Modelling of debt determinants in the agricultural sector

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Abstract

The agricultural sector represents one of the most perspective sectors in the Republic of Serbia that can contribute and generate more benefits to economic development. The subject of the paper represents the modelling of debt determinants of the agricultural sector in the Republic of Serbia from 2006 to 2021. The mean value of indebtedness for analyzed 1128 agricultural enterprises was 0.61 which implied that observed enterprises did not have a problem with debt in their business. The empirical analysis included different panel estimations such as pooled least squares, fixed-effects and random-effects to provide empirical implications of selected debt's determinants such as profitability, liquidity and a number of employees in the agricultural sector. The empirical results confirmed that profitability and liquidity significantly affect the debt level in the case of small, medium and large agriculture enterprises.

Keywords: Debt; Agriculture enterprises; Panel modelling. The Republic of Serbia.

1. Introduction

Sustainable financial performance is the main determinant for the company's success (Wei et al. 2017). In all spheres of the economy, including the agricultural sector, financial management plays a significant role in the overall management of company units (Kravčáková Vozárová et al. 2019). Every business strives to increase the value of the company or the owner's assets (Dang et al. 2019). Similarly, the main goal of an enterprise as it matures is value growth for shareholders (Kučera et al. 2021). According to, debt financing enables managers to maximize enterprise value using this type of sources (Sun et al. 2021). The company's performance is considered a source of sustainable growth and most important factors analyzed by the investors (Vieira et al. 2019). Thus, company development is a very important aspect of financial management and can be estimated based on financial analysis (Tobisova et al. 2022). Furthermore, the financial performance of companies can be evaluated using financial analysis, which is an essential segment of corporate financial management (Valaskova et al. 2021). According to mentioned, Durmanov et al. (2019) defined financial analysis as evaluates the financial health of the company in terms of four fundamental attributes such as liquidity, profitability, activity and indebtedness. When a company's financial health is compromised, it must deal with the financial distress that can lead to a financial crisis and default (Klepac and Hampel, 2017). Therefore, financial stability and

healthy financial position represent very significant aspects of company assessment by creditors and business partners (Valaskova et al. 2020). Access to finance is one of the most essential factors of business success (Rusu and Roman, 2022).

Precisely, modern agriculture is mostly dependent on debt which is usually enabled in the credit form (Henning et al. 2019). The issue of the cost of equity capital for a company can be seen from various perspectives, given its adoption in financial research (Franc-Dabrowska et al. 2018). For example, Tsuruta (2015) point out that highly indebted small companies are not capable to get sufficient loans to optimize the leverage effect with a harmful impact on potential profit. Company indebtedness shows the property resource structure and financial (in)dependence level (Mirović et al. 2018). Thus, companies may use various sources of capital for financing their operations, where these capital sources can be divided into two main components of equity and debt (Čámská, 2020). The financial structure of the business can impose an additional risk source (Pathak et al., 2019), so this issue is very important for an adequate business model. Therefore, it is essential for any company to be able to define optimal mix of equity and debt (Royer and McKee, 2020). The financing costs of a company refer to different expenses incurred by the company in the process of collecting own funds (Sun et al. 2023). As mentioned by Dinterman et al. (2018), agriculture companies are faced with financial stress during debt service payments. An increase in the debt volume causes greater problems in the agriculture sector, which implies lower net income and stagnation of land values (Patrick et al. 2016).

The structure of the paper is organized as follows. After the introduction, there is a theoretical background related to previous empirical studies that have estimated debt determinants in the agriculture sector. Furthermore, there is a methodology and data that implies the sample and developed hypotheses, as well as an empirical model approach. Finally, there are discussions and conclusions about obtained empirical findings with practical implications and suggestions regarding the identification of vital determinants of agriculture enterprises' debt.

2. Literature Review

The financial condition of companies is affected by different determinants, whose relevance must be determined to achieve sustainable business development in the long-run (Vavrek et al. 2021). Financial leverage is the ratio between total debt and equity that reflects the ability of financial managers to bring external resources to stimulate equity efficiency

(Borodin et al. 2015). Many previous empirical studies investigated the relationship between indebtedness and internal factors such as liquidity, profitability, company size (Lipson and Mortal, 2009Hanousek and Shamshur, 2011; Mateev et al. 2012; Pinková, 2012; Aulová and Hlavsa, 2013; Mokhova and Zinecker, 2013; Ručkova et al. 2015; Andrašić et al. 2018; Hang et al., 2018; Bilgin, 2019; Sikveland and Zhang, 2020; Czerwonka and Jaworski, 2021; Růčková and Škuláňová (2021; Sadiq et al. 2022).

The positive impact of profitability on debt level is identified in previous studies (Pinková, 2012, Aulová and Hlavsa, 2013; Mokhova and Zinecker, 2013; Bunea et al. 2019; Ogachi et al. 2020). Debt may have positive implications on company's profit and wealth if the rate of return is greater than the interest rate (Pech et al., 2015). For example, Ogachi et al. (2020) found a positive correlation between debt ratio and return on assets, as well as a negative relationship debt ratio with return on equity in the case of Kenya. This is in line with the study of Bunea at al. (2019) that have confirmed a positive relationship between financial leverage and profitability measured by return on equity. Růčková and Škuláňová (2021) confirmed that profitability, liquidity, asset structure significantly affect the indebtedness of companies from agricultural, forestry and fishing industry in selected Central and Eastern European countries (Bulgaria, Czech Republic, Hungary, Slovakia, Slovenia, Poland and Romania) for the observed period 2009-2016.

The positive correlation between liquidity and indebtedness is confirmed (Ručkova et al. 2015; Ramli et al. 2019), while negative impact is found in empirical studies such as (Lipson and Mortal, 2009; Bilgin, 2019). Namely, Sadiq et al. (2022) determined a significant relationship between liquidity risk and leverage on the sample of enterprises in Pakistan for the period 2000-2014. Contrary, the negative linkage between indebtedness and profitability is verified from (Hanousek and Shamshur, 2011; Mateev et al. 2012; Hang et al. 2018; Bilgin, 2019; Dakić and Mijić, 2020; Sikveland and Zhang, 2020; Alarussi, 2021; Naziri, 2021). Specifically, Dakić and Mjić (2020) confirmed negative relationship between profitability and debt ratio in meat processing companies in Serbia for the period 2007-2016. Fenyves et al. (2020) estimated the capital structure of agricultural companies in the Visegrad Group from 2015 to 2017. Their empirical findings confirmed negative impact of ROA on debt in Visegrad Group countries, whereas the greatest effect is identified in Czech Republic (-0.58). Likewise, Liu et al. (2020) investigated the financial performance of agricultural companies in China for the period 2013-2018. Their empirical results indicated that financial performance are negatively related to debt ratio for the observed period. Firm-specific determinants such as assets structure, liquidity and profitability play a significant role in explaining the debt

variability of small and medium enterprises (Czerwonka and Jaworski, 2021). Additionally, Alarussi (2021) confirmed negative impact of debt ratio on efficiency of public listed companies in Malaysia for the period 2012-2014. Finally, Naziri et al. (2021) investigated thirty companies listed in Pakistan stock exchange from 2013 to 2017 and found significant and negative relationship between debt and profitability for the observed period.

3. Methodology and Data

The empirical research estimates the debt's predictors in the agricultural sector in the Republic of Serbia from 2006 to 2021. The research sample implies 1128 agricultural enterprises, whereas 87 large enterprises, 271 medium enterprises and 770 small enterprises. The empirical analysis is conducted based on data of Serbian Business Registers Agency, as well as, financial statements of the analyzed agricultural enterprises.

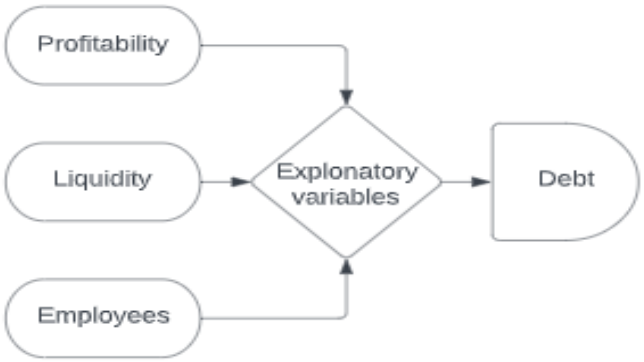

Figure 1: Model construction

The following regression model can be presented as:

$$y = \alpha + \beta_1 ROA_{it} + \beta_2 ROE_{it} + \beta_3 GL_{it} + \beta_4 CL_{it} + \beta_5 EMP_{it} + \varepsilon \quad (1)$$

$$y\ small = \alpha + \beta_1 ROA_{it} + \beta_2 ROE_{it} + \beta_3 GL_{it} + \beta_4 CL_{it} + \beta_5 EMP_{it} + \varepsilon \quad (2)$$

$$y\ medium = \alpha + \beta_1 ROA_{it} + \beta_2 ROE_{it} + \beta_3 GL_{it} + \beta_4 CL_{it} + \beta_5 EMP_{it} + \varepsilon \quad (3)$$

$$y\ large = \alpha + \beta_1 ROA_{it} + \beta_2 ROE_{it} + \beta_3 GL_{it} + \beta_4 CL_{it} + \beta_5 EMP_{it} + \varepsilon \quad (4)$$

where:

- y stands for the dependent variable DEBT
- ROA_{it} stands for return on assets *i* at time *t*
- ROE_{it} stands for return on equity *i* at time *t*
- GL_{it} stands for general liquidity indicator of company *i* at time *t*
- CL_{it} stands for current liquidity of company *i* at time *t*
- EMP_{it} stands for number of employees of company *i* at time *t*

Based on the model derived above, the authors defined the following hypotheses:

H_0: The internal determinants significantly affect the debt of agricultural enterprises.
H_1: Profitability significantly affects the debt of agricultural enterprises.
H_2: Liquidity significantly affects the debt of agricultural enterprises.
H_3: The number of employees significantly affects the debt of agricultural enterprises.

Panel data are widely used in econometric research because they enable the integration of spatial and temporal dimensions. In particular, panel data consist of many separate instances of the same observation unit. The most important need for an econometric approach, stationary data, is one of the prerequisites underlying the econometric analysis of time series (Musdaq, 2011). It refers to the constant values of the mean and variance of the time series. In this analysis, the authors used the Levin, Lin & Chu, Pesaran and Shin, Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests to determine the stationarity of the data. This test includes the following hypotheses:

H_0: Data is not stationary (has a unit root).
H_1: Data is stationary.

If the data has a p-value over 0.05, it means that the data has a unit root and is not stationary. The unit root test is performed to remove non-stationary data because the use of non-stationary data can result in an undesirable regression model (spurious regression). Also, one of the necessary tests to check the validity of the data is the multicollinearity test, which tells us whether there is a high level of correlation between the independent variables. Based on Lin et al. (2011), VIF test was used for the analysis, which after the calculated regression is calculated as follows:

$$VIF = 1/(1 - R_j^2) \quad (2)$$

where:

- VIF – Variance inflation factor,
- R^2_j – R square of the regression model.

This test includes the following hypotheses:

H_0: Multicollinearity exists.
H_1: There is no multicollinearity.

The data must be eliminated from the regression model if the variance inflation factor is more than the threshold value of 10, which indicates the presence of multicollinearity. One of the most crucial tests in panel analysis is the Hausman test, which allows one to choose between models with fixed-effects and models with working effects that are more suitable. The Hausman test in the form of a formula can be presented as follows (Hahn et al. 2011):

$$H = (\beta^{FE} - \beta^{RE})'[Var(\beta^{FE}) - Var(\beta^{RE})]^{-1}(\beta^{FE} - \beta^{RE}) \quad (3)$$

where:

- β^{FE} – fixed-effects model estimates,
- β^{RE} – random-effects model estimates.

The Hausman test includes the following hypotheses:

H_0: Random-effects model is adequate.
H_1: Fixed-effects model is adequate.

If the p-value of the Hausman test exceeds the limit of 0.05, the null hypothesis is accepted, and if it is below the limit value, the fixed-effects model is more adequate.

4. Empirical results and discussion

Within this part of the research, we introduced descriptive and empirical analysis of debts' predictors in the agricultural sector in the Republic of Serbia from 2006 to 2021. Descriptive and empirical analyses are conducted for small, medium and large agricultural enterprises to provide comprehensive view of the indebtedness level in the agricultural sector, but at the same time what are the crucial predictors of the agricultural enterprises' debt.

Table 1: Descriptive statistics

Enterprises	Variables	Mean	Std. Dev	Min	Max
Small	DEBT	0,669832	0,307312	0,005500	4,0000
	ROE	0,025929	0,552107	-19,00000	16,41670
	ROA	-0,187709	5,618141	-85,53850	134,6400
	GL	1,646733	1,409618	0,010000	10,41000
	CL	1,172363	1,228028	0,010000	6,840000
	EMP	1,088211	1,683042	0,00000	38,00000

Medium	DEBT	0,638213	0,300182	0,001500	3,124400
	ROE	0,026165	0,140745	-1,367900	1,902000
	ROA	-0,021204	2,876429	-64,416700	48,285700
	GL	1,437931	1,230777	0,010000	10,110000
	CL	0,950139	0,954566	0,010000	6,820000
	EMP	3,011956	4,363779	0,000000	78,000000
Large	DEBT	0,597032	0,296338	0,000700	2,269900
	ROE	0,020456	0,107150	-1,698100	1,492600
	ROA	-0,060201	3,322072	-76,952000	64,754100
	GL	1,471555	1,319396	0,010000	10,400000
	CL	0,883713	0,863479	0,010000	6,840000
	EMP	27,387790	124,572700	0,000000	2935,000000
Total	DEBT	0,625151	0,301593	0,000700	4,000000
	ROE	0,023197	0,294947	-19,000000	16,416700
	ROA	-0,082812	3,939621	-85,538500	134,640000
	GL	1,507402	1,324682	0,010000	10,410000
	CL	0,971987	0,995191	0,010000	6,840000
	EMP	14,952231	89,857825	0,000000	2935,000000

Source: Authors' calculation

This part of the research includes a descriptive analysis of the variables used. Values of variables for small, medium and large enterprises, as well as variables for the total sample, are presented. The study investigates 1128 observations of agricultural enterprises in the Republic of Serbia and covers the period from 2006 to 2021. The authors deal with the analysis of factors that influence the indebtedness of agricultural enterprises. Table 1 shows the mean values as well as the standard deviation, minimum and maximum values of the variables. In the total sample, we notice that the largest standard deviation is present in the EMP variable, which is also the case in large and medium-sized enterprises. This data lets us know that with the variable EMP there is the biggest difference between the minimum and maximum amount. In the case of small enterprises, the highest standard deviation is present in the ROA profitability indicator. The maximum amount of the ROA profitability indicator is present in small enterprises and is 134.64, as well as the liquidity indicator, which is 10.41. Small agricultural enterprises also have the largest amount of indebtedness indicators of 4.

Table 2: Panel unit root tests

Variables	Levin, Lin &	Pesaran and Shin	ADF	PP

	Chu			
DEBT	-207,619 (0,00000)	-42,9718 (0,00000)	4254,37 (0,00000)	5035,33 (0,00000)
ROE	-913,452 (0,00000)	-123,786 (0,00000)	6986,62 (0,00000)	7911,29 (0,00000)
ROA	-4000,23 (0,00000)	-343,746 (0,00000)	7320,63 (0,00000)	8488,46 (0,00000)
GL	-781,458 (0,00000)	-67,4272 (0,00000)	4763,52 (0,00000)	5417,69 (0,00000)
CL	-519,667 (0,00000)	-60,0447 (0,00000)	5355,67 (0,00000)	6120,38 (0,00000)
NUM OF EM	-71,1468 (0,00000)	-8,78257 (0,00000)	2590,45 (0,00000)	3202,64 (0,00000)

Source: Authors' calculation

In order to perform a valid regression model, it is necessary to perform certain diagnostic tests. One of the necessary tests is the unit root test to determine the stationarity of the data. In the analysis of panel data, the authors use four common unit root tests, Levin, Lin & Chu, Peasan and Shin, ADF and PP test. Based on the obtained results, the stationarity of all variables was established at the level of all indicators, which allows the authors to reject the null hypothesis of non-stationarity of the data.

Table 3: Variance infaltion factor

Variable	Uncerted VIF	Centered VIF
ROE	1,150384	1,149877
ROA	1,172332	1,165123
GL	6,271983	2,732567
CL	5,332773	2,730112
NUM OF EM	1,032428	1,004104
Average VIF		*1,7563566*

Source: Authors' calculation

Another condition for performing a correct regression model is the absence of multicollinearity of the variables. In Table 3 below, the authors use the Variance inflation factor to analyze the presence of multicollinearity in the used variables. The results show that no factor of the independent variables exceeds the value of 10, as well as their average. Based on these results, the authors can reject the null hypothesis of the presence of multicollinearity.

Table 4: Different panel estimation

Variable	Indebtedness								
	Small			Medium			Large		
	POLS model	FE model	RE model	POLS model	FE model	RE model	POLS model	FE model	RE model
ROE	-0,058766 (0,0000)	-0,035286 (0,0000)	-0,048769 (0,0000)	-0,106433 (0,0013)	-0,262965 (0,0000)	-0,254791 (0,0000)	-0,051491 (0,0835)	-0,258189 (0,0000)	-0,253348 (0,0000)
ROA	-0,003767 (0,0000)	-0,005160 (0,0000)	-0,003723 (0,0000)	-0,007106 (0,0000)	-0,002615 (0,0052)	-0,003093 (0,0005)	-0,004837 (0,0000)	7,73000 (0,8879)	-0,000711 (0,1810)
GL	-0,111989 (0,0000)	-0,108491 (0,0000)	-0,112410 (0,0000)	-0,093395 (0,0000)	-0,073583 (0,0000)	-0,076243 (0,0000)	-0,121835 (0,0000)	-0,060875 (0,0000)	-0,066678 (0,0000)
CL	-0,028764 (0,0000)	-0,030606 (0,0000)	-0,028691 (0,0000)	-0,033238 (0,0000)	-0,008644 (0,1764)	-0,013360 (0,0257)	0,222017 (0,0001)	-0,0006319 (0,1529)	-0,004812 (0,2599)
EMP	-0,009770 (0,0000)	-0,003952 (0,2784)	-0,007574 (0,0045)	-0,007818 (0,0000)	-0,001490 (0,1065)	-0,003089 (0,0003)	-0,00215 (0,0000)	1,6205 (0,7038)	-7,41005 (0,0450)
Constant	0,899420 (0,0000)	0,888616 (0,0000)	0,922311 (0,0000)	0,830270 (0,0000)	0,763545 (0,0000)	-0,003089 (0,0000)	0,763502 (0,0000)	0,697040 (0,0000)	0,752776 (0,0000)
R^2	*0,419992*	*0,801278*	*0,433672*	*0,26925*	*0,883669*	*0,283913*	*0,260990*	*0,846925*	*0,21925*
Prob*	*0,000000*	*0,000000*	*0,000000*	*0,000000*	*0,000000*	*0,000000*	*0,000000*	*0,000000*	*0,000000*
Observations	*3673*			*3513*			*7468*		

Source: Authors' calculation

Table 4 shows the results of the analysis of the POLS model, fixed-effects model and random-effects model. The results showed a negative relationship between all independent variables and the dependent variable of indebtedness. By analyzing the R^2 indicator, it is noticeable that, in the case of small, medium and large enterprises, the fixed effects model explains the largest percentage of change. The R^2 results are 0.801 for small, 0.8836 for medium and 0.8469 for large, which represents the percentage of changes in the dependent variable of indebtedness that is explained by the used independent variables. It is shown that a change in the ROA indicator by 1% leads to a decrease in indebtedness by -0.03% in small, -0.2629% in medium and -0.258189% in large enterprises. The changes are shown as statistically significant. With a change in ROE by 1%, the results show that there is a change in indebtedness by -0.005% in small enterprises, -0.002615% in medium-sized enterprises, while in large enterprises the change in the ROE indicator did not prove to be statistically significant. It is noticeable that the biggest changes, in terms of the ratio of profitability and indebtedness, are taking place on the example of medium-sized enterprises. Analysis of the impact of liquidity shows that the effect of general liquidity is statistically significant and negative in the case of small, medium and large enterprises, while the effect of current

liquidity is statistically significant only in the case of small enterprises. A change in general liquidity of 1% leads to a change in indebtedness of -0.108491% for small, -0.073583% and -0.060875% for large enterprises. In the case of current liquidity, a change of 1% leads to a change in indebtedness of -0.030606% only for small enterprises. The change in the number of employees did not prove to be statistically significant in the example of small, medium and large enterprises.

Table 5: Likehood ratio and Hausmann test

Variable	Likelihood ratio	Result	Haussmann test	Result
Small	Cross section F = 4,958953 Cross section Chi-square = 3934,274828	The fixed-effects model is more adequate	Chi-square statistic = 21,486361	The fixed-effects model is more adequate
	Prob. = 0,00000		Prob. = 0,00007	
Medium	Cross section F = 16,628612 Cross section Chi-square = 6453,801654	The fixed-effects model is more adequate	Chi-square statistic = 68,387132	The fixed-effects model is more adequate
	Prob. = 0,00000		Prob. = 0,00000	
Large	Cross section F = 24,878592 Cross section Chi-square = 11757,5072	The fixed-effects model is more adequate	Chi-square statistic = 166,918488	The fixed-effects model is more adequate
	Prob. = 0,00000		Prob. = 0,00000	

Source: Authors' calculation

Model adequacy analysis is required to complete the analysis. For that analysis, the authors used two tests, the Likelihood ratio test for the analysis of the POLS and fixed-effects models and the Hausmann test for the analysis of the fixed-effects and random-effects models. The obtained results of applied tests manifested that fixed-effects model is appropriate for empirical analysis of debt level in agricultural sector in the Republic of Serbia.

5. Conclusion

Improving agri-food competitiveness represents a major challenge for policymakers in any countries, especially for those economies that are still in process of EU integration (Matkovski et al., 2019). Thus, this sector should be market competitive to generate profits and enable success business. The agricultural sector provides vital products and therefore represents a special type of catalyst for the stable economic development of any national

economy (Golovina and Logacheva, 2021). This sector should be heavy reliance on natural factors giving the agricultural sector its unique characteristics (Fiala et al. 2020) and it is relatively dependent on environmental resources (Ren et al., 2022). The success of agricultural enterprises manifests an important issue for the overall economy in the Republic of Serbia. Accordingly, the economy of Serbia heavily depends on the agricultural sector due to its relatively high share in gross value added and total employment (Stojanović, 2022). One of the most significant components of the Republic of Serbia's economic structure is the agriculture industry, where it is necessary to design development strategy that will connect agriculture with other sectors (Dimitrijević et al. 2021).

Both legislators and the management of these enterprises must consider the business of agribusiness enterprises. Indebtedness is one of the most important factors in the stable operation of any company. Every company must take into account the level of its indebtedness as well as other factors that affect it. In this study, the authors used the distribution of agricultural enterprises into small, medium and large enterprises, while as independent variables they used indicators of profitability (ROA, ROE), liquidity (GL, CL) and the number of employees in the company. The sample included 1200 agricultural enterprises in the Republic of Serbia and the period from 2004 to 2020. The results showed that the fixed effects model represents the most authoritative model of the influence of independent variables on the dependent variable of indebtedness. The results indicated that profitability and liquidity significantly affect the debt, which implies that hypotheses H_1 and H_2 can be accepted. Contrary, the number of employees according to the fixed effects model does not affect on indebtedness, thus hypothesis H_3 can be rejected. Based on mentioned estimated findings, the null hypothesis H_0 can be partially accepted, where internal determinants such as liquidity and profitability have significant effect on debt of agricultural enterprises, which is not the case with the number of employees. The contribution of this paper implies new empirical approach for identifying debt's predictors in agricultural sector, which is an important for corporate management from the aspect of analyzing the significance of internal determinants in their business.

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