Performances of agro-food cooperatives: how do they depend on exogenously favored increases of capital?

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Abstract

Capital resources are a severe constrain for the growth of cooperatives and for their possibility to exploit the benefits of economies of scale that are required in the agro food sector. Agricultural policy measures are often implemented to help cooperatives to obtain the necessary resources at favourable conditions. Coopfond Spa is an Italian company that buys equities and loans money to cooperatives. In this paper we study the short period effects of this kind of intervention over the performances of cooperatives. We do a regression analysis on

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a cross section of available data in order to cope with the absence of long time series. The results show that there are indeed effects on performances and that it is definitely different if the geographical localization of cooperatives is taken into account.

1 Introduction

Capital resources are usually considered a severe constrain for the growth of cooperatives: moreover in Italy, mirroring an extremely fragmented primary sector, agro-food cooperatives traditionally lack the possibility of achieving significant economies of scale. These characteristics deeply influence the possibility of Italian agro food cooperatives to expand their activities in the particularly competitive European market. See Zamagni (2006).

Cooperative ownership of means of production, a low level of capital input with regard to privately owned competitive firms, cumbersome management practices and the absence of clear definitions about the objective function to maximize are generally considered an explanation for low efficiency and insufficient returns on investments. See Tirole (2006).

It is usual for governments to implement policies to address these issues, generally justified by the same reasoning behind agricultural policies as a whole.

In 1993 Coopfond Spa has been created by the Lega Nazionale Cooperative e Mutue under the law n. 59, 31/01/92, to support development projects of cooperatives that may consist of new firms, new investments of existing firms, debt restructuring, and aggregation of existing firms. See Coopfond Spa (2007). Interested cooperatives provide their financial statements, a budget and a detailed business plan in order to convince Coopfond of their profitability and to obtain an injection of money.

This can take two forms:

- Coopfond SpA becomes a member of the cooperative and brings capital by acquiring new shares, under the condition that also other members proportionally increase their shares: this is the typical method for financing a company by increasing the equity. The own capital from Coopfond SpA is withdrawn after a few years;
- Coopfond Spa lends money to the cooperative.

These two kind of intervention can take place at the same time. For the purpose of the study we decided to sum up the money from equity purchase and that given as a loan: in what follows we call this variable FINA. For the interested cooperative, the total cost of the new capital is linked to the market rate, but interest is generally lower and the capital easier to obtain than from a traditional bank. This is explained by a better knowledge that Coopfond's official have about the firm, its performances' history and its managers: all things that allow for a better assessment of the risk involved. Moreover, by acquiring shares, Coopfond gets a seat in the board and the possibility of continuous monitoring of the business.

The aim of this paper is to look at data to see if it is possible to assess an impact of the intervention over the profitability of cooperatives. A sample of data from about 50 agro-food cooperatives across years 2000-2006 is analyzed to investigate the influence that the new capital had on some performance variables of the receiving company.

The next section presents a description of utilized data set. This is followed by the econometric analysis. The paper concludes with a discussion of the results.

2 Description of the data set

Coopfond maintains a database of financial statements of cooperatives of which it owns shares. Available data span from 1994 to date and concern 88 cooperatives, not all different, since some of them were financed more than once. For all firms we know the amount of money given by Coopfond both in the form of equity purchases and loans. However, not all data are suitable for analysis:

- some financial statements are missing;
- the number of years in which Coopfond has been involved differs from 3 to more than 8;
- for projects concerning aggregations of firms it is difficult to compare the sum of separated financial statements with the financial statements of the resulting firm.

For example, we had 12 firms without financial statements at all, and 26 with data for equal or less than 4 years. The shortness of the time series ruled out the possibility of intervention analysis by regressions over time.

Due to this kind of problems, we carefully choose a sample of data from 46 agrofood cooperatives across years 2000-2006 and we built a matrix from the following table:

	FINA	X^1	X^2	$\cdots$	X^k
Firm_1	FINA_{1,j_1}	X^1_{1,j_1+1}	X^2_{1,j_1+1}	$\cdots$	X^k_{1,j_1+1}
Firm_2	FINA_{2,j_2}	X^1_{2,j_2+1}	X^2_{2,j_2+1}	$\cdots$	X^k_{2,j_2+1}
$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\ddots$	$\vdots$
Firm_T	FINA_{T,j_T}	X^1_{T,j_T+1}	X^2_{T,j_T+1}	$\cdots$	X^k_{T,j_T+1}

where $T(=46)$ is the number of firms, $j_i \in \{2000, 2001, 2002, 2003, 2004, 2005\}$ denotes the year in which the financing took place for the i^{th} firm and FINA is the total amount given by Coopfond. $X^1, X^2...X^k$ are k different variable of performances from financial statements of each firm; the entries in the table represent the values of these variables.

The 'slice' given by the cross section has to be 'thick' enough to span the period defined from the time in which the injection of capital occurs until the period in which the chosen variable becomes significant or can simply be measured. Given the available data, we choose this 'thickness' or length of time to be one year. In the future it will be possible to enlarge this period , to use as dependent variables the average of values n years after the intervention or even to use the difference of the averages of these values after and before the intervention. It is natural to think that over such a short period of time the volatility of market conditions and internal factors could conceal the relation between the investments and the performances.

Our chosen independent variable is FINA. The value FINA_{i,j_i} is the total amount received from Coopfond for the i^{th} firm in the year j_i. The dependent variables $X^1, X^2...X^k$ where chosen and tested from different categories of the balance sheets and income statements, with values relative to year

$j_i + 1$ associated to FINA_{i,j_i}. For example, we had added values, earnings before interest taxes depreciation and amortization (EBITDA), earnings before interest and taxes (EBIT), net income before taxes, net income and net income plus depreciation and amortization; we also built and tested some ratio indexes like EBITDA over total stock of capital or the interest coverage ratio (EBITDA over interest expenses); see Meigs and Meigs (1992).

We retained net income (RN) and net income plus amortization (RNAMM). The test made using the difference $\mathrm{RN}_{j_i+1} - \mathrm{RN}_{j_i}$ did not give good results, also because less data became available.

Since the geographical localization of each firm was also known, we introduced the vector dummy variable DUNS whose elements are either 1 or 0, if the firm is in the North - Center region or in the South region respectively: 28 firms are located in North-Center region, while 18 are in the South. This turned out to be a significative variable. We also used two other dummy variables D_5 and D_{45} in order to consider two observation on the dependent variable as outliers (the 5^{th} and 45^{th} observation).

All our statistical modeling was done using GRETL, an open source econometrics package available at http://gretl.sourceforge.net/index.html, see Baiocchi and Distaso (2003).

3 The econometrics analysis

We begin our analysis by estimating a regression model of the form:

$$\text{RN} = \beta_0 + \beta_1\text{D5} + \beta_2\text{D45} + \beta_3\text{FINA} + \epsilon \tag{1}$$

The results of estimate are reported in Table 1. They are a mixture of 'good news' and 'bad news'. Looking at the 'good news' first, we see the specification appears economically sensible. The coefficient of FINA is positive (0.275361) and significantly different from zero. The F statistic overwhelmingly rejects the null hypothesis that all coefficient values on explanatory variables are zero.

Now for the 'bad news'. The model suffers from mis-specification. The p-value of the RESET test (Regression Specification Error Test) (0.016029) is well under the conventional significance level of 0.05. Thus, there is evidence to suggest that the specification of model is inadequate.

Table 1. Dependent Variable: RN

Estimation by Least Squares, 46 observations

Variable	Coefficient	Std. Error	t-Statistic	p-value
const	−218178.0	83629.6	−2.6089	0.0125
FINA	0.275361	0.0468830	5.8734	0.0000
D5	−4.27460e-06	508927.0	−8.3992	0.0000
D45	1.35623e+06	511843.0	2.6497	0.0113

Mean dependent variable	−64002.0
Standard deviation dependent variable	934923.0
Sum squared residuals	1.06185e+13
S.D. of regression ($\hat{\sigma}$)	502815.0
R-squared	0.730039
Adjusted R-squared	0.710756
$F(3, 42)$	37.8594

RESET test

Null hypothesis: the specification of the model is adequate

Test statistic: $F(2, 40) = 4.59148$

p-value $= P(F(2, 40) > 4.59148) = 0.016029$

In order to find a better specification of the model we consider the possibility that there is a different effect of FINA depending on the region where the firm is located. Then, the previously defined dummy variable needs to be used.

In particular, we specify the following regression model:

$$\mathrm{RN} = \beta_0 + \beta_1 \mathrm{D5} + \beta_2 \mathrm{D45} + \beta_3 \mathrm{DUNS} + \beta_4 \mathrm{FINA} + \beta_5 \mathrm{DUFINA} + \epsilon \qquad (2)$$

where DUNS is our 'geographic' dummy variable and DUFINA=DUNS*FINA.

If DUNS is 0, the model becomes:

$$\text{RN} = \beta_0 + \beta_1\text{D5} + \beta_2\text{D45} + \beta_4\text{FINA} + \epsilon$$

The slope coefficient is β_4, however when the DUNS is 1, the model becomes:

$$\text{RN} = \beta_0 + \beta_1\text{D5} + \beta_2\text{D45} + \beta_3\text{DUNS} + (\beta_4 + \beta_5)\text{FINA} + \epsilon$$

The slope coefficient is now $\beta_4 + \beta_5$.

The estimates are presented in Table 2.

Table 2. Dependent Variable: RN

Estimation by Least Squares, 46 observations

Variable	Coefficient	Std. Error	t-Statistic	p-value
const	49725.6	202560.	0.2455	0.8073
D5	−4.35202e-06	439560.0	−9.9009	0.0000
D45	1.27203e+06	441855.0	2.8788	0.0064
DUNS	−200653	218484.0	−0.9184	0.3639
FINA	−0.891758	0.334471	−2.6662	0.0110
DUFINA	1.17559	0.336961	3.4888	0.0012

Mean dependent variable	−64002.0
Standard deviation dependent variable	934923.0
Sum squared residuals	7.49945e+12
S.D. of regression ($\hat{\sigma}$)	432997.0
R-squared	0.809338
Adjusted R-squared	0.785505
$F(5, 40)$	33.9590

RESET test

Null hypothesis: the specification of the model is adequate

Test statistic: $F(2, 38) = 8.34891$

p-value $= P(F(2, 38) > 8.34891) = 0.000987323$

Again, there is evidence from the RESET test to suggest the the model suffers from mis-specification. Since the coefficient β_3 is not significantly different to zero, we remove the intercept dummy (DUNS) from the model and we insert a non linear term (LFINA=log(FINA)), obtaining the following specification:

$$\text{RN} = \beta_0 + \beta_1\text{D5} + \beta_2\text{D45} + \beta_3\text{FINA} + \beta_4\text{DUFINA} + \beta_5\text{LFINA} + \epsilon \quad (3)$$

As we can see at the bottom of Table 3, the F-value (1.71685) is quite small and its corresponding p-value of 0.193271 is well above the conventional significance level of 0.05. Thus, there is no evidence from the RESET test to suggest that the model (3) is inadequate.

Table 3. Dependent Variable: RN

Estimation by Least Squares, 46 observations

Variable	Coefficient	Std. Error	t-Statistic	p-value
const	1.81322e+06	1.03220e+06	1.7567	0.0866
D5	−4.21755e-06	433143.	−9.7371	0.0000
D45	1.43675e+06	438332.	3.2778	0.0022
FINA	−0.518502	0.252019	−2.0574	0.0462
DUFINA	0.863618	0.239458	3.6066	0.0009
LFINA	−155178.0	82526.1	−1.8804	0.0674

Mean dependent variable	−64002.
Standard deviation dependent variable	934923.0
Sum squared residuals	7.03568e+12
S.D. of regression ($\hat{\sigma}$)	419395.0
R-squared	0.821128
Adjusted R-squared	0.798769
$F(5, 40)$	36.7248

RESET test

Null hypothesis: the specification of the model is adequate

Test statistic: $F(2, 38) = 1.71685$

p-value $= P(F(2, 38) > 1.71685) = 0.193271$

Since the inefficiency of OLS is thought to be a serious drawback, testing for the presence of heteroscedasticity is then desirable. In Table 4 we report the results of the White test for the model (3). The test statistic is TR^2=17.14 and the relevant critical value is $\chi^2_{.05}(11) = 19.67$. So the null hypothesis of of homoscedasticity is not rejected.

Table 4. Depended variable: Squared OLS residual

White auxiliary regression. Estimation by Least Squares, 46 observations

Variable	Coefficient	Std. Error	t-Statistic
const	2.62104e+013	5.54173e+013	0.473
D5	−2.99734e+011	3.61105e+011	−0.830
D45	−7.71697e+011	7.44827e+011	−1.036
FINA	−8.57718e+07	9.39000e+07	−0.913
DUFINA	$4.27607e+07$	$1.80854e+07$	2.364
LFINA	−5.24593e+012	1.11088e+013	−0.472
$FINA^2$	−5.15235	2.16721	−2.377
FINA*DUFINA	3.9123e+014	2.98460e+015	0.131
FINA*LFINA	6.34621e+06	6.25305e+06	1.015
$DUFINA^2$	−3.91237e+014	2.98460e+015	−0.131
DUFINA*LFINA	−3.51184e+06	1.44545e+06	−2.430
$LFINA^2$	2.65963e+011	5.62199e+011	0.473

R-square = 0.372428
Test-statistic: $TR^2 = 17.131696$
p-value = $P(\chi^2(11) > 17.131696) = 0.104040$

In conclusion, we adopt the following estimated regression model:

$$\widehat{\text{RN}} = \underset{(1.0322e+006)}{1.81322\text{e+}6} - \underset{(4.3314e+005)}{4.21755\text{e+}6}\,\text{D5} + \underset{(4.3833e+005)}{1.43675\text{e+}6}\,\text{D45} - \underset{(0.25202)}{0.518502}\,\text{FINA}$$

$$+ \underset{(0.23946)}{0.863618}\,\text{DUFINA} - \underset{(82526)}{155178}\,\text{LFINA}$$

$$T = 46 \quad \bar{R}^2 = 0.7988 \quad F(5, 40) = 36.725 \quad \hat{\sigma} = 4.1939\text{e+}5$$

(Standard errors in brackets)

The adjusted R^2 value indicates that 80% of the total variability of the RN about its mean value is explained by the model. For a cross-sectional regression, this is very high. Also, all variables are significant at the 7% level or lower and consequently, the regression F-statistic rejects very strongly the null hypothesis that all coefficient values on explanatory variables are zero.

For the firms in North Center of Italy the estimated model is:

$$\widehat{\text{RN}} = 1.81322\text{e}{+}6 - 4.21755\text{e}{+}6\,\text{D5} + 1.43675\text{e}{+}6\,\text{D45} + 0.345116\,\text{FINA}$$
$$-155178\,\text{LFINA} \tag{4}$$

In the South of Italy the following model holds:

$$\widehat{\text{RN}} = 1.81322\text{e}{+}6 - 4.21755\text{e}{+}6\,\text{D5} + 1.43675\text{e}{+}6\,\text{D45} - 0.518502\,\text{FINA}$$
$$-155178\,\text{LFINA} \tag{5}$$

By using equation (4), we have that the expected effect of a unit change in FINA on the dependent variable RN is

$$\frac{d\widehat{\text{RN}}}{d\text{FINA}} = 0.345116 - 155178\frac{1}{\text{FINA}}$$

so it depends on level of FINA. By posing FINA=6932282 (the mean of FINA in the North center) we have

$$\frac{d\widehat{\text{RN}}}{d\text{FINA}} = 0.121285$$

In the South, by using equation (5), we have

$$\frac{d\widehat{\text{RN}}}{d\text{FINA}} = -0.518502 - 155178\frac{1}{\text{FINA}}$$

By posing FINA=6232780 (the mean of FINA in the South) we have

$$\frac{d\widehat{\mathrm{RN}}}{d\mathrm{FINA}} = -0.767272$$

The effect is negative.

The results presented so far are based on a specific choice of the performance variable of the receiving company: the net income (RN). However, to check whether the results are robust to the choice of the performance variable we estimate a model with income plus amortization (RNAMM) as dependent variable. The estimates are reported in Table 5.

Table 5. Dependent Variable: RNANN

Estimation by Least Squares, 46 observations

Variable	Coefficient	Std. Error	t-Statistic	p-value
const	−4.76387e-06	2.82154e+06	−1.6884	0.0991
D5	−4.43553e-06	1.18400e+06	−3.7462	0.0006
D45	2.79363e+06	1.19819e+06	2.3315	0.0248
FINA	−1.5443	0.688900	−2.2418	0.0306
DUFINA	1.66200	0.654562	2.5391	0.0151
LFINA	416913.0	225587.0	1.8481	0.0720

Mean dependent variable	520901.0
Standard deviation dependent variable	1.50382e+06
Sum squared residuals	5.25715e+13
S.D. of regression ($\hat{\sigma}$)	1.14642e+06
R-squared	0.483413
Adjusted R-squared	0.418839
$F(5, 40)$	$7,48625$
p-value per $F(5, 40)$	$4,89054$e-05

RESET test

Null hypothesis: the specification of the model is adequate

Test statistic: $F(2, 38) = 1.34494$

p-value $= P(F(2, 38) > 1.34494) = 0.272676$

White test

Null hypothesis: homoscedasticity

Test statistic: $TR^2 = 13.1288$

p-value $= P(\chi^2_{11} > 13.1288) = 0.284987$

$$\widehat{\text{RNAMM}} = \underset{(2.8215e+006)}{-4.76387\text{e}+6} - \underset{(1.184e+006)}{4.43553\text{e}+6}\,\text{D5} + \underset{(1.1982e+006)}{2.79363\text{e}+6}\,\text{D45} - \underset{(0.6889)}{1.54436}\,\text{FINA}$$
$$+ \underset{(0.65456)}{1.66200}\,\text{DUFINA} + \underset{(2.2559e+005)}{416913.}\,\text{LFINA}$$
$$T = 46 \quad \bar{R}^2 = 0.4188 \quad F(5, 40) = 7.4862 \quad \hat{\sigma} = 1.1464\text{e}+6$$

(Standard errors in brackets)

By inspecting the above equation we can conclude that the results are fairly insensitive to the choice of the performance variable. The expected effect of a unit change in FINA on the dependent variable RNAMM is

$$\frac{d\widehat{\text{RNAMM}}}{d\text{FINA}} = 0.184231$$

in the North Center and

$$\frac{d\widehat{\text{RNAMM}}}{d\text{FINA}} = -1.483157$$

in the South.

4 Conclusions

The fact that it is possible to assess quantitatively the effect of 'external' investment over the performances of agro-food cooperatives even with short term analysis is undoubtedly positive. Our analysis shows that there is a significative effect of the financing over both the performances variable we used. In particular the relation between the variables mainly consists of a linear component even it if has been necessary to introduce a non linear component (LFINA) in order to pass the specification tests. The slope dummy (DUFINA) turned up to be a key variable: as model (1) shows, without it we have a positive expected effect of a unit change in FINA on the dependent variable RN equal to 0.27. However, since that model is misspecified we introduced the dummy and this allowed us to discover that the sign of the effect takes different values depending on the region: in the North Center regions the effect is positive, while in the South Regions it is negative. We were puzzled by the robustness of the model in which it is shown that the impact on firms in the south is negative. From the statistical point of view this is obviously not explained by the fact that 11 out of 18 cooperatives of the South had a negative net income in the years considered: in fact the sign of the derivative means that the two variable are inversely correlated. From the economic point of view it is difficult to draw a conclusion, since by construction the financial years considered for each cooperative is different and it is impossible to search for a common factor like a business cycle. It is clear then that further research is needed with a methodology that can study strategic choices and the governance of each cooperative in order to measure other variables that surely exist and influence the net income together with the investment. With additional independent variables introduced in the model it is clear that also the coefficient beta can take different values. Finally this result, given the limitation of available data, can only be considered as a warning for the procedures adopted by Coopfond SpA: interest on loans may be paid and the capital may be safely withdrawn at the end of the period but a closer attention or even involvement in the daily operations of the cooperatives might be needed in order to assure a beneficial effect of the investment.

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