Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 24, Issue 2, 2024
PRINT ISSN 2284-7995, E-ISSN 2285-3952

FARM DEBT AND INVESTMENT. EMPIRICAL EVIDENCE FROM BULGARIAN AGRICULTURE

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Abstract

This article explores the relationship between farmers' investment activity and debt structure in order to bring out the factors mediating the outcome. Overleveraging is one of the most serious problems faced by the Bulgarian farmers due to the high levels of competition in the EU. This research is based on a stratified random sample of 5% (2,985 observations) on farms in the agricultural sector encompassing the sub-sectors crop production, livestock production and auxiliary activities, with a research horizon of five years. A fixed-effect panel threshold regression analysis is used. The obtained results show that where the debt level is high, this has a negative impact on the investment activity of the farms in the agriculture sector.

Key words**:** *investment, debt, panel threshold regression*

INTRODUCTION

One of the predominant theories regarding the choice of capital structure in terms of investment, was elaborated by [15]. It is called "The Pecking Order Theory". According to its authors, there is no optimal capital structure, but rather a hierarchical approach when considering different sources of financing. They support the thesis that, when financing an investment opportunity, firmsuse their internal sources of finance (e.g. free cash flow) in the first place, as they arecheaper in comparison with the external sources of finance. This is followed by debt and then equity financing.

The second commonly applied theory with regards to choosing a capital structure when it comes to investment decisions, is called the "Trade of Theory". In the trade-off capital structure theory, the firm owners and managers aim at an optimal debt ratio. This maximization is obtained by estimating and comparing the costs and benefits of debt [16]. The thesis here is that time-tested firms often get a loan on more favourable terms in comparison with the newer ones. On the one hand, the longer a firm has been operating on the market, the lower the cost of its debt would be. On the other hand, firms which entering a given market, are seen as riskier and are treated more unfavorably when trying to access financing.

Both theories have undergone a number of empirical tests, mainly in the industry, and less often in the agricultural sector.

For instance, [17] analyzed the determinants of capital structure in the agriculture, forestry, and fishing industry in Central and Eastern Europe. The authors explore these three sectors based on data referring to the period from 2009 to 2016. Their research sample encompasses agricultural enterprises which have been continuously operating for at least two years and covering the period from 1997 to 2006.

In their regression analysis, the dependent variables cash flow, investment, short-term and long-term debt, are simultaneously and endogenously determined by each other for each particular time period. As it might be expected, delayed cash receipts *from receivables and the lower profitability,* are important signals for the creditors when evaluating the credit worthiness of farms. Their research confirms the pecking order theory mentioned above [17].

In a very recent study conducted in 2021, a group of authors use a research sample from agrarian farms in Poland referring to the period from 2009 to 2018. Their main objective is to test the two theories mentioned

above. Their results show that the farms with a higher profit rate are also less indebted. Therefore, their profitability reduces the need of external financing in accordance with "The Pecking Order Theory". Also, the increase in investment sends a positive signal to the creditors, which is an indication for a future cash flow [4].

Each farm faces a large number of risks during its existence. As early as in the 80s of the last century, [7] introduced two types of risks associated with the agrarian farm. They called the first type business risk and related it to the risk inherent to the farm, notwithstanding its means of financing. They called the second type financial risk, which they define as the constant variability in the net cash flows, resulting from the financial obligations in connection with the long-term debt financing. To the financial risk, they also add the probability of the farm's bankruptcy.

In 2020, [13] summarized the risk types in the agrarian enterprises analyzed over the years by their predecessors. They systematized them in 5 groups in total: production risks associated with the unpredictable natural processes, i.e. animal husbandry but also those related to weather and climate. Market risks to a large extent focus on uncertainty and price fluctuation in terms of the enterprise's own production but also in terms of the needed raw materials, cost dynamics and market access. Institutional risks are associated with changes in thenational policy and the agricultural legislation. Personal risks are associated with problems with human health or personal relationships. The financial risks which are also the subject of our researchstudy refer to the means of financing, the uncertainty faced by the farm with regards to the cash flows and its financial obligations related to the loans it might be using.

[2] used balanced panel data from a sample of 3,650 French farms referring to the period from 1989 to 1993. The variables for each farm are investments, capital and the new (long-term) loans. Their results show that the investment

behavior of the farms with high levels of indebtedness differs significantly from the bahaviour of the farmswhich are financially independent [2].

A group of authors, based on a survey on the agricultural enterprises in Poland and Slovakia referring to the period from 2017 to 2020, with the purpose of conducting a comparative analysis of the determinants impacting the financial results, obtain the following results: the return on assets in the agricultural sector is a statistically dependent variable, however in the different countries it is affected by different factors. There were a little different results in different countries: in Poland, return on assets and equity, and leverage have the strongest impact on the financial performance of agricultural enterprises. In Slovakia, return on assets and return on equity, debt-to-equity ratio and return on sales have the strongest effect. In Ukraine, return on assets and leverage, as well as the debt-to-equity ratio, have the greatest effect [14].

Other authors support the statement that the farm's capital investment is seen in a particular period of time in the farm's profit variation. Further, they use lagged variables of profitability in order to determine the impact of the capital cost on it [11].

According to a recent research study financed by the European Commission, the objectives of the investment loans vary significantly from country to country. On average for the EU, 63% of the loans provided to enterprises in the agricultural sector are for investment in new plant, machinery and equipment. This is followed by investment in working capital (41%) and land (15%). For Bulgaria, but also for Estonia, the Czech Republic, the Netherlands and Slovakia, investment in land is the main focus for more than 25% of the farms (European Investment Bank, 2019) [6].

In one particular research study on Bulgaria and the agricultural enterprises referring to the period from 2007 to 2020, Kirechev (2021) draws the following conclusions: Observed in an increase in the long-term loans as a result of the increase in investment. They remain a main factor in financing investment, including investment in the purchase of land [12].

On the basis of a survey on 1546 Hungarian farms referring to the period from 2001 to

2005 and related to investment decision-making, [1] concluded that cash flows are statistically significant and positively correlated with the investment which farms make. They also find out that farms with small loans and which use mostly leased land, have limited liquidity.

MATERIALS AND METHODS

Data and Variables Measurements

The data referring to this survey are based on a stratified random sample of 5% of the farms in the agriculturalsector encompassing the subsectors crop production, livestock production and auxiliary activities (code 01 according to classification of economic activities 2008) for the period from 2017 to 2021. The choice of this sample type is determined by the possibility for increasing the statistical efficiency and the need for adequacy in analyzing the sub-setsindividually. In the survey, the original data set encompasses 2985 observations, which after a procedure of refining and creation of a balanced panel dataset, the observations arefinally reduced to 2,540, or 635 groups of farms for the 5-year survey period. Among the farms surveyed, 78.74% are focused on crop production, 15.35% on livestock production and 5.91% are mixed farms. From all the observations made, the representatives of the micro and small business are predominant, which might suggest a small economic size of the surveyed group. Sharp changes in the relative shares of the farms operating in the sector for the different time periods are not observed, which to a certain extent indicates preservation of the structure in terms of the sectoral performance at national level.

Variables

Our research interest is focused on the variables – net investment and leverage so that as to bring out the relationship between investment activity and farm indebtedness. The dependent variable is defined as annual growth in total fixed assets.

The economic profitability indicator is used to bring out the farm's ability effectively to transform its assets into profit. The net sales growth is a factor, which we assume is positively correlated with the investment activity in the model and outlining the possibilities for growth. For the liquidity indicator, we use the current one. Lenders tend to rely in a higher degree on debt repayment capacity and solvency than on the borrower's profitability and financial efficiency [6]. In order to analyze the effect of indebtedness on the farmers' investment activity, three different estimates of the threshold regressor are included in the sample data (Table 1). This necessity is suggestedby the agricultural farms debt structure and in order to highlight the business risk but also the financial risk. The key to the long-term financial viability of the agricultural farm is investing wisely in production assets.

As main tools for financial risk management are included: financial reserves, savings, credit lines and the financial structure of the agricultural enterprise.

Our hypothesis is that per one unit of decreased debt level, the farms with long-term loans will increase their net investment more than the farms without a bank loan.

Table 1. Description of the study variables

Variables	Formula
Dependent variable	
NI	$(NTGA_t - NTGA_{t-1})/NTGA_{t-1}$
Thresholds	
TDA	Total debt/Total assets
LTDTA	Long term debt/Total assets
STDTA	Short term debt/Total assets
Explanatory variables	
ROA	Net profit/Total assets
SG	$(Sales_t - Sales_{t-1}/Sales_{t-1})$
CL	Current assets/Current liabilities
T	Fixed assets/Total assets
Firm size	LN(TA)
Age	LN(Age)

Source: Author`s calculations.

We should not miss the fact that a large part of the farms in the study are micro and small farms, where access to credit, its security and the lack of qualified staff for elaboration of the business plan constitute high barriers to the implementation of long-term financing. The above-listed factors however are not the subject of this study.

To identify non-linearities in the relationship between debt and investment in real assets, the panel threshold regression model Hansen [9], [10] is used.

This model allows the endogenous identification of threshold levels which divide the study sample into twosampling types for which the linear ratio between the dependent variable and one or more variables of interest are expected to differ. Further, the procedure tests for significance the identified thresholds, relying on confidence intervals obtained by appropriately designed likelihood ratio tests [10].

The model shows that the dependence of the β value on the threshold value is not of primary asymptotic significance, so that the interpretation of β can proceed since γ is a set value. In particular, we are estimating the following threshold model for different subsets of data, referring to the Hansen's model [9], [11] and following the methodology suggested by [8].

Threshold model for different subsets of data:

$$\boldsymbol{I_{it} = \beta_1 D_{it-1} I(D_{it-1} \leq \gamma) + \beta_2 D_{it-1} I(D_{it-1} > \gamma) + \phi Z_{it-1} + \delta_1 I(D_{it-1} \leq \gamma) + \varepsilon_{it}} \quad \text{..... (1)}$$

where:

$\boldsymbol{I_{it}}$ – annual change in the net investment in tangible fixed assets;

$\boldsymbol{\beta_1}$ and $\boldsymbol{\beta_2}$ - regression coefficients representing the effect of the leverage on the investment in tangible fixed assets;

$\boldsymbol{Z_{it}}$ –vector-predictor, including the lagged values of the studied variables;

$\boldsymbol{\delta_1}$ – specific intercept mode;

$\boldsymbol{\varepsilon_{it}}$ – statistical error.

It is assumed that the errors $\boldsymbol{\varepsilon_{it}}$ are independent and identically distributed in order to avoid problems with endogeneity.

The leverage measure used is:

$\mathbf{D_{it}}$ it denotes the indicator variable for which the sampling type separation threshold γ is calculated;

$\boldsymbol{I}$ **(●)** Included binary indicator function for whether a particular observation has a debt-to-asset ratio above or below the forecast threshold for a particular year.

Lagged values are used for all indicator variables except for the threshold parameter.

The objective here is to reflect and evaluate the current state but also the impact of the given factors from previous periods onto the resulting value. Hence, the explanatory variables in the model are lagged, and the lag length is 1 year.

After the threshold estimation, determined are the confidence intervals in order to measure thestatistical significance of the obtained value and to test the null hypothesis [18]. It should be considered that the likelihood ratio (LR) tests the null hypothesis where the threshold values are the same ($\gamma = \gamma_0$), while the F statistics also tests the null hypothesis,however with equal values of the regression coefficients (*β1 = β2*).

RESULTS AND DISCUSSIONS

The descriptive statistics of the variables in the present study (Table 2) shows a high volatility of the return on assets, net investment and current liquidity, due to the estimated high levels of the standard deviation.

The average farm in our sample has a debt-to-total assets ratio of 44%, which is an indication that less than half of the total assets are financed by debt. The economic profitability is 9.7% with a significant dispersion of the values.

The average net investment is negative with a high degree of the standard deviation and a high degree of dispersion. The independent variables for size, age and tangibility show a stable result, due to the lower levels of the standard deviation from mean.

It should be taken in consideration that in the asset structure there is almost a parity between the tangible fixed assets (T) and the inventories, receivables, cash and other liquid assets. The observed companies had a liquid business or 18.96 higher current assets to finance obligations in comparison with the value of their current liabilities during the period studied.

The average age of the farms in the sector is 19 years, the youngest being at the age of 11 years, and those with the longest existence -

32 years. In general, observed is heterogeneity in the variables of interest.

Table 2. Descriptive Statistics

Variable	Mean	Std. Dev.	Min.	Median	Max.
NI	13.20	108.35	-100	-0.95	2,700
ROA	.097	.15	-.57	0.05	3.24
TDA	.444	.58	.00	0.31	7
T	.48	.24	0	0.506	1
SG	.10	1.12	-1	0	37
CL	18.96	97.11	0	3.24	4,282
AGE	20.51	5.58	11	19	32
TA(log)	7.07	1.51	.69	7.13	12.16

Source: Author`s calculations.

Table 3. Matrix of Correlations

Var.	NI	ROA	T	SG	CL	AGE	TA
NI	1.00						
ROA	0.05	1.00					
T	0.04	-0.16	1.00				
SG	0.06	0.09	-0.00	1.00			
CL	-0.02	0.01	-0.07	-0.01	1.00		
AGE	-0.03	0.06	-0.01	-0.01	0.04	1.00	
TA	-0.03	-0.07	0.25	-0.01	0.05	0.09	1.00

Source: Author`s calculations.

The correlation matrix (Table 3) proves that there is no significant correlation between the studied variables.

Evaluation of the model is contained in Stata 15.1. The parameters, estimates, and statistics are presented in Table 4 and Table 5. The F statistics referring to the overall significance of the parameters is high enough as to reject the hypothesis that the parameters do not explain the changes in the dependent variable NI. The empirical results from the baseline regression presented in Table 4 are proven to be stable.

The estimated debt threshold is 42% at a confidence interval of 95% [0.387, 0.427]. The leverage variable coefficient is significant and negative which suggests the negative impact of the debt level onto the farm investment above the threshold value ($\beta 2$). It should be considered that 40% (1,016 farms) of the observations have debt levels which exceed the threshold value.

The results from the baseline regression confirm previous empirical studies where firm's size and return on assets are positively correlated with investment activity.

Table 4. Baseline Results – Panel Threshold Regression

γ		***Threshold estimate 0.423***
95% confidence interval		*[0.387, 0.427]*
p		*0.2600*
R^2		*0.0010*
Corr. (u_i, xb)		*-0.8393*
Threshold		
β1 (low debt)	*9.463***	*(0.003)*
β2 (hight debt)	*-25.602***	*(0.050)*
Estimated coefficients		p-value
ROA	*30.650 **	*(0.050)*
T	*-379.41 ****	*(0.000)*
SG	*-2.343*	*(0.256)*
CL	*-0.005*	*(0.850)*
AGE	*-2.367*	*(0.206)*
TA(log)	*55.800 ****	*(0.000)*
Rho	*0.548*	
Sector FE		
Year FE		
Observations	*2,540*	
No. of firms (group)	*635*	

Source: Author`s calculations.

Note: All independent variables are lagged by one period;***Significant at the 0.01 level, respectively; **Significant at the 0.05 level, respectively; *Significant at the 0.10 level, respectively.

In contrast, the leverage ratio is never positive for the unprofitable farms.

Therefore, even if debt is below the leverage threshold, the investment activity decreases whenever the farm becomes unprofitable.

These results suggest that high profitability in combination with a low debt most probably is an incentive for investment in the sector. This is also confirmed by a study authored by [3].
Another significant statistical result is the fixed tangible assets use intensity, which is negatively correlated to investment. In order to bring out the short-term but also the long-term indebtedness in the sector, we use the STDTA and LTDTA indicators as threshold values. The results from the threshold regression with STDTA, are presented in Table 5, and the results obtained from the threshold regression with LTDTA, are statistically insignificant.

Table 5. Results – Panel Threshold Regression with STDTA

γ		***Threshold estimate 0.621***
95% confidence interval *p* *R^2* *Corr. (u_i, xb)*		*[0.504, 0.631]* *0.2500* *0.0020* *-0.8969*
Threshold		
β1 (low debt)	*45.06**	*(0.100)*
β2 (hight debt)	*-59.615***	*(0.022)*
Estimated coefficients		p-value
ROA	*45.391 **	*(0.088)*
T	*-417.95 ****	*(0.000)*
SG	*-3.600*	*(0.279)*
CL	*-0.007*	*(0.714)*
AGE	*-4.052*	*(0.059)*
TA(log)	*71.751 ****	*(0.000)*
Rho *Sector FE* *Year FE*	*0.689*	
Observations	*1,156*	
No of firms (group)	*289*	

Source: Author`s calculations
Note: All independent variables are lagged by one period;***Significant at the 0.01 level, respectively; **Significant at the 0.05 level, respectively; *Significant at the 0.10 level, respectively.

The results from the sample show that the short-term debt is about twice as big as the long-term one, meaning that either the short-term debt was more accessible and/or firms had an increased need to finance large deficits in their working capital and therefore resorted to borrowing a short-term debt. It is encouraging that only 6% (53 farms) of our observations maintain levels above the short-term indebtedness threshold.

CONCLUSIONS

This article applies one of the methods for estimation of the investment activity in relation to farms' indebtedness threshold levels. Using a fixed effect panel threshold regression, the study finds out that the correlation between investment and debt is non-linear.
The estimates made suggest that when the debt is exceeding the determined threshold, this decreases the investment activity. We identify a debt-to-asset ratio threshold of 42 percent. For the farms with debt levels below the threshold, the relationship between debt and investment is strong and depends on a number of in-house characteristics.
These results suggest that the high profitability in combination with a low debt, is most probably an incentive for investment in the sector. A weaker relationship is observed when the debt/investment ratio exceeds the threshold, and hence, categorical statements or assumptions are avoided in the present study.
The findings from this study show that the indicators return on assets and farm size are positively correlated with investment, while the fixed tangible assets use intensity is negatively correlated with them. The short-term debt is approximately twice as high as thelong-term one, meaning that either the short-term debt was more accessible and/or firms had an increased need to finance large deficits of their working capital and hence resorted to borrowing a short-term debt.

ACKNOWLEDGEMENTS

This work was supported by the Bulgarian Ministry of Education and Science under the National Research Programs: "Smart crop production" approved by Decision of the Ministry Council No866/26.11.2020 and "Intelligent animal husbandry", No62/18.03.2021.

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