Financial Exposure and Productive Performance in French Arable Farms

Stéphane Blancard
CERESUR, University of La Reunion

Abstract

This paper examines the dynamic relationship between financial exposure and productive performance in agriculture. To this end, Granger's concept of causality and VAR representation are used. Indeed, in spite of several studies, the causality and the direction are not clearly defined. However, investigation of this question can provide with valuable information at policy makers to formulate appropriate credit policies. Using a large micro panel of French farmers over 1994−2001, we find that there is a bidirectional causality running from financial constraints and productive performance. Nevertheless, variance decompositions and impulse response analysis suggest a weak relationship existing between these two variables.

Corresponding author : CERESUR, University of La Réunion, 15 avenue Rene Cassin − BP 7151 − 97715 Saint−Denis Messag Cedex 9 – Tel: + 33 / (0) 262 93 84 52 – E−mail address: sblancar@univ−reunion.fr I would like to thank J.−P. Boussemart and K. Kerstens for valuable comments and suggestions. I have also benefited from discussions with G. Granderson. Finally, I thank Inessa Love for the use of her STATA programs to estimate Panel−VAR regressions. Of course, any remaining errors are my responsibility.
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1. Introduction

Since 1980s, a significant literature deals with the linkage between farm financial structure and productive efficiency (for survey, see, e.g. Shankar et al. 2001 or Blancard et al. 2006). This question can provide valuable information for policy makers to formulate appropriate credit policies. From a theoretical viewpoint, five main approaches have been employed in various studies: agency costs, free cash flow, credit evaluation (Nasr, Barry and Ellinger 1998), embodied capital (Chavas and Aliber 1993) and adjustment (Paul, Johnston and Frengley 2000). Following these main hypotheses, different relations between debt and performance of farms can be expected. Nevertheless, these hypotheses are not mutually exclusive and lead to some ambiguity on the precise nature of this connection and this direction. Second, inefficiency is generally analyzed by separately examining its two components (technical and allocative efficiency). Third, these studies use in general debt-to-asset ratio or liquidity as a measure of the financial constraints. Finally, most studies are based on cross-sectional data, which only account for the relationship between financial constraints and productive efficiency at current period. Thus, the literature did not test the possible effects of financial constraints in past periods. In other words, it did not consider the dynamic relationship as Granger's causality allows.

This study contributes to the literature on the relationship between financial exposure and productive performance, empirically and methodologically. Employing Granger's concept of causality and the vector autoregressive technique, we test whether financial exposure - as defined by Färe, Grosskopf and Lee (1990) and Blancard et al. (2006) - in past periods granger cause productive efficiency and *vice versa*. Data come from a large micro panel of French crop farmers in the *Nord-Pas-de-Calais* region over the period 1994-2001. The paper is organized as follows. Section 2 presents intuitions to evaluate the magnitude of financial exposure and a kind of productive performance which are labelled financial and actual efficiency. This section ends with a presentation of the econometric methodology to estimate the link between these variables. The data and empirical results are outlined in section 3, and section 4 concludes.

2. Methodology

The intuitions of financial and productive performance measures are first presented. We next focus on the model specification and estimation strategy to test causality.

2.1 Financial Exposure and Productive Efficiency Measures: Intuitions

To measure financial exposure in both the short- and the long-run, this paper repeats the approach proposed by Färe Grosskopf and Lee (1990) and Blancard et al. (2006). These authors employ nonparametric specifications of traditional and expenditure constrained profit functions that do not impose any functional form on technology. They assume that the difference between expenditure-constrained and -unconstrained profits in the short-and long run yield estimate of the magnitude of financial constraints (i.e. financial efficiency). By specifying the credit constraints in terms of current expenditures, they can directly verify whether units are exposed to financial restrictions in reaching the maximum profit. Moreover, they measure the productive performance (i.e. actual efficiency) from the gap between profit with credit constraints and observed profit. For all further details on methodology and empirical application, the reader should consult theirs papers.

2.2 Model Specification and Estimation Strategy

The investigation of the relationship between financial constraints (i.e. financial efficiency) and productive performance (i.e. actual efficiency) will be based upon Granger's concept of causality (Granger, 1969) from a bivariate vector autoregressive (VAR) technique. The VAR model adapted to a panel data context is specified as:

$$A_{it} = \sum_{l=1}^{m} \alpha_l A_{it-l} + \sum_{l=1}^{m} \delta_l F_{it-1} + \rho_i + \varepsilon_{i,t} \qquad (1)$$

$$F_{k,t} = \sum_{i=1}^{m} \beta_l F_{it-l} + \sum_{i=1}^{m} \gamma_l A_{it-l} + \nu_i + \mu_{i,t} \qquad (2)$$

where A and F are actual and financial efficiency, respectively. m is the lag length. We denote ρ_i and ν_i the farm individual effects. In other words, the models utilized in this study are panel data model with fixed coefficients. We test the null hypotheses is that financial constraints does not "Granger cause" productive performance $(\delta_l = 0)$ and the hypothesis that productive efficiency change does not "Granger cause" financial exposure $(\gamma_l = 0)$ using Fischer tests statistics.

For micro panels, where there are a large number of individuals observed on a short period, the fixed effects estimator of the coefficients of endogenous lagged variables are biased and inconsistent (Nickell, 1981). This implies that the statistics, associated to Granger causality tests, do not have a standard distribution, under H0, when T is small (see e.g. Hurlin and Venet, 2001). An appropriate way of overcoming the estimation problem consists in removing fixed effects using future mean-differencing, also referred to as the Helmert procedure (see Arellano and Bover 1995) and then estimating the transformed equations using GMM procedure[1].

3. Data and Results

We next introduce the selected data for analysis. Efficiency results are also provided in the second subsection. Finally, regression estimates are assessed.

3.1 Data

Data are provided by *Centre d'Economie Rurale du Pas-de-Calais*[2]. The balanced panel contains 178 French farms in the *Nord-Pas-de-Calais* region observed from 1994 to 2001[3] which are specialized in cash crops (grain, sugar beets, etc.). Turning to the specification of non parametric technology, one output (measured by total sales), two variable inputs (operational expenses, and salaried employees) and three fixed inputs (immobilizations, surface area and family labor) are retained.

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[1] Since entering in details (for that, see Arellano and Bover 1995), the Helmert transformation involves taking deviations from future means. This procedure leaves the untransformed variables orthogonal to the transformed error term for period t-1 and greater. Hence, we use as instruments, levels of the variables dated t-1 and earlier.

[2] Data are the same as in Blancard et al. (2006).

[3] Given all farms in the sample are geographically in the same field (Artois), they are relatively similar concerning characteristics as climate, soil type or slope etc. Nevertheless, to account for possible fertility differences, the surface area is weighted by yield per unit (Blancard et al. 2006). In addition, one can expect that they are equally affected by Common Agricultural Policy reforms (mainly MacSharry) over this period. Moreover, to compute expenditure-constrained and unconstrained profit, an annual profit frontier was used: we do not compare production plans over different years. Consequently, the methodology to compute efficiency score is not significantly affected.

3.2 Overall, Financial and Actual Efficiency Results

The main empirical results obtained by Blancard et al. (2006)[4] on the different efficiency measures are reported in Table 1. On average, overall efficiency is 69.00% and 37.29% respectively in the short- and in the long-run. This implies that farms could improve their profits by 31.00% and 62.71%. In the short-run, overall inefficiency is explained by actual inefficiency at approximately 24% and financial inefficiency at about 9%. Thus, while technical problems explain most of the gap between observed and maximal profits, the short-run financial constraints also have effects. In the long-run, financial constraints become the main source of ill functioning. In particular, limited access to financial resources explains about 47% of overall inefficiency. Finally, Blancard et al. (2006) observe that on average about 67% of farms are financially constrained in the short-run while nearly all farms face investment constraints in the long-run.

3.3 Regression estimates

Before testing Granger causality from a VAR model, we investigate the panel data properties of financial and actual efficiency in short- and long-run. For both variables, we take natural logarithms. To test for unit roots, we use the Im-Pesaran-Shin test (1997) and Hadri's LM test (1998). The Im-Pesaran-Shin (IPS) test is an augmented Dickey Fuller test with the null hypothesis of a unit root in all farms. On the other hand, Hadri proposes a Lagrange Multiplier test with the null of stationarity of all individual series. This is similar to the well know KPSS test in the pure time series framework. Table 2 reports the results from the two testing procedure. For series in level, the IPS test results show that the null hypothesis of the presence of a unit root can be rejected at the 5 % significance level for actual efficiency in the short- and long-run and financial efficiency in the long-run. Only the null hypothesis for financial efficiency in the short-run can not be rejected. However, the formulation of the alternative hypothesis in the IPS test allows for some of the cross sectional units to contain a unit root. The two versions of the Hadri (1998) test (i.e. homoskedastic (Hadri Ho) and heteroskedastic (Hadri He)) reject the null hypothesis of stationarity for all variables. Therefore, there is a reasonably strong evidence of the presence of unit root in our data. To take account this problem, data are first differenced[5].

The VAR models have been estimated in first differences of variables. Because variables are in logs, they correspond to growth rates. Moreover the parameters with positive signs indicate a source of efficiency. Before estimating equations (1) and (2), the number of lags is determined using Akaike Information Criteria (AIC). However, because of the shortness of time series in our data set, we use rather a different methodology in selecting lag length. We start with the first lag and continue with the second until we reach minimum AIC; yet we stop at the third lag whether we reach minimum AIC or not.

Then, we examine whether the change in the past period financial constraints statistically Granger cause productive efficiency. Separate regressions were estimated using measures obtained in the short- and the long-run. The Granger causality analysis is performed after estimating equations (1). Table 3 provides the regression estimates. The AIC statistic reached its minimum value at three and two in short- and long-run, respectively. These results show a negative relationship between actual and financial efficiency: F-statistics are 15.36 and 4.22, respectively. So, we reject the null hypothesis at the 5% level indicating that financial restrictions cause productive efficiency. Nevertheless, in the short-run, all three

[4] Results are slightly different to Blancard et al (2006) because we present them in a multiplicative context. Of course, the conclusions are the same.
[5] IPS and Hadri tests corroborate the stationarity hypotheses.

coefficients are statistically significant and have a negative sign while only one in the long-run. For the short-run, e.g., results indicate that an increase of 1 point in growth rate of the one-lagged financial efficiency will result in a 0.39 % decrease in the growth rate of actual efficiency. These results support the free cash flow hypothesis defined by Nasr, Barry and Ellinger (1998) which state there is less managerial laxity. Finally, notice that the coefficients of lagged actual efficiency are also negative expressing the difficulty to approach more and more full efficiency.

Finally, we test whether productive performance cause financial efficiency. Three and two lags are chosen from AIC statistic in the short and long-run, respectively. Regression results of equation (2) are reported in Table 4. Both in the short and long-run, the evidence which emerges is a positive relationship between actual and financial efficiency (F-statistics are 13.62 and 9.44, respectively). All coefficients of actual efficiency are statistically significant level and have a positive sign (except for the one-lagged actual efficiency in the long-run). In accordance with intuition, improvements in productive efficiency enhance future period financial performance since they allow making funds available for expenses. Furthermore, this finding is consistent with the credit evaluation hypothesis (Nasr, Barry and Ellinger 1998) suggesting that banks prefer borrowers who are low risk i.e. the more efficient.

To complete this study, the variance decompositions and impulse-response analysis were used. Variance decompositions split the k-step ahead forecast error variance of each variable into percentages attributed to innovations in each of the variables in the system. In the actual-financial efficiency ordering, shocks in financial efficiency explain only 4 % of the forecast error variance of actual efficiency in the short-run (Table 5). However, in the financial-actual efficiency ordering, shocks in financial efficiency account for 9.5% of the variation of actual efficiency. Next, in the financial-actual efficiency ordering, shocks in actual efficiency explain 4% of the variation of financial efficiency. In the actual-financial efficiency ordering, shocks in actual efficiency explain about 14% of the variation of financial efficiency. Responses to these shocks are almost similar in the long-run. After variance decompositions, the article proceeds to impulse response analysis. Impulse response function can provide an intuitive insight into the dynamic relationships in existence, because it will present the response of a variable to an unexpected shock in another over a certain time horizon. The greatest effect on actual efficiency or financial efficiency can be accounted for by a shock in themselves. To summarize, the results of the variance decompositions and impulse responses suggest a weak relationship existing between financial constraints and productive performance.

4. Conclusions

Credit constraints and rationing are particularly severe in agriculture for various reasons (e.g., inadequacy of collateral, substantial lag between purchasing inputs and selling,…). Over the last two decades, his effects on productive performance have been analyzed closely (e.g., Nasr, Barry and Ellinger 1998, Chavas and Aliber 1993, and Paul, Johnston and Frengley 2000). Nevertheless, in spite of all studies, the direction of causality is not clearly defined. Several hypotheses are mentioned but none of them have unanimous support.

This paper contributes to this literature in two points. First, to measure financial constraints in the short- and in the long-run, we use the approach developed by Färe Grosskopf and Lee (1990) and Blancard et al. (2006). Second, we attempt to establish empirically the dynamic of causal relationship between productive performance and financing constraints. Based on a panel of French farmers, we employed Granger’s concept of causality and the vector autoregressive technique to investigate this connection. Our results show us the existence of bidirectional causality for our sample. Nevertheless, there are indicators that suggest a weak relationship between financial exposure and productive performance.

By validating of free cash flow hypothesis, we show that facilitating access to both short- and long-run credit can lead to new financial problems and eventual bankruptcy instead of improving their situation. Therefore, a relaxing credit policy merits further attention particularly in the current european context.

REFERENCES

Blancard, S., Boussemart, J.-P., Briec, W. and Kerstens, K. (2006) Short- and long-run credit constraints in French agriculture: a directional distance function framework using expenditure-constrained profit functions. *American Journal of Agricultural Economics* 88: 351-364.

Chavas, J.-P. and Aliber, M. (1993) An analysis of economic efficiency in agriculture: a non-parametric approach. *Journal of Agricultural and Resource Economics* 18: 1-16.

Färe, R., Grosskopf, S. and Lee, H. (1990) A nonparametric approach to expenditure-constrained profit maximization. *American Journal of Agricultural Economics* 72: 574-581.

Granger, C. W. J. (1969) Investigating causal relations by econometric models and cross-spectral methods. *Econometrica* 37: 424-438

Hurlin, C. and Venet, B. (2001) Granger Causality Tests in Panel Data Models with Fixed Effects. Mimeo, University Paris IX.

Love, I. (2001) Estimating Panel-data Autoregressions, Package of Programs for Stata. Columbia University, *Mimeo*.

Nasr, R.E., Barry, P.J. and Ellinger, P.N. (1998) Financial structure and efficiency of grain farms. *Agricultural Finance Review* 58: 33-48.

Nickell, S. (1981) Biases in dynamic models with fixed effects. *Econometrica* 49: 1417-1426

Paul, C.J.M., Johnston, W.E. and Frengley, G.A.G. (2000) Efficiency of New Zealand sheep and beef farming: the impacts of regulatory reform. *The Review of Economics and Statistics* 82: 325-337.

Shankar, B., Hadley, D., Thirtle, C. and Coelli, T. (2001) Financial exposure, technical change and farm efficiency: evidence from the England and Wales dairy sector. Paper selected at the annual meeting of AAEA. Chicago.

APPENDIX

Table 1. Efficiency scores over the years 1994-2001 (%)

	Short-Run			Long-Run		
	Overall Efficiency	Financial Efficiency	Actual Efficiency	Overall Efficiency	Financial Efficiency	Actual Efficiency
1994	58.52	83.18	70.35	35.44	58.40	60.68
1995	71.58	91.82	77.96	40.03	60.30	66.38
1996	71.25	92.96	76.65	39.93	58.49	68.26
1997	73.59	93.17	78.99	38.65	54.35	71.12
1998	66.77	94.88	70.37	36.18	52.28	69.20
1999	72.98	97.42	74.91	37.25	51.91	71.75
2000	70.49	88.46	79.69	33.63	44.11	76.24
2001	68.12	87.85	77.54	30.80	40.22	76.59
Average	69.00	91.12	75.73	37.29	52.95	70.42

Source: Computed from Blancard et al. (2006)

Table 2. Unit root tests for actual and financial efficiency

	IPS	Hadri Ho	Hadri He
Short-Run			
ln(Actual Efficiency)	-2.062*	4.888*	4.113*
Δln(Actual Efficiency)	-2.748*	-5.801	-4.601
ln(Financial Efficiency)	-1.535	7.687*	6.954*
Δln(Financial Efficiency)	-1.803*	1.072	0.936
Long-Run			
ln(Actual Efficiency)	-2.423*	2.379*	6.366*
Δln(Actual Efficiency)	-2.866*	-8.790	-7.362
ln(Financial Efficiency)	-2.116*	29.472*	25.180*
Δln(Financial Efficiency)	-3.554*	-3.233	-3.438

Note: * significant at the 5% level.
IPS and Hadri programs are performed by STATA.

Table 3. Estimates results of VAR equation (1) with actual efficiency (*A*) as dependent variable and Granger causality test

Variables	Actual Efficiency			
	Short-Run		Long-Run	
	Coef.	*Std. Err.*	*Coef.*	*Std. Err.*
$A_{i,t-1}$	-0.4553***	0.0494	-0.6398***	0.0277
$A_{i,t-2}$	-0.4014***	0.0461	-0.3227***	0.0263
$A_{i,t-3}$	-0.2405***	0.0526		
$F_{k,t-1}$	-0.3886***	0.0806	-0.7053***	0.0975
$F_{k,t-2}$	-0.3684***	0.1079	-0.4347***	0.1128
$F_{k,t-3}$	-0.3785***	0.0926		
R^2	0.52		0.59	
Granger causality test				
F-statistics	15.36 (0.000)		4.22 (0.000)	
Results	F Granger cause A		F Granger cause A	

Note: ***, **, * Statistical significant at 1%, 5% and 10%, respectively. The figures in parenthesis next to the diagnostic tests are probability values.
STATA programs (Love 2001) to estimate Panel-VAR regression are used.

Table 4. Estimates results of VAR equation (2) with financial efficiency (F) as dependent variable and Granger causality test

Variables	Financial Efficiency			
	Short-Run		Long-Run	
	Coef.	*Std. Err.*	*Coef.*	*Std. Err.*
$A_{i,t-1}$	-0.0419**	0.0198	0.0521***	0.0104
$A_{i,t-2}$	0.0648***	0.0223	0.0290***	0.0088
$A_{i,t-3}$	0.0409**	0.0182		
$F_{k,t-1}$	-0.1340**	0.0617	-0.2910***	0.0451
$F_{k,t-2}$	-0.01240	0.0793	-0.4990***	0.0516
$F_{k,t-3}$	0.1358***	0.0487		
R^2	0.28		0.43	
Granger causality test				
F-statistics	13.62(0.000)		9.44(0.000)	
Results	A Granger cause F		A Granger cause F	

Note: ***, **, * Statistical significant at 1%, 5% and 10%, respectively. The figures in parenthesis next to the diagnostic tests are probability values.
STATA programs (Love 2001) to estimate Panel-VAR regression are used.

Table 5 - Summary of variance decomposition

	Short-run	
1. Actual - Financial efficiency Ordering		
	Actual efficiency	Financial efficiency
Actual efficiency	95.97	4.03
Financial efficiency	13.70	86.30
2. Financial - Actual efficiency Ordering		
	Financial efficiency	Actual efficiency
Financial efficiency	96.11	3.89
Actual efficiency	9.47	90.53
	Long-run	
1. Actual - Financial efficiency Ordering		
	Actual efficiency	Financial efficiency
Actual efficiency	93.31	6.69
Financial efficiency	16.22	83.78
2. Financial - Actual efficiency Ordering		
	Financial efficiency	Actual efficiency
Financial efficiency	97.61	2.39
Actual efficiency	10.18	89.82

Note: The columns indicate the variable which is shocked. The rows indicate the affected variable. For example, in the short-run 4.03 refers to the percentage of the forecast error variance of Actual efficiency resulting from one-standard-deviation shock from Financial efficiency. Results in the 10th are reported.