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The capital structure of agricultural enterprises in the Visegrad countries

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Abstract: The Visegrad countries – or the V-4 countries: the Czech Republic, Hungary, Poland and Slovakia – is strong regional cooperation of four EU member states in Eastern-Central-Europe aimed at strengthening the positions of the members on both a European and a global level. The aim of this research is to analyse the capital structure of the agricultural and food companies in the V4 Member States. The results show that more profitable companies were less dependent on debt finance, while the fast-growing companies had limited access to the financial market. Company size had a significant effect only in the Czech Republic. Overall, the capital structure seemed to be strongly affected by the farm structure and the relative company size.

Keywords: agriculture; food industry; leverage; pecking order theory

In 2004, the Czech Republic, Hungary, Poland and Slovakia joined the European Union. These four countries account for more than one-tenth of the EU's territory and its total population and contribute nearly 6% to the EU's economic performance in terms of GDP (HCSO 2018). The V4 countries used to have many similarities in terms of agriculture and, with the exception of Poland, large and strongly concentrated companies were common. Most of these businesses have been dismantled and the previously homogeneous agricultural production sector has become fragmented (Szabo et al. 2018). Agriculture has an important role in the V4 countries' economy; however, these Member States still face problems with technological and financial constraints. This research aims to improve the understanding of the capital structure of agricultural and food companies, which could have an important effect on these firms' profitability and overall performance.

LITERATURE REVIEW

Agriculture in the V4 Member States

The share of GDP in agriculture in the V4 countries is around 2–4% generally, which is not outstanding compared to other sectors. Table 1 summarises the relative importance of the most important indicators for agriculture in the Visegrád countries. Poland is the largest agricultural country among the Visegrad countries,

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Table 1. Main agricultural indexes in V4 countries

	Czech Republic	Poland	Hungary	Slovakia
Employment in agriculture (2016, %)	2.7	10.1	5.7	2.1
Persons employed in agriculture (2016, number)	137 860	1 608 800	247 280	46 740
Contr. of agriculture to GDP (%)	0.8	2.2	2.6	0.7
Gross value added (at basic prices, mill EUR)	1 633	10 273	3 538	652
Value of agricultural output (at basic prices, mill EUR)	4 937	24 938	8 331	2 390
Value of crop output (mill EUR)	2 744	11 244	4 831	1 272
Value of animal output (mill EUR)	1 902	13 071	2 918	860

Source: EUROSTAT (2018)

and has the highest number and proportion of agricultural workers, while Hungary ranks second. The role of agriculture in terms of employment is much smaller in both the Czech Republic and Slovakia compared to Poland and Hungary. Poland has the largest agricultural area among the Visegrád countries, followed by Hungary and the Czech Republic with significantly lower areas. Slovakia's small territory and mountainous location are not favourable for the development of agricultural production. Poland has the highest agricultural output, of which the livestock sector has a larger share, which is exceptional in the V4 countries. In the case of Hungary, which ranks second in terms of agricultural outputs, crop production has a larger share than livestock production, similarly to the Czech Republic in third place and Slovakia in fourth place.

Table 2 shows the agricultural farm structure in the Visegrád Group for 2016. Among the V4 countries, the Czech farms operate on an exceptionally large agricultural area per farm (168 ha). Furthermore, farms with less than EUR 2 000 SO (Standard Output) made up only 4–5% of the total number of farms, while this figure was between 24% and 60% in the other countries. Furthermore, more than 7% of these farms had a standard output of EUR 500 000 or more, which was again, exceptionally high among the V4 countries. In Hungary, an exceptionally large number of small-scale farms were present, making up almost 60% of the total farm numbers. At the same time, the utilised area of these farms was not even 3% of the total area. Poland had a similar structure, but the small-scale farmers were not so marginalised since farms with less than EUR 2 000 SO made up 26% of the total number of farms and their utilised area was higher compared to Hungary (more than 5.1% as opposed to 2.4%). However, really large farms were absent in Poland, since the proportion of farms with EUR 500 000 SO or above was under 0.3%. The farm structure in Slovakia was very atypical among the V4 countries. The UAA/farm (Utilised Agricultural Area/farm) of more than 73 ha was relatively large, and the high proportion of small-scale farmers (more than 24%) utilised less than 1%

Table 2. Farm structure in the V4 countries in 2016

	Total		Under EUR 2 000 SO		EUR 500 000 or above	
	farm number	UAA (ha)	farm number	UAA (ha)	farm number	UAA (ha)
Czech Republic	26 530	4 468 500	1 150	5 870	1 930	2 281 920
Hungary	430 000	4 670 560	253 770	112 710	1 720	1 345 280
Poland	1 410 700	14 405 650	367 130	735 740	3 450	1 200 580
Slovakia	25 660	1 889 820	6 200	14 600	880	1 200 400
		UAA/farm (ha)	% of total	% of total	% of total	% of total
Czech Republic		168.43	4.33	0.13	7.27	51.07
Hungary		10.86	59.02	2.41	0.40	28.80
Poland		10.21	26.02	5.11	0.24	8.33
Slovakia		73.65	24.16	0.77	3.43	63.52

SO – standard output, UAA – Utilised Agricultural Area; 2016 is the last available data currently

Source: EUROSTAT (2019)

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of the total area; however, at the same time, there was a high proportion of large-scale farms (3.4%) with the largest proportion of the utilised area (63.5%).

Capital structure and the pecking order theory

There are only a few research studies which analyse the capital structure of companies in the V4, while papers related to agriculture and food are very scarce. Our assumptions were partly based on the pecking order theory, which has been developed by Myers and Majluf (1984) and Myers (1984). The practical relevance of the theory is that it explains why the bulk of external financing comes from debt; furthermore, it states that more profitable firms borrow less. Thus, the theory assumes a negative relationship between profitability and leverage. More profitable firms have more internal resources to finance growth (Myers 2001). The central issue in the pecking order theory is the choice between internal and external sources of financing (Nivorozhkin 2002). According to Michaelas et al. (1999), the order originates from the existence of information asymmetries and reflects the relative cost of these resources. Other theories, such as the "static trade-off theory", are commonly tested or compared to the pecking order theory (Chmelíková 2002), but due to space limitations, we only focus on the latter. These theories, although they provide a solid basis for empirical research, are usually not able to fully explain the capital structure. Modification of these theories provides a more flexible framework in some cases; see, for example, Delcoure (2007). During the research, we employed some of the main predictions of the pecking order theory.

Some important results from the capital structure literature

Since the capital structure literature usually employs a fairly standard regression model, the results were grouped by variables. Due to space limitation, only a few results were selected from the vast literature related to capital structure.

Size related results. Michaelas et al. (1999) found an overall positive relationship between company size and total debt ratio. However, dividing the ratio into a short- and a long-term part, a negative sign was found for the former, while a positive sign was found for the latter. This indicates that the overall connection could be dependent on the type of debt. Nivorozhkin (2002) found a non-significant relationship between size and leverage, while this time the parameter sign was dependent on the proxy for leverage. According to Nivorozhkin (2002), the relationship between the leverage ratio and the size of the company was neutral. Cassar and Holmes (2003) found a significant relationship between size and leverage for Australian small and medium-sized enterprises (SMEs). Delcoure (2007) also found a debt-dependent relationship (positive for short-term and negative for long-term debt). Adair and Adaskou (2015) reached a similar conclusion.

Asset structure related results. Michaelas et al. (1999) found that a high fixed asset level was associated with higher short-term and long-term debt. A higher fixed asset level means that small firms are able to raise a higher level of collateral for debt finance. The positive relationship is due to the size of the companies. Lenders are unwilling to finance small firms with a high probability of failure. A higher fixed asset level provides an opportunity to secure debt by fixed assets and to decrease information asymmetry and agency costs. According to Colombo (2001), assets that serve as collateral should have a positive relationship with debt, since they provide an explicit guarantee over debt. Colombo (2001) found a positive relationship between tangible assets and debt. Cassar and Holmes (2003) found different results regarding the relationships between non-current assets, long-term debt (a positive relationship) and short-term debt (a negative relationship). Delcoure (2007) uncovered an overall positive relationship between tangibility and leverage for Central and Eastern European firms. Adair and Adaskou (2015) found that companies with higher fixed assets and inventories were more leveraged.

Profitability related results. Many research studies, including Michaelas et al. (1999), Colombo (2001), Nivorozhkin (2002), Cassar and Holmes (2003) and Adair and Adaskou (2015) have found a negative relationship between a company's leverage ratio (measured by total debt to total assets) and profitability. Stekla and Grycova (2016) found a negative relationship between total debt to total assets, short-term debt to total assets and long-term debt to total assets and profitability. Delcoure (2007) found support for the modified pecking order theory, but overall, the relationship was negative and significant. The pecking order theory predicts the relationship to be negative, and in the literature, the negative relationship between profitability and leverage is mostly usually well- and strongly supported. Furthermore, the negative relationship is relatively independent of the selected companies in terms of activity, industry or size, as well.

Growth related results. Cassar and Holmes (2003) and Adair and Adaskou (2015) found a positive rela-

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tionship between the growth of a company and the leverage ratio. Colombo (2001) found no relationship between the company's growth prospects and leverage (the growth prospects were measured by past investments) with cross-sectional data, but the relationship was significant with panel data estimates. The growth of a company is usually measured by the growth in the net sales or the total assets of the company (among other measurements), which can only be a crude approximation of the real growth. Thus, results could be strongly dependent on the measurements used.

MATERIAL AND METHODS

Data and method

We followed a standard capital structure regression model, as can be seen, for example, in Cassar and Holmes (2003), although we used panel regression methods instead of cross-section regression. We employed a fix effect model with an unbalanced panel dataset between 2015 and 2017 from the EMIS (2018) database. While the companies are affected by a number of factors, measurements are not available in some cases (or the given characteristic cannot be measured accurately). For example, the firm technology level, and the tenure and education of the company management are both important determinants of the capital structure, but there was no available information in this respect (from a regression point of view). Ignoring these variables causes omitted-variable bias. It can be safely assumed that although these omitted effects differ among the entities (firms, in this case), they are time-invariant for a given firm. A fixed-effect model removes the effect of these time-invariant "fixed effects" by demeaning the equation. At the same time, we cannot assess the effect of the time-invariant variables (such as sector and area dummies) due to the demeaning. The model and the following section is based on Wooldridge (2010). The basic model is an unobserved effect model (UEM) presented as Equation (1):

$$y_{it} = \boldsymbol{x_{it}}\boldsymbol{\beta} + c_i + \lambda_t + u_{it} \quad (1)$$

where: y_{it} – dependent variable for company i and time t; $\boldsymbol{x}_{it}$ – contains explanatory variables; β – contains the slope parameters of $\boldsymbol{x}_{it}$; c_i – individual fixed effect of unobserved homogeneity (has no time index and is invariant of time but allowed to change between entities); λ_t – denotes the time fixed-effect; u_{it} – idiosyncratic error which changes across t as well as across i; the bold face denotes matrix notation.

The unobserved effect c_i and the explanatory variables $\boldsymbol{x}_{it}$ can have arbitrary dependence. As Equations (2) and (3) show, demeaning removes the unobserved variable c_i, as well as other time-invariant variables. At the cost of the latter, it provides a great framework to mitigate the consequences of the omitted-variable bias. By averaging over time (without the time fixed-effect), we can write out an equation of the form:

$$\bar{y}_i = \bar{\boldsymbol{x}}_{\boldsymbol{i}}\boldsymbol{\beta} + c_i + \bar{u}_i \quad (2)$$

Subtracting Equation (2) from Equation (1) gives the transformed Equation (3), where the unobserved effect has disappeared:

$$y_{it} - \bar{y}_i = (x_{it} - \bar{x}_i)\boldsymbol{\beta} + (u_{it} - \bar{u}_i) \quad (3)$$

$$\tilde{y}_{it} = \tilde{\boldsymbol{x}}_{\boldsymbol{it}}\boldsymbol{\beta} + \tilde{u}_{it} \quad (4)$$

where: $\tilde{y}_{it} = y_{it} - \bar{y}_i$, $\tilde{\boldsymbol{x}}_{\boldsymbol{it}} = \boldsymbol{x}_{\boldsymbol{it}} - \bar{\boldsymbol{x}}_{\boldsymbol{i}}$ and $\tilde{u}_{it} = u_{it} - \bar{u}_i$ by definition. We formally tested the difference between the random effect and the fixed effect model by the Hausman test (Hausman 1978). We employed the company database of EMIS (2018) between 2015 and 2017. The data were given in million Euros. Some of the variables were Winsorised. We preferred Winsorised variables to trimmed variables since observations remained in the sample but with reduced weight.

Hungary had 7 856 observations for the full period (2 419 companies in 2015, 2 387 companies in 2016 and 2 270 companies in 2017). Slovakia had 2 239 observation in the sample, but these were unevenly distributed among the sample years. In 2015, there were only 540 companies with available data, while there were 866 in 2016 and 829 in 2017. Due to these issues, we estimated a different model for Slovakia, only using the last two years. The Czech Republic sample contained 2 256 observations, with 756 companies reporting data in 2015, 783 in 2016 and 717 in 2017. Poland had the largest sample with 8 330 observations, 2 581 from 2015, 2 443 from 2016, and finally 2 803 from 2017.

Variables

Leverage. The dependent variable was the company's leverage ratio (*LEV*), defined as the total debt to total assets ratio. Michaelas et al. (1999), Colombo (2001), Cassar and Holmes (2003), and Adair and Adaskou (2015) used debt over total assets as a measure for leverage. To give less weight to extreme leverage points, *LEV* was Winsorised at the upper tail with a 1% threshold. No distinction was made between short-term and long-

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term debt, since in some cases, the number of companies with long-term debt was low, which strongly reduced the sample size.

Independent variables

Size. The proxy for the company size (*SIZE*) was the (natural logarithm) of the firm's total assets, as in Cassar and Holmes (2003). We assume that the larger companies are less likely to rely on external sources, resulting in a negative relationship. Similar proxies could be found in other studies. Nivorozhkin (2002) used the logarithm of company turnover, while Michaelas et al. (1999) used the total assets of the company. Other measures are available; Colombo (2001) used the logarithm of the net sales and the level of employment. Adair and Adaskou (2015) captured the size effect by dummy variables for the different size categories. Due to the log transformation, the size was not Winsorised.

Capital structure. The fixed assets to total assets ratio was used to proxy the company's fixed asset structure (*CAP*). Michaelas et al. (1999) and Cassar and Holmes (2003) used the fixed assets to total assets ratio, as well. We assumed that fixed assets could be used as collateral resulting in a positive relationship between fixed assets and leverage. The variable was Winsorised at the upper tail with a 1% threshold.

Profitability. The Return on Assets (*ROA*) was used as a proxy for profitability, defined as the sales before tax over total assets. This variable was pre-calculated in the database. The *profitability* variable should have a negative relationship with the leverage ratio, according to the pecking order theory. The variable was Winsorised at the lower and the upper tail with a 1% threshold.

Growth. To measure the growth possibilities of the company, we used a pre-calculated measurement of the sales growth from the database (the sales trend in percentages). Especially in this case, alternative variables are diverse, which could affect the result in different studies. The variable *GROWTH* was Winsorised at the lower and the upper tail with a 1% threshold.

RESULTS AND DISCUSSION

Descriptive statistics of the regression variables

The median values and the standard deviations of the regression variables are shown in the **Table S1** [Table S1 in electronic supplementary material (ESM); for the supplementary material see the electronic version]. The median values were calculated instead of the usual averages due to the high standard deviation of the variables, which stems from the presence of extremely high or low values. This is a common problem in the capital structure literature, which was treated by taking logarithms or by Winsorisation in our sample. Based on the results, the median total assets of the companies were high in the Czech Republic and Slovakia compared to Hungary and Poland between 2015 and 2017 (around 3–5 million EUR in the former countries as opposed to 1–2 million EUR in the latter). The fixed assets showed a similar tendency. The leverage (debt over total assets) was rather stable in the sample period. The ratio was almost the same in the Czech Republic and Hungary (around 0.3), while it was around 0.4 in Poland and between 0.5 and 0.6 in Slovakia. This shows that companies in Poland and Slovakia were more likely to be financed by debt. The sales trend median was negative in 2016 in every V4 country, which turned into a positive in 2015 only for Hungary. In 2017, the growth measurements became positive, which indicated increasing sales. The extreme standard deviations (except in the Czech Republic) implied huge fluctuations among the companies in terms of sales growth. Finally, the ROA was positive overall between 2015 and 2017; thus the companies were profitable (in terms of returns over assets). The Czech Republic and Hungary possessed slightly higher ROA measurements, followed by Poland. At the same time, profitability in Slovakia was much lower compared to the other countries in the sample.

Estimation results for the Visegrad countries

The estimations results are presented in this section, with comparisons with some of the relevant research findings.

Size of the company. According to Table 3, the leverage ratio (*LEV*) and the size of the company was positively related in the Czech Republic, which was not the expected sign of the parameter. However, Bauer (2004) and Delcoure (2007) found similar results for Czech companies too. This indicates that larger companies may have easier access to external sources in the country, and as the company size increases, the debt ratio increases as well. In Hungary and Poland, the size of the firm was not related to the leverage ratio. One possible reason behind this is that producer organisations and small-scale farming remained common in Poland, while the truly large firms are absent, which may explain the lack of a relationship between size and leverage. The high share of small-scale farmers and the tendency towards self-financing in the Hungarian agriculture and food sector may explain the lack of a relationship as well. The results were inconclusive

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Table 3. The fixed effect (unobserved heterogeneity) models for the V4 countries

	Czech Republic	Hungary	Poland	Slovakia
	(1)	(2)	(3)	(4)
Dependent variable	LEV_{it}	LEV_{it}	LEV_{it}	LEV_{it}
Independent variables				
$SIZE_{it}$	**0.25***	**–0.02**	**–0.06**	**0.02**
	(0.05)	(0.02)	(0.05)	(0.09)
CAP_{it}	0.04	–0.23*	0.05	–0.16
	(0.12)	(0.04)	(0.10)	(0.20)
ROA_{it}	**–0.58***	**–0.29***	**–0.39***	**–0.32***
	(0.14)	(0.04)	(0.07)	(0.12)
$GROWTH_{it}$	0.0003	0.0002*	0.0001*	0.0000
	(0.00)	(0.00)	(0.00)	(0.00)
Constant	–0.07	0.51*	0.47*	0.63*
	(0.11)	(0.02)	(0.06)	(0.17)
Individual fixed effect	YES	YES	YES	YES
Time fixed effect	YES	YES	YES	YES
Test of time fixed effects	0.00*	0.00*	0.00*	0.69
R^2 – within	0.27	0.11	0.17	0.05
R^2 – between	0.00	0.03	0.06	0.01
R^2 – overall	0.00	0.03	0.07	0.01
F-test	0.00*	0.00*	0.00*	0.14
Number of observations	1 019	6 717	4 642	1 140
Number of groups	734	2 428	2 481	861

*denotes significance at the conventional significance levels; parameters with **bold**, clustered robust standard errors under the parameters in parentheses; Slovakia (4) model is calculated for 2016 and 2017 only; variables (except *SIZE*) were Winsorised; *LEV* – total debt/total assets; *SIZE* – natural log(total assets); *CAP* – fixed assets/total assets; *ROA* – sales before tax/total assets; *GROWTH* – sales trend in percentages

for Slovakia since the regression was not significant. This may indicate that the capital structure in Slovakia follows a completely different path compared to the neighbour countries. Other studies revealed contradictory results as well. Some of the studies have found no relationship, such as those by Nivorozhkin (2002) and Adair and Adaskou (2015). Michaelas et al. (1999) indicate that the overall connection may be dependent on the type of debt.

Asset structure. The capital structure measurement (CAP) was significant only for Hungary, with a negative sign. This means that companies with a higher fixed ratio were less likely to rely on debt, which is the opposite of the assumed relationship. Bauer (2004) found a negative relationship between tangibility and leverage in the case of the V4 countries as well. Michaelas et al. (1999), Colombo (2001), and Adair and Adaskou (2015) found that companies with higher fixed assets and inventories were more leveraged, while the results of Cassar and Holmes (2003) were dependent on the type of debt. Our results may be due to the higher share of short-term debt in Hungary. A likely scenario behind the negative relationship could be due to the investment structure in the Hungarian agriculture and food sector. Around 56% of the Hungarian agricultural investments were related to machinery purchases and 20% to livestock purchases. The proportion was almost 65% in the food industry in 2017 (HCSO 2017). These investments are not a priority anymore for companies with a high proportion of fixed assets, which could result in a negative relationship between fixed assets and leverage.

Profitability. The profitability measurement (ROA) was negatively related to the leverage ratio (LEV) in the Czech Republic and in Hungary, as the pecking order theory predicted. As a company becomes more profitable, it is less dependent on external debt to finance itself. In the case of Poland, the profitability measurement (ROA) was also negative, which is again in accordance with the pecking order theory. Even though the regression was not significant, the profitabil-

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ity parameter sign was in accordance with the theory in Slovakia, as well. These results support the findings of Nivorozhkin (2002), Adair and Adaskou (2015), Colombo (2001), Cassar and Holmes (2003), Bauer (2004) and Michaelas et al. (1999).

Growth. Hungary and Poland were the only countries where the net sales growth had a significant effect. Fast-growing companies in Hungary and Poland tended to look for external sources to finance their growth. This is hardly surprising, especially in Poland, since the Polish agriculture and food sector has shown a strong development since the regime change in 1990, and at the same time, the small-scale farmers have not been marginalised, as they have in other V4 countries. Michaelas et al. (1999), Holmes (2003), Cassar and and Bauer (2004), and Adair and Adaskou (2015), found support for the growth assumption too, while Colombo (2001) found a significant relationship only with panel estimation methods.

Time fixed effects were employed and they were significant in all cases, except Slovakia. The Hausman test supported the fixed effect model over the random effect model in every case. Clustered robust standard errors were used to correct for any remaining heteroskedasticity. Since variables took values both on the negative and the positive scale, we did not employ logarithm transformation for the dependent variable, which is common in the literature. However, taking logarithms (or using different data transformations) may improve the linearity between the variables.

CONCLUSION

More profitable firms were less likely to rely on debt in the Czech Republic, Hungary and Poland. In the case of the Czech Republic, the size and the leverage ratio was positively related. This may indicate that in the Czech Republic small-scale companies may have to face obstacles when applying for debt. The results appear to be strongly affected by the characteristics of the farms in different countries. The fixed asset structure did not seem to have an overall effect on the debt ratio of the V4 countries, except for Hungary, where a higher fixed assets over total assets ratio was associated with a lower leverage ratio. The proxy for growth was positive in every case, although significant only in the case of Hungary and Poland, where farm structure was the most fragmented. Thus, firms with higher growth potential were more likely to finance their growth from debt, which does support the pecking order theory. The regression results were inconclusive for Slovakia, where other theories might have greater power. The pecking order theory was only partly able to explain the capital structure of these companies. This stems from the fact that country-specific factors strongly affect the capital structure; the involvement of other theories (for example the static trade-off theory or the modified pecking order theory) can increase the effectiveness of the analysis. From a methodological point of view, the comparison of cross-section and panel estimation methods may provide useful insight into future research.

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