such as *Propensity Score*[4] has been observed. However, the characteristics of the available data not always allow the application of these models. The impracticability of obtaining information about a relatively large group of control, with aspects similar to the group of program beneficiaries, as well as the possibility of using data that contain information about the same individuals before and after treatment may suggest the usage of other methodologies.

As an alternative, the assessment methodology used in this paper involved the calculation of financial indicators from balance sheets obtained with the studied cooperatives. Subsequently, a means and medians test for the selection of those indicators changed during the period considered in the analysis was carried out. Next, an econometric method of dynamic panel for establishing the importance of PROCAP-AGRO as an explanatory factor of variation in financial indicators was employed. The next step was to obtain efficiency scores using the methodology of Data Envelopment Analysis (DEA). Finally, estimation was made of the Tobit econometric model to study the significance of the PROCAP-AGRO as an explanatory variable of changes in the levels of efficiency scores.

2.1. Economic Financial Indicators

From the financial statements published in the reports of the directors of agricultural cooperatives for the period comprising 2006 to 2010, the analysis was developed using the following steps:

a) standardization of financial statements;

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[4] Studies such as those by Magellan, Silveira Neto, Dias and Barros (2006) and Duarte Sampaio Sampaio (2007) used the methodology of estimation of treatment effects. For details on these models, *cf.* Becker and Ichino (2002) and Khandker, Koolwal and Samad (2010).

b)   correction of their nominal values by the Brazilian General Index of Market Prices (IGP-M), of Getúlio Vargas Foundation, with 2010 as the taxable year;

c)   reclassification of equity accounts;

d)   calculation of financial indicators.

Subsequently, the financial statements were studied according to the analysis techniques of balance sheets tailored to the socioeconomic reality of partnerships.

The Equity Ratios refer to comparisons between values of the equity structure of the organization, i.e., those observed in the Balance Sheet. For better representation of the results, these asset values can be obtained by arithmetic means between the initial and final balance of the accounts or distinguished group of balances (not proceeding with the simple use of balances at end of the year). Thus, we can examine both the sources of funds (enforceable and non-enforceable obligations) and their applications (assets and rights), establishing relationships, according to the branch of activity of the company, allowing better visualization of results obtained from the performed operations (ASSAF NETO, 2010).

The ratios of Asset Variations, in turn, are derived from a comparison of both main components of financial reports: the Statement of Income for the Year and the Balance Sheet. As in equity ratios, assets and liabilities used for calculation can be represented by means of the review period.

Chart 1 presents the key ratios that were calculated for the sample of cooperatives.

[Chart 1]

As this is the study of a Program aimed at improve the working capital of assisted cooperatives, the dynamic indicators for this particular item were also analyzed according to the approach suggested by Fleuriet (1980)[5]. These indicators can be found in Chart 2.

[Chart 2]

2.2. Effects of PROCAP-AGRO on Economic and financial indicators

The mean and median tests are the first step of data treatment by univariate analysis, aiming to capture the behavior of the accounting and financial indicators (also called quotients) used in the study before and after the implementation of the Program of

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[5] For more details, *cf.* Assaf Neto (2010) and Marques and Braga (1995).

Capitalization of Agricultural Cooperatives – PROCAP-AGRO. These tests tell whether the indicators are statistically the same or different in the periods before and after the Program.

This study tested whether the indicators followed a normal distribution[6], and if not, no differences in means were evaluated. Additionally, a non-parametric test was used to assess whether there are differences in medians.

In summary, we verified whether the financial indicators changed in the periods before and after the entry of the Cooperative in PROCAP-AGRO.

2.3. Determinants of the cooperatives performance

Under a model of panel data, we sought to evaluate the results of PROCAP-AGRO on agricultural cooperatives fitting to the Program, using the calculated indicators, as shown in the previous section, and the control variables, in order to capture other characteristics that may have caused changes in the performance of these cooperatives, without this factor being directly linked to PROCAP-AGRO.

According to a study by Anuatti-Neto *et al.* (2005), the use of dynamic panel data becomes suitable for the analysis of financial indicators, where it is expected that the inclusion of the lagged dependent term between the explanatory variables capture an element of persistence.

According to Greene (2008), by resorting to the estimation of dynamic panel, it is asserted that in addition to the variables that are able to generate the dependent variable in a given period, the entire history of the dependent variable is deemed important in this respect.

Thus, the empirical model used in this work, considering the use of the dynamic panel data, is represented below by equation (1):

$$ID_{it} = \alpha + \beta_1 ID_{i(t-1)} + \beta_2 PROCAP_{it} + \beta_3 GDPB_{AGRO\,it} + \beta_4 EXCHANGE_{it} + \beta_5 AGE_{it} + \beta_6 ASSETS_{it} \quad (1)$$
$$+ \varepsilon_{it}$$

where ID_{it} represents each performance indicator described in Charts 1 and 2; $ID_{i(t-1)}$ represents the lagged ID_{it} variable; the PROCAP-AGRO *Dummy* variable takes value 0 (zero) for the years previous to the contract of PROCAP-AGRO and value 1 (one) for the years subsequent to PROCAP-AGRO, and aims to capture the possible effect of the Program

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[6] For more details on the tests of normality, *cf.* Doornik and Hansen (1994).

on the variation of indicators ; GDP$_{AGRO}$ refers to the Gross Domestic Product – Agricultural, whose source of data is the Brazilian Institute of Geography and Statistics (IBGE); EXCHANGE is the commercial Exchange Rate for sale: real (R$) / US dollar (US$) – end of period, published on the Bulletin of the Central Bank of Brazil (BCB); AGE is the age in years of cooperatives; and ASSETS is the total assets of each cooperative. Finally, we have the term $\varepsilon_{it} = \eta_i + u_{it}$, where u_{it} is the stochastic disturbance, and η_i is the stochastic term for single units, capturing factors that affect the indicators and are constant over time, but differ from cooperatives, consisting of the so-called individual heterogeneity.

Due to the dynamic nature of the esteemed panel, the developments made by Blundell and Bond (1998)[7] for the estimation of the model were used.

2.4. The Model for Data Envelopment Analysis and Efficiency Analysis

To measure the levels of efficiency in agricultural cooperatives, a non-parametric technique with approach to multiple inputs and outputs of data envelopment analysis - *DEA*, developed by Charnes, Cooper and Rhodes (1978), from Farrell (1957), was used as an alternative to conventional parametric methods.

To facilitate the implementation of the method, Ferreira (2005) enumerated some basic assumptions that must be met, namely: a) the set of inputs and outputs used by the DMUs[8] should be the same; b) each DMU should be autonomous in decision making and; c) the DMUs should be homogeneous and operate in the same unit of measure.

This work overcomes the assumption of higher amount of DMU's relative to the number of model inputs, using a number of cooperatives greater than the number of inputs and outputs used in the DEA.

The assumption of homogeneity of DMU's, which could become a limitation for the study, was met as both the product and the inputs are measured from a single measurement, the monetary value of the output and inputs. Thus, although the cooperatives negotiate various outputs, the measure is the same for all.

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[7] According to Baltagi (2005), the estimator of Blundell and Bond (1998) has indicated its use for generating efficient to model the dynamic panel estimators when the number of periods of analysis is small.
[8] The term DMU (Decision Making Unit) refers to production units in which the relative efficiency of the group being analyzed.

Another limitation that may affect the possibility of DEA providing reliable results would be the measurement of variables. Thus, in order to minimize this problem, inputs and outputs were measured on the same basis: monetary and standardized.

The use of the model with variable returns (BCC), capable of capturing technical efficiency of cooperatives, was chosen. The orientation for output was also chosen, depending on the specificities of the agricultural products market, which seeks the best use of basic raw material, determining the quest for an answer to the following question: what is the maximum that could be produced, given the amount of existing inputs?

The following algebraic notation (2) can represent the BCC model, which assumes variable returns to the scale and orientation for output:

$$max_{\phi,\lambda}\phi,$$
$$s.a.\,\phi y_i - Y\lambda \leq 0,$$
$$-x_i + X\lambda \leq 0, \qquad\qquad (2)$$
$$N_1\lambda = 1$$
$$-\lambda \leq 0,$$

where N_1 is a (n x 1) vector of numbers one; y_i is a vector (m x 1) of quantities of output of the i-th DMU; x_i is a vector (k x 1) of amounts of input from the *i-th* DMU; Y is a matrix (n x m) of outputs of *n* DMU's; X is a matrix (n x k) of inputs of *n* DMU's; λ is a vector (n x 1) of weights; and φ is a scalar that has values equal to or greater than 1 and indicates the efficiency score of DMU's. It is worth noting that the score of technical efficiency of the *i-th* DMU, ranging from 0 to 1, can be obtained by 1/φ.[9]

The work of Ferreira and Braga (2007), who also employed such measures of output and input to measure the efficiency of cooperatives that operated with multiple outputs, was used as a reference for application of DEA in cooperatives in Brazil.

The output and inputs, consisting of annual data from 2006 to 2010, were selected based on studies of Reis, Braga and Bressan (2010): Output (Y) - GROSS SALES (R$) of each cooperative, represented by the sales volume of cooperatives, providing a measure of overall outcome of the DMU. Input (X) - OPERATING EXPENSES (R$), which represent the size of the operational structure, in addition to representing a proxy for the level of

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[9] For further details about the parametric and nonparametric approaches used in efficiency measurement, cf., Cooper *et al.* (1995), Reinhard (1999), Perelman and Coelli (1999), Reinhard, Thijssen and Lovell (2000).

professionalization of the cooperative management, since much of the amount is made up by Expenses with Salaries; PERMANENT ASSETS (R$), which represent the amount of capital of the cooperatives applied in fixed assets, usually high in agricultural cooperatives.

2.5. Effects of PROCAP-AGRO regarding efficiency scores of agricultural cooperatives

Checking the efficiency, by itself, brings many elements that could indicate whether, in fact, there was some interaction of PROCAP-AGRO with calculated scores, which made it necessary to use econometric models able to capture the existence or non-existence of relationship between the variation of the efficiency and the Program.

Thus, with the values or the efficiency scores of the surveyed cooperatives, in a second moment, the Tobit model was used in Panel to investigate, after the implementation of PROCAP-AGRO, whether the surveyed agricultural cooperatives benefited or not in terms of efficiency.

Tobit model is used where the dependent variable is situated between certain values or concentrated in equal aspects to a threshold value (Greene, 2008). This is the case in the present study, as the efficiency scores range from 0 to 1 (zero to one). In these cases, we have, in statistical terms, a censored sample. In these situations, the application of the Tobit model aims to circumvent the problem of restriction in efficiency score range by resorting to statistical techniques that allow inferences to the entire population without loss of quality, as it would occur in the case of truncated variables.

Equation (3) shows the variables used in the Tobit model estimated:

$$DEA_{it} = \alpha + \beta_1 PROCAP_{it} + \beta_2 GDPB_{AGRO_{it}} + \beta_3 EXCHANGE_{it} + \beta_4 AGE_{it} + \beta_5 ASSETS_{it} \quad (3)$$
$$+ \varepsilon_{it}$$

- Dependent variable (Y): in determining the efficiency conditions, the efficiency scores obtained using the Data Envelopment Analysis were employed as a dependent variable. Therefore, each DMU has a positive coefficient of efficiency, limited to the range from 0 to 1.
- Independent variables (X): the same variables described in equation 1 referring to the dynamic panel data model were used.

Grosskopf (1996) states that there are a number empirical studies that use this

methodology, given the characteristics of the distribution of efficiency measures from the DEA. Moreover, Banker and Natarajan (2008), in a study that analyzed several methods for assessing the impact of environmental variables on changes in efficiency scores, found no significant advantages in the use of other methods, compared to the Tobit model.

2.6 The sample

A non-experimental model was adopted, and the sample consisted only of those cooperatives participating in the Program. Thus, the situation of the period previous to obtaining the PROCAP-AGRO was compared with that after obtaining it.

All assessment was conducted by an evaluator external to cooperatives and agencies responsible for formulating and implementing the Program in order to strengthen the neutrality of the assessment.

We used a representative sample of cooperatives covered with funds from PROCAP-AGRO, in the crop year of 2009/2010, distributed geographically by states with the highest number of signed contracts.

In order to determine the sample size, we adopted the formulation proposed by Rea and Parker (2000), suitable for small populations:

$$Sample = \frac{Z^2[p(1-p)]N}{Z^2[p(1-p)] + (N-1)C^2} \tag{4}$$

where *C* is the maximum permissible error in terms of proportions; *Z* indicates the confidence level in units of standard deviation; *p* is the proportion of the researched universe; and *N* indicates the number of elements of the population.

To determine the sample size, we set up a confidence interval (*Z*) of 99% and a maximum margin of error (*C*) of 10%, where 105 cooperatives obtained PROCAP-AGRO in the season 2009/2010, with this defined as the number of elements in the population (*N*). The Brazilian states of Minas Gerais (MG), Paraná (PR), Rio Grande do Sul (RS) Santa Catarina (SC) and São Paulo (SP) held together, 91.43% of the cooperatives benefited by PROCAP-AGRO during the season of 2009/2010, and this is the value of the Population Proportion (*p*) used for calculation of the sample size.

From (4), the sample size was set to 36 cooperatives. However, in order to avoid that fewer cooperatives studied than the minimum specified in the sample size calculation, we chose to visit a greater number of cooperatives, settling at 40 the number of cooperatives actually surveyed.

These cooperatives were distributed in order to consider the proportionality of the number of contracts approved in 2009/2010 in each of the five states taken into consideration. Thus, 11 cooperatives in MG, 9 cooperatives in PR, eight cooperatives in RS, 5 cooperatives in SC and 7 cooperatives in SP were visited.

Selected cooperatives were grouped as the Gross Sales of the fiscal year 2010, in Group 1, containing 26 cooperatives with revenue lower than R$ 500 million, or in Group 2, containing 14 cooperatives with revenues greater than R$ 500 million, considering the specificities contained in these two groups of different financial bearings. According to the t-test of difference of performed means, a significant difference between the average Gross Sales of the two groups of specified cooperatives was found.

The collection of quantitative data (primarily financial statements) and the application of semi-structured interviews with professionals and/or managers of cooperatives were held at the chosen cooperatives to obtain qualitative data.

Table 1 contains information regarding the evolution of the Gross Sales of cooperatives studied during the five years of the analysis.

[Table 1]

As it can be noticed, the years 2009 and 2010 were marked by a decline in average gross income, which can also be a reflection of the international economic crisis.

The spread of the crisis had as a consequence a reduction in international demand, which affected domestic exports of farm products, impacting negatively on its prices.

Thus, the cooperatives exercising export activities, or those that, as it usually occurs in the agricultural sector, are subject to internationally listed commodity prices, suffered setbacks with the unfolding crisis.

3. Results and Discussion

In this section, the results obtained by analyzing Group 1 are presented, containing the 26 cooperatives with Gross Sales lower than R$ 500 million, and Group 2, containing the 14 cooperatives, which, in 2010, had Gross Sales greater than R$ 500 million.

3.1. Effects of PROCAP-AGRO on Economic and Financial indicators

We evaluated the economic and financial indicators that presented differences in the period of one year before earning the resources of PROCAP-AGRO with respect to one year after PROCAP-AGRO. The results are shown in Table 2

Initially, we tested whether the indicators of the groups of Solvency, Capital Guarantee, Profitability, Growth and Dynamic Analysis of Working Capital had a normal distribution, to then apply the difference of means test. We also considered the difference of means test, representing Group 1 of cooperatives with Gross Sales lower than R$ 500 million and Group 2 of cooperatives with Gross Sales exceeding R$ 500 million.

We note, by the analysis of Table 2, that the majority of indicators have suffered some sort of statistically significant changes in mean their and/or median during the specified period, considering Group 1 of the cooperatives.

[Table 2]

Growth was expected from the indicators of the Solvency group, as it was observed due to lengthened payment terms and the shortage obtained by many of the cooperatives in hiring PROCAP-AGRO.

With regard to the group of Capital Guarantee, the Short-term debt (DB) was reduced, as well as the debt in general (LI), indicating the change in the debt profile, as expected, passing to the long-term profile, with increased LTI. NWC was compromised, being reduced in the period. However, NCA, conceptualized by Assaf Neto (2010), as the surplus of permanent resources (long-term), whether self-acquired or from third parties, allocated by the company, in relation to the amount also applied in the long term, had positive and increasing value, indicating the possibility of growth in the activities of the cooperative. NCA indicated improvement in the short-term financial situation, given the conditions of payment of PROCAP-AGRO. It becomes important to maintain a long-term monitoring in order to determine if, after the payment of funds, cooperatives will be able to keep improving.

The Profitability group had a decrease in means and/or medians after PROCAP-AGRO, an expected situation due to increased interest expense, and it may also indicate an increase in the physical structure, with a consequent increase in operating costs, compared to the results of the activities of cooperatives, which may be the result of investments that had not yet completed their period of maturation.

Ratio of the Growth group had different behavior. While the NE and TA indicators rose in line with expectations, GR decreased, which may be the evidence of a great 2008, compared to 2010, year of economic activity recovery after the international crisis of 2009 and problems in the price of certain goods, as put by some respondents in the cooperatives. As these are indicators should be analyzed in a longer period than just one year, if one wants to observe any trends in their behavior, such indicators depend on more time after obtaining the PROCAP-AGRO to produce more robust assessments.

With respect to the ratios of the Dynamic Analysis of Working Capital, it was felt that LT had a positive change in its median, comparing before and after PROCAP-AGRO, which is an expected result, since long-term pay and shortage of many cooperatives brought PROCAP-AGRO to compose Non-Current Liabilities, which may have promoted the change in the debt profile of these cooperatives.

Quotients with differences in statistically significant means and/or medians were fewer in Group 2, from cooperatives with Gross Sales in 2010 over R$ 500 million. However, it is worth noting that the General Liquidity indicator (GR), not significant in the analysis of Group 1, was significant in Group 2, and with drop between the periods of analysis, which shows, together with the analysis of other liquidity ratios, variations of Non-Current Liabilities greater than the value of operations in long-term, since this indicator includes long-term in its composition.

In summary, these results indicate that there are opportunities to capture differences in the accounting and financial indicators in the periods before and after PROCAP-AGRO from multivariate econometric models. The use of these models is needed, since the univariate analyzes presented here do not allow reliable inferences in order to signal whether the changes in the calculated indicators were due to PROCAP-AGRO.

3.2. Analysis of the effects of PROCAP-AGRO against indicators using Regression model in Dynamic Panel Data

According to the results estimated by the regression model with dynamic panel data, using the indicators selected by the mean and median test, only some indicators were statistically significant to assess the effects of PROCAP-AGRO in the surveyed agricultural cooperatives.

Table 3 presents the results of the dynamic panel model with respect to the indicators

presented in Table 2, obtained considering only cooperatives in Group 1.

[Table 3]

With respect to the regression of Current Liquidity (CR) of the Solvency group, presented in Table 3, it is noticed that the coefficient of the PROCAP-AGRO variable was significant and with a negative sign, indicating that the PROCAP-AGRO resource influences the ratio inversely. Agustini (1999) states that the CR is related to the ratio of working capital of the cooperative and can represent its funding sources.

Yet in view of the connection between CR and working capital, Alves (2003) highlights that agricultural activity requires a large volume of credit, due to the peculiarities of the sector, such as the seasonality of production and the fact that the capital employed in the activity becomes unavailable for several months. Thus, the necessary working capital turns out to be higher than that required in other economic activities, and thus, the agricultural cooperatives assume the role of redistributors of resources to members.

In the same vein, in a study on the financial management of agricultural cooperatives, Gimenes and Gimenes (2008) emphasize that the liquidity reduced from the cooperatives of Parana, which was a function of the magnitude of the Receivables account, accounting for 72.27% of current assets, as the result of a scenario where cooperatives financed their members, assuming all the risk of default.

Thus, based on the results of the dynamic panel for the CR display, it appears that the resources of PROCAP-AGRO were not able to allow better management of liquidity of the surveyed cooperatives, at least in the short term.

The indicator of the Level of Indebtedness (LI) was explained by PROCAP-AGRO, for Group 1 of cooperatives. It is noted, by examination of Table 3, that the PROCAP-AGRO variable presented positive sign, having a direct relationship with LI. According to Assaf Neto (2010), LI is a measure that reveals the level of dependency of the company in relation to its financing through its own resources. In general, for this indicator, a result higher than 1 denotes greater financial dependence of the company in relation to third-party resources.

Despite the decline of this ratio in the year after joining the program, as shown in Table 2, this decrease was not due to PROCAP-AGRO, as shown by the positive sign of the regression displayed in Table 3, which indicates that access to resources is directly linked to increased LI by elevation of Total Liabilities. Again, this is a consequence considered normal in the period soon after taking the loans, and the reversal of this trend depends on the use of these resources.

The indicator of Working Capital Profitability (WCP) was another quotient explained by PROCAP-AGRO only when Group 1 of the cooperatives was analyzed. The positive sign indicates an improvement in these WCP after PROCAP-AGRO. This finding goes against one of the general objectives of the Program – sanitation and financial improvement.

Nevertheless, Table 2 contains information denoting low return on working capital, with the indicator dropping after PROCAP-AGRO, which confirms the theoretical discussion about the low levels of profitability of Brazilian agricultural cooperatives.

The positive result of PROCAP-AGRO regarding WCP can be linked to a price negotiation with suppliers and/or buyers more favorable to cooperatives, given the possibility of using the resources of the Program, both for cash and storage with a view to better market conditions for the sale of their outputs, as declared by Group 1.

Thus, it is noticed that, even with worsening levels of WCP after the Program, PROCAP-AGRO was not responsible for its drop. Instead, it prevented WCP from being more pronounced.

Finally, with respect to the indicators of Group 2, it was found, by means of econometric model of dynamic panel, that none of them had significant variable *dummy* PROCAP-AGRO to explain them. Therefore, there are no results about this group being presented. This lack of significance of the PROCAP-AGRO resources to explain changes in financial and economic ratios of the largest cooperatives may reflect the lower output from the Program in cooperatives that have large financial structure. However, one cannot dismiss the importance of this Program for cooperatives in Group 2, including as the result of this on the efficiency of cooperatives with higher Gross Sales, presented in Table 5.

3.3. Analysis of efficiency using Data Envelopment Analysis (DEA)

Based on accounting data, we applied the model of DEA efficiency analysis, aiming both to assess the evolution of the efficiency of cooperatives adhering to PROCAP-AGRO and to analyze changes in the levels of Operating Expenses and Fixed Assets (input) and Gross Revenue (output) of these cooperatives.

It is relevant to highlight that the efficiency score measured by the DEA model is a measure concerning the group of cooperatives in the analyzed sample, so a cooperative with efficiency index equal to 1 (or 100%) in this surveyed group could be classified as inefficient in another group of agricultural cooperatives.

Table 4 provides an analysis of some important points[10]. First, there is a small number of 100% efficient cooperatives when analyzing the billing groups: Group 1 had no more than 23% of 100% efficient cooperatives in 2009, while Group 2 had at most 29%, also in 2009.

[Table 4]

Concerning the mean, the analysis of the evolution of efficiency scores over the years infers, in Group 1, increase in efficiency, with the measure in 2010 higher than in 2006. These cooperatives may have taken advantage of the favorable economic situation and high commodity prices in the second half of the decade, without, however, having been very affected by the economic crisis of 2009, by basing most of its activities in the domestic market. However, Group 2 dropped in its mean efficiency score, with constant oscillation during the study period. The reduced levels of exports of agricultural cooperatives can explain this result in recent years of the analysis, as evidenced by data from MDIC/SECEX/DEPLA (2010). The export activity is mainly exerted by the largest Brazilian cooperatives, which may have been hardest hit by the global economic recession in the most acute years of the latest crisis.

One must also consider that the sources of inefficiency from cooperatives may be linked to social demands, since they partly base their decisions on meeting the demands of the members, even if that means, ultimately, decreased efficiency of operations.

These results present a scenario in which cooperatives in Group 1 behaved more efficiently after crediting PROCAP-AGRO and showing a drop of efficiency in Group 2. However, it is not possible to say whether PROCAP-AGRO was responsible for the behavior observed in the efficiency scores. This item will be clarified in the next section.

3.4. Analysis of the AGRO-PROCAP effects on the efficiency ratio using the Tobit model

In order to verify that the resources of PROCAP-AGRO were significant to explain the changes observed in the efficiency scores of the surveyed cooperatives, we used the Tobit econometric model, aiming to identify whether the PROCAP-AGRO *dummy* variable was significant. This variable received a value of 0 for the period prior to making the appeal, and a value of 1 for the period after the decision of the appeal. Control variables that could impact directly or indirectly on the efficiency scores of cooperatives were added.

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[10] In Appendix of this paper It lies in Table 1A efficiency scores of each analyzed cooperative.

Given the different dimensions of the surveyed cooperatives, it is valid to use the Tobit model in both Groups of cooperatives formed from the total sample.

In doing so, we obtained the results presented in Table 5, for Group 1, of cooperatives with Gross Sales under R$ 500 million, and for Group 2, composed by cooperatives with Gross Sales exceeding R$ 500 million.

[Table 5]

We note that the PROCAP-AGRO variable is significant for Group 1, with a negative sign, showing that obtaining the resource interferes negatively in the scores of efficiencies from cooperatives in this group.

Considering that most cooperatives belonging to Group 1 used the funds obtained in PROCAP-AGRO to complement the capital used for investment, as quoted in interviews, we can explain this negative sign by noting that the Operating Expenses and Permanent Assets (inputs of the DEA model) were high on their values before the Gross Sales (output of DEA model) was affected by the investment. Thus, it is expected that the PROCAP-AGRO resources adversely affect the efficiency of scores and that, in the long run, with the recovery of investment; these scores may be affected positively.

Moreover, the coefficient of the GDP_{AGRO} variable, *proxy* for economic growth, represented by the Agricultural GDP, was significant and positive. The EXCHANGE, AGE and ASSETS variables were not significant in explaining the variations in the efficiency of cooperatives of Group 1 cooperatives. However, these are control variables used with the primary purpose of isolating the effect that one wants to capture.

Table 5 also contains the Tobit regression analysis performed only with cooperatives belonging to Group 2. In this group, the PROCAP-AGRO coefficient was significant and positive, indicating that the features of the Program are related positively to the efficiency scores generated by the DEA model. Given the main destination of the resources of PROCAP-AGRO by the cooperatives of Group 2, as stated in interviews as a source of working capital for their operations, one can expect almost no impact on Operating Expenses, as well as in Fixed Assets, inputs of the DEA model; however, there may have been an indirect positive result in Gross Sales, due to more favorable negotiations with suppliers, buyers and/or debt renegotiation, which would increase the observed efficiency scores.

Besides the PROCAP-AGRO variable, the EXCHANGE variable also had significant positive coefficient in the regression that considers the largest cooperatives in the sample, identifying the importance of export activities concerning the organization of this size.

Thus, given the obtained results, PROCAP-AGRO is a significant factor in explaining the performance of their efficiency in cooperative groups: in Group 1, the relationship is negative, but as explained, it is expected that this relationship becomes positive in the long term; in Group 2, a positive relationship was noted between PROCAP-AGRO and efficiency, and given the employment reported to perform the resources, we noticed a potential improvement in the efficiency of these cooperatives after the taking of resources.

4. Conclusions

Characterized as an assessment process of the results of a public policy, which affected a relatively large universe of agents, we used a sample study in this work due to its more practical and less costly character.

The used indicators, in addition to seeking to settle the existing subjectivity in surveys of this kind, provided the basis for the discussion of the presented results. The goal of applying an econometric analysis model also arises from the attempt to endorse any positive or negative perceptions about the Program, captured during interviews.

Regarding the results, it was found that, despite the verified efforts of cooperatives in becoming more efficient and professionalized, it is clear that social issues such as investments made based on the demands of the members, or the transfer of risks from operations for these cooperatives, are known points which can contribute to the non-optimal use of the resources. It is relevant that this social role, which provides cooperative identity to these organizations, does not substitute their good financial and patrimonial practices, as they will then succeed, in a sustainable manner, in maintaining their operations and benefits to society in a more permanent form.

We can notice the value of PROCAP-AGRO with regard to its objectives and conditions given to borrowers. However, the use of resources in their proper purposes must be ensured, not being diverted from their duties to offset the lack or difficulty of obtaining financing lines for long-term investments or loans or funding for rural commercialization. Thus, it is suggested that deficiencies in these last lines must be met so that these deviations will not occur.

The need to redefine the scope of the Agricultural Cooperatives Capitalization Program is remarkable. We should clarify the purpose of its resources: if any, it should be to finance working capital, which is theoretically how these funds were taken by cooperatives.

By the way, the most recent changes in the Program, with increased financial cost and decrease in time to discharge, already move in this direction, although they contradict the expectations of the industry. The total remodeling of PROCAP-AGRO, in this sense, cannot be a ruled out alternative.

The disadvantages of financing working capital, such as the low yield observed in the application of funds borrowed, should be stressed to cooperatives and policymakers, which could hamper the subsequent settlement of the loan. These points bring any funding initiative in this direction to be monitored closely, in order to not transform cooperatives into eternal hostages of new funding lines each season.

It is concluded that the proposed assessment methodology involving analysis of technical efficiency and economic-financial situation of the considered cooperatives was able to generate the results, which, together, allowed the objectives of this study to be achieved.

Finally, we must emphasize again that the short time between the making and maturation of the results of applications made by cooperatives of resources by PROCAP-AGRO may have limited some of the analyzes, despite the use of robust methodology. Conducting survey on the topic in the coming years is likely to reduce this limitation, since it can incorporate, to the analysis, more years subsequent to obtaining resources.

Charts and Tables

Chart 1 – Performance indicators used in the study[11]

Name	Formula
Liquid Ratio (LR)	AVLB/CL
Quick Ratio (QR)	(AVLB + Credits) / CL
Current Ratio (CR)	CA / CL
General Ratio (GR)	(CA + LTA) / (CL + NCL)
Use of Third Party Capital (UTPC)	(CL + NCL) / (CL + NCL + NE)
Debt Breakdown (DB)	CL / (CL + NCL)
Level of Indebtedness (LI)	(CL + NCL) / NE
Long Term Indebtedness (LTI)	NCL / Total Assets
Net Working Capital (NWC)	NE – NCA
Net Current Assets (NCA)	CA – CL
Equity Immobilization (IE)	Fixed Assets / NE
Equity Profitability (EI)	Net Profit / NE
Working Capital Profitability (WCP)	Operational Result / Total Assets
Gross Margin (GM)	Gross Profit / Net Revenue
Operating Margin (OM)	Operating Income / Net Revenue
Net Margin (NM)	Net Profit / Net Revenue
Growth in Gross Revenue (GR)	$[(RB_{X1}/RB_{X0}) - 1] \times 100$
Growth in Net Equity (NE)	$[(NE_{X1}/PL_{X0}) - 1] \times 100$
Growth in Total Assets (TA)	$[(Total\ Assets_{X1}/Total\ Assets_{X0}) - 1] \times 100$

Source: Prepared by the author.

Chart 2 - Indicators used in the dynamic analysis of the working capital

Name	Formula
Need for Investment Working Capital (NIC)	Operational CA – Operational CL
Treasury (T)	Financial CA – Financial CL
Net Working Capital (NWC)	NE – Permanent Assets
Long Term (LT)	NCL – LTA

Source: Prepared by the author.

Table 1 - Gross Sales of the surveyed cooperatives (thousand R$)

	2006	2007	2008	2009	2010
Mean	R$422.611,34	R$510.338,39	R$593.715,32	R$584.710,48	R$561.711,32
Standard deviation	R$549.839,84	R$690.885,12	R$861.239,64	R$831.106,20	R$789.141,99
Minimum	R$8.841,95	R$16.036,25	R$24.815,83	R$24.186,88	R$25.054,07
Maximum	R$3.130.317,10	R$3.992.997,35	R$4.946.878,51	R$4.892.586,25	R$4.583.988,00

Source: Survey data.

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[11] The Appendix at the end of the study contains Chart 1A, which shows the meaning of the acronyms, used in the formulas of the indicators presented in Charts 1 and 2.

Table 2 - Effects of PROCAP-AGRO on the performance of agricultural cooperatives that raised funds, one year later

The mean is reported in the first line and the median in the second line.
The test of differences in means was the t-test, when it meets the assumption of normality, and the test statistic is t. We used the *median* test for differences between medians, and the statistic of this test is χ^2.

	Indicator	Group1		Group 2	
		Before	**After**	**Before**	**After**
Solvency	LR (%)	12,44 7,40	23,56˜ 14,25***	16,23 8,66	24,62˜ 11,14
	QR (%)	82,60 72,96	97,52˜ 84,29***	102,08 96,07	111,98 105,28
	CR	1,23 1,11	1,30˜ 1,20*	1,44 1,33	1,56** 1,47**
	GR	1,12 1,09	1,09˜ 1,09	1,14 1,14	1,10** 1,10**
Capital Guarantee	UTPC (%)	66,91 65,96	64,17 65,21	65,07 65,54	62,74 62,76
	DB (%)	80,89 78,70	74,86** 76,34**	73,42 70,99	65,37*** 64,17***
	LI	2,51 1,94	2,18˜ 1,88*	2,13 1,93	1,84˜ 1,69
	LTI (%)	12,29 13,08	15,71** 15,10**	16,85 17,28	21,62*** 21,59***
	NWC (thousand R$)	854,38 -1601,61	-5596,98˜ -3714,02**	82808,05 24582,57	68691,99˜ 10847,05
	NCA (thousand R$)	16069,74 2167,19	20608,34˜ 7084,02***	229582,70 143805,80	283840,85˜ 197705,49***
	IE (%)	76,28 71,83	77,12 70,76	74,87 62,25	76,97˜ 61,31
Profitability	EI (%)	15,39 11,28	8,18˜ 6,79*	12,55 10,14	9,97 8,78
	WCP (%)	5,92 5,17	3,86˜ 3,04***	7,51 7,64	4,42*** 4,03***
	GM (%)	12,73 12,11	12,95 12,97	14,55 14,40	14,54 14,25
	OM (%)	3,22 3,02	2,65 2,41	5,03 5,07	3,61** 3,35**
	NM (%)	2,16 2,07	1,77 1,52	3,20 3,04	3,08 3,01
Growth	GR (%)	17,06 11,59	-3,02˜ 0,41*	18,01 18,12	-2,31*** -0,85***
	NE (%)	14,87 0,97	39,04˜ 13,45*	3,63 6,16	16,90˜ 4,28
	TA (%)	8,01 7,08	19,94˜ 10,83*	8,24 7,95	12,48˜ 5,79
Working Capital	NLCDG (thousand R$)	44007,05 22016,31	42648,50˜ 23241,69	273228,56 205273,66	293702,94˜ 212631,24
	T (thousand R$)	-27866,09 -16275,30	-22046,10˜ -11556,25	-43518,11 -76457,35	-9863,97˜ -20721,56*
	LT (thousand R$)	4779,34 2258,56	13081,51˜ 5747,00***	85515,56 82640,12	145919,60*** 152827,11***
	NWC (thousand R$)	14845,34 3927,39	12596,73˜ 5459,38	157770,48 95103,97	160503,82˜ 116471,80

Source: Survey Results.

˜ does not have a normal distribution;

* Significant difference between means and/or medians at 10%;

Table 3 - Effects of PROCAP-AGRO on the economic and financial performance of agricultural cooperatives: Group 1

Variables	Solvency	Capital Guarantee	Profitability
	Current Ratio (CR)	Level of Indebtedness (LI)	Working Capital Profitability (WCP)
$ID_{i(t-1)}$	0,4635	0,2681**	0,3807*
	(0,3584)	(0,1201)	(0,2162)
PROCAP-AGRO	-0,1634***	0,4518*	2,6850*
	(0,0629)	(0,2615)	(1,5254)
GDP_{AGRO}	5,72e-06***	-0,0001**	-0,0001
	(1,42e-06)	(0,0001)	(0,0002)
EXCHANGE	-0,1916	0,3743	5,5891**
	(0,1256)	(0,3955)	(2,4818)
AGE	0,0052	-0,0657	0,0455
	(0,0070)	(0,0647)	(0,2780)
ASSETS	-3,78e-07	4,63e-06	-2,30e-06
	(5,91e-07)	(4,37e-06)	(0,0001)
Constant	0,0808	6,7331*	1,6317
	(0,6575)	(4,0946)	(22,5602)
Observations	104	104	78
Number of groups	26	26	26

According to the first-order autocorrelation test of Arellano and Bond, the estimated models do not have autocorrelation issues.

Source: Survey Results.

* Significant at 10%.

** Significant at 5%.

*** Significant at 1%.

( ) standard error of the estimate.

Table 4 - Scores of efficiency assuming Variable Returns to Scale: Group 1 and Group 2

Group	Year	Efficient Units (%)	Mean	Standard deviation	Maximum	Minimum	Degree of Inefficiency
Group 1 (26 coop.)	2006	15,3846	0,5430	0,2770	1,0000	0,1673	84,1533
	2007	15,3846	0,5990	0,2813	1,0000	0,1958	66,9462
	2008	19,2308	0,6231	0,2761	1,0000	0,2264	60,4851
	2009	23,0769	0,5938	0,2858	1,0000	0,1884	68,4093
	2010	19,2308	0,6204	0,2630	1,0000	0,2627	61,1895
Group 2 (14 coop.)	2006	28,5714	0,6590	0,2482	1,0000	0,2654	51,7444
	2007	28,5714	0,6019	0,2804	1,0000	0,2846	66,1330
	2008	21,4286	0,5829	0,2713	1,0000	0,3022	71,5664
	2009	28,5714	0,6405	0,2730	1,0000	0,2348	56,1402
	2010	21,4286	0,5745	0,2619	1,0000	0,3089	74,0773

Source: Survey results.

Table 5 – Effects of PROCAP-AGRO on economic and financial performance of agricultural cooperatives: Group 1 and Group 2

Variables	Efficiency score – Assuming Variable Returns	
	Group 1 coefficients	Group 2 coefficients
PROCAP-AGRO	-0,1541**	0,1836**
	(0,0769)	(0,0806)
GDP$_{AGRO}$	3,77e-06***	-2,78e-06*
	(1,37e-06)	(1,52e-06)
EXCHANGE	-0,0171	0,3469***
	(0,1016)	(0,1050)
AGE	-0,0012	0,0118**
	(0,0036)	(0,0058)
ASSETS	-4,55e-07	1,03e-07
	(4,07e-07)	(1,07e-07)
Constant	0,3401*	0,0152
	(0,2720)	(0,3390)
Observations	130	70
Number of groups	26	14
Sigma_u:	0,2790***	0,2810***
	(0,0456)	(0,0744)
Sigma_e:	0,2040***	0,01173***
	(0,0171)	(0,0158)
Rho:	0,6516	0,8516
	(0,0819)	(0,0738)
Wald χ^2 (5):	9,37*	14,10**

Source: Survey results.

* Significant at 10%.

** Significant at 5%.

*** Significant at 1%.

( ) standard error of the estimate.

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Appendix

Chart 1A – Description of variables related to financial indicators

Variable	Acronym	Description
Current Assets	CA	Total Assets, except Non-Current Assets
Current Liabilities	CL	Total Assets, except Non-Current Liabilities
Financial Current Assets	FCA	Availabilities, plus Funding of Members
Financial Current Liabilities	FCL	Funding of Current Liabilities
Operational Current Assets	OCA	Current Assets, except Financial Current Assets
Operational Current Liabilities	OCL	Current Liabilities, except Financial Current Liabilities
Availabilities	AVLB	Current Assets, except Loans and Stocks
Non-Current Assets	NCA	Total Assets, except Current Assets
Long-term Assets	LTA	Non-Current Assets, except Investments, Fixed and Intangible

Non-Current Liabilities	NCL	Total Liabilities, except Non-Current Liabilities
Net Equity	NE	Share Capital, plus Reserves and Legal and Statutory Funds, plus others
Revenue	RV	Gross Operating Revenue, except returns and tax
Gross Profit	GR	Revenue, except Costs of Sold Products

Source: Prepared by the authors based on Anuatti-Neto *et al.* (2005) and Santos (2005).

Table 1A - Scores of efficiency assuming Variable Returns to Scale

DMU	2006	2007	2008	2009	2010
Coop_1	0,8019	1,0000	1,0000	0,6596	0,9004
Coop_2	0,6841	0,8588	0,7776	0,7321	0,5249
Coop_3	1,0000	0,8447	0,8354	1,0000	1,0000
Coop_4	0,3737	0,5068	0,4347	0,3691	0,6042
Coop_5	0,3670	0,4389	0,7491	1,0000	0,8866
Coop_6	0,5470	0,4557	0,3911	0,3730	0,6429
Coop_7	0,2583	0,3294	0,3183	0,2666	0,2825
Coop_8	0,8030	0,9174	0,7472	0,5331	0,5952
Coop_9	1,0000	1,0000	1,0000	1,0000	1,0000
Coop_10	0,6222	0,7540	0,8261	0,7032	1,0000
Coop_11	1,0000	1,0000	1,0000	0,6637	0,8607
Coop_12	1,0000	1,0000	1,0000	1,0000	0,7846
Coop_13	1,0000	1,0000	0,8507	1,0000	1,0000
Coop_14	0,6436	0,5905	0,6617	0,8055	0,6425
Coop_15	1,0000	1,0000	1,0000	1,0000	1,0000
Coop_16	0,7447	0,6490	0,6149	0,6300	0,4767
Coop_17	0,5131	0,4617	0,4541	0,5599	0,4457
Coop_18	0,4983	0,3137	0,3355	0,4213	0,3262
Coop_19	0,4405	0,4461	0,3787	0,5030	0,3618
Coop_20	0,2278	0,2956	0,2869	0,2089	0,4333
Coop_21	0,6239	0,6749	1,0000	1,0000	1,0000
Coop_22	0,4922	0,8218	0,5881	0,8155	0,7503
Coop_23	0,8332	0,9122	0,9672	1,0000	1,0000
Coop_24	0,3766	0,3301	0,3939	0,5410	0,3311
Coop_25	0,4747	0,3734	0,4437	0,5304	0,4240
Coop_26	0,2139	0,3804	0,4278	0,3398	0,5429
Coop_27	0,2952	0,2493	0,3212	0,2294	0,3468
Coop_28	0,2654	0,2846	0,3022	0,2348	0,4578
Coop_29	0,2214	0,2689	0,2264	0,2473	0,4446
Coop_30	0,6202	0,5589	0,4204	0,5803	0,4492
Coop_31	0,2651	0,3260	0,5169	0,5725	0,3401
Coop_32	0,5423	0,5730	0,5833	0,4909	0,4640
Coop_33	1,0000	1,0000	1,0000	1,0000	1,0000
Coop_34	0,5260	0,3554	0,3299	0,3581	0,2627
Coop_35	0,5915	0,7063	0,7841	0,7342	0,7501
Coop_36	0,5258	0,3969	0,3131	0,3889	0,3652
Coop_37	0,2851	0,3783	0,4575	0,4122	0,4640
Coop_38	0,4997	0,3520	0,3851	0,3124	0,3089
Coop_39	1,0000	1,0000	1,0000	1,0000	0,4333
Coop_40	0,1673	0,1958	0,2381	0,1884	0,2696

Source: Survey results.