sustainability

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Assessing the Economic Viability of Agricultural Holdings with the Inclusion of Opportunity Costs

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Abstract: A key area of sustainable agriculture is the economic sustainability of agricultural holdings. Agricultural holdings should achieve such an income that they are able to cover all of their costs. As part of this study, an indicator of entrepreneurial income and an indicator of economic profit were proposed. Economic profit, in contrast to entrepreneurial income, considers the costs of lost opportunities, so-called opportunity costs. For this purpose, three indicators of the opportunity costs of production factors of labor, land, and capital were defined and calculated. To assess economic profit between different groups of holdings, an economic viability index is established, which identifies a holding as sustainable or at risk. This indicator is composed of the entrepreneurial income indicator and the difference between entrepreneurial income and economic profit. Based on FADN data of a five-year time series, it was confirmed that extensive holdings specializing in grazing livestock are among the most economically endangered subjects. The highest proportion of sustainable holdings was found in holdings specializing in milk production. From the size point of view, small holdings are most endangered, which was confirmed for all production focuses. In contrast, more large and very large holdings were included in the group of viable holdings.

Keywords: sustainability; viability of farms; opportunity costs; economic profit; farm typology; economic viability; production factors; farm accountancy data network

Citation: Hloušková, Z.; Lekešová, M.; Prajerová, A.; Doucha, T. Assessing the Economic Viability of Agricultural Holdings with the Inclusion of Opportunity Costs. *Sustainability* **2022**, *14*, 15087. https://doi.org/10.3390/su142215087

Academic Editor: Antonio Boggia

Received: 12 October 2022
Accepted: 9 November 2022
Published: 14 November 2022

1. Introduction

The Common Agricultural Policy currently addresses many long-term issues, but it also has to deal with new issues. It can be simply stated that, from a long-term perspective, the CAP (Common Agriculture Policy) in the EU is aimed at supporting the income of farms to reach a balanced productive agriculture. The relatively new focus of a green Europe aims at the mutual reciprocity of many diverse aspects with an emphasis on the environment. However, the economic sustainability of agricultural enterprises cannot be neglected in the picture of new policy goals. The research is focused on the issue of the dual farm structure, which is characterized by the different nature of two groups of agricultural enterprises and occurs especially in countries that have undergone the transformation of agriculture. The dual farm structure in agriculture is relatively unusual among EU states, for which the generally applied EU methodology is not sufficient. For this reason, we proceeded with the proposal of a methodology that will allow an objective assessment of the economic situation of farms in this non-standard environment. The aim of this paper is to provide knowledge for the evaluation of farms in an environment with a significant dual farm structure, such as in the Czech Republic.

Data from a Farm Accountancy Data Network (FADN) sample survey are used in EU countries to assess the economic situation of agricultural holdings. Establishment of a FADN survey and its administration according to harmonized rules is one of the conditions for joining the EU. In the Czech Republic, these data from the FADN survey have been available since 2004. The advantages of using FADN data are considerable. The

database contains information on both the structure of the holding and its production, costs, financial situation, received subsidies, and economic results. The survey is carried out regularly every year when the same comparable indicators are available. Harmonized methodology ensures comparability between individual EU states. A wide spectrum of classification enables results to be found for different types of holdings. Tracking data at the company level serve to support a microeconomic view of the economic management of agricultural entities. Last but not least, representativeness of the obtained data for the region, production focus, and economic size according to the unified typology of agricultural holdings in the EU is methodologically ensured. Unfortunately, in addition to a wide list of advantages, certain limits can also be discussed in the use of data from the FADN database, which are mainly caused by changes in society, economic developments, as well as shifts in the needs of agricultural and environmental policy. These are, for example, changes in methodological guidelines over time, which can cause difficulties when evaluating results in a time series, or a narrowly specified list of monitored and published indicators that adapts to the above-mentioned changes over time. This article is focused on the final indicators of the economic management of agricultural holdings, as defined by FADN standard results [1]. FADN standard results are a set of indicators that are calculated according to uniform formulas and are commonly used in EU member states and the European Commission.

In connection with the preparation of the new CAP in the EU, the question of which kinds of farms may be threatened by the effects of the agricultural policy has raised again. In the EU environment, employing FADN impact indicators for evaluating income does not allow for a unified view of farms due to their dual structure in some countries. One of these countries, where the dual structure of farms is very pronounced, is the Czech Republic.

The dual structure of farms can be described by the high difference between the two groups of enterprises. In the Czech Republic, one of the groups is a group of large enterprises, which contains a smaller number of farms, but produces most of the agricultural production. Large companies are legal entities and are in a better position to obtain bank loans. The second group is smaller-sized businesses. These are mostly family farms with a predominance of unpaid labor and owned land. These differences do not allow identification of the real threat to farms from changes in the impact of agricultural policies.

Standard results contain several indicators that are considered indicators of the economic result of agricultural holdings. These are gross farm income (total output minus intermediate consumption plus balance current subsidies and taxes), farm net value added (gross farm income minus depreciation), and farm net income (farm net value added minus total external factors plus balance subsidies and taxes on investments). Total external factors include wages paid, rent paid, and interest paid. The final indicator does not take into account the costs of unpaid labor, the owned land, and the equity capital, which are available to agricultural holdings. In practice, the valuation of own factors is approached as the valuation of lost opportunity costs, also known as opportunity costs. Opportunity costs are an important component for assessing the long-term viability of a holding. Czech agriculture has an extreme and, among EU countries, unique dual structure; on the one hand, large holdings, which mainly use paid employees, rent land, and use external capital intensively, and, on the other hand, smaller entities (often family farms), which use mostly unpaid family workers, manage their own land, and use external capital on a smaller scale. In view of this fact, the question arises as to whether the indicator farm net income, which should represent the final profit of business activity, is the most suitable indicator for comparing economic results among all agricultural entities in the Czech Republic.

The authors are searching for a way to compile an indicator, here called the economic viability index, that would solve the shortcomings of the current impact indicators. The intention is to enable the assessment of policy impacts from a production sector perspective as a farm size perspective without the necessity to separate family farms and legal entities. This means objectively assessing the threats to both groups of businesses.

The novelty of the research comes from the design of a method that enables the evaluation of economic viability between economic subjects with a different approach to business. It brings the comparability of results into an environment with a dual character of business and thus enables a more accurate setting of agricultural policy measures.

Within this study, an economic viability index was designed, and opportunity costs of labor, land and capital were calculated for various farming specializations and economic size classes. The economic viability index identifies the farm as sustainable or endangered. Moreover, since the data are based on the FADN methodology, the method can also be applied to other EU countries. The findings are very important as they enrich the knowledge of the farms' economic viability and they allow them to target agricultural policies to the appropriate group of farmers.

Within this study, we discuss the possibility of using opportunity costs for the evaluation of the economic viability of agricultural holdings in the Czech Republic, the design of indicators of opportunity costs, and subsequent final economic indicators using the FADN database, including the assessment of the results found.

1.1. Sustainability and Viability

The FADN is used in the European Union to assess the economic (income) level of agricultural holdings, to plan strategic measures of the Common Agricultural Policy, and also to retrospectively evaluate previously adopted political measures. The aim is to ensure functional agriculture, i.e., food production, biodiversity, clean environment, permanent qualitative soil potential and improvement, the settlement of a functioning countryside and, last but not least, the viability of agricultural holdings, which have an impact on all the areas mentioned. The aim of the CAP, together with national (state) aid and other measures, is therefore permanent sustainability based on production, economic, environmental, and social areas. In his recent study, Darnhofer [2] considers the prospective possibility of changing the CAP and the approach of holdings to the benefit of sustainability and resilience. Indicators of the economic sustainability of agricultural holdings include among others information on profitability, productivity and viability [3]. Viability in relation to economic sustainability in agriculture was analyzed by O'Donoghue et al. [4] using supplemented data to the FADN survey; comparing eight states, they identified the highest proportion of economically sustainable holdings in Germany, and the lowest in Poland. The authors concluded that there are several definitions in the literature that explain the concept of economic viability. However, the emphasis is on the farmer making a living. In some studies, there is also a requirement for returns from on-farm investment. Views differ on whether to consider viability as a farm household welfare measure or an opportunity cost measure.

To determine the viability of agricultural holdings in this study, indicators constructed on the basis of the accounting results and the value of evaluated opportunity costs are used.

The EU pilot study [4] compared the viability of eight EU member states based on FADN data. The broad model of viability, identifying sustainable and vulnerable farms, was constructed as:

$$\frac{FFI - COC}{HWF} > TW, \tag{1}$$

where *FFI* is family farm income, *COC* is cost of own capital, *HWF* is hours worked on the farm, and *TW* is threshold wages.

One of the most recently published outputs was prepared by Hlavsa et al. [5], who proposed the farm economic viability (FEV) indicator. This indicator considers only opportunity costs of labor and capital and is calculated based on the following formula:

$$FEV = \frac{FNVA - RP - (IP + OCC)}{W + OCL}, \tag{2}$$

where *FNVA* stands for farm net value added, *RP* is rent paid, *IP* is interest paid, *OCC* is opportunity costs of capital (including land), *W* is wages, and *OCL* stands for opportunity costs of labor.

An agricultural holding is economically viable if the *FEV* value is greater than one. If it is lower than or equal to one, then a holding is considered unviable from the point of view of its further development.

The European Commission 2018 [6] classified agricultural holdings from the FADN survey between 2004 and 2013 according to their farm net income compared to opportunity costs and depreciation. Four classes were compiled from the results: (1) income > opportunity costs; (2) income is still positive; (3) delayed depreciation; and (4) financial distress. The largest share of holdings classified in class 3 and 4 was in 2009. Conversely, the largest share of the sustainable group of holdings (class 1 and 2) was found in 2007.

To assess the viability of agricultural holdings, an estimate of the costs of lost opportunities is used [3,4,7]. It stands for lost activities in which the holdings could put their own production factors if they did not run the farm business activity. The advantage of this approach lies in the possibility of comparing the economic results of holdings using mainly external resources with holdings that use their own resources. In addition, the different structure and degree of use of own production factors in different types of agricultural holdings requires the inclusion of opportunity costs for a more objective assessment of economic profit. Opportunity costs of own production factors are equivalent to external factors which, unlike own factors, are already considered in the final management indicator (farm net income).

1.2. Opportunity Costs

The costs of lost opportunities, so-called opportunity costs, are estimated for production factors in agriculture, which include unpaid labor, land owned, and equity capital. Opportunity costs are not part of the FADN business data database. Another component for the overall determination of the economic viability of holdings is off-farm income, which is important for assessing the situation of smaller holdings [8,9]. The FADN system does not contain this information and cannot be ascertained in any way other than direct investigation; therefore, it is often not included in the viability assessment. These data were supplemented, for example, in the FLINT project [4].

The opportunity costs of unpaid labor express the income that the entrepreneur would receive if he/she were to terminate his/her entrepreneurial activity and work as an employee. For small-scale sole proprietorships, this item contains a large volume of opportunity costs. The different authors lean towards different approaches for determining wage costs that are used to value unpaid labor. Here, one can consider both the employment relationship in agriculture [4] and outside agriculture [10,11] or the workplace in the same region [6,12] or not. Wage costs value the amount of unpaid labor, which in the FADN system is monitored by the indicator of the input of unpaid labor (FWU). For this purpose, the European Commission 2021 [13] applies the calculation of the average hourly regional wage of paid workers in agricultural holdings in the FADN database and the number of hours worked by unpaid labor. In the case of a small number of farms in a region, the national average value is taken into account.

The opportunity costs of equity capital are higher than the cost of external capital because of the higher risk involved in investing one's own funds in a business versus the risk of a creditor. Furthermore, an entrepreneur using equity capital loses the possibility of reducing income tax by deducting cost interest. This is also why it is appropriate to consider the valuation of the cost of equity capital when assessing the economic situation of holdings. An alternative cost for using equity capital can be, for example, depositing capital in a savings account, or income from investing in securities or real estate. Among the methods used for equity capital valuation are, for example, the capital asset pricing model (CAPM), the arbitrage pricing model, and the dividend growth model. These models were built mainly for large corporate firms; they cannot be used to adequately value the cost of

land owned, and therefore are not suitable for agricultural holdings. However, even for determining the viability of agricultural holdings, some authors [4,5,14–16] do not value land owned and use the value of the total property owned. In contrast, other studies [13,17] use an equity capital valuation approach after deducting the value of agricultural land. This approach makes it possible to determine the opportunity cost for the production factor of land separately. The opportunity costs of equity capital can be derived using a certain percentage of the equity capital value in the form of an interest rate. Its amount can be determined, for example, in the form of Eurostat's ten-year government bond yields [16], the long-term interest rate of government bonds for convergence purposes of the European Central Bank [4], or the long-term interest rate for own property from the Global Insight database [13].

In addition, some authors consider a risk premium for depositing capital in a risky environment [18,19], which can be determined in several ways. The value of the risk premium for doing business in a given country is published by Damodaran [20] under an indicator called total equity risk premium. A different approach is applied by agri benchmark (a network of agricultural economists, producers, specialists and advisors in key sectors of the agricultural chain, agribenchmark.org (accessed on 10 September 2022)), which uses a uniform value of 3% for property valuation due to the comparability of results between individual European countries.

The opportunity costs of land owned represent the returns from its alternative use. If the farmers did not carry out their economic activity, then they could rent their land or sell it. Soil differs from other production factors in its non-reproducibility and immobility. Land is permanent, it is not consumed, and thus it is not depreciated as an asset. Approaches to determine the opportunity costs of land also differ. Some authors value land within equity capital [16] and do not specifically single it out. The valuation of land owned, i.e., the alternative income of renting it, can be completed using the average rent rate in a given region or holding [11]. Authors considering the sale of land as an alternative for its pricing use the average market price of agricultural land in the region or in the holding [6,13,17]. In its methodology, agri benchmark uses the equivalent of rent in the value for which the farmer would like to enter into a new lease agreement.

2. Materials and Methods

The case study is located to the Czech Republic. There are 62,151 registered farmers, of which 82% are family farms, and 18% are legal entities. Agriculture covers approximately half (53%) of the country's total area and contributes 2% to the national gross domestic product. There are 4.2 million hectares of agricultural land in the Czech Republic, of which 3 million hectares is arable land. In 2021, the main crop production was cereals (1,334,000 ha), oilseeds (442,000 ha), sugar beet (61,000 ha), legumes (43,000 ha), and others. In livestock, the Czech Republic focuses on production of meat, milk, and eggs. The total number of reared beef cattle is 1.4 million, pigs are 1.5 million, and poultry is 23.8 million. All technologies used in agriculture are comparable to neighboring EU countries. The importance of organic farming is rising (constituting more than 19% of beef cattle and more than 15% of land in 2019).

The FADN database in the Czech Republic [21] was used for this paper. The data set was used for the five-year time series from 2016 to 2020 as the economic viability should be analyzed as a multiannual average [14].

Agricultural holdings were classified according to the typology of agricultural holdings in the EU into the group of holdings specializing in field crops, grazing livestock, milk, and mixed. Furthermore, holdings were classified according to economic size into small (EUR 8000–50,000 of standard output (SO)), medium (EUR 50,000–500,000 of SO), large (EUR 500,000–1,000,000 of SO), and very large (more than EUR 1,000,000 of SO).

The proposed method takes into account opportunity costs of own labor, opportunity costs of land owned, and positive values of opportunity costs of equity capital after deducting the value of owned agricultural land.

On the basis of a literature search, an indicator of the opportunity costs of land (OpC) was determined, which is calculated by multiplying the land owned in hectares and the amount of rent in the given region determined from the FADN database. In this way, the current situation on the agricultural land market is taken into account. This study also works with the opportunity cost of labor indicator (OpCLB), which is determined by multiplying the input of unpaid labor by the farm average wage in the region. Both values are obtained from the FADN CZ database. The last own factor considered is the opportunity cost of capital (OpCA), where the value of the final state of land owned is subtracted from the equity. This difference is then multiplied by the interest rate. To estimate the cost of equity capital, according to the agri benchmark methodology, a uniform 3% interest rate for long-term government bonds is used, which takes into account the risk premium.

Total opportunity costs are the sum of the above individual components according to the following equation:

$$TOpC = OpCLB + OpCL + OpCA, \tag{3}$$

where *TOpC* is total opportunity cost, *OpCLB* is opportunity cost of labor, *CpCL* is opportunity cost of land, and *OpCA* is opportunity cost of assets.

As the final economic indicator, FADN standard results determine the farm net income, which includes investment subsidies. To determine entrepreneurial income, it is necessary to subtract investment subsidies from farm net income. Entrepreneurial income using basic FADN indicators is calculated according to the following equation:

$$EI = TO - IC + BCST - EC - D, \tag{4}$$

where *EI* is entrepreneurial income, *TO* is total output, *IC* is intermediate consumption, BCST is balance current subsidies and taxes, *EC* is external costs, and *D* is depreciation.

In general, accounting profit represents income minus costs; if we subtract the opportunity costs of the entrepreneur's own production factors from this indicator, we obtain economic profit. Using the indicators of the FADN system, economic profit can subsequently be achieved by applying the following equation:

$$EP = TO - IC + BCST - EC - D - TOpC, \tag{5}$$

where *EP* is economic profit, *TO* is total output, *IC* is intermediate consumption, *BCST* is balance current subsidies and taxes, *EC* is external costs, and *D* is depreciation and *TOpC* is total opportunity costs.

The following simple but complex equation is subsequently defined for the calculation of the economic viability index of agricultural holdings:

$$EVI = \frac{EI}{EI - EP}, \tag{6}$$

where *EVI* is economic viability index, *EI* is entrepreneurial income, and *EP* is economic profit.

An economic viability index threshold of 1 has been defined. Farms with an economic viability index equal to 1 make neither a profit nor a loss. Farms whose economic viability index is higher than 1 are likely to be viable in the long term. The higher the index result, the better off the farm is, as it achieves a higher economic profit. Farms with an economic viability index less than 1 generate a loss if we consider opportunity costs. The lower the number, the higher the threat and the risk of leaving the business and the farms viability is likely to be endangered. With a negative result, farms operate at a clear loss even without deducting opportunity costs.

A value of the economic viability index higher than 1 indicates a long-term viable agricultural holding. In contrast, a result that is equal to 1 or lower means that the viability

of the holding is endangered, because it does not have the means for further development, or it must be compensated by a lower standard of living on farms, respectively.

The Mann-Whitney U test was used to determine whether there are statistically significant differences between two independent groups for a single continuous variable with nonparametric distribution. The test was performed for the economic viability index to be compared between groups of farms classified according to type of farming and economic size. The Mann–Whitney U test has many suitable uses, and it should be considered when using ranked data, data that deviate from acceptable distribution patterns, or for when there are noticeable differences in the number of subjects in the two comparative groups [22].

The data were processed in the TIBCO Statistica program.

3. Results

From the data presented, significant differences are evident both between the type of farming and between farms with different economic sizes within individual specializations. Holdings in mixed production and milk production have the highest workload. Usually, large and very large farms employ paid workers, whereas small and medium farms have a larger share of their own labor. Larger holdings have more available external capital, which accounts for almost 40% of total assets for livestock holdings. As the size of the holding increases, the share of land owned and the share of permanent grassland decreases. The effect of size is also evident in the shares of opportunity costs, which is highest for small and medium farms. In contrast, for large and very large farms, the influence of opportunity costs is minimal. The lowest farm net value added per annual work unit (AWU) is found in grazing livestock holdings with a focus on meat production, while the highest farm net value added per AWU is also achieved by grazing livestock holdings, specializing in milk production.

The presented results demonstrate the diversity of Czech agriculture and confirm the need for further research (e.g., how to improve the sustainability of Czech small- and medium-sized farms with a higher share of their own resources). An overview of average values of selected indicators and their comparison between groups of holdings of individual types of farming and economic size is shown in Table 1.

Table 1. Average values of selected indicators for the period 2016–2020.

Type of Farming	Field Crops				Milk			
Economic Size	**Small**	**Medium**	**Large**	**Very Large**	**Small**	**Medium**	**Large**	**Very Large**
Number of observations	241	1204	313	407	28	271	65	241
Annual work unit/100 ha	5.65	2.21	1.57	2.28	8.28	4.28	3.24	3.78
Livestock unit/ha forage crops	0.26	0.61	0.21	0.38	1.09	1.13	0.99	1.10
Share of unpaid labor (%)	94.63	70.42	11.92	2.43	100.00	68.58	4.41	0.00
Total liabilities per total assets (%)	5.69	16.90	27.27	29.18	3.44	17.29	36.29	38.67
Share of rented land (%)	47.05	63.25	80.19	78.44	37.44	54.81	83.56	83.78
Share of permanent grassland (%)	9.14	6.16	4.68	4.20	56.81	54.06	52.69	33.70
Total output per ha (CZK)	33,056	29,775	34,541	46,601	43,124	47,673	40,815	55,137
Total intermediate consumption per ha (CZK)	22,225	19,784	23,302	33,846	29,899	31,207	31,339	42,304
Total subsidies excl. on investments per ha (CZK)	8364	7881	8526	9823	11,307	13,737	14,092	17,997
Farm net value added per AWU (CZK)	12,259	12,932	15,638	17,674	19,141	23,612	18,603	23,784
Total subsidies excl. on investments per total output (%)	33.23	30.31	27.26	26.27	28.71	35.25	38.12	34.99

Table 1. *Cont.*

Type of Farming	Field Crops				Milk			
Economic Size	**Small**	**Medium**	**Large**	**Very Large**	**Small**	**Medium**	**Large**	**Very Large**
Total opportunity costs per ha (CZK)	17,800	7250	1985	2038	31,611	12,757	2172	2219
Total costs per total costs plus opportunity costs (%)	61.16	80.20	94.31	95.69	52.09	76.69	95.47	96.92
Type of Farming	**Grazing Livestock**				**Mixed**			
Economic Size	**Small**	**Medium**	**Large**	**Very Large**	**Small**	**Medium**	**Large**	**Very Large**
Number of observations	632	498	36	10	222	439	177	1002
Annual work unit/100 ha	3.89	2.07	1.63	2.47	7.45	3.19	2.17	2.92
Livestock unit/ha forage crops	0.55	0.58	0.69	0.82	1.10	0.87	0.89	1.20
Share of unpaid labor (%)	96.66	52.70	1.37	0.91	99.09	80.89	4.60	0.11
Total liabilities per total assets (%)	9.08	20.03	27.96	43.08	5.50	16.67	31.55	38.27
Share of rented land (%)	51.71	63.43	76.71	82.80	33.52	61.16	82.21	81.90
Share of permanent grassland (%)	89.07	86.23	73.03	39.87	40.08	29.70	32.43	17.09
Total output per ha (CZK)	16,289	14,918	18,060	34,594	36,572	31,793	30,734	51,373
Total intermediate consumption per ha (CZK)	16,452	14,411	17,601	25,723	22,997	22,507	24,038	39,130
Total subsidies excl. on investments per ha (CZK)	14,310	15,165	14,847	12,337	9593	10,676	10,893	13,324
Farm net value added per AWU (CZK)	8579	11,848	11,786	16,684	16,087	14,334	13,851	19,621
Total subsidies excl. on investments per total output (%)	135.58	145.80	104.76	36.80	51.34	49.62	45.92	28.69
Total opportunity costs per ha (CZK)	15,331	6133	1642	1473	30,128	11,532	1973	1972
Total costs per total costs plus opportunity costs (%)	60.52	78.80	94.58	96.62	53.61	73.81	95.10	96.78

ha—utilized agricultural area, AWU—annual work unit, and source—FADN CZ (2022).

It is clear that the farm type has an influence on the farm's economic viability in the conditions of the Czech Republic. In general, the lowest economic viability index is for grazing livestock farms. The highest viability was found at milk farms.

The lowest level for the economic viability index is found in small-sized holdings for all production focuses. Small field crops and small mixed farms are most endangered. In contrast, large crops and large mixed farms, which achieve the highest economic viability, can be assessed as economically viable. Very large farms achieve the highest economic viability index in the production focus of milk and grazing livestock.

It was found that the largest margin of economic viability between the lower and upper quartile occurs in large and very large farms with a focus on field crops and mixed farming. Conversely, small mixed and milk farms show the lowest variability of this indicator. The results of the distribution of the economic viability index are presented in Table 2. An interesting finding was detected in the lower quartile for very large field crops farms, large milk farms, and large mixed farms. These groups of farms have a negative index in the lowest quartile, although the median value reaches rather high values. The economic results of farms in these groups are negative even without subtraction of the opportunity costs.

Table 2. Descriptive statistics of the economic viability index.

Groups	Mean	Median	Lower Quartile	Upper Quartile	Std.Dev.	Coef.Var.
Field crops	**1.42**	**1.14**	**0.30**	**2.46**	**2.84**	**199.81**
Small	0.42	0.43	0.12	0.76	1.03	246.42
Medium	1.24	1.15	0.47	2.15	2.03	163.88
Large	2.70	2.54	0.41	4.61	4.54	168.24
Very large	1.57	1.51	−0.08	3.34	3.51	223.01
Milk	**1.60**	**1.41**	**0.51**	**2.62**	**2.22**	**138.84**
Small	0.57	0.50	0.24	0.83	0.52	90.77
Medium	1.56	1.39	0.74	2.38	1.94	124.07
Large	1.63	0.91	−0.20	2.91	2.93	180.27
Very large	1.75	1.65	0.44	2.88	2.38	136.30
Grazing livestock	**1.02**	**0.73**	**0.25**	**1.51**	**1.78**	**174.98**
Small	0.59	0.45	0.14	0.86	0.81	136.90
Medium	1.49	1.32	0.57	2.23	2.41	162.15
Large	1.69	1.58	0.41	2.40	1.95	115.15
Very large	2.10	1.78	1.21	3.60	1.66	79.09
Mixed	**1.20**	**0.98**	**0.16**	**2.16**	**2.67**	**223.26**
Small	0.47	0.41	0.16	0.70	0.53	114.55
Medium	1.02	0.97	0.28	1.58	1.74	169.92
Large	1.51	1.22	−0.27	2.83	3.30	219.13
Very large	1.38	1.39	0.08	2.67	3.10	224.87

Source—FADN CZ (2022).

Hlavsa et al. [5] performed a similar analysis, taking into account differences in the production focus of agricultural holdings. Their output confirms the established results of viability; using the FEV indicator (Equation (1)), the least resilient holdings in the livestock grazing group were found, followed by holdings of mixed production. In contrast, different results were found for sustainable (viable) holdings, where the FEV indicator was the highest for field production holdings; however, using the economic viability index calculated here, the highest value was found for the group of holdings specializing in milk production.

In order to divide the holdings according to economic viability, the holdings were classified into two classes of economic viability: (1) the class that contains endangered holdings, whose economic viability index is equal to or less than 1; and (2) the class of viable holdings, whose economic viability index is greater than 1. During the examined five-year period, the same proportion of viable holdings (49.9%) and endangered holdings (50.0%) was found.

The largest share of viable holdings (61%) can be found in milk production. The same share, but of endangered holdings, can be found in the livestock grazing specialization. Field production holdings in the viable group are in the most favorable position, with an average value of 3.04 of the economic viability index. In the endangered group, holdings with mixed production are in the least favorable position, with the economic viability index

of −0.44 (Table 3). The reason can be found in the highest representation of small farms, whose negative index of economic viability lowers the average of the entire group.

Table 3. Representation of enterprises by economic viability class.

Groups	Economic Viability Index		Share of Observations (%)	
	Endangered	Viable	Endangered	Viable
Field crops	**−0.42**	**3.04**	**46.8**	**53.2**
Small	0.22	1.52	84.6	15.4
Medium	−0.12	2.38	45.7	54.3
Large	−2.00	4.62	29.1	70.9
Very large	−1.32	3.61	41.3	58.7
Milk	**−0.19**	**2.73**	**38.8**	**61.2**
Small	0.38	NS	82.1	17.9
Medium	0.03	2.40	35.4	64.6
Large	−0.48	3.93	52.3	47.7
Very large	−0.49	2.90	34.0	66.0
Grazing livestock	**0.16**	**2.37**	**61.3**	**38.7**
Small	0.31	1.69	79.7	20.3
Medium	−0.18	2.64	40.8	59.2
Large	−0.04	2.56	33.3	66.7
Very large	NS	NS	NS	NS
Mixed	**−0.44**	**2.86**	**50.4**	**49.6**
Small	0.32	1.50	87.8	12.2
Medium	0.05	2.06	51.5	48.5
Large	−0.90	3.54	45.8	54.2
Very large	−0.95	3.10	42.5	57.5

NS—not shown for low number of observations, source—FADN CZ (2022).

In a more detailed analysis according to economic size, the largest share of viable holdings was found in the group of large field crops farms. This group is closely followed by large grazing livestock farms and very large milk farms. The highest share of endangered holdings was detected in groups with small holdings of all production focuses (79% of farms and more). The group of small mixed farms shows almost 88% of endangered farms (Table 3).

Testing was performed for a statistically significant difference in the distribution of the economic viability index between groups of holdings of different production orientations and sizes, both for the entire set and for the distribution according to the class of economic viability for the group of endangered and viable holdings.

Hlavsa et al. [5] also found a statistically significant difference in some production orientations, based on testing the analysis of variance between groups of holdings in areas with natural constraints (ANC). In our case, where the economic viability index reflects the opportunity costs of all three production factors, a statistically significant difference in distribution was found between almost all the tested pairs. The hypothesis of the same distribution was only confirmed in five pairs. This is the mean value of the economic viability index for endangered field crops and mixed farms, and field crops and milk farms. For the group of viable farms, three pairs with a statistically similar distribution were found, namely field crops and mixed farms, field crops and milk, and milk and mixed farms (Table 4).

Table 4. Analysis of statistically significant differences in the distribution of the economic viability index between groups of agricultural enterprises with different production orientations.

Compared Groups A–B	Rank Sum A	Rank Sum B	U	Z	*p*-Value	Nb. of Observation A	Nb. of Observation B	Sig.
All								
Mixed-field crops	3,565,207	4,456,808	1,871,487	−3.299	0.001	1840	2165	*
Grazing livestock-field crops	1,774,566	3,808,245	1,082,490	−7.155	0.000	1176	2165	*
Milk-field crops	886,082	2,951,753	607,058	2.752	0.006	605	2165	*
Mixed-grazing livestock	2,860,666	1,688,970	996,894	3.645	0.000	1840	1176	*
Mixed-milk	2,174,734	815,501	481,014	−5.018	0.000	1840	605	*
Grazing livestock-milk	960,845	626,026	268,769	−8.461	0.000	1176	605	*
Endangered farms								
Mixed-field crops	876,972	1,007,739	445,916	−1.955	0.051	928	1013	
Grazing livestock-field crops	676,524	827,721	314,130	4.968	0.000	721	1013	*
Milk-field crops	151,150	628,226	114,635	0.882	0.378	235	1013	
Mixed-grazing livestock	696,320	664,105	265,264	−7.223	0.000	928	721	*
Mixed-milk	530,346	146,520	99,290	−2.120	0.034	928	235	*
Grazing livestock-milk	353,965	103,481	75,751	2.439	0.015	721	235	*
Viable farms								
Mixed-field crops	918,043	1,213,037	501,715	−1.755	0.079	912	1152	
Grazing livestock-field crops	309,072	982,956	205,332	−6.771	0.000	455	1152	*
Milk-field crops	273,172	885,831	204,537	−1.167	0.243	370	1152	
Mixed-grazing livestock	660,458	274,570	170,830	5.329	0.000	912	455	*
Mixed-milk	583,732	238,671	167,404	−0.219	0.827	912	370	
Grazing livestock-milk	171,900	168,825	68,160	−4.704	0.000	455	370	*

Mann-Whitney U Test (w/continuity correction) marked tests are significant at * $p < 0.05$, source–FADN CZ (2022).

From the economic point of view, the results confirm that economic viability varies between different farming groups. Grazing livestock stands out compared to other groups. This is because there are mostly small farms in this group. They are mainly extensive cattle breeding farms in foothills and mountain locations, which must be maintained despite the lower economic performance due to the lower productivity. According to the results found, as is discussed in the next section, it is confirmed that this is the most endangered group of businesses.

When assessing the difference in the mean value (median) of the economic viability index from the perspective of farm size, a large influence of this aspect was found. Only

between the groups of endangered small and medium farms was the null hypothesis of the same distribution accepted. Testing other pairs confirmed a statistically significant difference in the distribution between holdings of different sizes (Table 5). These results prove the impact of the dual farm structure. Large farms are likely to be the most sustainable. This finding is in line with the new strategic plan of the Czech agricultural policy focusing on the small farm support.

Table 5. Analysis of statistically significant differences in the distribution of the economic viability index between different sized groups of agricultural holdings.

Compared Groups A–B	Rank Sum A	Rank Sum B	U	Z	*p*-Value	Nb. of Observation A	Nb. of Observation B	Sig.
All								
Very large–small	2,631,205	1,242,731	611,605	15.411	0.000	1660	1123	*
Very large–medium	3,507,808	4,784,820	1,874,742	3.451	0.001	1660	2412	*
Very large–large	1,819,894	714,732	441,264	−3.631	0.000	1660	591	*
Small–medium	1,416,102	4,833,778	784,976	−20.153	0.000	1123	2412	*
Small–large	837,312	632,443	206,186	−12.902	0.000	1123	591	*
Medium–large	3,509,277	1,001,229	599,199	−6.011	0.000	2412	591	*
Endangered farms								
Very large–small	416,699	870,511	186,518	−13.902	0.000	678	926	*
Very large–medium	471,530	1,065,851	241,349	−11.924	0.000	678	1075	*
Very large–large	310,826	91,030	67,159	2.028	0.043	678	218	*
Small–medium	923,236	1,079,765	494,035	−0.286	0.775	926	1075	
Small–large	582,237	72,703	48,832	11.871	0.000	926	218	*
Medium–large	745,817	90,754	66,883	10.004	0.000	1075	218	*
Viable farms								
Very large–small	639,378	56,232	36,729	13.756	0.000	982	197	*
Very large–medium	1,314,832	1,375,208	480,755	11.029	0.000	982	1337	*
Very large–large	629,196	289,494	146,543	−5.689	0.000	982	373	*
Small–medium	98,669	1,078,676	79,166	−9.050	0.000	197	1337	*
Small–large	29,707	133,028	10,204	−14.191	0.000	197	373	*
Medium–large	1,034,719	428,186	140,266	−12.936	0.000	1337	373	*

Mann-Whitney U Test (w/continuity correction) marked tests are significant at * $p < 0.05$, source–FADN CZ (2022).

4. Discussion

In general, farm economy and incomes are usually measured in the EU by the so-called indicator A (farm net value added per AWU), but also by the entrepreneurial income. Any interpretations of the mentioned indicators across different farm categories are influenced in the Czech conditions by the extreme dual farm structure. The Czech dual farm structure is characterized by the existence of a relatively low number of very large farms with a very low share of unpaid labor and own land, and at the same time with many small and medium enterprises (SMEs) as family farms in the majority of cases, with just a contrary prevailing share of unpaid labor and own land. To objectively assess the real economic situation of farms under the mentioned dual farm structure is a problem that is not so important in EU countries with a relatively homogeneous (non-dual) farm structure. The

inclusion of opportunity costs in the complex assessment of the real economic situation of farms is therefore very important in the Czech Republic. This kind of assessment has also been used in the preparation of the Czech strategic plan for the CAP 2023+ and has been reflected, e.g., in a very high level (23%) of the so-called redistribution of direct payments to the benefit of smaller farms, the highest level in EU countries. The 23% redistribution in the Czech policy means that this share of the basic income support system (BISS–the main part of direct payments in the CAP) is used for an additional payment per ha for the first 150 ha of each farm, regardless of its size.

From the results found, in accordance with the conclusions of other studies [12,23–25], it can be stated that the least developable and economically viable holdings are oriented on extensive production, as are, for example, livestock grazing holdings in the Czech Republic. One of the reasons why farmers focused on grazing livestock do not leave agriculture is the fact that they are in remote areas where there is not a large availability of other livelihood opportunities. The continuation of their agricultural activities is important for the preservation of the rural settlement and its further development.

A study of the technical efficiency of milk farms in EU countries states in its conclusions that holdings classified in a narrowly specialized milk production are less efficient and can achieve an increase in efficiency by diversifying activities [25]. This article, however, using the economic viability indicator, points out that holdings of mixed production are endangered to a greater extent, although the largest share of milk produced in the Czech Republic comes from mixed holdings. In addition, the type of production focus also has an impact on the development of costs (e.g., rent) due to changes in individual CAP measures [26,27].

Based on a set of European agricultural holdings, Baležentis et al. [28] confirmed that their economic profit increases with their size. This follows on from the finding that higher resilience is achieved by larger holdings, and, in contrast, small holdings are endangered from the point of view of economic viability in the conditions of the Czech Republic. A similar suggestion was also proposed by Coppola et al. [29] who analyzed the economic viability of farms in Italy. Moreover, Biagini et al. [30] concluded that the benefits from the large-scale farm structure can also be applied to the efficiency of income gained from CAP measures.

A high share of endangered enterprises is in the group of the smallest enterprises. There is a high risk of leaving agriculture for these businesses. This leads to the question of why these businesses do not abandon agriculture, and why they do not take advantage of other livelihood opportunities. One of the reasons can be the off-farm income of farms. Off-farm income can cover a significant share of the total income of family farms. However, the FADN system does not currently track this income. The differences between the size, production orientation, and natural conditions of agricultural holdings are particularly significant in Czech agriculture. One of the key areas of sustainability in agriculture is the economic sustainability of agricultural holdings. For its assessment, an indicator called the economic viability index was established. According to the index, agricultural holdings were classified into two groups: viable and endangered. This indicator includes estimates of opportunity costs of all three production factors—labor, land, and capital. Based on the data of the five-year time series, it was confirmed that among the most economically endangered subjects are extensive holdings specializing in livestock grazing. The highest proportion of sustainable holdings was found in holdings focused on milk production. From the size point of view, small holdings are most endangered, which was confirmed for all production orientations. In contrast, more large and very large holdings were included in the group of viable holdings. This finding confirms the need to support the viability and resilience of smaller, extensive farms. These are farms focused on grazing livestock. These farms are located in remote areas that need to be maintained in a sustainable way. Agriculture is important to preserve employment and social interaction so that the countryside is not abandoned. A relevant type of this kind of support is redistribution. This methodology was applied as one of the impact assessment factors for its determination. The redistribution is

also aimed at small farms, to which it contributes a relatively large share of direct payments on the first 150 hectares. From the point of view of EU policy, the high value of this support in the Czech Republic is unique, in that it also emphasizes the need to support small farms. To continue this research, there could be deeper examination of the group of endangered holdings, of all size groups, with a focus on identifying the causes of their non-viability. These findings could help to identify effective CAP tools to increase the resilience of the vulnerable farms identified in this study.

At the same time, the proposed indicator could be used for modelling the impact of future agricultural policies, for their optimization, and for evaluation of current tools. Any dual structure provokes e.g., questions about the efficiency of flat policy measures. The extreme dual structure of Czech farms thus stimulates further research following the need to respect this structure in shaping agricultural policy instruments, to look for the improvement in the economic viability of smaller farms and for a higher internal (national) convergence in this area among different farm categories. Another important politically sensitive question arises from the presented findings: how strong is the resilience of small Czech farms in particular, and what stimulates them to survive and to continue in business? This, however, is a question mainly for sociologists.

Author Contributions: Conceptualization, Z.H. and M.L.; formal analysis, Z.H. and M.L.; investigation, Z.H. and A.P.; methodology, M.L. and T.D.; project administration, A.P.; validation, Z.H., M.L. and A.P.; writing—original draft, Z.H., M.L. and A.P.; writing—review and editing, Z.H., M.L., A.P. and T.D. All authors have read and agreed to the published version of the manuscript.

Funding: This study was supported by the Ministry of Agriculture of the Czech Republic, institutional support MZE-RO0922 (1281/2022).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy restrictions (GDPR).

Conflicts of Interest: The authors declare no conflict of interest.

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