Comparative Economic Research. Central and Eastern Europe
Volume 27, Number 2, 2024
https://doi.org/10.18778/1508-2008.27.18

A Comparative Study of Capital Structure Determinants: Agricultural Businesses in Central-Eastern vs. Western EU Countries

Magdalena Gostkowska-Drzewicka https://orcid.org/0000-0002-4383-7711
Ph.D., University of Gdańsk, Sopot, Poland, magdalena.gostkowska-drzewicka@ug.edu.pl

Julia Koralun-Bereźnicka https://orcid.org/0000-0003-4498-0381
Ph.D., Assistant Professor, University of Gdańsk, Sopot, Poland, julia.koralun-bereznicka@ug.edu.pl

Abstract

This article undertakes a comparative analysis to investigate the distinctive determinants of capital structure in agricultural businesses located in Central and Eastern Europe (CEE) and Western Europe (WE). Given the unique financing characteristics inherent to agricultural enterprises and the substantial economic and historical distinctions between these regions, the exploration of financing strategies within this sector constitutes a crucial research task. The study incorporates financial data from agricultural firms operating in 12 European Union (EU) countries from 2000 to 2020, sourced from the BACH-ESD database. The primary analytical approach involves the application of panel data regressions, separately conducted for the two specified groups of 12 EU countries. The comparative analysis investigates the consistency of factors that affect the capital structure of agricultural firms between CEE and WE countries. The findings reveal that although there is no significant divergence in capital structure across countries, the influence of individual factors exhibits variability across the two macro-regions. The comparative analysis provides valuable insights for policymakers, financial institutions, and agricultural businesses in both groups of countries. Understanding the nuances of capital structure determinants specific to each region can aid in the development of more targeted and effective financing policies. Moreover, agricultural businesses should consider region-specific factors when making financial decisions. This research contributes to the existing literature by shedding light on the differences and similarities in the capital structure determinants of agricultural businesses in CEE and WE. It not only deepens our understanding of how financing strategies vary across regions but also highlights the importance of recognising the unique financial landscape of agricultural

Received: 4.05.2023. Verified: 17.10.2023. Accepted: 2.02.2024

enterprises. By doing so, this study adds substantial value to the field of agricultural finance and provides grounds for more informed decision-making in the sector.

Keywords: Pecking-order theory, trade-off theory, agriculture holdings, leverage, farm finance

JEL: G32, Q140

Introduction

The capital-intensive nature of agricultural production generates a high demand for financial resources. This problem mainly concerns investments. Therefore, the need to modernise and renew existing resources on farms forces these operators to seek sources of capital that can meet their needs. Unfortunately, limited access to finance is a significant obstacle to achieving the sustainable development of agricultural firms across the EU (Tropea and De Carvalho 2016, pp. 1–12). Unlike manufacturing or service businesses, farms do not have direct access to most of the financial instruments the capital market offers. They use a very narrow range of financing sources, including internal funds, short- and long-term loans and various subsidies. However, for agricultural firms, as for all other business entities, the problem of shaping their capital structure is one of the most critical aspects of financial decisions. Agriculture has specific characteristics that distinguish it from other sectors, and they also affect the financial decisions of agricultural firms.

The analysis of capital structure in different countries poses additional problems due to the various economic conditions, as exemplified by the countries of Central and Eastern Europe (CEE). During the socio-economic transition, these countries had a similar level of socio-economic development. However, despite the similarities, the CEE countries did not develop at the same pace. Differences included the conditions and level of development of the agricultural sector, which was largely due to the structure of agriculture and the availability of financial resources for modernisation and restructuring.

This article aims to assess the impact of selected factors on the capital structure of agricultural firms in CEE countries compared to Western European (WE) countries, and to determine whether these firms make financial decisions according to trade-off theory or pecking-order theory. There are only a few studies on this topic in the literature, so this article also aims to fill the gap. To achieve the research objective, two main hypotheses are verified: The financing patterns of agricultural firms are significantly different between CEE and WE countries (H1), and the influence of capital structure determinants also varies between these two groups (H2).

The article consists of an introduction, five parts and a conclusion. The first part indicates the characteristic features of agriculture in the context of capital structure formation.

The second part deals with the formation of the capital structure of farms according to the assumptions of the trade-off theory and the pecking-order theory. It also explains the links between the factors analysed and the level of indebtedness on the grounds of the main theoretical trends, which forms the basis for formulating research hypotheses. The next section reviews the available research on the capital structure of companies in the agricultural sector. This is followed by a presentation of the research methodology, detailed hypotheses and research results, and concludes with a summary.

Distinctive features of the agriculture industry in terms of capital structure

Agricultural firms are characterised by distinctive features that arise from the specific nature of agricultural activity. These characteristics significantly affect the capital structure of these entities. They include the seasonality of agricultural production, the family nature of most farms, the unique life cycle of the farm, unlimited responsibility for liabilities, a specific taxation system, an extensive system of subsidising activities, and the unique nature of land understood as a productive asset (Zhengfei and Lansink 2006, pp. 644–656).

The debt financing of operations is a standard solution in agriculture. The seasonal nature of agrarian production creates a significant lag between incurring expenditure and receiving receipts. Firstly, the financing gap that occurs between these two events establishes the need for external financing. Second, the high level of risk that accompanies agricultural activity and the low profit margins mean that debt is treated as a buffer against the profit volatility associated with seasonality. Furthermore, in most cases, farms are deprived of access to equity capital (Ahrendsen, Collender, and Dixon 1994, pp. 108–119). It is also important to highlight the constraints on access to debt financing that farms with poor financial health may face. It is noted, however, that applying the capital structure theories described in the next section of this paper may either be difficult in practice or produce surprising results in the agricultural sector because of the fundamental differences between farms and other businesses.

In the agricultural sector, the predominant form of business organisation is the family farm, where the workforce consists mainly of family members. Compared to enterprises employing workers on a market basis, such a model can be problematic, as there is no possibility of reducing the number of employees in difficult times. This can further worsen the entity's financial situation. The possible bankruptcy of a family farm means that the lifestyle of the farmer and their family will have to change, which increases the costs of bankruptcy (Zhengfei and Lansink 2006, pp. 644–656).

Family farms have a unique life cycle, significantly influencing capital structure decisions. This cycle consists of four stages: start-up (entry), expansion, consolidation and exit or divestment. According to this approach, debt levels are high when the farmer invests in developing the farm. Then, during the consolidation phase, the proportion of debt in the capital structure decreases as the income generated from the farm peaks and provides internal financing (Kay and Edwards 1994, pp. 218–219). It is worth noting that making the level of leverage dependent on the farm's life cycle can distort the results of capital structure studies.

Unlike companies in other sectors, agricultural businesses mainly operate as sole proprietorships or partnerships. The owners of such entities have unlimited liability for the farm's obligations. Banks that extend credit or loans to such a farm require that security be provided over production assets and housing. For the farmer, this means the risk of losing personal assets, especially their residence. The agency costs associated with the capital structure of agriculture are, therefore, secondary to those of other sectors. In agriculture, the interests of the owners of the capital (farmers) are, to some extent, aligned with those of the creditors. For the same reason, the disciplinary role of debt is more important in agriculture than in other sectors.

How farms are taxed differs from that of enterprises in other sectors. Farmers operating as a sole proprietorship or partnership generally pay tax on their personal income. In the Netherlands, such tax is calculated jointly on the agricultural and non-agricultural income of all family members working on the farm (Zhengfei and Lansink 2006, pp. 644–656). In contrast, Poland has an agricultural tax based on the area of agricultural land. The taxation method changes the tax burden's importance in shaping the capital structure, but does not exclude the use of various types of tax deductions (shields).

EU farms can benefit from government and EU subsidies, which increases their financial capacity. The level of subsidisation of agricultural activities is many times higher than in other sectors. Subsidies help to increase farm cash flow and reduce the need for debt capital. However, as farmers look for opportunities to continue to receive subsidies for their activities, they may choose subsidised solutions. Still, those solutions may not be conducive to high income in the long term.

A final feature that distinguishes agriculture from other sectors is the need for agricultural land. Land as a means of production is seen as a non-destructive asset, which is its unique characteristic. This means, firstly, that land can be used in perpetuity, i.e. there is no depreciation. Secondly, land is ideal collateral for debt, improving farmers' access to credit markets.

EU agricultural firms' financial choices according to the trade-off and pecking-order theories

The main premise of trade-off theory is to optimise the capital structure to maximise the firm's market value. The optimal capital structure, i.e. the combination of debt and equity, is the result of balancing the interest of tax benefits with financial distress costs (bankruptcy costs) together with the agency costs of equity and debt (Myers 1984, pp. 575–592).

Large firms tend to be more diversified. This leads to less volatility in revenues and, therefore, a lower level of risk. Therefore, bankruptcy for such entities is less likely than for smaller firms, and large entities can borrow more (Titman and Wessels 1988, pp. 1–19). The lower profit volatility associated with the diversification of activities characteristic of large firms reduces the indirect costs of bankruptcy so that such a firm can use debt to a greater extent. In addition, entities that have a significant stock of physical assets can use them as collateral for debt. This implies a positive relationship between asset structure and leverage. This hypothesis is particularly relevant for agricultural holdings, which are characterised by a very high share of physical assets, especially land, in the asset structure (Zhengfei and Lansink 2006, pp. 644–656). Like the asset structure, liquidity is positively related to leverage. Firms with high liquidity ratios are willing to use debt because they show an excellent ability to repay liabilities. The liquidity category is linked to and reflected in the working capital, i.e. the difference between current assets and current liabilities. According to trade-off theory, the link between working capital and leverage is positive as companies can increase their debt to finance their working capital requirements.

Firms with high profitability are more indebted because high revenues reduce the likelihood of bankruptcy. It has been stated that subsidies such as government bailouts or EU grants are a driver of improved profitability and financial stability in the agricultural sector, leading to increased indebtedness (Latruffe et al. 2010, pp. 351–365). Agricultural firms face high risks due to various factors, e.g. the weather or the volatility of agricultural prices and costs. These risks lead to increased uncertainty about the value of future cash flows. This may reduce the availability of debt financing, as lenders may perceive agricultural firms as potentially generating higher bankruptcy costs. The relationship between growth opportunities and debt can be similarly explained. Established firms with low growth potential are considered to have a better reputation. Therefore, they can borrow on better terms than growth firms. This is because the realisation of growth opportunities is associated with higher risks and expected costs of financial difficulties, resulting in reduced debt.

According to the trade-off theory, the tax shield effect is one of the reasons that leads to an increase in debt. However, this behaviour is only attractive for companies that

generate income that allows tax benefits to be obtained but that do not have other costs which act similarly to the tax shield. Such costs include, in particular, depreciation, which, as a proportion of total assets, determines the level of the investment tax shield. Unlike the tax shield, it leads to a reduction in debt (DeAngelo and Masulis 1980, pp. 3–29).

Pecking-order theory takes the opposite approach to capital structure formation (Myers and Majluf 1984, pp. 187–222) and explains companies' preferences for particular sources of financing. The order is as follows: Internal sources, i.e. retained earnings, together with surplus cash and short-term financial assets, are used first. Once they are exhausted, companies turn to external sources. Thus, they first turn to loans and bank borrowings, followed by a decision to issue debt securities and only finally to issue shares.

According to the pecking-order theory, profitable companies borrow less. They prefer internal financing because they can accumulate profit and therefore show less need for debt financing (Fama and French 2002, pp. 1–33). Entities with high growth opportunities, which require additional financing for investments after internal funds have been exhausted, first turn to debt financing for risky investments, and only once they have done this will they turn to external equity. Therefore, growth opportunities positively relate to leverage (Myers 1984, pp. 575–592). The high volatility of agricultural returns is associated with an increased likelihood of debt repayment difficulties. Therefore, risk negatively affects leverage (Barry, Bierlen, and Sotomayor 2000, pp. 920–933). According to pecking-order theory, asset structure harms capital structure as firms with a high proportion of tangible assets in their asset structure are less susceptible to problems arising from information asymmetries. Therefore, their propensity to take on debt is lower. Moreover, companies with high liquidity first use accumulated cash and cash equivalents. Therefore, they borrow less (Martucheli 2020, pp. 26–42).

The relationship between working capital and capital structure is the same. To optimise working capital management, firms seek to maintain high liquidity and independence from debt capital. Pecking-order theory predicts both negative and positive effects of firm size on debt levels. However, in the case of agricultural companies, a positive relationship should be considered first and foremost. The lower level of risk that is characteristic of large entities reduces information asymmetry problems. It lowers the cost of debt relative to other sources of financing. For this reason, large companies are more indebted than smaller ones.

The impact of the tax burden on the capital structure is not considered in pecking-order theory (Frank and Goyal 2003). However, the relationship between the non-interest tax shield and debt is negative. Firms that raise funds through depreciation show a lower need for debt capital because they have higher internal financing capacity (Öhman and Yazdanfar 2017, pp. 106–124).

In addition to the company-specific factors, the impact of the country could also be significant regarding financial policies adopted by European agricultural firms. Section 4 highlights the distinct features of agricultural firms in CEE and WE countries, suggesting that differences are likely in the capital structure behaviour across countries.

Empirical studies on the capital structure of agricultural firms

Most studies on capital structure formation focus on large manufacturing, service or financial enterprises. Only a limited number can be found on the agricultural sector. Most studies focus on the markets of highly developed countries, especially the USA, e.g. Barry, Bierlen, and Sotomayor (2000, pp. 920–933) and Zhao, Barry, and Katchova (2008, pp. 805–820). Both studies obtained mixed results, which, however, although they confirmed that the analysed farms make financial decisions primarily according to the principles of pecking-order theory. Steele, Mugera, and Kingwell (2021, pp. 391–412) examined the capital structure factors of Australian farms. The results indicate that, as in the US, financial decisions are made according to the principles of the pecking-order theory of financial sources.

Some of the available research on capital structure concerns agricultural firms of highly developed European countries. For example, Zhengfei and Lansink (2006, pp. 644–656) analysed the impact of capital structure on the profitability and productivity of Dutch agricultural firms. Debt did not affect the profitability of equity, although it did lead to increased productivity. Slightly different results were obtained by Wu, Guan, and Myers (2014, pp. 115–132). They found that the same factors affect the capital structure of agricultural firms in the Netherlands with varying strength depending on the level of indebtedness. Macroeconomic determinants had a more substantial effect on entities with higher leverage, implying that firms should choose their financial strategy depending on their debt level.

Sikveland and Zhang (2020, pp. 1–7) investigated the influence of internal factors on the debt level of Norwegian salmon farms. They found that in unlisted entities, profitability negatively affected the level of short-term debt and total debt. In contrast, public companies relied less on debt than unlisted companies. Furthermore, asset structure positively affected the amount of long-term debt in both listed and unlisted companies. Schoor and Lips (2019, pp. 323–337) conducted a comparative analysis of the optimal capital structure of dairy farms in different regions of Switzerland. They showed that owners of farms located in the mountains exhibited a higher risk propensity than those whose farms were located in the valleys. This was reflected

in a higher proportion of debt in the capital structure of those from mountainous regions than those from lower-lying areas.

Few studies on capital structure factors and financing decisions can be found in the literature for farms in CEE countries. Fertő et al. (2017, pp. 1–7) conducted a comparative analysis of investment decisions of agricultural firms from CEE and WE countries in 2003–2008. Despite the differences in the agricultural structure shown in the analysis and the limited availability of debt capital due to the underdeveloped financial market in the CEE countries, it was found that the investment patterns of the compared farms were similar. Investment expenditure was positively related to sales growth, indicating a preference for internal financing. In addition, subsidies and grants were shown to positively affect investment levels, which mitigated the effects of low credit and loan availability. In contrast, in the long term, they showed the crucial importance of the farm's ability to compete in the market and to receive high revenues from this, which can be used to finance further investments.

Difficulties related to the availability of debt capital were identified as an important factor negatively influencing farm financial decisions by Simonovska, Gjosevski, and Campos (2014, pp. 273–280). They analysed the impact of internal conditions on the capital structure of 26 Macedonian agricultural firms between 2006 and 2010. Despite the underdeveloped financial market, these entities relied heavily on debt financing. Liquidity was an important factor that shaped the capital structure of the analysed farms. Entities with high liquidity made financial decisions following the principles of pecking-order theory. In contrast, farms with less liquidity followed the trade-off theory.

Fenyves et al. (2020, pp. 160–167) investigated capital structure factors in a large sample of agricultural firms from the Visegrad countries (i.e. Czechia, Hungary, Poland and Slovakia) between 2015 and 2017. The results were strongly influenced by the structure of agriculture in each country. Highly profitable farms preferred internal financing in Poland, the Czech Republic, and Hungary. In the Czech Republic, enterprise size influenced the debt increase. In contrast, small farms in the country used debt less due to availability limitations. Asset structure was a significant factor in capital structure only for Hungarian farms, resulting in lower debt levels. Growth opportunities were positively related to leverage in Hungary and Poland, countries with highly fragmented agricultural structures. Polish, Czech and Hungarian farms shaped their capital structure in line with the principles of the pecking-order theory. For Slovakia, on the other hand, the theory was only partially confirmed. Furthermore, the research indicated a strong influence of the country effect on the capital structure of V4 farms.

Similar results on capital structure factors for agricultural holdings in Poland were obtained by Enjolras, Sanfilippo, and Soliwoda (2021, pp. 113–133). Based on data covering the period 2009–2018, they found that the capital structure of Polish farms was positively

related to size and growth opportunities. In contrast, profitability and asset structure negatively impacted the size of their debt. These entities primarily used internal funds, especially retained earnings, which is consistent with the pecking-order theory. Moreover, Polish farms had a low target debt level, which they adjusted dynamically, partially confirming the trade-off theory.

Characteristics of Central and Eastern versus Western EU agricultural firms

The historical development and evolution of EU agricultural enterprises varies from country to country. This variation is not only between CEE and WE but also within these regions. In CEE, the differences in farm size are caused by the conditions that resulted from the previous communist system and the institutional and political reforms introduced during the economic transition. In WE, on the other hand, variations in farm size are mainly related to the long-term impact of market, institutional and political factors. For example, in France and other WE countries that were originally part of the European Economic Community and then the European Community, the contemporary farm structure has evolved mainly under the influence of market mechanisms and the institutional support system that was mainly shaped by the Common Agricultural Policy implemented in 1962 (Fertő et al. 2017, pp. 1–7). It is also worth noting that these countries have a well-developed market for debt financing of agricultural firms. In France, for example, agricultural cooperative banking activities were initiated as early as the 19th century. These institutions were established in response to the difficulty farmers had in obtaining finance through loans and credit from commercial banks (Benjamin and Phimister 2002, pp. 1115–1129).

In Italy, the average farm size is among the lowest in the EU, which is historically and culturally determined (Kochanowicz 1984, pp. 119–125). Contemporary agricultural policy draws heavily on historical tradition, resulting in strong support for small family farms and, consequently, in the predominance of such actors in the agricultural structure (Costato 2007, pp. 11–25).

The structural changes in agriculture in the countries that joined the EU later were somewhat different. In Spain, for example, the transformation within farms in the post-accession period was dynamic. The average size of the farm increased during this period, although it also saw a sharp decrease in the number of small farms. However, EU accession did not increase agricultural income, and in the post-accession period, a significant proportion of farms struggled to achieve adequate levels of profitability and competitiveness (Iraizoz 2008).

The current agricultural structure in Germany is the result of the market, institutional and political factors that have shaped agriculture in the WE countries mentioned earlier. However, the impact of the economic transformation in the former East Germany in the 1990s also played a part. During this period, the importance of family farms and those run in the form of partnerships (Einzelunternehmen) increased. A feature of both entities is unlimited liability for debts. The main reason for creating agricultural partnerships was to overcome the difficulties faced by family farms in accessing debt financing. The last type of agricultural firms to emerge in East Germany due to the transformation are equity companies (Juristische Personen). These entities were mainly created due to the privatisation of state farms, mainly large-scale farms (Mathijs and Swinnen 1997).

Under communism, large state farms strongly dominated agriculture in CEE countries. Their acreage was much larger than the average farm size in WE countries. During the economic transition, land ownership was restored to citizens in most CEE countries, and previously nationalised land and other agricultural assets were re-privatised. The new private owners of the privatised agricultural firms started to operate as family farms. These entities had a much smaller acreage than the earlier state-owned farms, although the acreage of many of the newly established private farms was comparable to those in WE countries. However, not all state farms were converted into family farms. Some continued in the form of capital companies or partnerships. The current structure of agriculture in CEE countries was shaped by the privatisation methods and policies adopted in each country. Ultimately, privatisation led to the creation of small farms in most of these countries. Examples include Romania and Slovenia, where the average farm size is 3.7 and 7 ha, respectively (Eurostat 2023). In Slovakia and the Czech Republic, on the other hand, agriculture is still dominated by large-scale agricultural firms (Ciaian, Pokrivcak, and Drabik 2009, pp. 191–201).

Croatia, one of several countries that emerged from the break-up of Yugoslavia, is characterised by a highly fragmented and polarised farm structure. A small number of large-scale agricultural firms dominate the country's agricultural market. However, there is a lack of medium-sized entities to form the backbone of agriculture and rural development. The remaining farms are tiny and have virtually no production potential. Croatia's agricultural structure is a legacy of the country's socialist past and the subsequent inept privatisation that led to the destruction of large agricultural enterprises and cooperatives. The situation was further complicated by the tragic displacement that took place during the civil war fought between 1991 and 1995 (Mikuš 2014, pp. 95–104).

Economic transformation and EU accession are key factors that shape structural change within the farms of CEE countries. However, the impact of cultural conditions on the agricultural sector cannot be overlooked. In Poland, the deep-rooted tradition of family farming is very strong. Even under communism, the country's agricultural structure

was dominated by private farms. Only a tiny proportion were collectivised and nationalised. In the early 1990s, private agriculture covered 76% of arable land, with only about 23% belonging to the state (Milczarek 2002, pp. 1–137). However, after EU accession, many of the smallest subsistence farms (up to 2 ha) disappeared from Poland because they were not eligible for financial or pension support for farmers.

Data and methods

The source of the data for the analytical part of this study is the BACH database (BACH, 2023), which provides harmonised annual accounts statistics of European non-financial enterprises for twelve EU countries: Austria (AT), Belgium (BE), the Czech Republic (CZ), Germany (DE), Spain (ES), France (FR), Croatia (HR), Italy (IT), Luxembourg (LU), Poland (PL), Portugal (PT) and Slovakia (SK). The database contains aggregated information on company balance sheets, income statements, cash flow statements, and other financial indicators, as well as data on company size and industrial classification. It is published by the European Committee of Central Balance Sheet Data Offices (ECCBSO).

The analysis in this study covers the agricultural industry, i.e. section A according to the NACE classification (Agriculture, forestry and fishing) in 11 countries and three size classes (S – small, M – medium and L – large) between 2000 and 2020. The countries include four CEE countries (Czechia, Croatia, Poland and Slovakia) and seven WE member states (Austria, Belgium, Germany, Spain, France, Italy and Portugal). We have excluded Luxembourg from our analysis. The primary reason for this exclusion is the country's small size, which makes it challenging to compare accurately with other European agricultural producers.

The structure of the analysed data is three-dimensional. The three dimensions correspond to the three size classes of firms, 11 countries and 21 years. Due to the data release delays, 2020 is the most recent year available in 2023. For each object defined by the three dimensions, several dependent and explanatory variables were computed. The construction of these ratios is shown in Tables 1 and 2, respectively.

Table 1. Construction of dependent variables

Symbol	Ratio	Formula
D/A	Total debt ratio	Total debt / Assets
LTD	Long-term debt ratio	Non-current debt / Assets
STD	Short-term debt ratio	Current debt / Assets

Source: authors' own compilation based on BACH (2023).

The selection of explanatory variables aligns with the factors typically examined as the primary determinants of capital structure by other studies in the field.

Table 2. Construction of explanatory variables

Symbol	Ratio	Formula
TAX	Tax burden	Tax on profit / Earnings before tax
TNG	Asset tangibility	Tangible fixed assets / Assets
LIQ	Financial liquidity	Cash and bank / Assets
DPR	Depreciation	Depreciation and amortisation of intangible and tangible fixed assets / Net turnover
ROE	Return on equity	Net profit or loss for the period / Equity
WCR	Working capital ratio	Operating working capital / Net turnover
GRT	Firm growth	(Assets of year *n* + 1 – Assets of year *n*) / Assets of year *n*
RSK	Risk (earnings variability)	(Net profit or loss of the year *n* + 1 – Net profit or loss of the year *n*) / Net profit or loss of the year *n*
SIZE	Size dummies	Dummy variables for size groups: S, M, L
CT	Country dummies	Dummy variables for size countries: AT, BE, CZ, DE, ES, FR, HR, IT, PL, PT, SK

Source: authors' own compilation based on BACH (2023).

The techniques employed in the research match the primary objective, which is to investigate whether the factors that influence the choices regarding capital structure in agricultural firms are consistent in WE and CEE countries.

As differences in debt structures among agricultural companies across countries could vary in importance based on firm size, the initial hypothesis (H1) relating to variation in East/West financing strategies should be separated into three sub-hypotheses concerning distinct size categories. We incorporate an additional digit to H1 for each size category: 1 – all size groups, 2 – small, 3 – medium, and 4 – large firms. Furthermore, since we are examining three debt indicators, the research hypothesis must also be examined independently in terms of diverse debt maturities. As a result, the principal hypotheses are further subdivided. This categorisation is accomplished by utilising the following extensions: a – for total debt, b – for long-term debt, and c – for short-term debt. Consequently, H1 can be clarified, as illustrated in Table 3.

Table 3. The structure of research hypothesis H1 according to debt measures and size classes

Debt ratio	Size class of agricultural firms			
	All sizes	Small	Medium	Large
D/A	H1.1a	H1.2a	H1.3a	H1.4a
LTD	H1.1b	H1.2b	H1.3b	H1.4b
STD	H1.1c	H1.2c	H1.3c	H1.4c

Source: authors' own compilation.

Using the symbols presented in the table, for example, H1.2b would indicate: The long-term debt of small agricultural firms is significantly different between the CEE and WE countries. The remaining hypotheses are constructed in a comparable manner. The second hypothesis (H2), regarding the different influence of capital structure determinants between CEE and WE countries, is broken down into more precise assumptions that pertain to each factor considered as a capital structure determinant. This is done by including a digit in H2 that represents each explanatory variable. The same letter extensions (a, b, c) as for H1 are used for different debt maturities. Thus, H2 can be specified as demonstrated in Table 4.

Table 4. The structure of research hypothesis H2 according to debt measures and explanatory variables

Debt ratio	Independent variables										
	TAX	TNG	LIQ	DPR	ROE	WCR	GRT	RSK	SIZE	CT	YEAR
D/A	H2.1a	H2.2a	H2.3a	H2.4a	H2.5a	H2.6a	H2.7a	H2.8a	H2.9a	H2.10a	H2.11a
LTD	H2.1b	H2.2b	H2.3b	H2.4b	H2.5b	H2.6b	H2.7b	H2.8b	H2.9b	H2.10b	H2.11b
STD	H2.1c	H2.2c	H2.3c	H2.4c	H2.5c	H2.6c	H2.7c	H2.8c	H2.9c	H2.10c	H2.11c

Source: authors' own compilation.

The symbols utilised in Table 4, such as H2.3b, indicate that the impact of liquidity on the long-term debt of agricultural firms differs significantly between the CEE and WE countries. Comparable sub-hypotheses are constructed in a similar manner.

To compare the debt level, the initial phase of the analysis entailed examining fundamental descriptive statistics for agricultural companies across various country and size categories. To test the first set of research hypotheses (H1a–c), an analysis of variance was conducted for the three debt ratios as dependent variables, and the countries were classified into either CEE or WE as the categorical predictor. The second set of research hypotheses (H2a–c) was assessed based on the panel data

regression results that were performed independently for the two groups of EU countries. The model is defined by formula (1):

$$D_{cst} = \beta_0 + \beta_1 TAX_{cst} + \beta_2 TNG_{cst} + \beta_3 CSH_{cst} + \beta_4 DPR_{cst} + \beta_5 ROE_{cst} + \\ + \beta_6 WCR_{cst} + + \beta_7 GRA_{cst} + \beta_8 RSK_{cst} + \gamma_s SIZE + \alpha_c CT + \rho_t YEAR + \xi_{cst} \quad (1)$$

where:

- D_{cst} – one of the three debt measures (D/A, LTD, STD) in c country of firm size s in year t,
- CT – dummy variables representing countries, $c = 1,\ldots 11$,
- $SIZE$ – dummy variables representing size classes, $s = S, M, L$,
- $YEAR$ – dummy variables representing years, $t = 1,\ldots 21$,
- β, γ, α, ρ – coefficients,
- ξ – random factor,
- other variables as specified in Table 3.

We outline the findings in the next section.

Results and discussion

The initial phase of the analysis focused on comparing debt levels, which entailed assessing basic descriptive statistical data for agricultural companies in various country and size categories. The examination of mean debt values in the agricultural sector across 11 EU countries, as depicted in Figure 1, reveals that there are no significant differences within the countries examined. Notably, Croatia had the lowest percentage of total and short-term debt, but this is not a common characteristic for other CEE countries. Conversely, Austrian agricultural firms had the highest mean total and long-term debt levels, while in France, they relied heavily on long-term financing.

Based on the findings presented in Figure 1, it can be concluded that there is minimal discernible variation between individual countries and between the CEE and WE country groups. This conclusion can be supported by the one-way ANOVA results shown in Table 5.

The table reveals that the effect of a firm's location (CEE vs WE) on its debt structure varies depending on the size of the firm and the type of debt. Specifically, for small firms, there is a significant effect of location on total debt and short-term debt, but not on long-term debt. For medium firms, location has a significant effect on both total debt and long-term debt, but not on short-term debt. The absence of a significant impact of location on any type of debt for large firms could be attributed to the likelihood of these

firms operating on a global scale, or at least within European markets, which may reduce their sensitivity to regional factors that affect smaller firms. Finally, for the overall group that includes all size classes, there is no significant effect of location on total debt or short-term debt, but there is a significant effect on long-term debt. Overall, the results suggest that the effect of location on a firm's debt structure is not uniform across different firm sizes and types of debt. These findings only partially confirm the hypothesis regarding significant variations in financing policies among agricultural firms in the two country groups. The details of the H1 hypothesis verification are shown in Table 6.

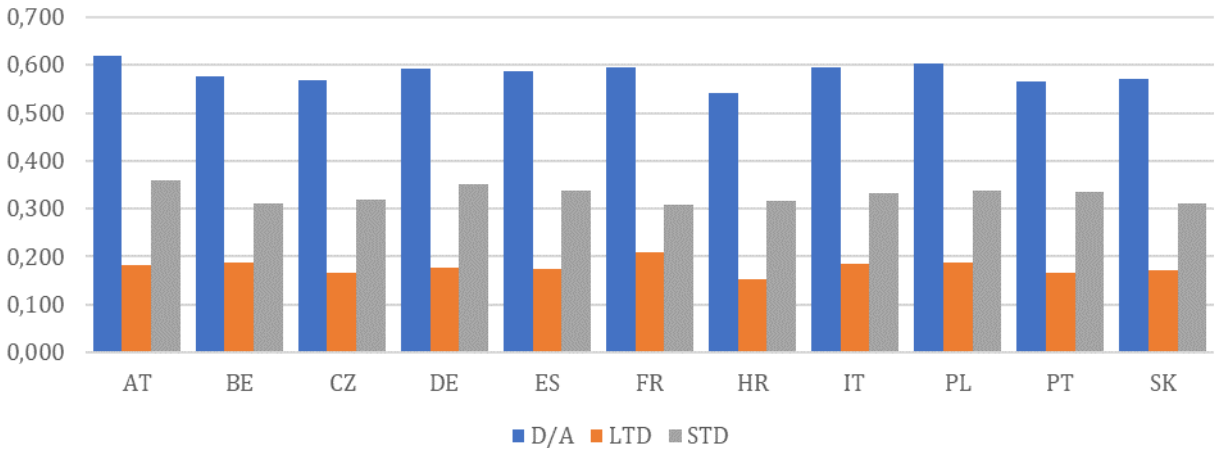

Figure 1. Mean values of debt ratios in the agricultural sector across countries

Note: The mean values are calculated for all size groups of firms (small, medium and large) and for all years available for a given country in the period 2000–2020.
Source: authors' calculations based on BACH (2023).

Table 5. One-way ANOVA results with the grouping factor as the classification of country as the CEE or WE EU member; values of F statistics and p-value in parentheses

Size	Dependent variable		
	D/A	LTD	STD
SMALL	**15.48 (0.000)**	0.423 (0.516)	**4.891 (0.028)**
MEDIUM	**2.774 (0.097)**	**3.068 (0.081)**	2.573 (0.110)
LARGE	0.014 (0.906)	1.112 (0.293)	1.776 (0.184)
All size groups	1.580 (0.209)	**3.331 (0.068)**	0.492 (0.483)

Note: The values of F statistics were bolded for $p < 0.1$.
Source: authors' calculations based on BACH (2023).

Table 6. The verification of research hypothesis H1

Debt ratio	Size class of agricultural firms			
	All sizes	Small	Medium	Large
D/A	H1.1a	H1.2a	H1.3a	H1.4a
LTD	H1.1b	H1.2b	H1.3b	H1.4b
STD	H1.1c	H1.2c	H1.3c	H1.4c

Notes: The shading in the table represents support for the sub-hypothesis.
Source: authors' own compilation.

The examination of the average debt ratio values across different size groups of firms, shown in Figure 2, is more meaningful compared to the international breakdown. The analysis reveals a clear relationship between enterprise size and debt level. The data indicate that the total debt of small enterprises is significantly greater than that of medium and large enterprises. Additionally, small enterprises have considerably more short-term debt than other enterprise groups. Moreover, the level of long-term debt increases with the size of enterprises.

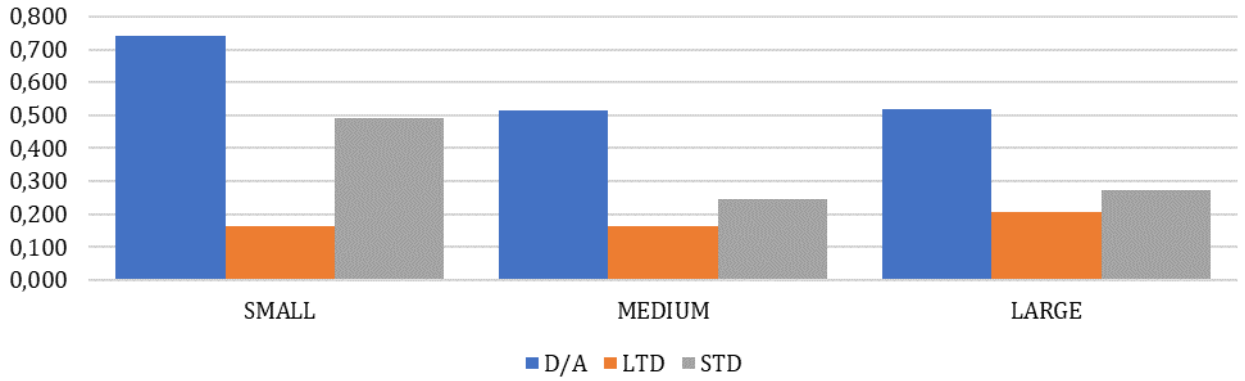

Figure 2. Mean values of debt ratios in the agricultural sector across size groups of firms

Note: The mean values are calculated for 11 countries (AT, BE, CZ, DE, ES, FR, HR, IT, PL, PT, SK) and for all years available for a given country in the period 2000–2020.
Source: authors' calculations based on BACH (2023).

The panel data regression results were utilised to test the second set of research hypotheses for the two groups of EU countries. Tables 7 and 8 display the estimation results of model (1) for CEE and WE EU countries, respectively.

Table 7. Estimation results of panel regressions for Central and Eastern EU countries (CZ, HR, PL, SK)

Variable	Model (1) (D/A)		Model (2) (LTD)		Model (3) (STD)	
	Estimate	Std. error	Estimate	Std. error	Estimate	Std. error
const.	0.936***	0.027	0.178***	0.015	0.638***	0.019
TAX	−0.002*	0.001			−0.003**	0.001
TNG	−0.304**	0.100			−0.309***	0.070
DPR	−0.962***	0.285			−1.074***	0.297
ROE	−0.629***	0.189	−0.480***	0.140		
WCR	−0.263***	0.056				
GRA	0.040*	0.018	0.031*	0.014		
RSK			−0.003*	0.002		
M	−0.182***	0.029			−0.189***	0.017
L	−0.181***	0.019			−0.155***	0.009
PL			0.042*	0.022	−0.029**	0.010
SK					0.026**	0.009
No. obs.	105		105		105	
R^2	0.841		0.384		0.845	
Adj. R^2	0.824		0.353		0.834	
AIC	−300.8		−268.6		−296.1	
Hausman test	36.2 [0.000]		6.3 [0.095]		26.3 [0.000]	
Joint significance robust F test						
Size	48.58 [0.000]		N/A		200.13 [0.000]	
Country	N/A		3.82 [0.082]		14.25 [0.002]	

Notes: Interpretation of parameters in relation to small firms and Czechia; * – significant at the 10% level, ** – 5%, *** – 1%.
Source: authors' calculations based on BACH (2023).

As can be seen from Table 7, the factors that significantly influence capital structure formation decisions of agricultural firms in CEE countries are asset structure, non-interest tax shield, profitability, working capital, growth opportunities and risk. In all cases, the direction of influence of these factors indicates that the analysed companies shape their capital structure according to the principles of the pecking-order theory. This means that these companies prefer primarily internal financing, as evidenced by the negative impact of profitability on total and short-term debt. Similarly, the negative relationship between asset structure and debt, both total and short-term, confirms the lower propensity of the companies to take on debt.

Similarly, the negative impact of working capital on total and long-term debt can be explained as these companies strive to maintain high liquidity and thus become independent of debt financing.

On the other hand, the positive relationship between growth opportunities and total and long-term debt means that agricultural firms, having exhausted internal funds, first choose debt financing. This is justified, given the scarcity of capital markets for firms that operate in the agricultural sector. The negative relationship between the non-interest tax shield and total and short-term debt also confirms agricultural firms' preference for debt reduction. Also, risk negatively affects the debt of the surveyed entities, but this relationship is statistically significant only for long-term debt.

Surprising results were obtained for the tax burden, which negatively affects the level of total and short-term debt. This relationship cannot be explained either by pecking-order theory or trade-off theory. The negative impact of the tax burden on the indebtedness of agricultural firms is most likely related to the interventionist policy of the EU and the Member States towards the agricultural sector and to the specific taxation system in agriculture and related tax reliefs. These factors may reduce the propensity for agricultural firms' indebtedness; however, this issue requires further in-depth research.

Another factor that significantly affects indebtedness is the size of the enterprise. Large and medium-sized farms have lower total and short-term debt levels than small farms. The study also confirms the country effect in the capital structure of the entities analysed, although this does not apply to all countries in the group nor to all debt measures.

Table 8. Estimation results of panel regressions for Western EU countries (AT, BE, DE, ES, FR, IT, PT)

Variable	Model (1) (D/A)		Model (2) (LTD)		Model (3) (STD)	
	Estimate	Std. error	Estimate	Std. error	Estimate	Std. error
const.	0.824***	0.019	0.116***	0.019	0.671***	0.019
TAX					0.002*	0.001
TNG	−0.215***	0.040	0.090**	0.040	−0.329***	0.042
CSH		0.139	−0.374**	0.139		
DPR		0.286	0.982***	0.286	−1.239***	0.289
ROE	−0.129**	0.054			−0.096***	0.015
WCR	−0.107*	0.055				
GRA			−0.020*	0.011		
RSK	−0.001***	0.000	−0.001*	0.000		
M	−0.184***	0.021			−0.191***	0.010

Variable	Model (1) (D/A)		Model (2) (LTD)		Model (3) (STD)	
	Estimate	Std. error	Estimate	Std. error	Estimate	Std. error
L	−0.197***	0.013	0.036**	0.013	−0.201***	0.012
BE					−0.028***	0.007
ES	−0.020*	0.012			−0.035***	0.012
FR					−0.025*	0.013
PT			−0.044*	0.024	0.024*	0.013
No. obs.	293		293		293	
R^2	0.559		0.354		0.838	
Adj. R^2	0.551		0.335		0.832	
AIC	−739.7		−710.5		−807.6	
Hausman test	75.3 [0.000]		16.1 [0.041]		59.8 [0.000]	
Joint significance robust F test						
Size	283.8 [0.000]		7.65 [0.012]		239.07 [0.000]	
Country	3.07 [0.095]		3.29 [0.085]		10.07 [0.000]	

Notes: Interpretation of parameters in relation to small firms and Austria; * – significant at the 10% level, ** – 5%, *** – 1%.
Source: authors' calculations based on BACH (2023).

Agricultural firms in WE countries shaped their capital structure in a slightly different way than those from CEE countries (Table 8). First of all, a positive effect of the tax burden on financial leverage was found in these entities, although it only concerns short-term debt. This relationship is consistent with the trade-off theory. The asset structure was negatively related to total and short-term debt, i.e. it is in line with the principles of the pecking-order theory. By contrast, a positive relationship was observed between long-term debt and asset structure. This implies that agricultural companies in WE countries increase their long-term debt due to the possibility of establishing collateral on their physical assets, which is in line with the trade-off theory. Additionally, the effect of the non-interest tax shield on their long-term debt is positive, which is not consistent with any of the theories tested. As in CEE, this relationship may be due to EU interventionism applied to agricultural companies.

The direction of the influence of other factors on the capital structure of the analysed companies is in line with the pecking-order theory. Thus, profitability negatively influenced total and short-term debt, i.e. as it did in CEE. A negative relationship was observed between liquidity and long-term debt. Growth opportunities had the same effect on this category. Working capital was negatively related to total debt. Risk, on the other hand, had a negative impact on both total and long-term debt.

Company size was also a factor that significantly influenced the amount of debt in WE agricultural firms. Both medium-sized and large firms exhibited lower leverage than small firms. The same pattern applied to short-term debt. Similar patterns occurred in agricultural companies in CEE. Only large WE agricultural firms had more long-term debt than small firms.

The WE country group also saw a statistically significant country effect. However, as in CEE, it only applied to certain countries and debt measures. The assessment of the estimation results for the two country groups leads to the conclusions that are concisely summarised in Table 9.

Table 9. Comparison of the impact of variables on capital structure between CEE and WE countries

Variable	Impact on capital structure		
	Total debt	Long-term debt	Short-term debt
Tax burden (TAX)	slightly different	similar	very different
Asset tangibility (TNG)	similar	slightly different	similar
Financial liquidity (CSH)	similar	slightly different	similar
Deprecation (DPR)	slightly different	slightly different	similar
Profitability (ROE)	similar	slightly different	slightly different
Working capital (WCR)	similar	similar	similar
Firm growth (GRA)	slightly different	very different	similar
Risk (RSK)	slightly different	similar	similar
Size effect (SIZE)	similar	different	similar
Country effect (CT)	different	similar	similar
Year effect (YEAR)	different	similar	similar

Notes: If the impact of a variable was significant for both groups of countries but in opposite directions, it was interpreted as a "very different" impact. If the impact was significant in one group but insignificant in the other group, it was interpreted as a "slightly different" impact. If a variable had the same sign and significance or was insignificant in both groups, it was interpreted as a "similar" impact. Regarding the size, country and year effect, the impact was interpreted as similar if the effect was significant or insignificant in both groups of countries. If the significance differed between the two groups of countries, the effect was considered "different".
Source: authors' own compilation.

Table 9 also provides information about the level of support for the research hypotheses regarding the diversity of impact of various factors on debt between the CEE and WE countries. For the tax burden variable, strong support was found for short-term debt, weak support for total debt, but no support for long-term debt. Regarding asset tangibility and financial liquidity, only weak support was found for long-term debt. The impact of non-debt tax shields on total and long-term debt differs slightly between

the two groups of countries, providing weak support for these two debt measures. In the case of profitability, slight differences in its impact on debt occur when long-term and short-term debt are considered, thus providing weak support here. Working capital is the only variable for which no support was found for any debt measure. The impact of the ratio is significantly negative for both groups of countries, but only for total debt. Regarding firm growth, weak support was found for total debt, strong support for total debt, and no support for short-term debt, as the asset growth proved insignificant for short-term debt regardless of which group of countries was considered. Regarding the risk variable, only weak support can be found in the case of total debt. The size effect shows different intensity levels for long-term debt between CEE and WE countries, whereas the country and year effect proved different in the case of total debt only. Table 10 summarises the verification of research hypotheses H2.

Table 10. Verification of research hypothesis H2 concerning the diverse impact of various factors on debt between CEE and WE countries

Debt ratio	Independent variables										
	TAX	TNG	LIQ	DPR	ROE	WCR	GRT	RSK	SIZE	CT	YEAR
D/A	H2.1a	H2.2a	H2.3a	H2.4a	H2.5a	H2.6a	H2.7a	H2.8a	H2.9a	**H2.10a**	**H2.11a**
LTD	H2.1b	H2.2b	H2.3b	H2.4b	H2.5b	H2.6b	**H2.7b**	H2.8b	**H2.9b**	H2.10b	H2.11b
STD	**H2.1c**	H2.2c	H2.3c	H2.4c	H2.5c	H2.6c	H2.7c	H2.8c	H2.9c	H2.10c	H2.11c

Notes: The shading in the table represents weak support for the hypotheses, while bolding indicates support, and both shading and bolding together indicate strong support.
Source: authors' own compilation.

In general, it can be inferred that differences in the effect of capital structure determinants on debt between CEE and WE countries exist, although they are not particularly striking.

Conclusions

The primary objective of this article was to evaluate how certain factors influence the capital structure of agricultural companies in Central and Eastern European (CEE) nations compared to Western European (WE) nations. It also sought to ascertain whether those firms base their financial choices on the trade-off theory or the pecking-order theory. Given the limited existing research on this subject, the article also aimed to bridge this gap in the academic literature.

The capital structure of CEE agribusinesses is formed based on the principles of the pecking-order theory. This is evidenced by the direction of the effect that all the variables

studied had on the leverage level of these businesses. Similar regularities were found in WE countries, with a positive relationship between tax burden and asset structure and debt, partially confirming the trade-off theory. Notably, the direction of the effect of tax burden on leverage was negative for agricultural firms from CEE. In contrast, there was a positive relationship between non-interest tax shields and long-term debt in WE countries. Due to the unique nature of agriculture, these results are unusual and cannot be explained by any of the theories tested. These links may be due to the interventionist policy of the EU and the Member States regarding agriculture, the unique taxation system in this sector, and the associated tax concessions.

Limited research has been conducted on the capital structure of agricultural companies in the existing scholarly literature. Hence, the outcomes of our analysis constitute a significant addition to the ongoing discourse surrounding the financial choices made by agricultural enterprises.

Overall, our findings provide only partial support for the research hypotheses concerning the diversity of capital structure and its determinants among agricultural firms in CEE vs WE countries. The effect of a firm's location on its debt structure varies depending on firm size and debt type. Similarly, the differences in the impact of individual factors on debt ratios do not apply equally to all factors or all debt maturities. These findings can have implications for policymakers and investors, as they highlight the need to consider firm size and debt maturity when evaluating the impact of location on firm financing in the agricultural sector.

In summary, two main conclusions can be drawn from this research. First, both CEE and WE agricultural enterprises show a preference for internal financing, which is consistent with the assumptions of the pecking-order theory. Moreover, this conclusion is in line with previous global research on the formation of capital structure in agricultural firms. Secondly, a statistically significant country effect was confirmed for some debt measures only. This is due to the specifics of agricultural activity and the impact of regulations that result from the EU's Common Agricultural Policy. The cross-country and cross-regional differences are likely to decrease in the long term, paving the way for further research in this area.

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Analiza porównawcza czynników struktury kapitału przedsiębiorstw rolnych w krajach Europy Środkowo-Wschodniej i Zachodniej UE

Celem artykułu jest porównanie wpływu określonych czynników na strukturę kapitału przedsiębiorstw rolnych w Europie Środkowo-Wschodniej i Zachodniej. Ze względu na specyficzne cechy finansowania gospodarstw rolnych, a także odmienności ekonomiczne i historyczne między badanymi regionami, polityka finansowania przedsiębiorstw w tym sektorze stanowi ważny temat badawczy. Analizą objęto dane finansowe przedsiębiorstw rolnych z dwunastu krajów UE w latach 2000–2020, pozyskane z bazy danych BACH-ESD. Główną metodą zastosowaną w badaniu jest modelowanie panelowe przeprowadzone oddzielnie dla dwóch grup krajów. Wyniki wskazują, że choć nie ma znaczących różnic między krajami w strukturze kapitału, wpływ poszczególnych czynników różni się między badanymi makroregionami. Prezentowana w niniejszym opracowaniu analiza porównawcza dostarcza wartościowych informacji dla ustawodawców, instytucji finansowych i przedsiębiorstw rolnych zarówno w krajach Europy Środkowo-Wschodniej, jak i Zachodniej. Zrozumienie różnic w zakresie czynników struktury kapitału specyficznych dla każdego z badanych regionów może pomóc lepiej ukształtować i podnieść skuteczność polityki finansowania rolnictwa. Ponadto zaleca się, aby decyzje finansowe przedsiębiorstw rolnych uwzględniały czynniki specyficzne dla regionu. Badania wnoszą wkład do istniejącej literatury, rzucając światło na różnice i podobieństwa w determinantach struktury kapitałowej przedsiębiorstw rolnych w Europie Środkowo-Wschodniej i Zachodniej. Analiza nie tylko pogłębia wiedzę na temat różnic między strategiami finansowania w poszczególnych regionach, ale także podkreśla znaczenie specyfiki finansowania przedsiębiorstw rolnych. Dzięki temu badanie to wnosi istotną wartość dodaną w zakresie finansowania rolnictwa i stanowi podstawę do podejmowania bardziej świadomych decyzji w tym sektorze.

Słowa kluczowe: teoria hierarchii finansowania, teoria substytucji, gospodarstwa rolne, dźwignia finansowa, finansowanie przedsiębiorstw rolnych