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European benchmarking of determinants of profitability for companies with accrual accounting in the agricultural sector

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Abstract: In this study, differences in common measures of profitability, such as return on sales, return on capital employed and return on equity, are analysed in agricultural firms with accrual accounting in 10 European countries. The resulting differences in profitability are broken down using an additive decomposition method, which addresses the quantified impact of several affecting factors. This approach is based on a ratio system, which follows the principles of the DuPont identity. According to the general intention of benchmarking, the leading country within the sample for each measure of profitability provides the relevant reference point, representing best practice. This approach provides insight into the specific comparative strengths and weaknesses of the agribusinesses in the countries within the sample and indicates useful starting points for effective improvements. In addition to the value-creating operations, this involves, in particular, labour productivity, the efficient use of fixed assets and the degree of debt financing.

Keywords: agribusiness; comparative analysis; return on capital employed; return on equity; value-added; variance analysis

This study focusses on the European agribusiness in the wider sense and according to the statistical classification of economic activities in the European Community NACE 2 (Eurostat 2008), represented by its entire sector A of "Agriculture, Forestry and Fishing". Even if this sector contributes only about 1.7% to the total gross domestic product of the European Union (EU), it is seen to be of very high importance (EU 2018). This is reflected, for instance, by the fact that more than a third of the total EU budget was spent on this sector during recent years [European Commission (EC) 2015]. However, agricultural businesses will only succeed if they provide sufficient competitive performance. For comparisons of economic performance, the relative construct of profitability is commonly used. This sets the economic results of a business in relation to important influencing factors, such as invested capital or turnover. Typical measures of profitability in this sense are the return on equity, the return on capital employed, and the return on sales or the value-added ratio, also called gross margin. Common definitions of these ratios are shown in the Equations (1) to (4):

$$RoE = \frac{Net\ income}{Equity} \quad (1)$$

where: *RoE* – return on equity.

$$RoCE = \frac{Earnings\ before\ interest\ and\ taxes}{Fixed\ assets + working\ capital} \quad (2)$$

where: *RoCE* – return on capital employed.

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$$RoS = \frac{Earnings\ before\ interest\ and\ taxes}{Turnover} \quad (3)$$

where: *RoS* – return on sales.

$$VAR = \frac{Value\ added}{Turnover} \quad (4)$$

where: *VAR* – value added ratio.

While *RoE* describes the final outcome for an investor by setting gained net income in relation to the provided equity, *VAR* is the first interim result of the business process. *VAR* shows the part of revenues that exceeds the inputs purchased from third parties, excluding any aspects of labour or capital usage and taxes (Hossain 2017). A stepwise integration of these aspects leads from *VAR* via *RoS* and *RoCE* and finally to the *RoE*, as will be explained in detail later. For managerial purposes, knowledge of the determinants and their specific impact on these measures of profitability is essential. In the case of a comparative situation, this uncovers the reasons for advantages or disadvantages. Such issues accord with the managerial approach of benchmarking, where the "underdog" tries to learn from the "class topper" to find effective starting points for targeted improvements (Jarrar and Zairi 2001).

Economic research on the determinants of profitability is often concerned with analytic decomposition models to identify and quantify relevant factors of influence. Such analytical models usually start with the formal mathematical definitions for specific measures of profitability. These are disaggregated based on fundamental theoretical interrelations, such as the so-called DuPont identity or the financial leverage effect (Bunea et al. 2019). Empirical studies on profitability often use the parameters of such decomposition models as predefined sets of independent variables for regression models on profitability (Burja and Marginean 2014) or as subjects of specific research (Mishra et al. 2012). A further step in the decomposition of profitability can be made by considering dynamic changes of these elements over time or by referring to differences regarding specific reference points (Lesáková et al. 2019), which is an important element of the present study.

Empirical research on the determinants of profitability has been conducted in the past for a wide variety of sectors and economies. Their issues shall be reflected here exemplarily only for the parameters that are of specific relevance to this study. The impact of *VAR*, also called gross margin, either as an own measure of profitability or in reference to its influence on other performance ratios, has been analysed in several studies (Katchova and Enlow 2013). Aspects of labour costs and labour productivity were found to be another important determinant of profitability (Samo and Murad 2019). Various impacts on profitability from asset management and investment policy, considering aspects of fixed assets and of working capital (Deloof 2003), have been discussed. Furthermore, the effects on profitability from debt financing were found in several studies (Chandrapala and Knapková 2013). Finally, taxation is seen to be a relevant competitive factor amongst nations, even within the EU (Heinemann et al. 2010) and causes differences in profitability (Weidman et al. 2019). Although these results vary in detail and are concerned with different sectors and economies than those analysed herein, the general relevance for the profitability of these elements is underlined. This is confirmed by studies that focus in particular on the agricultural sector. For instance, Mijic and Jaksic (2017) showed the impact of financial leverage and fixed assets on the profitability of agricultural firms in southeast Europe. Mishra et al. (2012) analysed influences on net profit margin, asset turnover and financial leverage for US agricultural firms, which were derived from a decomposing DuPont model. Gołaś (2020) showed the profitability impact of working capital management for Polish dairy firms. Further, determinants of profitability have been subject to comparative analyses and benchmarking within the agricultural sector (Wilson et al. 2005) and other businesses (Katchova and Enlow 2013). Using a multiplicative index decomposition model, Balezentis et al. (2019) explained changes in the RoE of Lithuanian farms over time, based on elements of the DuPont identity.

This study contributes to the research field in several ways. Using an additive decomposition model, it analyses differences between the national characteristics of agricultural sectors, according to the general approach of benchmarking or comparative analysis. This is based on the fundamental hypothesis that differences in profitability are not only caused by the fundamental value-adding operations but also by several alterable aspects, which are typical subjects of management decisions or elements of the national economic policy, and particularly managerial decisions about staffing, investment or financing issues, or the national levels of wages, interests and taxes. This study analyses specific national differences between certain determinants for European agricultural firms and quantifies their impact on several measures of profitability. Since definitions of profitability are commonly based

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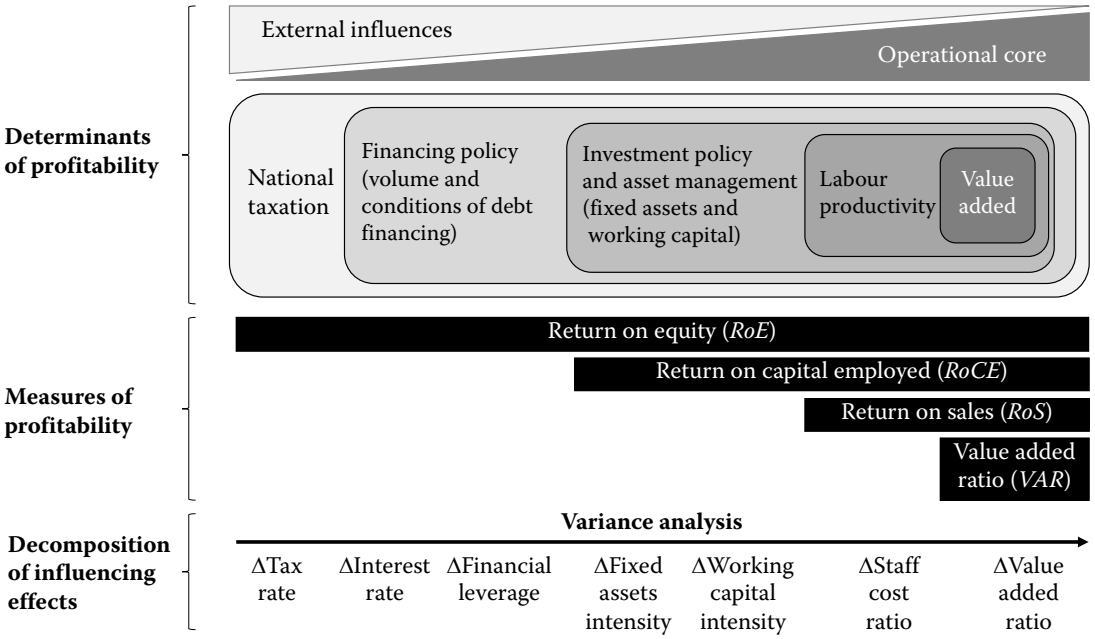

Figure 1. Determinants and measures of profitability
Source: Own elaboration

on accounting terms and book values, the analysis is focused on firms with accrual accounting. The approach incorporates a mathematical ratio system, which follows the general principles of the DuPont identity. This system involves internal aspects, which can be directly controlled by the firms, such as their value-adding activities or investment policies, and external aspects, such as interest rates or national taxation. Figure 1 illustrates the approach in more detail.

The aim of this study is to show how different measures of profitability are affected by these determinants in specific national ways. It incorporates two analytical elements. The first is of an empirical nature, where 10-year average values of the chosen determinants of profitability are extracted for each country and examined for significant differences. The second is the technique of cumulative variance analysis, which enables an additive decomposition of national differences in profitability to their driving factors in order to quantify their effects. According to the principles of benchmarking, the front-runner country for each measure of profitability, analysed provides a specific reference point of best practice.

MATERIAL AND METHODS

Measures of profitability set a quantification of economic success in relation to an affecting factor. In case of the *RoCE* and the *RoE*, the latter quantifies specific forms of capital usage based on the book values from balance sheets. Thus, any calculation of such profitability ratios requires data of accrual accounting. Two main issues arise in the comparative analysis of European agricultural firms from this. At first, national accounting principles vary in details and may not always be directly comparable. The second problem arises from the fact that many agricultural firms do not have comprehensive accounting, providing income statements and balance sheets. Specific easements are granted here, in particular to small and family-based unlimited liability enterprises or self-employed farmers, which are very common in the agricultural sector. This study deals with these two issues by using data from the Bank for the Accounts of Companies Harmonized, hereinafter referred to as the BACH database (BACH 2020). This database was established under the aegis of the European Commission, which makes aggregated and harmonised accounting data on national and sectoral bases available in order to enable cross-national comparisons (BACH Working Group 2018). This information is provided by national central balance sheet data offices in association with national central banks or national statistical institutes and is available for 13 participating European countries. The BACH Working Group makes significant efforts to ensure the cross-border comparability of the accounting data provided by using harmonised templates [European Central Bank (ECB) 2015]. The BACH database can thus be seen as one of the most reliable sources of comparable

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accounting data for European companies [European Banking Authority (EBA) 2012]. The data for the agricultural sector (A) follows the NACE 2 classification (Eurostat 2008). The current study is based on data for a complete 10-year cycle, from 2008 to 2017. The agricultural sector data for 10 nations, available in the BACH database, fulfils all requirements of the study. These countries are Austria, Belgium, Czechia, Germany, France, Italy, Poland, Portugal, Slovakia and Spain. The remaining three nations, Luxemburg, Croatia and Denmark, were excluded due to the incompleteness of the required data or cycle.

The second issue involves the problem of sectoral coverage within the database and its representativeness regarding the entire sector. The required accounting information means that the BACH database concentrates on larger firms and limited liability companies or rather legal entities, which have to draw up balance sheets and income statements (ECB) 2015. The consequences of this study are ambivalent. Excluding smaller family farms and unlimited liability corporations to a great extent reduces the coverage and representativeness of the entire sector. On the other hand, this concentration on companies with accrual accounting increases the cross-border comparability within the sample because of the common legal framework of the European Accounting Directives. Similar legal obligations to keep business records for certain legal forms and business sizes reduce the possible sample bias of comparing small family farms from one country with large public limited companies from another. Nevertheless, even with this concentration on larger corporations and legal entities, the sample covers substantial parts of the entire agricultural sector of each country, as described in Table 1. The coverage rates are provided by the BACH database itself, and refer to the national population of agricultural corporations with accrual accounting, depending on national industry classifications and business registrations. In some countries, administrative systems enable full access to the accounting data of the entire national population, but for other countries, only a subset is covered by the sample. Since no such coverage rates are given for Poland and Spain in the BACH database, they were approximated here by the relationship between national sample size and the number of legal entities in the country, provided by Eurostat. The relationship between the total turnover of the sample and the total production value of the entire sector based on Eurostat data gives an impression of the coverage of the whole sector, including all sizes and legal forms.

The huge number of firms covered in each country is thus assumed to give reliable insights into the typical national characteristics of agricultural firms of comparable sizes and legal forms, based on the common view of accrual accounting and harmonised BACH data. This provides useful reference points for economic benchmarking between these countries. This comparative analysis of profitability integrates all measures

Table 1. Annual average values of sample size parameters

Country	Number of firms	Coverage of (%)			Share of the total sectoral production value[c] (%)
		number of firms[a]	turnover[a]	employees[a]	
AT	599	45.12	–	–	24.40
BE	5 319	98.44	–	98.49	50.75
CZ	508	21.73	–	–	28.10
DE	479	7.87	16.94	–	4.92
FR	2 738	77.10	87.61	77.85	14.55
IT	10 658	100.00	100.00	100.00	34.52
PL	1 258	31.82[b]	–	–	22.54
PT	13 341	100.00	100.00	100.00	48.83
SK	1 514	44.77	76.57	47.40	42.20
ES	13 386	23.42[b]	–	–	23.50

[a]The relevant population of companies with accrual accounting is based on specific national obligations for drawing up balance sheets depending on national industry classifications and business registrations; [b]not provided by BACH database, but approximated here as average of the relation between sample size and the number of legal entities in the sector in the years 2010, 2013 and 2016 provided by Eurostat; [c]sample turnover is set here in relation to the aggregated sectoral production value of agriculture, forestry and aquaculture at current prices provided by Eurostat; AT –Austria; BE – Belgium; CZ – Czechia; DE – Germany; ES – Spain; FR – France; IT – Italy; PL – Poland; PT – Portugal; SK – Slovakia
Source: BACH database (2020) with additional own calculations based on Eurostat database (2020)

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$$RoE = (1-t)\times\left\{-i\times FL+(1+FL)\times\left[\underbrace{\frac{1}{WCI+FAI}\times(1-SCR)\times\underbrace{\underbrace{VAR}_{Value\ added}}_{=RoS}}_{=RoCE}\right]\right\} \quad (5)$$

where: *RoE* – return on equity; *t* – statutory corporate tax rate; *i* – average interest rate on debt; *FL* – financial leverage; *FAI* – fixed assets intensity; *WCI* – working capital intensity; *SCR* – staff cost ratio; *VAR* – value added ratio; *RoS* – return on sales; *RoCE* – return on capital employed.

described in Equations (1–4), and their calculative determinants, as mentioned in Figure 1, into one comprehensive model. This is shown in Equation (5), which aggregates common financial and accounting terms to a mathematical function of these arguments. While the value-added ratio represents the operational core of all other measures, a stepwise integration of further determinants of profitability finally leads to the resulting return on equity. *RoS* and *RoCE* are integrated as interim results. Equation (5) is written here in a form that is in visual accordance with the presentation in Figure 1 and with the analytical order of the cumulative variance analysis presented, later on, thus going from external toward internal effects.

The annual statutory national tax rates were taken from the Organisation for Economic and Cooperative Development (OECD) (2020) data. All other variables mentioned above were extracted from the BACH database. Definitions and calculative details for these parameters are presented in Table 2. Combining these input variables with the relevant parts of Equation (5), characteristic measures of profitability can be calculated for each country. The reasons for the resulting differences in profitability between these nations are of particular interest. Following the principles of benchmarking (Camp 1989), the relevant reference point will always be the class topper for each ratio, which is the country with the highest profitability, representing best practice. There are several methods available to decompose differences or changes in an index or other aggregating mathematical models and to address certain influencing factors. These include structural and index decomposition analysis (Hoekstraa and van der Bergh 2003) or the cumulative variance analysis, which is used herein. The latter is a very common technique in the field of managerial accounting, where for instance the variances between planned and actual costs or revenues have to be quantified and allocated to certain influencing factors (Bhimani et al. 2012). Such techniques aspire to achieve a complete additive decomposition without residuals (Ang and Zhang 2000). However, this is difficult if influencing factors are interacting in a multiplicative way. The cumulative variance analysis solves this problem in a pragmatic way by fixing a particular sequence for the analysed influences. Incorporating differences in the driving factors in a gradual manner according to this preset order will allocate the compounded effects to those influencing factors that are considered first. This principle is illustrated in Figure 2. Here, the volumes *V* of two cuboids, which are the mathematical product of the side lengths *A*, *B* and *C*, shall be exemplarily compared. The total differential volume ΔV, which is to be seen in the middle of the figure, is decomposed to the influences from ΔA, ΔB and ΔC, considering the specific analytic order A→B→C. The resulting decomposition is complete and leaves no residuals. However, the first seceded effect ΔV^A, and to a lesser extent ΔV^B, still incorporates some compound influences from changes in other parameters. The last remaining differential, volume ΔV^C, is, however, a pure effect of ΔC.

Considering these consequences, it is recommended that the analysis of economic terms starts with external influences and ends with these parameters, which are under the firms' own control. For the present study, this is realised by starting with those aspects that are the least designable by the firms themselves, such as taxation, progressing via financing aspects and investment policy towards the parameters of the firms' core business operations. Like peeling an onion, the differences in profitability are explained by differences in the underlying determinants, as illustrated in the lower part of Figure 1.

In addition to this cumulative variance analysis, which quantifies the impact of differences in the determinants of profitability, the drivers themselves are all analysed for significant differences between the nations of the sample. In a first step, this is done for each variable by conducting a one-way ANOVA with all groups or, rather, countries. This is a common

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Table 2. Definition of model variables and their extraction from the BACH database

Fields of management decisions		Model variables			Variables used for calculation (BACH or other source)	Affected measure of profitability		
		variables		definitions		return on equity	return on capital employed	return on sales
National taxation		*t*	tax rate	= statutory corporate tax rate	average (2008–2017) Source: OECD (2020)			
Financing	volume of debt financing	*FL*	financial leverage	= financial debt/equity	= (*LP*1 + *L*1 + *L*2 + *L*3 – *L*321 + *L*62)/*E*			
	price of debt financing	*i*	interest rate	= interest and similar charges/debt	= *I*10 × turnover/(*LP*1 + *L*1 + *L*2 + *L*3 – *L*321 + *L*62)/ /total assets			
Investment policy		*FAI*	intensity of fixed and other non-current assets	= fixed and other non-current assets/turnover	= (*A*1 + *A*42 + *A*52) × total assets/turnover/100			
Operations	working capital management	*WCI*	working capital intensity	= net working capital/turnover	= *(A*2 + *A*3 + *A*4 – *A*42 +*A*5 – *A*52 + *A*6 + *A*7 – *LP* + *LP*1 – –*L*321 – *L*4 – *L*5 – *L*6 + *L*62*)* × turnover/total assets/100			
	human resource management	*SCR*	staff cost ratio	= staff costs/value added	= *I*7/(*I*1 + *I*2 + *I*3 + *I*4 – *I*5 – *I*6 – *I*8 – *I*9*)*			
	value adding operations	*VAR*	value added ratio (gross margin)	= earnings before interest, taxes and staff costs/turnover	= (*I*1 + *I*2 + *I*3 + *I*4 – *I*5 – *I*6 – *I*8 – *I*9)/100			

BACH variables as percentages of total assets or turnover; *A*1 – fixed assets; *A*2 – inventories; *A*3 – trade receivables; *A*4 – other receivables; *A*42 – non-current receivables; *A*5 – deferred assets; *A*52 – non-current deferred assets; *A*6 – other current financial assets; *A*7 – cash and bank; *E* – total equity; *I*1 – net turnover; *I*2 – variation in stocks of finished goods and work in progress; *I*3 – capitalised production; *I*4 – other income; *I*5 – cost of goods sold, materials and consumables; *I*6 – external supplies and services; *I*7 – staff costs; *I*8 – other expenses; *I*9 – depreciation and amortisation on intangible and tangible fixed assets; *L*1 – bonds and similar obligations; *L*2 – amounts owed to credit institutions; *L*3 – other creditors; *L*321 – current other non-financial creditors; *L*4 – trade payables; *L*5 – current payments received on ac-count of orders; *L*6 – deferred liabilities; *L*62 – non-current deferred liabilities; *LP* – provisions; *LP*1 – provisions for pensions and similar obligations

The gray box shows values not included in the calculation

Source: Own research based on BACH Working Group (2018) and BACH database (2020)

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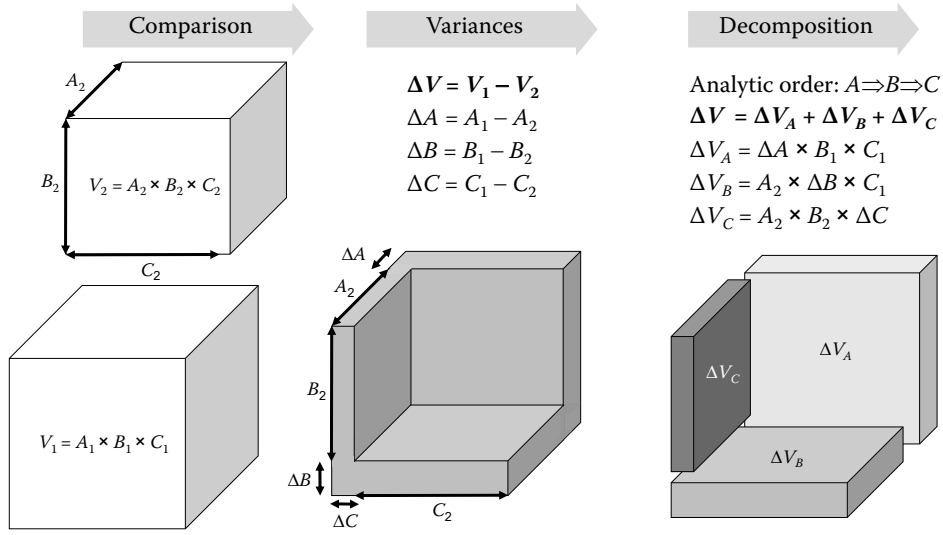

Figure 2. General principle of the cumulative analysis of variances
Source: Own elaboration

method to test the hypothesis that the mean values of more than two groups are significantly different, using a comparison of observed variability between samples and observed variability within samples. In addition to this general result, that there are significant differences between all countries, the specific comparison with the leading country is of special interest in a benchmarking approach. A further unpaired two-tailed *t*-test was thus applied to identify significant differences between the variables in a direct comparison of each country with the class topper. The null hypothesis for both tests is that the means of the compared groups would be equal and that there are no significant differences. Marks with * or ** always reflect confidence levels higher than 95% or 99% for these statistical tests, at which this null hypothesis can be rejected. Since the current analysis is based on a formal mathematical ratio system with analytically derived and economically meaningful variables, other multivariate methods of exploring functional interrelationships or finding new variables, such as multivariate regressions or factor analyses, are not relevant for the approach conducted here. The results of these analyses are presented in the following section. All calculations were performed using MS Excel (version 2016).

RESULTS AND DISCUSSION

The model variables according to Equation (5) and Table 2 were extracted for all 10 nations for the 10-year cycle from 2008 to 2017 and condensed to their 10-year average values (download Jan 10, 2020). These average values are assumed to be representative for the recent past since the period covers prosperous years as well as the years of economic crises. To go beyond the year 2008 was seen to increase the risk of incorporating conditions that are out of date. The results of this data extraction and consolidation are characteristic national specific determinants of profitability, as given in Table 3. For each variable, a one-way ANOVA showed significant differences within the sample. Thus, the null hypothesis of equal means among the sample can clearly be rejected for all parameters.

The tax rates in the first column are not based on actual empirical tax payments of the firms so that distortions such as loss-carry-overs from previous years could be excluded. Instead, the 10-year averages of statutory tax rates on corporate profits for 2008 to 2017 are used here (OECD 2020). All the other values in Table 3 are 10-year average values of the cycle 2008 to 2017 for each country, extracted from the BACH database (2020). These values provide the basis for the analysis of profitability and the following decomposition of resulting differences to its determinants. Inserting these parameters into Equation (5) gives the resulting measures of profitability, as shown in Table 4. The class topper – that is, the benchmark country for each measure of profitability in the following comparative analysis – is highlighted in bold. The highest *VAR* results are for Germany, while Czechia reaches the highest *RoS* and Poland the highest *RoCE*. The highest *RoE*, however, is for Austria. The differences between these countries and the others are explained in terms of their determining influences. A discussion of practical implications and recommendations for firms is exemplarily made from the perspective of Czechia, considering a firm with parameters at national mean levels. The arguments can be applied to other countries, depending on their results.

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Table 3. Determinants of profitability per country (%)

Country	*t***	*i***	*FL***	*FAI***	*WCI***	*SCR***	*VAR***
AT	25.00	2.66	135.31	73.25	20.60	77.66	27.84
BE	33.99	4.73	118.30	78.14	10.06	60.96	14.24
CZ	19.30	2.73	16.52	171.41	10.16	57.72	27.36
DE	29.62	3.90	73.86	105.65	16.69	70.41	29.74
FR	36.84	3.09	75.48	65.45	21.64	72.68	26.45
IT	30.99	2.69	113.03	119.74	7.31	82.33	13.92
PL	19.00	3.96	17.75	100.20	15.10	66.25	29.61
PT	29.10	3.20	100.60	165.65	4.54	77.72	21.52
SK	20.50	3.60	83.51	112.05	4.52	79.03	23.23
ES	28.80	3.29	59.71	108.22	10.95	78.19	20.55

***P*-value of a one-way ANOVA < 0.01; AT –Austria; BE – Belgium; CZ – Czechia; DE – Germany; ES – Spain; FR – France; IT – Italy; PL – Poland; PT – Portugal; SK – Slovakia; *FAI* – fixed assets intensity; *FL* – financial leverage; *i* – interest rate; *SCR* – staff cost ratio; *t* – tax rate; *VAR* – value added ratio; *WCI* – working capital intensity

Source: Own calculations based on BACH database (2020)

Table 4. Measures of profitability per country (%)

Country	*VAR*	*RoS*	*RoCE*	*RoE*
AT	27.84	6.22	6.63	**9.00**
BE	14.24	5.56	6.30	5.39
CZ	27.36	**11.57**	6.37	5.63
DE	**29.74**	8.80	7.19	6.78
FR	26.45	7.22	8.29	7.72
IT	13.92	2.46	1.94	0.75
PL	29.61	9.99	**8.67**	7.70
PT	21.52	4.80	2.82	1.72
SK	23.23	4.87	4.18	3.71
ES	20.55	4.48	3.76	2.88

AT –Austria; BE – Belgium; CZ – Czechia; DE – Germany; ES – Spain; FR – France; IT – Italy; PL – Poland; PT – Portugal; SK – Slovakia; *RoCE* – return on capital employed; *RoE* – return on equity; *RoS* – return on sales; *VAR* – value added ratio; the values highlighted in bold – the highest value of the evaluated countries

Source: Own calculations based on BACH database (2020)

Table 5. Partial differences in the value added ratio to the leading benchmark country (Germany) (%)

Country	*VAR*	+ Δ*VAR*	= VAR_{DE}
AT	27.84	1.91	
BE	14.24	15.50**	
CZ	27.36	2.38	
FR	26.45	3.30*	
IT	13.92	15.83**	29.74
PL	29.61	0.13	
PT	21.52	8.22**	
SK	23.23	6.51**	
ES	20.55	9.19**	

*, ***P*-value of the *t*-test < 0.05 and < 0.01 respectively, for a comparison of the driver variables with those of the benchmark; AT –Austria; BE – Belgium; CZ – Czechia; DE – Germany; ES – Spain; FR – France; IT – Italy; PL – Poland; PT – Portugal; SK – Slovakia; *VAR* – value added ratio; Δ*VAR* – difference in value added ratios

Source: Own calculations based on BACH database (2020)

This comparative analysis starts with the operational core of the business, the *VAR*, which is compared in Table 5. It shows the remaining part of revenues in excess of input factors bought from third parties. This quantifies the relative value-added, which can be delivered to the stakeholders (i.e. employees, lenders, investors and the state). Thus, it provides an economic basis for each of following measures of profitability. The VARs of Austria, Czechia and Poland do not differ significantly from those of Germany according to the *P*-values of a *t*-test. All other countries, however, show significant disadvantages toward Germany, rejecting the null hypothesis of equal means. These differences are dramatically high for Italy and Belgium. In addition to natural conditions that cannot be influenced, such as climate and soil quality, there are two ways to make direct improvements to *VAR*: pricing policy and cost management. Since price premiums are hard to realise in competitive and transparent markets, cost reductions due to a cheaper sourcing of bought-in materials and their more efficient use seem to be more promising. For Czechia, for example, the potential of such improvements seems relatively low,

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since no significant disadvantages towards the class topper were found. For other countries, however, the lack of added value causes further deficits in the other analysed measures of profitability.

Combining value added with labour productivity leads to the *RoS*. The *SCR* sets staff expenditures in relation to the value-added, and it should not be misunderstood as a reflection purely of wage levels, which is only one aspect amongst others, such as the efficient use of staff or the degree of automation. The value of *SCR* as defined here reflects the part of value-added that is distributed to employees. This ratio stands in a reciprocal relation to labour productivity. The highest *RoS* is for Czechia (Table 6). Differences in the *RoS* are caused by two determinants: value-adding business processes (*VAR*) and labour productivity (*SCR*). The latter factor is the most important influence on differences in *RoS*. Nearly all countries show significant disadvantages in comparison with Czechia in the rejection of a null hypothesis of equal means (Belgium and Poland being the exceptions). This specific comparative advantage of Czech firms has been found in previous research (Beyer and Hinke 2018). Despite not having the highest *VAR* (Table 3), Czechia's advantage in *RoS* is primarily caused by a low staff cost ratio. If Czech firms want to maintain this competitive advantage, they have to ensure that increasing wages are compensated by a more efficient use or higher productivity of the staff.

Table 6. Partial differences in the return on sales to the leading benchmark country (Czechia) (%)

Country	RoS	$+ \Delta RoS^{SCR}$	$+ \Delta RoS^{VAR}$	$= RoS_{CZ}$
AT	6.22	5.46**	–0.11	
BE	5.56	0.89	5.12**	
FR	7.22	4.10*	0.25	
DE	8.80	3.47*	–0.70	
IT	2.46	6.74**	2.38**	11.57
PL	9.99	2.34	–0.76	
PT	4.80	5.47**	1.30*	
SK	4.87	5.83**	0.87	
ES	4.48	5.6**	1.49*	

*, **P-value of the t-test < 0.05 and < 0.01 respectively, for a comparison of the driver variables with those of the benchmark; AT –Austria; BE – Belgium; CZ – Czechia; DE – Germany; ES – Spain; FR – France; IT – Italy; PL – Poland; PT – Portugal; SK – Slovakia; *RoS* – return on sales; ΔRoS^{SCR} – difference in *RoS* caused by staff cost ratios; ΔRoS^{VAR} – difference in *RoS* caused by value added ratios

Source: Own calculations based on BACH database (2020)

Enlarging *RoS* by aspects of capital commitment from fixed assets and working capital gives the *RoCE*, according to the classical DuPont identity. Investment policy and working capital management are reflected here by the variables *FAI* and *WCI*, which set the capital commitment in relation to revenues. Table 7 shows the results for the sample.

Although the working capital management of all countries except Germany and Czechia differs significantly from Poland, the resulting effect on *RoCE* is relatively weak. In all cases, this causes differences in *RoCE* of less

Table 7. Partial differences in the return on net assets to the leading benchmark country (Poland) by their determining factors (%)

Country	$RoCE$	$+ \Delta RoCE^{FAI}$	$+ \Delta RoCE^{WCI}$	$+ \Delta RoCE^{SCR}$	$+ \Delta RoCE^{VAR}$	$= RoCE_{PL}$
AT	6.63	–2.64**	0.66*	3.60**	0.42	
BE	6.30	–2.05**	–0.61**	–1.78	6.8**	
CZ	6.37	3.31*	–0.15	–1.39	0.52	
FR	8.29	–3.74**	0.93**	2.19	0.99**	
DE	7.19	0.39	0.11	1.01	–0.03	8.67
IT	1.94	1.26**	–0.45**	3.75**	2.18**	
PT	2.82	3.14**	–0.34**	1.99*	1.06**	
SK	4.18	0.81*	–0.71**	3.24*	1.15**	
ES	3.76	0.56*	–0.28**	2.96**	1.66**	

*, **P-value of the t-test < 0.05 and < 0.01 respectively, for a comparison of the driver variables with those of the benchmark; AT –Austria; BE – Belgium; CZ – Czechia; DE – Germany; ES – Spain; FR – France; IT – Italy; PL – Poland; PT – Portugal; SK – Slovakia; *RoS* – return on sales; *RoCE* – *r*eturn on capital employed; $\Delta RoCE^{FAI}$ – difference in *RoCE* caused by fixed assets intensities; $\Delta RoCE^{SCR}$ – difference in *RoCE* caused by staff cost ratios; $\Delta RoCE^{VAR}$ – difference in *RoCE* caused by value added ratios; $\Delta RoCE^{WCI}$ – difference in *RoCE* caused by working capital intensities

Source: Own calculations based on BACH database (2020)

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than 1%. Such a moderate but significant impact of working capital has also been found by Gołaś (2020), where inventory management played a dominant role.

Some countries, such as Austria, Belgium and France, have advantages over Poland regarding the *FAI*. However, this is overcompensated by disadvantages in other fields. Although Czechia had the highest *RoS* of the sample, this top position was lost against Poland due to a significant higher fixed asset intensity. Improvements in this field could be reached, for instance, by a higher degree of utilisation and more efficient use of capital investments. There seems to be great potential for improvement in this field for Czech firms, especially as other countries, such as France, Austria or Belgium, have even lower capital tie-up than Poland. This general importance of a low capital tie-up confirms the results of other studies (Katchova and Enlow 2013; Mijic and Jaksic 2017; Balezentis et al. 2019; Gołaś 2020).

The final measure of profitability considered in this study is the *RoE*. This adds aspects of debt financing and taxation to the *RoCE*, referring to the financial leverage effect. These issues are operationalised here by financial leverage (*FL*), which expresses the relation of debt to equity, as well as the interest rate on debt (*i*) and the statutory corporate tax rate (*t*). The results considering influences of all variables are presented in Table 8, with Austria as the relevant benchmark for the *RoE*.

The null hypotheses of equal means for pairwise comparisons toward Austria have to be rejected for almost all parameters and countries, as described in the following. The degree of debt financing of Austrian firms differs significantly from nearly all other compared countries. Higher financial leverage increases Austria's *RoE* in particular. This strong impact of the financing policy for agricultural profitability is in line with other studies (Mijic and Jaksic 2017; Balezentis et al. 2019). The interest rates of Belgium, Germany and Poland differ significantly from Austria, causing a further advantage for the Austrian *RoE* by more than 1%. Taxation, even with significant and remarkable differences in the nominal tax rates, has only a slight influence on the resulting *RoE*, which is surprising considering other research (Heinemann et al. 2010). This marginal importance of tax effects might be a result of interactions with other influences since the determinant analysed first includes compound effects, as described above. Efficient use of fixed assets in terms of the age and capacity utilisation of these investments seems to provide a further significant advantage for Austrian firms. The Austrian capital tie-up for working capital appears to be significantly less efficient than nearly all the other countries. However, this disadvantage causes only small reductions in *RoE*. The issue of labour productivity puts the Austrian *RoE* at a significant disadvantage compared with countries such as Belgium, Czechia and Poland, as well as Germany and France. With the exception of Belgium, the ability of Austria to generate value-added does not differ significantly from these countries. If Czech firms want to reduce their disadvantage in *RoE* against Austria, reduced fixed asset

Table 8. Partial differences in the return on equity (*RoE*) to the leading benchmark country (Austria) by their determining factors (%)

Country	*RoE*	ΔRoE^{t}	ΔRoE^{i}	ΔRoE^{FL}	ΔRoE^{FAI}	ΔRoE^{WCI}	ΔRoE^{SCR}	ΔRoE^{VAR}	$= RoE_{AT}$
BE	5.39	1.08**	1.85**	0.21	0.47	–1.08**	–7.59**	8.67**	
CZ	5.63	–0.68**	0.08	3.73**	3.19**	–0.18*	–2.87**	0.10	
FR	7.72	1.42**	0.37	1.34**	–0.67	0.10	–1.76**	0.48	
DE	6.78	0.55**	1.18**	1.18**	2.08*	–0.19	–2.02**	–0.56	
IT	0.75	0.72**	0.03	0.61**	3.23**	–0.68**	1.51*	2.85**	9.00
PL	7.70	–0.72**	1.43**	2.54**	1.41**	–0.23*	–2.63**	–0.49	
PT	1.72	0.49**	0.52	0.84**	4.67**	–0.45**	0.01	1.18**	
SK	3.71	–0.54**	1.01*	1.25**	2.83**	–0.94**	0.48	1.21*	
ES	2.88	0.46**	0.61	1.8**	2.05**	–0.44**	0.14	1.52**	

*, **P-value of the t-test < 0.05 and < 0.01 respectively, fora comparison of the driver variables with those of the benchmark; AT –Austria; BE – Belgium; CZ – Czechia; DE – Germany; ES – Spain; FR – France; IT – Italy; PL – Poland; PT – Portugal; SK – Slovakia; *RoE* – return on equity; ΔRoE^{FAI} – difference in *RoE* caused by fixed assets intensities; ΔRoE^{FL} – difference in *RoE* caused by financial leverages; ΔRoE^{i} – difference in *RoE* caused by interest rates; ΔRoE^{SCR} – difference in *RoE* caused by staff cost ratios; ΔRoE^{t} – difference in *RoE* caused by tax rates; ΔRoE^{VAR} – difference in *RoE* caused by value added ratios; ΔRoE^{WCI} – difference in *RoE* caused by working capital intensities

Source: Own calculations based on BACH database (2020)

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intensity and increased debt financing seem to have the highest potential for success. If both parameters were at the Austrian level, *RoE* could be increased by more than 3% from each of these two drivers. Considering the significant advantages in other fields, such as taxes or the staff cost ratio, the *RoE* for Czech firms would be even higher than for Austrian ones.

CONCLUSION

The study shows that for the European agricultural firms analysed here, advantages and disadvantages in terms of profitability present a complex and differentiated picture. The fundamental hypothesis that various determinants of profitability differ significantly among European countries could clearly be confirmed. Further, the specific impact of these differences among the drivers could be quantified for several measures of profitability, such as *RoS*, *RoCE* or *RoE*. The reference points for these comparisons were always provided by the class topper for each of these measures of profitability. This kind of benchmarking approach helps to identify specific strengths and weaknesses and to find effective starting points for improvements. In addition to the undamental value-adding operations, the highest potential here was found in the fields of personnel and investment policy, reflected in the staff cost ratio and the fixed asset intensity. Certain recommendations for such improvements were discussed as an example for Czechia.

Although the results reported here are given at aggregated national level, they also provide useful reference points for individual firms by transferring this benchmarking approach to their specific situation. Companies can compare their own ratios, which determine profitability, with their national means or even with the leading European country within the sample. This helps them to understand their own competitive position and indicates levers for effective improvements. Even if there is no accrual accounting, several aspects, like value-adding ratios, staff cost ratio or *RoS*, can be compared to these benchmarks even without balance sheet information.

As stated above, the study focusses on agricultural firms with accrual accounting covered by the European BACH database, which tend to be larger legal entities and limited liability companies. Small family farms or other unlimited companies without balance sheets are excluded from the sample to a large extent. This restriction has two important advantages. Firstly, the companies compared across countries are more similar in structure, and the European Accounting Directive ensure more comparable information, which is further harmonised by the BACH database. Secondly, analysed measures of profitability, such as *RoCE* or *RoE*, are of particular relevance for investors in these companies.

However, this approach also has some substantial negative aspects. One very important issue refers to the fact that smaller family farms represent a very important part of the total agricultural sector. These firms typically have no information on accrual accounting, and therefore the results presented may not be representative of these firms. Further, the analysed measures of profitability might be of less importance in comparison to other goals, such as ecological or social aspects of sustainability. Many other aspects, such as the willingness to borrow, labour costs or personal tax rates, might also differ across countries for self-employed farmers or family farms, and in comparison to the analysed sample. Thus, the results presented do not claim to be representative of the entire sector. However, they provide useful reference points if profitability matters, indicating effective levers for improvements.

Another limitation involves the data within the BACH database. All the results presented above are based on highly aggregated data for each country. Looking more closely at the data at firm level would obviously provide more precise results. The available time series and countries are also limited. Although the BACH data are harmonised, there may still be some distortions as a result of national differences in accounting patterns. All these aspects weaken the power of statistical tests. Nevertheless, since the statistics used here, namely the *t*-test and ANOVA, are regarded as very robust, any bias might be negligible. Further research is needed to address regional differences in profitability between European countries. If this could be achieved for the agricultural sector, it would be another step on the path to economic equality among EU member states.

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