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Income and Asset Situation of Companies Producing Arable Crops in the Visegrad Countries

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Abstract: The V4 countries (Poland, Slovakia, Czechia, Hungary) hold significant importance within the European Union, contributing nearly 20% of the EU's arable land and 10% of its crop output from 2018 to 2020. The study focuses on companies as organizational entities engaged in arable crop production, representing a specific segment of agricultural producers. The objective is to analyze the concentration and financial performance of these companies in the V4 countries during the period 2018–2020. Financial data from 822 companies in Hungary, 226 in Slovakia, 17 in Czechia, and 967 in Poland were processed from the EMIS database (Emerging Market Information System). In Poland and Czechia, a significant proportion of the companies were classified as micro-enterprises, while in Hungary and Slovakia, they were predominantly small farms. The Gini index indicates a high concentration of Polish farms, a medium concentration of Hungarian and Slovakian farms, and a low concentration of Czech companies. In terms of financial profitability, Hungarian and Polish companies are the most favorable, while Slovak farms are the least favorable. Polish companies exhibit significant heterogeneity, which may also be attributed to high concentration. The results suggest that higher financial profitability is associated with a lower debt rate in the capital structure. Based on the examined sample, there is no close relationship between farm size and financial efficiency in the case of companies engaged in arable crop production in the V4 countries. This study also found that as farm size increases, the profit (EBIT) tends to increase, but the magnitude of this effect varies among the companies in different countries. The study's findings also support that other factors play a role in the development of profitability.

Keywords: crop production; sectorial structure; Gini index; profitability; economic performance

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1. Introduction

Enhancing the overall sustainability of agriculture is the primary objective, encompassing economic, environmental, and social aspects. Economic sustainability, in particular, holds significant importance and remains a central concern for the majority of farmers [1]. Arable crops play a crucial role in agriculture as they provide raw materials for food, feed, and bioenergy to meet the growing needs of the global population. Nowadays, crop producers face numerous challenges, such as ensuring food security, addressing environmental concerns, adapting to climate change, managing limited resources, promoting sustainable livelihoods, and dealing with geopolitical and economic impacts [2–8].

Recognizing the significance of agriculture, particularly arable crops, the European Union (EU) has designated it as a key sector. The Common Agricultural Policy (CAP) allocates approximately 270 billion EUR under the first pillar of the next budget cycle (2023–2027), aiming to enhance the income-generating capacity of farmers [9]. Quiroga et al. [10] found that first pillar crop subsidies and pillar two environmental programs generate a disincentive effect on productivity. However, in general, the Common Agricultural Policy (CAP) promotes technical efficiency convergence within Europe.

The farms within the EU are characterized by their abundance and diversity, exhibiting a wide range of sizes, crops, and reared animals. These farms operate under different management structures and are dispersed across various regions with diverse geologies, topographies, and climates. While the number of farms in the EU has been declining sharply, the total land area utilized for agricultural production has remained relatively stable [11].

In the year 2020, EU farms utilized a total of 157 million hectares of land for agricultural purposes. In this year, there were 9.1 million agricultural holdings in the EU. The overwhelming majority (94.8%) of EU's farm were classified as family farms, while almost two-thirds (63.8%) of EU's farm were less than 5 hectares in size. These farms play a crucial role in mitigating the risk of rural poverty, providing additional income, and contributing to food production. On the other end of the production scale, 7.5% of the EU's farms were 50 hectares or more in size and used two-thirds (68.2%) of the EU's utilized agricultural area. These larger agricultural enterprises are more likely to have a legal form or be cooperatives [11].

Of the EU Member States, the Visegrad Group (Poland, Slovakia, Czechia, Hungary) deserves special attention, accounting for about 19% of the EU's arable land on average in 2018–2020. The EU-27's crop output averaged 219 billion EUR in 2018–2020, with these countries contributing almost 10% (Hungary: 2.2%, Czechia: 1.4%, Slovakia: 0.6%, Poland: 5.4%) [12].

The study specifically focuses on companies as organizational enterprises involved in the production of arable crops, representing a specific segment of agricultural producers. The main objective of the study is to explore and compare the income and asset situation of companies engaged in arable crop production in the V4 countries. To achieve this, the research aims to answer the following questions:

- What were the harvested areas, average yields, and selling prices for the main arable crops (wheat, barley, maize, rapeseed) grown in the V4 countries during the examined period?
- How did the farm size and consequent concentration of companies producing arable crops in the V4 countries evolve during the period 2018–2020?
- How did the profitability of companies producing arable crops in the V4 countries evolve during the period 2018–2020?
- How did the financial situation of companies producing arable crops in the V4 countries evolve during the period 2018–2020?
- What correlation can be demonstrated between farm size and its financial efficiency?

2. Literature Review

The Visegrad Cooperation is the regional organization of four states (Czechia, Poland, Hungary, and Slovakia) known as the Visegrad Group (V4). The aim of this cooperation is the joint representation of economic, diplomatic, and political interests of these Central–Eastern European countries and the coordination of their possible measures [13]. Both historical and current farm development patterns differ strongly between Central–Eastern European countries [14,15]. Despite all the differences, these countries have some common problems to solve. One of them is that the agricultural businesses suffer from a lack of capital and unfavorable loan conditions [16].

The efficiency of farms within the Visegrad Group (V4) has been the subject of several studies in various aspects. Szabo et al. [17] compared the efficiency of agricultural enterprises in the V4 countries with the EU average and with German farms (as one of the main competitors) for the period 2010–2013. Among other findings, they highlighted that the capacity utilization of productive assets was the most favorable for Hungarian farms. Additionally, the amount of subsidies for Hungarian and Polish farms was higher compared to others. Fenyves et al. [18], taking a different perspective, concluded that "the capital structure seemed to be strongly influenced by the farm structure and the relative company size". Subsequently, Ladvenicová et al. [19] and Koszorús–Tarnóczi [20] focused

their research on profitability indicators. The former found that return on assets and return on sales (ROA and ROS) have a pronounced effect on the fall in return on equity (ROE), while the latter found that ROA and ROE, as well as debt stock ratios, impacted the evolution of the market capitalization/equity ratio (as dependent variable) in regression analysis. In their analysis, Galaczka et al. [21] found that, when comparing the profitability of farms in the Visegrad Group, the most favorable return on assets was achieved by farms in Hungary, while the least favorable was achieved by farms in Slovakia.

Industrialization of agriculture has resulted in increased emphasis on business focus on specialization and farm size [22]. The pursuit of efficiency will become even more prominent in agriculture. This is supported by the study of Felföldi et al. [23], which explains that efficiency improvement is achievable through various investments if farms can adapt crop rotation and available resources (machinery, arable land, technology) to constantly changing conditions. Enhancing production efficiency can be ensured through the application of available modern technology, automation, digitalization, and the necessary expertise [16,24–26]. In addition to efficient management, enhancing corporate performance nowadays also emphasizes the use of strategic [27] and operational [28] flexibility, going beyond traditional management techniques.

Farm size plays a critical role in agricultural sustainability [29]. A study [22] evaluated US farm's data between 1989 and 1998 shows that farm size had a significant impact on return on equity. Sheng and Chancellor [30] found a positive farm size–productivity relationship in the Australian grains industry. Ren et al. [29] found that increasing farm size has a positive impact on Chinese farmer's net profit, as well as on economic, technical, and labor efficiency. They highlighted that the expansion of large-scale farming is a critical path for modernizing agricultural production. The size of farms affects the ability to invest and introduce technical progress, achieve economies of scale, and achieves higher efficiency [31].

In the comparison of farm sizes, larger farms have more opportunities to produce at lower unit cost due to economies of scale. However, small farms are less efficient due to lower profit margins. Despite this, small farms play a vital role in the agricultural sector by retaining the rural population and providing employment opportunities [31,32]. In Poland, small farms, often family-owned, are prevalent [33,34]. The findings of Kocsis and Major [35] indicate that enterprises of different sizes possess distinct characteristics. Smaller farms tend to demonstrate greater flexibility, whereas larger farms show higher efficiency. However, medium-sized farms do not seem to enjoy the benefits of either profitability or efficiency.

Beside farm size, other factors also influence the financial efficiency of agricultural companies. Langemeier et al. [22] highlighted that farms that are more specialized have a higher return on equity. Lambert and Bayda [36] state that farm financial structure may affect both short- and long-run input usage, thereby affecting farm efficiency.

Table 1 summarizes the relative importance of key indicators for agriculture in the V4 countries. The contribution of agriculture to GDP emphasizes its significant importance in these countries' economy. However, in the case of Czechia and Slovakia, the agriculture sector registers lower GDP percentage from the total national GDP, highlighting the potential of further development of the sector in these countries [37]. Poland stands as the largest agricultural country among the V4 countries, with Hungary ranking second. The role of agriculture is much smaller in both Czechia and Slovakia compared to Poland and Hungary. The share of crop production is the largest in Hungary, but it also accounts for over 50% in Czechia and Slovakia. In 2020, the value of crop output in Poland was nearly 13 billion EUR. The Hungarian value was 38% of the Polish one. The value of crop output was even lower in Czechia and Slovakia than in Hungary.

Table 1. Main agricultural indicators in the V4 countries (2020). Source: EUROSTAT [38].

Indicators	Hungary	Czechia	Slovakia	Poland
Contribution of agriculture to GDP (%)	2.5	0.9	0.7	2.0
Gross value added of agriculture (at basic prices, million EUR)	3420	1935	642	10,306
Value of agricultural output (at basic prices, million EUR)	8398	5633	2348	26,406
Value of crop output (at basic prices, million EUR)	4939	3303	1289	12,925
Share of crop production (%)	58.8	58.6	54.9	48.9

Table 2 summarizes the number of agricultural companies and the utilized agricultural area according to farm types based on EUROSTAT [38] data. Among the V4 counties, Poland has the highest number of agricultural farms, totaling more than 1.3 million units. However, the share of companies from the total farms is only 0.6%, and these companies only account for a negligible share of the agricultural area (8.7%), resulting in the lowest average farm size among the V4 countries. Conversely, Hungary, Czechia, and Slovakia have significantly higher agricultural land per farm, ranging between 220 and 575 hectares. Hungary has the largest number of companies specializing in cereals, oil, and protein crops, accounting for nearly 21% of total agricultural area. Slovakia, on the other hand, has a third of the number of companies compared to Hungary, but their share of agricultural area is higher (33%). The average agricultural area per farm specializing in cereals, oil, and protein crops in Slovakia is almost twice as high as in Hungary. Czechia has the largest company size in this farm type, with an average of 586 hectares per farm, while Poland has the smallest farm size, with an average of 224 hectares per farm. Poland exhibits a fragmentation pattern in its agricultural sector [39]. Similar findings can be observed for other specializations.

Table 2. Farm structure by farm type and legal form in the V4 countries (2020). Source: EUROSTAT [38].

Indicators	Hungary	Czechia	Slovakia	Poland
Farm type: total				
Farm number (legal form: legal person/company)	8690	4260	3610	7370
Share from total farms (%)	3.7	14.9	18.4	0.6
Utilized agricultural area by companies (ha)	2,450,390	1,908,710	1,518,430	1,280,170
Share from total utilized agricultural area (%)	70.2	38.8	81.5	8.7
Average farm size of companies (ha/farm)	220	575	421	174
Farm type: Specialist cereals, oilseed, and protein crops (calculated with Standard Output)				
Farm number (legal form: legal person/company)	3490	890	1160	2400
Share from total farms (%)	1.5	3.1	5.9	0.2
Utilized agricultural area by companies (ha)	1,023,250	521,270	162,450	537,670
Share from total utilized agricultural area (%)	20.8	14.9	33.2	3.6
Average farm size of companies (ha/farm)	293	586	532	224
Farm type: General field cropping (calculated with Standard Output)				
Farm number (legal form: legal person/company)	1150	660	640	3010
Share from total farms (%)	0.5	2.3	3.3	0.2
Utilized agricultural area by companies (ha)	196,760	207,470	83,430	311,430
Share from total utilized agricultural area (%)	4.0	5.9	3.3	2.1
Average farm size of companies (ha/farm)	171	314	130	103

Table 2. *Cont.*

Indicators	Hungary	Czechia	Slovakia	Poland
Farm type: Mixed cropping (calculated with Standard Output)				
Farm number (legal form: legal person/company)	480	60	40	150
Share from total farms (%)	0.2	0.2	0.2	0.0
Utilized agricultural area by companies (ha)	67,540	39,470	22,150	12,550
Share from total utilized agricultural area (%)	1.4	1.1	1.2	0.1
Average farm size of companies (ha/farm)	141	658	554	84

3. Materials and Methods

3.1. Data Collection and Sample Size

In the present study, the size, concentration, and financial performance of arable crop producer organizations in the Visegrad countries are compared for the period 2018–2020. Various databases, including EUROSTAT [38], FAOSTAT [12], and EMIS [40], were used in the research. The EUROSTAT and FAOSTAT databases provided general industrial data regarding farm structure, harvested area, average yield, and sales price for the most important arable crops (wheat, maize, barley, rapeseed) in Hungary, Czechia, Slovakia, and Poland.

The EMIS (Emerging Markets Information System) database was used to obtain financial data (balance sheet and income statement) of the annual financial accounts of the companies during the period 2018–2020. EMIS [40] includes reports and corporate financial data about different industries and their companies. It should be noted that the specific data available in the EMIS database can vary depending on the region, country, and individual company coverage. The filtered and surveyed companies from the EMIS database can be characterized by their main activity, which is the "growing of cereals (except rice), leguminous crops, and oilseeds". The main activity can be filtered from the database based on the unified sectoral classification system of economic activities in the specific country (TEÁOR 08′; SK NACE Rev.2.; CZ-NACE, PKD 2007). However, this main activity does not rule out the possibility that the examined companies may have other activities. Moreover, it is possible that companies not primarily engaged in arable crop production have been excluded from the sample.

Companies that were not included or did not have data for each year in EMIS were excluded from the sample, and critical/extreme values in the dataset were also filtered out. After filtering, the financial data for 822 companies in Hungary, 17 in Czechia, 226 in Slovakia, and 967 in Poland were processed. Comparing the sample size to the number of companies reported by the EUROSTAT [38], which are categorized as specialist cereals, oilseed, and protein crop farms (Table 2), the sample size constitutes 24% in Hungary, 2% in Czechia, 20% in Slovakia, and 40% in Poland. Unfortunately, the sample size of 17 units for Czechia cannot be the representative enough to draw conclusions regarding the entire country's arable crop producer companies. Therefore, our results regarding this country are to be treated with reservations depending on this. The used financial data expressed in each currency were converted into EUR using the average exchange rate for the period 2018–2020 (331.86 HUF/EUR; 4.33 PLN/EUR; 25.93 CZK/EUR) [41].

3.2. Analysis of Company Size and Concentration

The companies filtered from EMIS were also classified according to their size, following the provisions of Act XXXIV of 2004 [42]. Consequently, either the net sales revenue or the total assets determined the size category (micro, small, medium, large). Micro-enterprises can be classified in the category below 2 million EUR for both net sales revenue and total assets. In contrast, an enterprise is considered a small enterprise with total assets and net sales revenue up to 10 million EUR and a medium enterprise with total assets up to 43 million EUR and net sales revenue up to 50 million EUR. Additionally, an enterprise

with total assets exceeding 43 million EUR or net sales revenue exceeding 50 million EUR can be classified as a large enterprise.

To determine the degree of concentration, the Lorenz curve and the Gini index (Equation (1)) were used. The former plots the cumulative relative distribution and the cumulative relative sum of values in an equilateral square, while the latter represents the ratio of the area enclosed by the curve and the diagonal to the area under the diagonal, and it can take a value between 0 and 1 [43–47].

$$G = \frac{\sum_i \sum_j \left| y_i - y_j \right|}{2n \sum_{i=1}^{n} y_i} \quad (1)$$

where n represents the number of companies; y represents the size of the companies; i refers to the ith company in the rank (ranked based on size); and j denotes the jth company in the rank that follows the ith company.

The size of the companies, and consequently the concentration, was evaluated based on both the total assets and the net sales revenue of the sample.

3.3. Analysis of Financial Performance

To assess the profitability of companies, the EBIT (Earnings Before Interest and Tax) indicator was used. Operating profit (EBIT) eliminates the effects of taxes and interest, which may vary among different countries. The EBIT focuses on the core business functions of a company. Different indicators were used to assess profitability: return on sales (ROS) (Equation (2)) and return on assets (ROA) (Equation (3)). The equity to total assets ratio (Equation (4)) was used to examine the capital structure. The ROA and ROS indicators were applied similarly to previous works, such as Ladvenicová et al. [19], Koszorús–Tarnóczi [20], Hamad–Tarnóczi [48], and Vavrina–Lacina [49], while the equity to total asset ratio was used in line with studies by Pille–Paradi [50] and Glushchenko et al. [51].

$$\text{ROS} = \frac{\text{EBIT}}{\text{Net sales revenue}} \times 100 \quad (2)$$

$$\text{ROA} = \frac{\text{EBIT}}{\text{Total assets}} \times 100 \quad (3)$$

$$\text{Equity to Total Assets ratio} = \frac{\text{Equity}}{\text{Total assets}} \times 100 \quad (4)$$

3.4. Analysis of Financial Performance

Descriptive statistical analysis was performed on the dataset filtered from EMIS. Mean, relative standard deviation, median, and inter-class distribution were used to process and analyze the financial indicators. Correlation and regression analyses were carried out to assess the relationships between financial performance indicators (EBIT, ROS, and ROA) and company size (net sales revenue and total assets). Where the conditions of Pearson's correlation were not met (non-normally distributed sample), Spearman's correlation was used. To evaluate the strength of correlations, the following target values based on the correlation coefficient were used: weak (0.0–0.4), moderate (0.4–0.7), strong (0.7–0.9), and very strong (above 0.9) [52].

4. Results and Discussion

4.1. The Role of Main Crop (Wheat, Barley, Maize, and Rapeseed) Production in the V4 Countries

On average, there are nearly 100 million hectares of arable land in the European Union, which is projected to shrink by one percent over the next decade (Table 3). Regarding the rank of the quantity of total crop production, the most important arable crops in the Visegrad countries are wheat, barley, maize, and rapeseed. This chapter presents key figures (harvested area, average yield, selling price) for these main crops. Legumes are

not included in the top four crops and are not so important in the field of arable crop production; therefore, they are not presented in detailed way, despite the fact that the main activity of companies analyzed involves legumes production as well.

Table 3. Production area of certain arable crops in the European Union. Source: EC [53].

Crops (million ha)	2018–2020 Average	2021	2026 *	2031 *
Common wheat	21.4	21.7	21.3	21.1
Barley	11.2	10.4	10.5	10.1
Maize	8.7	9.1	8.8	8.9
Rapeseed	5.5	5.3	5.6	5.1
Total arable area	99.5	98.8	98.5	98.1

* projections.

It is projected that wheat area could decrease by one percent, rapeseed by 7%, and barley by 10%, while maize could increase by two percent by 2031. Yields for wheat (−1%), rapeseed (−2%), and barley (−10%) are projected to decrease, while maize volumes are expected to remain stable by 2031, compared to the average for the 2018–2020 period. Additionally, these crops are expected to decrease in their volume for consumption (between −7% and −2%) by the end of the next decade, compared to the average for the same period [53].

Comparing the main crop production in the Visegrad countries, Poland produced the most wheat on the largest area (an average of 2.4 million hectares). Compared to Poland, Slovakia's wheat production covers one-sixth of the area, Czechia's covers one-third, while Hungary produces wheat on a 60% smaller area. The highest average yield was achieved in Czechia (5.9 t/ha), while the lowest was recorded in Poland (4.6 t/ha) (Figure 1).

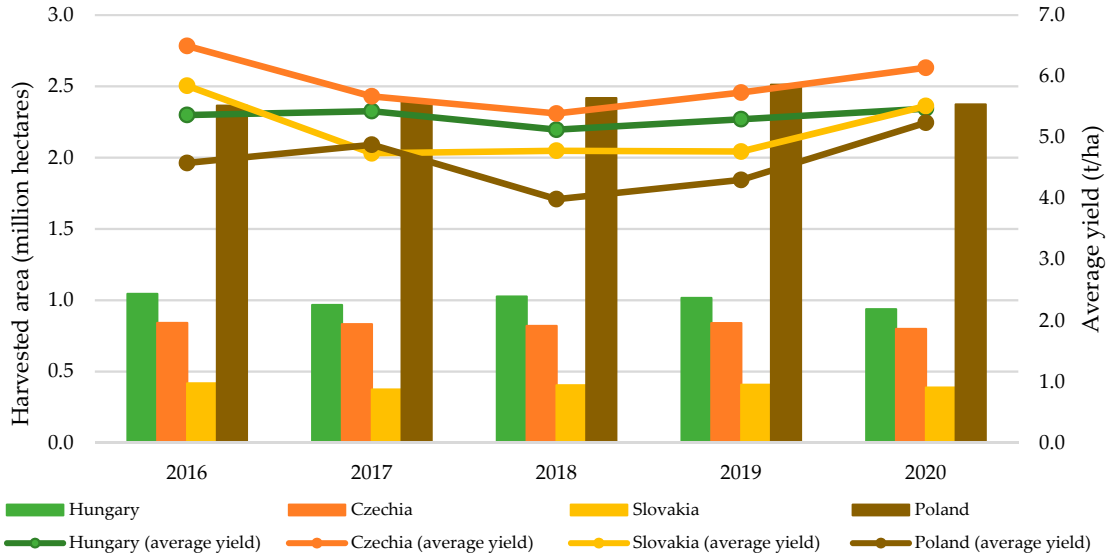

Figure 1. Harvested area and average yield of wheat in the V4 countries (2016–2020). Source: FAOSTAT [12].

In contrast to wheat, Hungary had the largest maize production area, averaging 1 million hectares. Hungary is traditionally known as a maize producer country, with an average yield of 8.1 t/ha in 2018–2020, same as Czechia. The lowest average yield, similar to wheat, was recorded in Poland (6.6 t/ha) (Figure 2), primarily due to the less favorable climatic conditions for maize production in the country.

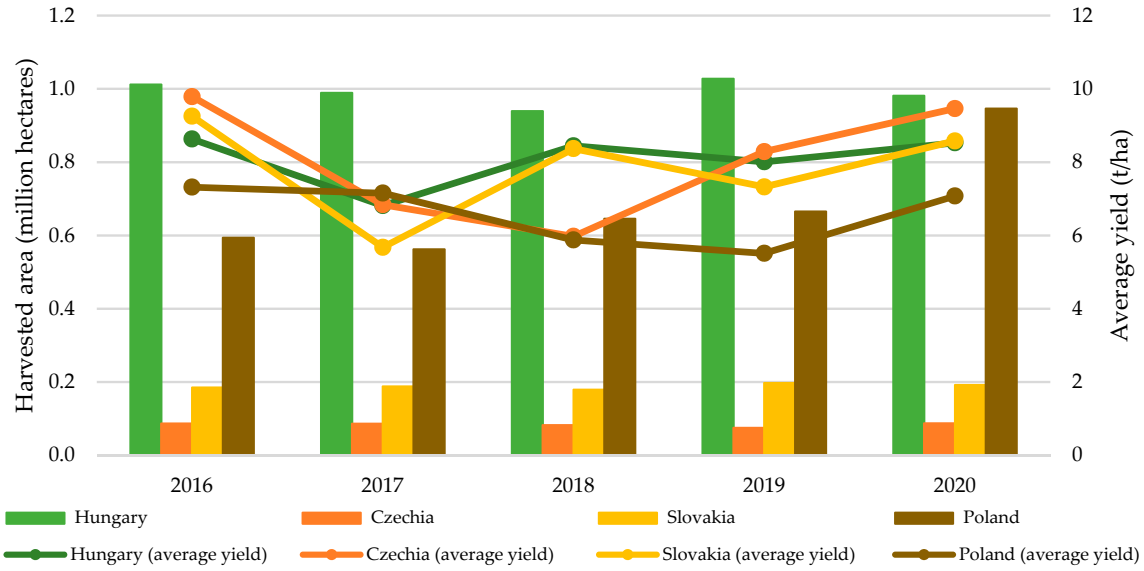

Figure 2. Harvested area and average yield of maize in the V4 countries (2016–2020). Source: FAOSTAT [12].

Among the Visegrad countries, Poland harvested barley on the largest area (an average of 900 thousand hectares), compared to a significantly smaller area in Czechia (326 thousand hectares), Hungary (267 thousand hectares), and Slovakia (123 thousand hectares). For this crop, Hungary and Czechia achieved the same average yield (5.3 t/ha), while Poland had the lowest yield (3.7 t/ha) (Figure 3).

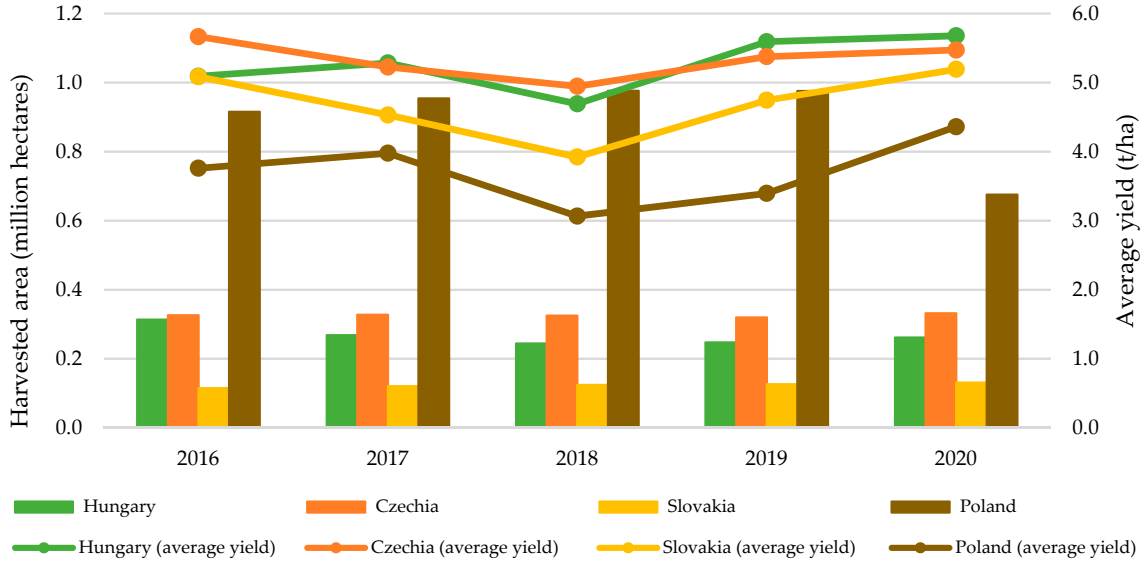

Figure 3. Harvested area and average yield of barley in the V4 countries (2016–2020). Source: FAOSTAT [12].

Compared to cereals, rapeseed yields do not vary as much between countries. However, the lowest average yield, similarly to other crops, was recorded in Poland (2.8 t/ha), and the highest in Czechia (3.24 t/ha). The harvested area was the largest in Poland (888 thousand hectares). In comparison, Czechia produced rapeseed on 389 thousand hectares, Hungary on 300 thousand hectares, and Slovakia on 145 thousand hectares (Figure 4).

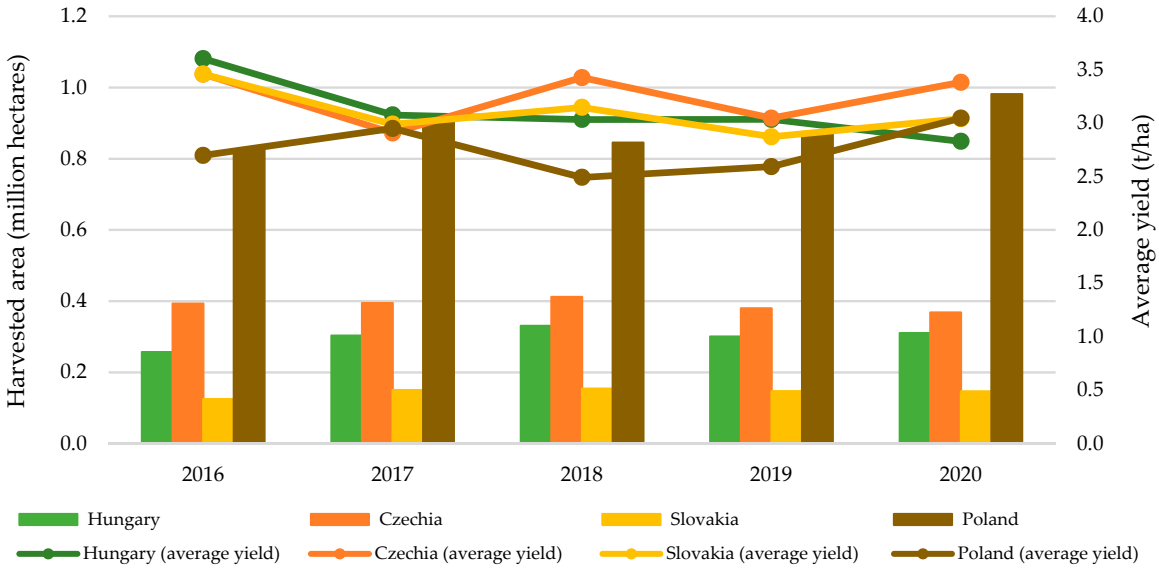

Figure 4. Harvested area and average yield of rapeseed in the V4 countries (2016–2020). Source: FAOSTAT [12].

The yield differences observed in arable crops across the V4 countries can be attributed to a combination of agro-climatic conditions, soil characteristics, agricultural practices, technological advancements, and policy factors. Factors such as agro-climatic conditions and soil characteristics play a significant role in determining the natural growth potential of crops [54,55]. Regarding farming conditions, Czechia, Slovakia, and Poland have more than 50% of their areas classified as less-favored areas, compared to less than 20% in Hungary [56]. Agricultural practices, including crop management techniques and technology adoption, further impact yield levels [57,58]. According to Simionov et al. [37], the crop yield is directly influenced by technology factors such as irrigation and fertilizer use. Additionally, policy factors can influence agricultural inputs, market access, and support mechanisms, which can, in turn, affect yield differences.

The profit of enterprises focused on crop production is most affected by external economic conditions, particularly by climatic conditions and price developments. Therefore, the development of financial indicators is characterized by significant fluctuations [59].

Sales prices for the main crops demonstrated a general similarity across countries, aligning with international market trends. The relative standard deviation of the prices varied between 5–9% per crop during the examined years. Specifically, wheat prices ranged from 150 to 169 EUR/tonne, barley from 133 to 162 EUR/tonne, maize from 138 to 155 EUR/tonne, and rapeseed from 352 to 368 EUR/tonne on average for the 2018–2020 period (Figure 5). In general, it can be concluded that prices for all crops, with the exception of wheat, were more favorable in Czechia compared to other countries. For barley and rapeseed, the average price was the lowest in Hungary, while for wheat and maize, it was the lowest in Slovakia.

4.2. Size and Concentration of Companies Producing Arable Crops in the V4 Countries

The companies filtered from EMIS were classified according to their size following the provisions of Act XXXIV of 2004 [42]. The following categories were distinguished:

- Micro-enterprises: net sales revenue and total assets are up to 2 million EUR.
- Small enterprises: net sales revenue or total assets are higher than 2 million EUR, but net sales revenue and total assets are maximum 10 million EUR.
- Medium enterprises: net sales revenue or total assets are higher than 10 million EUR, but net sales revenue is up to 50 million EUR and total assets is maximum 43 million EUR.

- Large enterprises: total assets exceeding 43 million EUR or net sales revenue exceeding 50 million EUR.

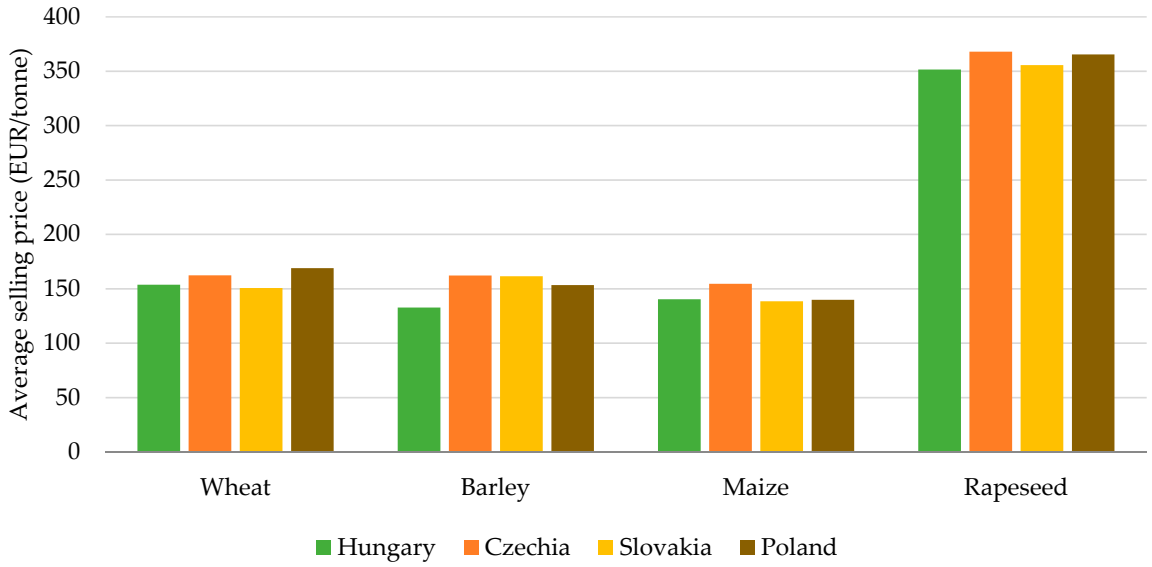

Figure 5. Selling prices of the main crops in the V4 countries (2018–2020 average). Source: EUROSTAT [38] and FAOSTAT [12].

While in Hungary (51%) and Slovakia (70%), the majority of the corporate farms were small, in Poland (67%) and Czechia (76%), the vast majority of farms were in the micro category, based on average data for the period 2018–2020 (Figure 6).

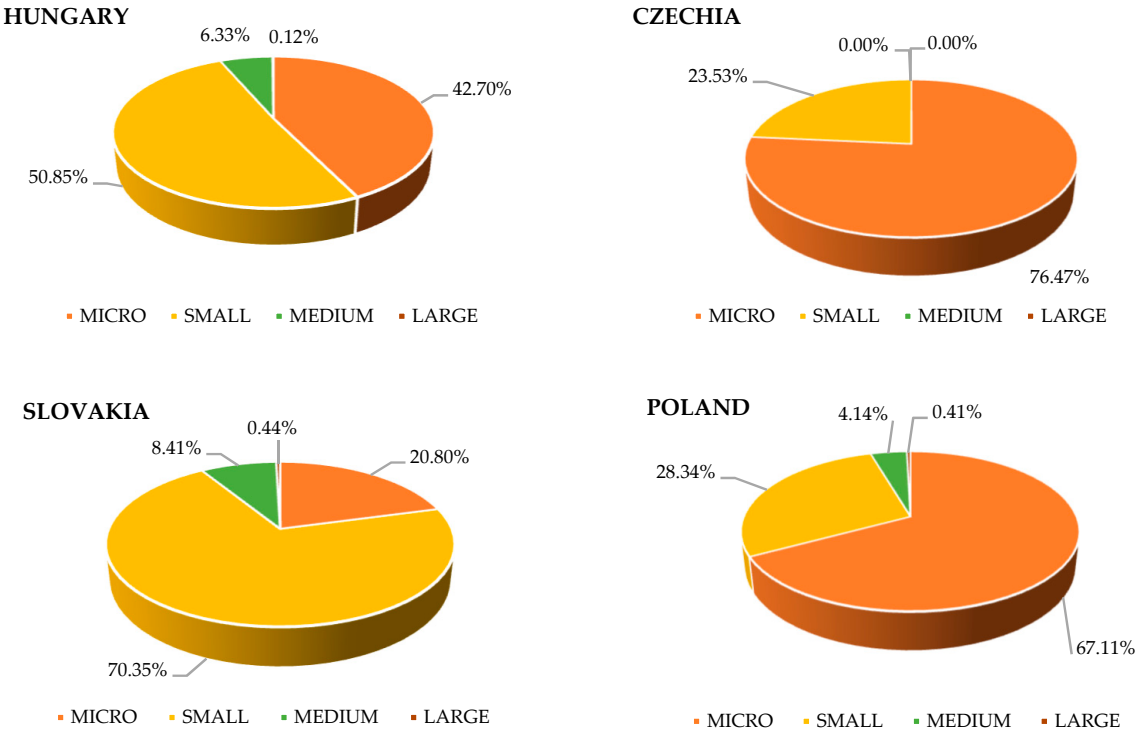

Figure 6. Size of companies in the V4 countries. Source: own calculation based on EMIS [40] data.

Smaller farms have usually more fragmented structure, lower economic profitability, and insufficient human capital compared to more concentrated agricultural enterprises.

Thus, the differences between enterprises limit the integration within the food chain and the optimization of production [60].

Authors' opinion aligns with the perspective presented by Akimowicz et al. [61], which suggest that the size of agricultural companies could be influenced by various limitations and factors that affect their expansion. Policy and regulatory frameworks, land ownership patterns, access to finance, labor market dynamics, and market structure are all potent factors that can impact the size of agricultural enterprises. Therefore, it is crucial to take these factors into account when evaluating the growth potential and scalability of agricultural companies.

Figures 7 and 8 depict the concentration of the companies filtered from EMIS based on total assets and net sales revenue. In Hungary and Slovakia, 2% of farms accounted for 15% of the total assets, while in Poland, 2% of enterprises held a quarter of the total assets. For Czech farms, 5% of enterprises accounted for 10% of total assets, with a small sample size being noteworthy. According to the Gini index, the concentration of Czech and Slovak companies was low, Hungarian organizations showed medium concentration, and Polish farms demonstrated high concentration.

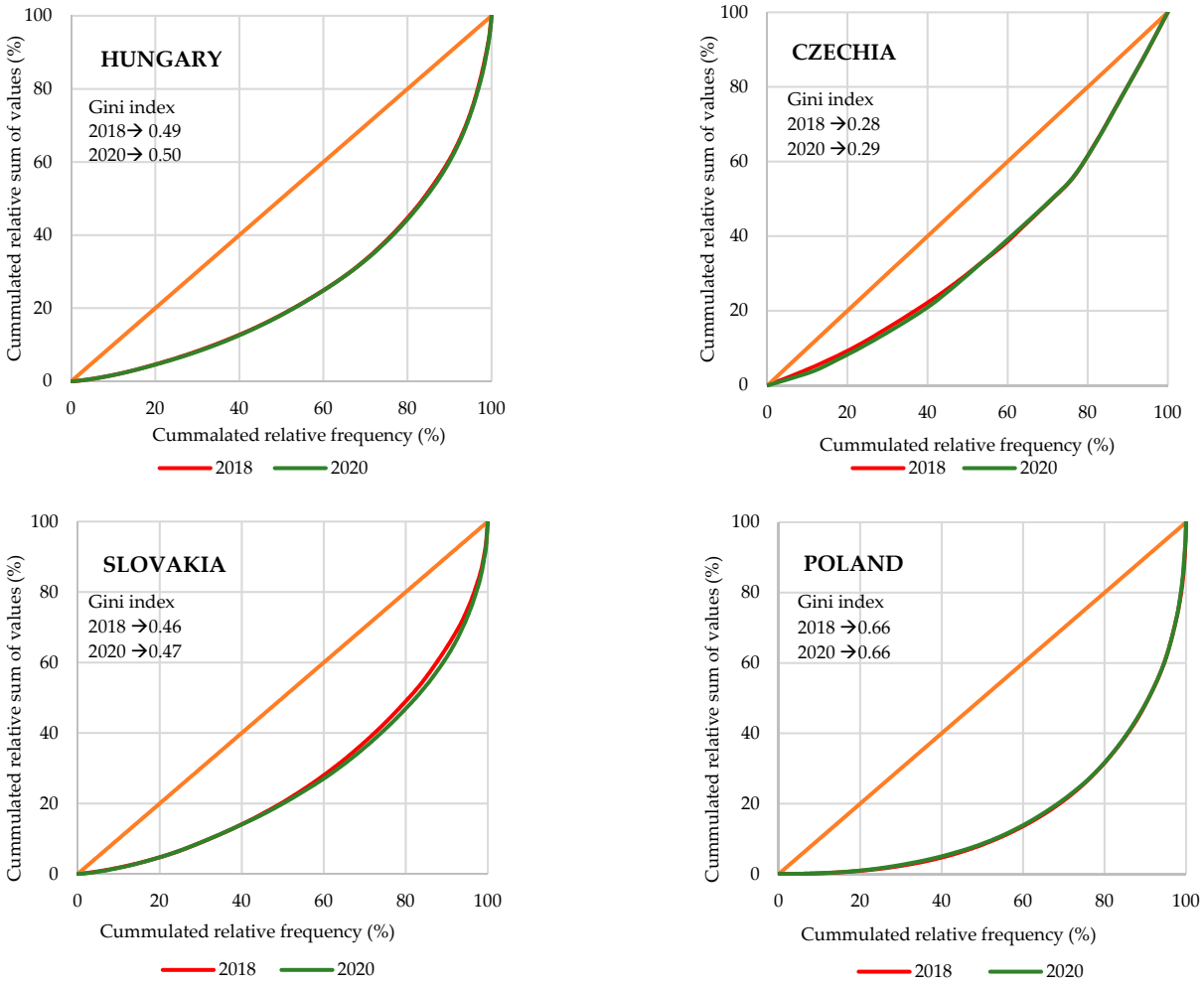

Figure 7. Concentration of companies producing arable crops in the V4 countries based on total assets. Source: own calculation based on EMIS [40] data.

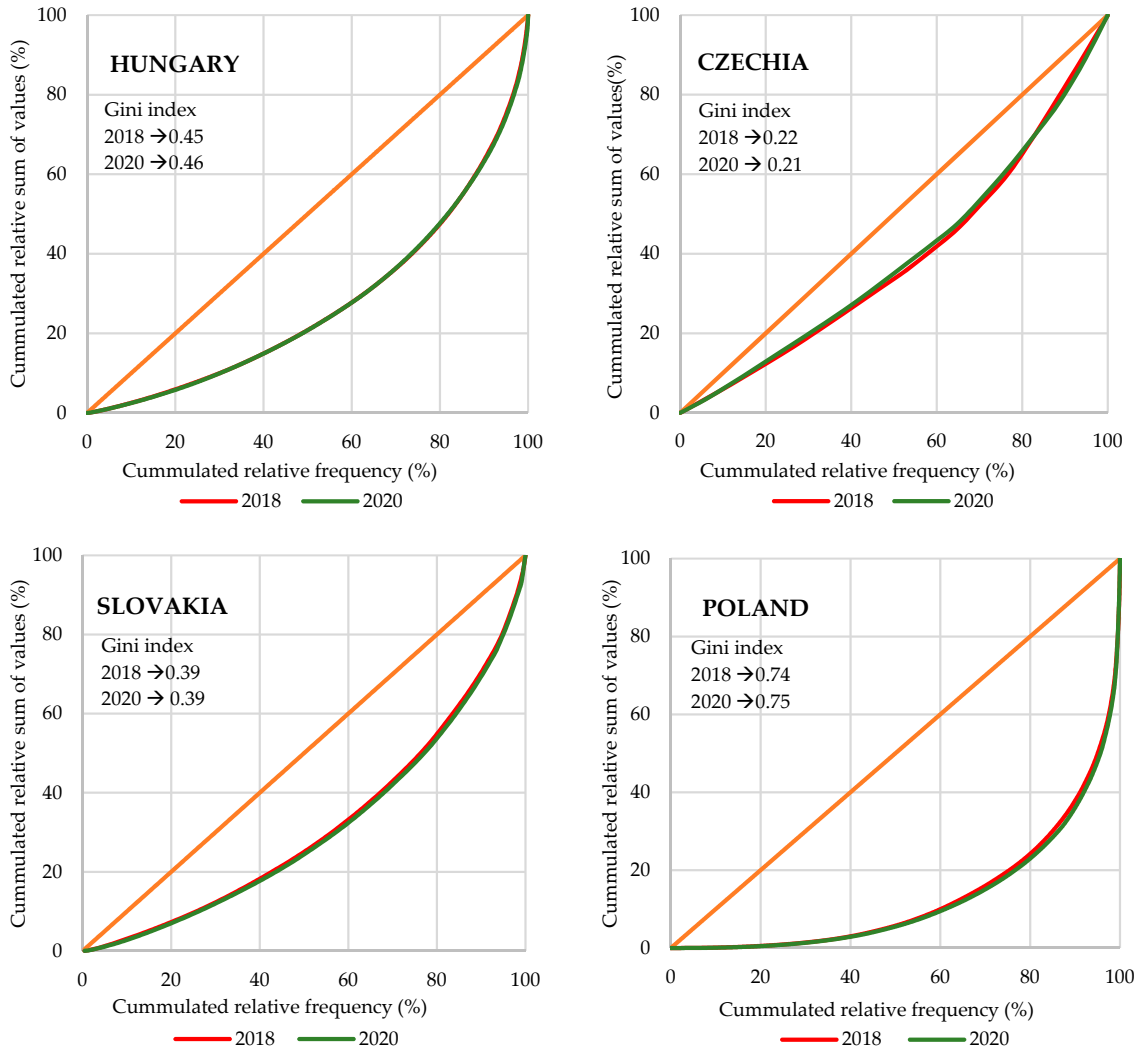

Figure 8. Concentration of companies producing arable crops in the V4 countries based on net sales revenue. Source: own calculation based on EMIS [40] data.

The analysis also examined the evolution of concentration based on net sales revenue. While 2% of Polish farms accounted for 40% of net sales revenue, there was no significant change in other nationalities compared to the breakdown by total assets. In Slovakia, 2% of farms contributed to 10% of net sales revenue, just 5 percentage points lower than the previous concentration (Figure 8). This pattern suggests a more efficient use of assets in larger Polish companies, while smaller companies appear to have a less efficient use of assets in contrast to farms operating in the other three countries.

A high concentration in the agricultural sector can have implications for smaller farms, agricultural competitiveness, and the broader economy. It may limit market access for smaller farms, potentially reduce their profitability, and hinder their growth opportunities. Moreover, concentration can influence innovation, technological progress, and the adoption of sustainable practices. Specifically, concentrated firms can shape markets, technology, innovation agendas, and policy and governance frameworks. Therefore, it is crucial to consider the potential impacts of concentration and assess policies and regulations that promote a fair and competitive agricultural sector while ensuring the sustainability and resilience of the entire industry [62].

Average net sales revenue per company increased in all concerned countries between 2018 and 2020. This increase can be attributed to higher average yields or higher sales prices (Figure 9). The most significant change (+18%) was observed for Hungarian organizations,

while the smallest (+1%) was found for Czechia (despite a slight increase in the average yields of wheat, maize, and barley). Slovakian farms had the highest average specific net sales revenue (3–3.1 million EUR), whereas the lowest average (0.9–1 million EUR) was recorded in Poland, largely due to the prevalence of micro-enterprises, which is influenced by farm size.

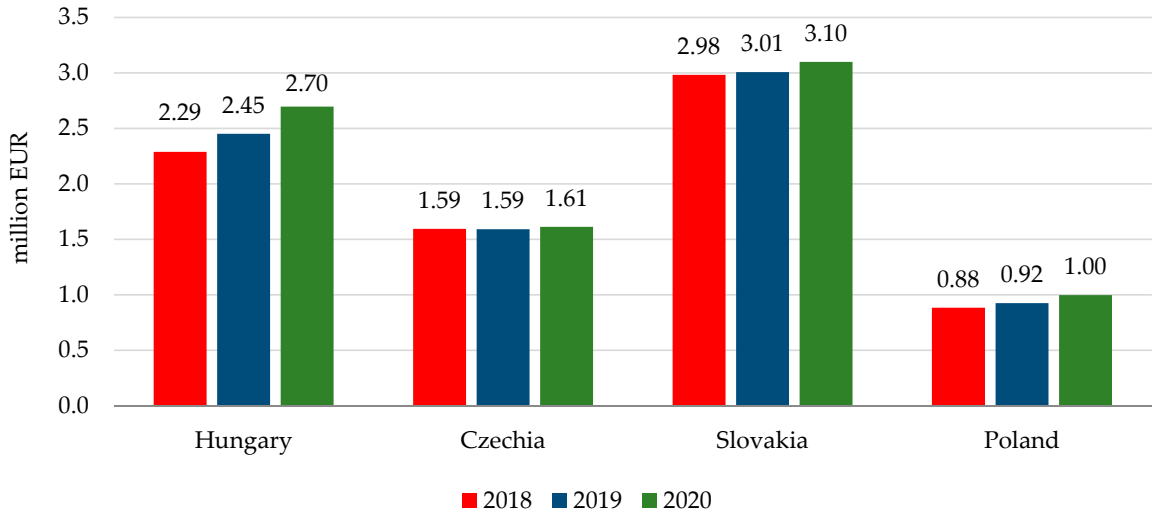

Figure 9. Average net sales revenue per company producing arable crops in the V4 countries. Source: own calculation based on EMIS [40] data.

4.3. Income and Asset Situation of Companies Producing Arable Crops in the V4 Countries

Average income per company increased in Czechia (+50%), Poland (+51%), and Hungary (+39%), while it decreased in Slovakia (−24%) from 2018 to 2020 (Figure 10). The decline in Slovakian organizations can be explained by a higher increase in operating costs, as net sales revenue moved in the opposite direction. The trend in EBIT may be determined by the size of the business on the one hand, and the evolution of net sales revenue and costs on the other. Net sales revenue is influenced not only by yield averages but also by the selling prices of the crops grown. Additionally, crop structure also affects the development of revenue and costs. Taking these relationships into account, the average revenue per company and profitability (ROS, ROA) can be examined.

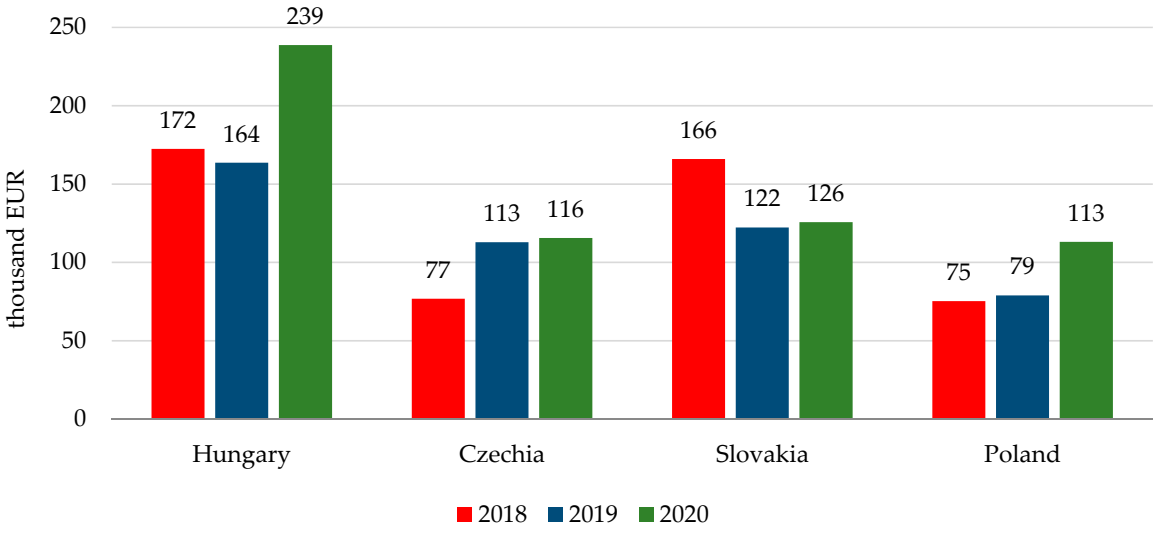

Figure 10. Average EBIT per company producing arable crops in the V4 countries. Source: own calculation based on EMIS [40] data.

The ROS value indicates the proportion of the net sales revenue accounted for by EBIT. When comparing the ROS values of the companies in each country, the highest weighted mean was observed in Poland (9.54%), with the median significantly above this value. The difference between the two indicators can be attributed to the high relative standard deviation and the higher share of highly profitable farms (36%), as well as high concentration. It is worth noting that in the entire sector, the average yields of the main crops were the lowest in Poland. Overall, based on the ROS, the most heterogeneous sample can be observed in Poland. Nearly 60% of Hungarian organizations had a ROS of 0–9.9%, while 25.34% of Polish farms operated at a loss, and an additional 35.99% were highly profitable (above 20%) based on the ROS. In terms of ROS, the most homogeneous sample can be found in Hungary for the evaluated time period. In Slovakia, 21.24% of companies operated at a loss, and 43.36% of companies fell into the 0–4.9% ROS category, with the lowest weighted mean value observed in this country. This trend may be related to a significant decrease in income per company (−12%) and a slight increase in specific revenue (+2%). On the other hand, 47.06% of Czech organizations achieved a favorable 5–14.9% ROS, mainly due to the fact that farms in this country experienced the highest increase in specific revenue (+25%) over the period (Table 4).

Table 4. ROS of the companies producing arable crops in the V4 countries (averaged over 2018–2020). Source: own calculation based on EMIS [40] data.

ROS (%)	Hungary		Czechia		Slovakia		Poland	
	Number of Companies (pc)	Distribution (%)	Number of Companies (pc)	Distribution (%)	Number of Companies (pc)	Distribution (%)	Number of Companies (pc)	Distribution (%)
<0	74	9.00	2	11.76	48	21.24	245	25.34
0–4.9	239	29.08	5	29.41	98	43.36	101	10.44
5–9.9	225	27.37	4	23.53	41	18.14	102	10.55
10–14.9	125	15.21	4	23.53	23	10.18	100	10.34
15–19.9	79	9.61	1	5.88	9	3.98	71	7.34
>20	80	9.73	1	5.88	7	3.10	348	35.99
Total	822	100.00	17	100.00	226	100.00	967	100.00
Weighted mean	7.73		6.35		4.56		9.54	
Relative standard deviation (%)	100		160		145		479	
Median	6.76		5.36		3.40		11.82	

The evolution of specific income may also be influenced by the level of subsidies. Szabo et al. [17] found in their study for the previous period that the amount of subsidies per hectare was one of the highest for Hungarian farms among the Visegrad Group. In contrast, Slovakia did not reach the EU average in this indicator and lacked adequate assets, which could be explanatory factors for the low profitability indicators, relevant for both the previous and the current period of study.

ROA provides the amount of EBIT that can be generated per unit of asset value. In Hungary, 71.78% of farms fall into the 0–9.9% profitability category, compared to 56.05% for Polish and 71.68% for Slovakian companies. However, 82.35% of Czech companies are in the 0–9.9% range. On the basis of the evaluated three years' data, in Poland and Slovakia, more than 20% of companies operated at a loss (in terms of returns over assets). The share of farms with negative ROA value was the lowest in Hungary. This fact contributed favorably to that the highest weighted mean belonged to Hungarian organizations, as found by Galaczka et al. [21], and the median value was close to this. The weighted mean and median values of the asset-based profitability of Slovak, Polish, and Czech companies are almost similar (Table 5). This study did not evaluated the development of the ratio of fixed assets, but the authors agree with the finding of Galaczka et al. [21] that the ratio of fixed assets has a significant impact on the development of ROA, especially for agricultural enterprises, which are characterized by fundamentally lower values compared to other enterprises in other economic activities.

Table 5. ROA of the companies producing arable crops in the V4 countries (averaged over 2018–2020). Source: own calculation based on EMIS [40] data.

ROA (%)	Hungary		Czechia		Slovakia		Poland	
	Number of Companies (pc)	Distribution (%)	Number of Companies (pc)	Distribution (%)	Number of Companies (pc)	Distribution (%)	Number of Companies (pc)	Distribution (%)
<0	68	8.27	2	11.76	46	20.35	212	21.92
0–4.9	339	41.24	8	47.06	129	57.08	342	35.37
5–9.9	251	30.54	6	35.29	33	14.60	200	20.68
10–14.9	103	12.53	1	5.88	15	6.64	90	9.31
15–19.9	29	3.53	0	0.00	3	1.33	45	4.65
>20	32	3.89	0	0.00	0	0.00	78	8.07
Total	822	100.00	17	100.00	226	100.00	967	100.00
Weighted mean	5.24		3.84		2.75		3.52	
Relative standard deviation (%)	97		177		143		182	
Median	5.09		3.33		2.21		3.91	

The equity to total asset ratio shows the proportion of equity capital in the total assets. Based on this ratio, the Hungarian farms included in the analysis had the most favorable value (above 70%), with a slightly higher median value, similar to the situation observed for Polish companies. For Czech and Slovak farms, the weighted mean and median values were almost identical. In terms of class distribution, 60.58% of Hungarian farms were categorized as the most capital-intensive category, compared to 44.88% of Polish, 26.11% of Slovak, and 35.29% of Czech organizations. However, for Polish and Slovakian companies, almost a quarter of the sample fell into the critical category (below 30%). These companies relied significantly on external financing (Table 6).

Table 6. Equity to total asset ratio of the companies producing arable crops in the V4 countries (averaged over 2018–2020). Source: own calculation based on EMIS [40] data.

Equity to Total Asset Ratio (%)	Hungary		Czechia		Slovakia		Poland	
	Number of Companies (pc)	Distribution (%)	Number of Companies (pc)	Distribution (%)	Number of Companies (pc)	Distribution (%)	Number of Companies (pc)	Distribution (%)
0–29.9	39	4.74	2	11.76	59	26.11	235	24.30
30–49.9	93	11.31	4	23.53	60	26.55	130	13.44
50–69.9	192	23.36	5	29.41	48	21.24	168	17.37
>70	498	60.58	6	35.29	59	26.11	434	44.88
Total	822	100.00	17	100.00	226	100.00	967	100.00
Weighted mean	72.11		62.91		47.12		57.15	
Relative standard deviation (%)	28		30		57		71	
Median	75.30		63.65		48.66		65.05	

Comparing the equity to total assets ratio and the figures of financial efficiency (ROS, ROA) of the countries, it can be concluded that higher financial profitability was associated with a lower debt rate in the capital structure. This result aligns with the findings of Fenyves et al. [18], which indicated that more profitable firms in Czechia, Hungary, and Poland were less likely to rely on debt.

The possible correlation between farm size and its financial efficiency was also investigated. After conducted the Kolmogorov–Smirnov and Shapiro–Wilk tests, it was evident that neither variable in the sample followed a normal distribution. Therefore, Spearman correlation analysis was performed. Overall, contrary to the literature [22,30], statistically significant correlations between the indicators representing the company size (net sales revenue and total assets) and financial efficiency indicators (ROS, ROA) were mostly not evident in the examined sample data (Table 7).

Table 7. Results of correlation analysis between company size and financial efficiency. Source: own calculation based on EMIS [40] data.

Country	Variable 1	Variable 2	Correlation Coefficient (r) (Spearman)	*p*-Value
Hungary (n = 2466)	ROS	Net sales revenue	−0.014	0.491
	ROS	Total assets	0.105	0.000
	ROA	Net sales revenue	0.021	0.290
	ROA	Total assets	−0.085	0.000
Czechia (n = 51)	ROS	Net sales revenue	0.014	0.921
	ROS	Total assets	0.346	0.013
	ROA	Net sales revenue	−0.002	0.991
	ROA	Total assets	0.204	0.152
Slovakia (n = 678)	ROS	Net sales revenue	−0.021	0.596
	ROS	Total assets	−0.014	0.729
	ROA	Net sales revenue	−0.026	0.520
	ROA	Total assets	−0.012	0.763
Poland (n = 2901)	ROS	Net sales revenue	−0.016	0.395
	ROS	Total assets	0.000	0.981
	ROA	Net sales revenue	0.212	0.000
	ROA	Total assets	−0.082	0.000

For Hungarian companies engaged in arable crop production, there is a weak positive correlation between total assets and ROS (r = 0.105), and a weak negative correlation between total assets and ROA (r = −0.085). This suggests that changes in total assets, as a measure of company size, are not strongly associated with predictable changes in ROA and ROS. For Czech companies, there is a slightly stronger but still weak correlation between total assets and ROS (r = 0.346). In the case of Polish companies, weak positive correlations are observed between net sales revenue and ROA (r = 0.212), and weak negative correlations are found between total assets and ROS (r = −0.082).

Overall, the finding indicates that, based on the examined sample, there is no close relationship between farm size and financial efficiency in the case of companies engaged in arable crop production in the V4 countries. Furthermore, changes in farm size do not consistently correspond to changes in financial efficiency.

It was also examined whether there is a detectable relationship between farm size and profit based on data from sample companies in the V4 countries (Table 8). The results show that there is a moderate positive correlation between net sales revenue and EBIT, as well as between total assets and EBIT for companies in each country. In other words, there is a statistically significant relationship between the variables, but it is not extremely strong. Our result is consistent with the findings of Ren et al. [29]. We can conclude that as farm size increases, the profit (EBIT) also tends to increase, but the magnitude of this effect varies among the companies in different countries.

Table 8. Results of correlation and regression analysis between company size and profit. Source: own calculation based on EMIS [40] data.

Country	Dependent Variable (Y)	Independent Variable (X)	Correlation Coefficient (r) (Spearman)	*p*-Value	Linear Regression Model ($Y = \beta_0 + \beta X$)	Coefficient of Determination (R^2)	*p*-Value
Hungary (n = 2466)	EBIT	Net sales revenue	0.464	0.000	Y = 0.048 + 0.058X	0.265	0.000
	EBIT	Total assets	0.477	0.000	Y = 0.048 + 0.039X	0.256	0.000
Czechia (n = 51)	EBIT	Net sales revenue	0.292	0.038	Y = −0.075 + 0.111X	0.177	0.002
	EBIT	Total assets	0.552	0.000	Y = −0.094 + 0.074X	0.354	0.000
Slovakia (n = 678)	EBIT	Net sales revenue	0.402	0.000	Y = −0.028 + 0.055X	0.253	0.000
	EBIT	Total assets	0.418	0.000	Y = 0.032 + 0.021X	0.229	0.000
Poland (n = 2901)	EBIT	Net sales revenue	0.546	0.000	Y = 0.003 + 0.096X	0.605	0.000
	EBIT	Total assets	0.401	0.000	Y = −0.044 + 0.054X	0.535	0.000

The weight of the variable (β) in the linear regression model indicates how much the EBIT is expected to increase with a unit increase in total assets or net sales revenue. For Hungarian companies, a unit increase in total assets leads to nearly twice the profit increase compared to Slovak companies. However, in the case of Czech companies, this linear relationship is even more favorable than that of Hungary. For Polish and Czech companies, a unit increase in net sales revenue results in nearly twice the profit increase compared to Hungary and Slovakia.

Overall, it is important to note that the coefficient of determination (R-squared) for the linear models is generally low. This lower R-squared value indicates a weaker fit of the model to the data, meaning that a smaller proportion of the variance in the dependent variable can be explained by the independent variable. Therefore, the presented correlations and linear regression model should be interpreted with caution.

5. Conclusions

The analysis of companies engaged in arable crop production in the V4 countries yielded several important findings. In Poland and Czechia, a significant proportion of the companies filtered from EMIS were classified as micro-enterprises, while in Hungary and Slovakia, they were predominantly small farms. When examining concentration by net sales revenue and total assets, the pattern suggests a more efficient use of assets in larger Polish companies, while smaller companies appear to have a less efficient use of assets compared to farms operating in the other three countries. The Gini index indicates a high concentration of Polish farms, a medium concentration of Hungarian and Slovakian farms, and a low concentration of Czech companies.

Regarding financial profitability, Slovak companies had the highest net sales revenue per farm but showed the worst profitability indicators and the lowest equity to total asset ratio. Polish farms had the most favorable average measures of ROS (9.54%), but the lowest farm size based on net sales revenue and the lowest income per farm. However, this favorable average ROS value can be attributed to the high proportion of micro-enterprises with high profitability (above 20%) and the high concentration of companies in the country. Hungarian business organizations had the highest values in terms of ROA (5.24%) and equity to total asset ratio (72%).

Overall, in terms of financial profitability, Hungarian and Polish companies are the most favorable, while Slovak farms are the least favorable. Polish companies exhibit significant heterogeneity, which may also be attributed to high concentration. The results suggest that higher financial profitability is associated with a lower debt rate in the capital structure.

The correlation analysis results indicate that, based on the examined sample, there is no close relationship between farm size and financial efficiency in the case of companies

engaged in arable crop production in the V4 countries. Therefore, changes in farm size do not consistently correspond to changes in financial efficiency. It also can be concluded that as farm size increases, the profit (EBIT) tends to increase, but the magnitude of this effect varies among the companies in different countries. Due to the low R-squared value of this correlation, caution should be exercised in interpreting the results, as other factors also influence the financial performance of agricultural companies.

The study's findings also support that not only the average yield but also other factors play a role in the development of profitability [1]. These factors may include the level of subsidies and other financial and managerial aspects.

The results of this study can contribute to the identification of areas for development of business organizations producing arable crops in the Visegrad Group countries and can serve as a starting point for policymakers. Continuous monitoring of European agricultural performance is essential to identify long-term trends, develop forecasting models, and facilitate future improvements in the sector's support strategies and legislative frameworks [37].

It is essential to highlight some limitations that significantly influenced the development of the results. The study analyzed companies that may have more activities (mixed business profile), as it was not possible to filter out complementary activities. Additionally, the analysis of the average yields has been based on national data, including data from both individual farms and companies. The small sample size for Czechia also restricts the generalization of results regarding the entire country's agriculture. Therefore, these limitations should be considered and taken into account when interpreting the findings.

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