https://doi.org/10.17221/327/2019-AGRICECON

Statistical analysis of economic viability of farms operating in Czech areas facing natural constraints

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Citation: Hlavsa T., Spicka J., Stolbova M., Hlouskova Z. (2020): Statistical analysis of economic viability of farms operating in Czech areas facing natural constraints. Agric. Econ. – Czech, 66: 193–202.

Abstract: The redesign of the Common Agricultural Policy (CAP) allows for more room to address issues related to stabilising farmers' income and developing their viability in areas facing natural constraints (ANC). Maintaining income levels, developing farm economies in rural areas, and encouraging competitive agricultural practises are the challenges facing the new CAP. ANCs in the Czech Republic are characterised by a lower level of income compared to areas outside ANCs and their generally prevailing specialisation in livestock production, which has been facing a relatively turbulent development in the last decade. The main aim of this paper is to evaluate the economic viability with regard to the level of natural disadvantage and with regard to farm specialisation. The database of Farm Accountancy Data Network (FADN) was used for assessment; the authors built the Farm Economic Viability indicator, which is based on modified Farm Net Value Added. The differences between the farm groups were tested through analysis of variance. Significantly lower viability was found in ANCs compared to farms outside ANCs. Field crops achieved significantly higher levels, both in and outside ANCs. The most threatened group of farms are grazing livestock in ANCs.

Keywords: agriculture; analysis of variance; areas facing natural constraints; farm economic viability; farm specialisation

Support for farms in areas with natural constraints (ANC) is related to the "European model" of agriculture in which agriculture plays a role not only in food production but also in the maintenance of the cultural landscape, environment and biodiversity as defined in the Cork Declaration (1996). Following the objectives of the current CAP payments to farmers in mountain areas or other areas facing natural or other specific constraints should, by encouraging continued use of agricultural land, contribute to maintaining the countryside as well as to maintaining and promoting sustainable farming systems. The purpose of ANC payments is to provide compensation to farmers for the natural or specific disadvantages of farming in areas with natural or specific handicaps "by encouraging continued use of agricultural land and contributing to maintaining the countryside as well as to maintaining and promoting sustainable farming systems. To ensure the efficiency of such support, payments should compensate farmers for income foregone and additional costs linked to the disadvantage of the area concerned" (European Parliament and the Council of the European Union 2013). The compensation payment shall ensure the economic viability of farms in the countryside, especially in mountain areas.

The Czech Republic has a specific farm structure. It has the highest average farm size (130 ha) compared to other EU countries; farms with up to 100 ha of utilised agricultural area (UAA) cultivate only 12% of agricultural land (Land Parcel Information System 2018).

Supported by the Institute of Agricultural Economics and Information Prague, Czech Republic, Internal Research Grant (IVP) No. 1297/2019.

https://doi.org/10.17221/327/2019-AGRICECON

Similar farm structure can be found in ANCs. Agriculture holdings with more than 1 000 ha of UAA represent only 2% of farms in ANCs but cultivate around 44% of UAA in ANCs. On the contrary, around 79% of farms in ANCs are those with less than 50 ha UAA, these farms being mostly family farms that cultivate around 10% of UAA in the ANC. It is necessary to take this into consideration when proposing indicator measuring and comparing farm viability.

Economic viability has no universal definition. A recent study (O'Donoghue et al. 2016) compares different definitions of economic viability in previous literature. The crucial finding is a difference between the US and the European concepts of economic viability. Whereas the US and Canadian experts define viability in terms of meeting the income needs of the farm family, the European definitions understand viability as an opportunity cost measure. One of the older but more comprehensive cash flow-based definitions by US authors states that a farm is defined as economically viable when it generates a certain "level of annual cash income sufficient to cover farm operating costs, meet the households minimum consumption needs, replace capital items at a rate that ensures constant serviceability of the capital stock, and finance loan retirement as scheduled" (Smale et al. 1986).

A later definition of economic viability (Hennessy et al. 2008) considers not only the minimum consumption needs of families but also extra, risk-free revenue in the form of a 5% return on non-land assets, which include machinery, livestock and production quotas (but not land which has low liquidity, especially in family farms). Authors explain the 5% return on non-land assets as "opportunity costs of investing the capital in a low-risk conservative investment, such as a bank account" (Hennessy et al. 2008). The 5% return was set for the specific land market in Ireland. A Dutch study on farm viability in the European Union (Vrolijk et al. 2010) defines economic viability based on the opportunity cost. The authors distinguish between five different levels of economic (financial) viability according to the relationship between income and opportunity costs. A critical discussion of the concepts of farm-level viability, sustainability and resilience (Hooks et al. 2017) put stress also on traditional resilience strategy in agriculture – cooperative actions, which involves farmers working together to enhance their viability and sustainability.

Economic viability is mainly measured by profitability, liquidity, stability and productivity (Latruffe et al. 2016). The first three categories have been frequently used in financial statement analyses (Gibson 2013). Research studies used the financial ratios as indicators of firm economic viability such as return on investment, debt to net income ratio, the expense to income ratio, direct payments to producers and dependency, return to equity (Slavickiene and Savickiene 2014b; Miceikiene and Girdziute 2016; Blazkova and Dvoulety 2018a,b), profitability of sales, profitability of assets, percentage coverage ratio (profit to interest charges) and debt to equity ratio (Koleda and Lace 2010). One of the most significant problems of financial ratios is a purely accounting perspective which does not consider the opportunity cost of owning land, labour and capital. Authors suggest that viability assessments through financial indicators is rather financial viability than economic viability because it does not consider productivity and opportunity costs.

Productivity is one of the most popular ways how to measure economic viability. Productivity is a measure of the ability of the factors of production to generate output (Latruffe et al. 2016), either as partial productivity of labour, land, capital (Slavickiene and Savickiene 2014a; Ryan et al. 2016), total factor productivity (Davidova et al. 2005) or technical efficiency (Latruffe and Desjeux 2016).

Official statistics show family farms and off-farm income as important issues which must be considered in economic viability and sustainability indicators. The optimal solution is to separate family farms from non-family agricultural enterprises. In the case of family farms, the literature review highlights problems of off-farm income, cash flow, private consumption and private expenditures when calculating farm households' economic sustainability (Mishra and Holthausen 2002; Hennessy et al. 2008). Family farms stress cash flow more than income, unlike (usually larger) non-family agricultural enterprises, which focus on income (economic or accounting profit). A suggestion is that operating farm cash flow, together with off-farm household cash flow, must cover all private expenses and cover expected household cash surplus. Households can then use surpluses for future investments and private savings. Nevertheless, available data from the Farm Accountancy Data Network (FADN) do not contain personal economic data of family, and FADN-based farm-level sustainability studies have limitations (Latruffe and Mann 2015). The advantage of legal entities like joint stock companies, limited liability companies and cooperatives is the availability of financial statements. This allows economic viability and sustainability to be measured through financial ra-

https://doi.org/10.17221/327/2019-AGRICECON

tios of profitability, liquidity and stability or multivariate scoring models. However, some profitability ratios (Return On Assets – ROA) provide misinterpretation because the assets do not include hired land, which takes up more than 80% of the utilised agricultural land of Czech large farms.

When considering both family farms and legal entities together (typically in Czech ANCs), the productivity indicators are the best solution for calculating economic viability and sustainability, despite some bias in the evaluation of family farms (Spicka et al. 2019). The authors recommend using a modified Farm Net Value Added (MFNVA), allowing for opportunity costs of owning land and non-land assets. The MFNVA must be higher than the sum of wages and expected income for unpaid labour input.

There are various papers analysing economic viability and sustainability. Farm size is considered an important factor affecting viability in papers Davidova et al. (2005) or Slavickiene and Savickiene (2014a). Farm specialisation has been analysed in Ryan et al. (2016) as well as Vrolijk et al. (2010). The viability of farming varies substantially among farm systems. More viable are dairy farms, whereas farms with grazing livestock obtain worse results. The analysis by Balezentis and Novickyte (2018) revealed that general field cropping and horticultural Lithuanian family farms are characterised by relatively higher profitability and growth than other farm types.

Stolbova and Micova (2012) provide a structural survey of agriculture in the Czech Republic. The results of the analysis prove that large farms situated in less favoured areas (LFA; ANCs since 2018) are more successful than small farms. Even more successful are the extensive farms in mountain areas that are, however, highly dependent upon support aid (Lososova and Zdenek 2013). The most threatened farms, in the authors' opinion, are those situated in other than mountain LFAs focusing on mixed plant and livestock production. Lososova and Zdenek (2014) provide an analysis of farm profitability in the Czech Republic. They investigate the impact of factors such as profits and profitability, efficiency of production factors, debt, financial health and dependency on subsidies. The authors confirm that farms located in mountain less favoured areas have the highest dependence on subsidies. Less dependent on subsidies are farms focusing on plant production, but their profit is most affected by other external economic conditions, particularly by climatic conditions and price developments. Doucha et al. (2012) analyse the impact of agricultural policy on the economy of farms in Czech LFAs. A multi-criteria impact assessment shows that under the Czech conditions for support in LFAs, the economic situation of larger extensive farms, measured by the farm net value added per one annual working unit, is very good, even in comparison with farms in the regions with the best natural conditions and out of LFAs. On the other hand, these farms – usually with extensive cattle breeding – operate with very low labour inputs, and they earn adequate rents.

The main goal of this article is to perform statistical verification of the economic viability of Czech farms operating in areas with different natural conditions and with different farm specialisation.

MATERIAL AND METHODS

For the classification of individual farms by ANC 2018, the Land Parcel Information System (LPIS) and the share of the utilised agricultural area (UAA) belonging to the ANC were used.

Farms with more than 50% of the agricultural land situated outside the ANC (non-ANC) are marked as farms in favoured natural conditions. Mountain ANC (ANC-M) farms are those with more than 50% of the UAA in the mountain regions. Other than mountain ANCs (ANC-O) are represented by farms with more than 50% of the UAA in the ANC and less than 50% in a mountain ANC. The FADN CZ database for the period 2011–2016 was used for analyses (IAEI 2019). The FADN database provides for internationally comparable data for assessing the income of agricultural holdings and the impacts of the Common Agricultural Policy. The structure of farms is available in Table 1.

Based on Table 1, generally higher labour intensity is associated with specialisation in dairy production, which has the highest Annual Working Unit per 100 ha (AWU/100 ha). A lower share of paid AWU is evident in mountain ANC and in grazing livestock farms, where about half of the AWU is unpaid. Mountain ANCs show a higher rate of cost factor (total costs/total production), which is a risk factor for farm viability. The table also shows a lower Farm Net Value Added per AWU (FNVA/AWU) in the mountain and other than mountain areas and a lower FNVA/AWU in grazing livestock and milk specialisation. High dependence on subsidies can be recognised in mountain ANCs especially, where the entire FNVA is covered by subsidies. The same may be concluded for the grazing livestock specialisation, where the share of operating

https://doi.org/10.17221/327/2019-AGRICECON

subsidies to FNVA is approximately 137%. ANC payments and environmental subsidies play an important role in farms in mountain areas and grazing livestock specialisation, for which about one-fifth of total operating subsidies is represented by ANC payments.

The paper by Spicka et al. (2019) provides a literature review of various approaches to measuring the economic viability of farms. The authors found family farms and off-farm income as important limitations of the FADN database (Farm Accountancy Data Network) for evaluation of the economic sustainability of farm household. Moreover, some financial ratios (ROA and assets turnover) are not suitable viability indicators for farms with a high share of hired land (typically large legal entities). Joining family farms and legal entities, the authors recommend using modified Farm Net Value Added (MFNVA) allowing for opportunity costs of own land and non-land assets.

$$MFNVA/AWU = \frac{FNVA - IP - RP}{AWU} \quad (1)$$

where: *FNVA* – Farm Net Value Added (code SE415 in Standard Results database of FADN); *IP* – Interest Paid (SE380); *RP* – Rent Paid (SE375); *AWU* – Annual Working Unit (SE010).

MFNVA should cover not only paid employee wages but also the expected income for the unpaid labour force, including owners (opportunity cost of equity). When considering the opportunity cost of own capital, labour and land, a farm is viable when:

$$FNVA - \left(IP + OCC\right) - \left(RP + OCL\right) > W + UL \quad (2)$$

where: *OCC* – Opportunity Costs of Own Non-Land Capital [calculated as: (SE436 – SE490 – SE495) × return to non-land assets]. The common approach of a 5% return to non-land assets for determining farm viability was followed (Hennessy et al. 2008; Barnes et al. 2015); *OCL* – Opportunity Costs of Own Land (represented by rent paid for non-own land – SE375; calculated as SE375 × hectares of own land); *W* – Wages of Employees (SE370); *UL* – Expected Income for Unpaid Labour (unpaid labour is represented by costs at the level of paid labour, i.e. SE370; calculated as SE370/AWU × number of unpaid AWU. Since SE370 also contains social security charges paid by an employer, SE370 used for unpaid labour is without social security charges paid by employer).

Table 1. Descriptive statistics of selected farm types

	ANCs			Farm specialisation			
	M	O	non	grazing livestock	milk	field crops	mixed
Count	1 032	2 832	2 692	1 187	819	2 308	2 242
Average ha UAA per farm	186	229	264	137	296	194	361
Own land/UAA (%)	27.13	18.31	17.99	31.47	16.03	21.07	14.95
AWU/100 ha	2.74	2.74	2.69	2.27	3.82	2.15	3.06
Paid AWU/total AWU (%)	73.53	77.88	83.28	51.51	86.19	71.49	88.98
Indebtedness (%)	25.23	29.23	25.36	19.98	33.91	23.46	28.79
Cost factor	1.39	1.19	1.08	1.66	1.20	1.07	1.14
FNVA/AWU (EUR)	17 617	18 730	23 451	17 330	17 464	24 225	20 347
Current subsidies/FNVA (%)	108.04	78.40	56.13	137.36	76.24	59.62	63.14
SAPS/current subsidies (%)	39.99	51.54	58.56	38.68	41.00	67.38	52.25
ANC payments/current subsidies (%)	19.48	8.25	0.55	18.78	10.02	1.07	5.14
Environmental subsidies/current subsidies (%)	24.48	13.41	5.07	31.55	11.20	4.86	7.97
Subsidies on intermediate consumption/current subsidies (%)	3.04	5.55	7.80	1.91	4.26	7.30	7.44

ANC – areas facing natural constraints; ANC-M – mountain ANC; ANC-O – other than mountain ANCs; non-ANC – agricultural land situated outside the ANC; UAA – Utilized Agricultural Area (ha); AWU – Annual Working Unit based on FADN methodology; FNVA – Farm Net Value Added; Cost factor = total costs/total production; SAPS – Single Area Payment Scheme (including payment for agricultural practices beneficial for the climate and the environment and payment for young farmers)

Source: IAEI (2019) – FADN CZ database, 2011–2016; own calculation

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Based on the MFNVA approach, the authors developed the indicator of Farm Economic Viability (*FEV*) using the following equation:

$$FEV = \frac{FNVA - (IP + OCC) - (RP + OCL)}{W + UL} \quad (3)$$

The *FEV* ratio/score ranges theoretically (−∞,+∞). *FEV* = 1 means that MFNVA covers employee wages, including the opportunity costs for unpaid labour. A farm with *FEV* > 1 is considered economically viable. *FEV* < 1 represents farms for which the MFNVA does not cover employee wages, including opportunity costs, and therefore is not considered economically viable.

First, the authors performed an exploratory data analysis, covering the basic descriptive characteristics, i.e. average, standard deviation and standard error, quantiles. Along with providing a description, the main goal was to clean up the data and reduce the impact of outlying observations. Farms with outlying results were excluded. The identification of outliers was based on the Tukey Fences. An outlier values below $Q_1 - 1.5(Q_3 - Q_1)$ or above $Q_3 + 1.5(Q_3 - Q_1)$, where: Q_1 is first quartile and Q_3 is third quartile.

Furthermore, the significance of the impact factor (qualitative variables, i.e. ANC category, farm specialisation) on farm economic viability (quantitative variable) was tested with a one-way ANOVA analysis (Hebak 2013).

Testing was performed for each parameter separately by using a one-way analysis of variance (ANOVA). This is a multi-sampled test performed when differences in more than two groups of units are tested. The method of one-way analyses of variance is based upon the distribution of total variance on the dispersion between classes, which is related to the indicator and the residual variance, which represents the rest of the influences on fluctuations of the values (Hebak 2013). The null hypothesis that among the selected groups, there is no difference in the average value of the given indicator is tested. To verify the rejection or acceptation of the null hypothesis, the *F*-test is used. Decisions are made by comparing the maximum first type error (the *P*-value), based on our data, and errors of the first type of alpha (5%), which we have set before testing. If the *P*-value is less than 5% alpha, the null hypothesis is rejected, and it shows that there is a significant difference in the average value of the indicators between monitored groups. Otherwise, the null hypothesis cannot be rejected and thus, it is considered valid.

In the case of rejection of the null hypothesis, further detailed pairwise comparison by Scheffe's method is carried out.

RESULTS AND DISCUSSION

Viability is steadily lower in the ANC during the observed period. Based on Figure 1, the trend of *FEV* indicator development can be characterised as slightly increasing in all monitored areas, except for the year 2015, when agricultural prices dropped. The average *FEV* for 2011–2016 is about 0.96 for both ANC-H and ANC-O, compared to 1.18 for areas outside of an ANC (Table 1). In terms of farm specialisation, for the period 2011–2016, on average, the viability measured by *FEV* is lower for grazing livestock, at 0.90; for milk, it is 1.02, for field production 1.26 and for mixed production 0.92 (Table 1). The development

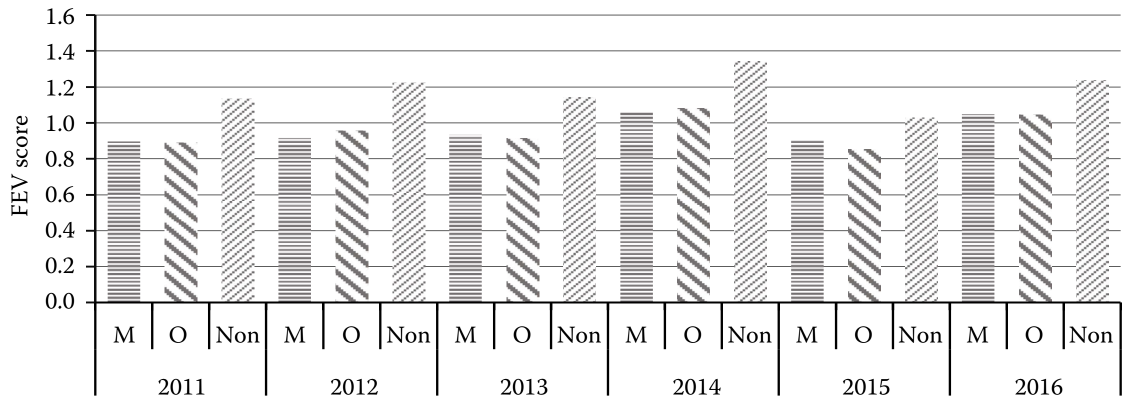

Figure 1. Score of Farm Economic Viability (FEV) in ANC types

ANC – areas facing natural constraints; ANC-M – mountain ANC; ANC-O – other than mountain ANCs; non-ANC – agricultural land situated outside the ANC

Source: IAEI (2019) – FADN CZ database, 2011–2016; own calculation

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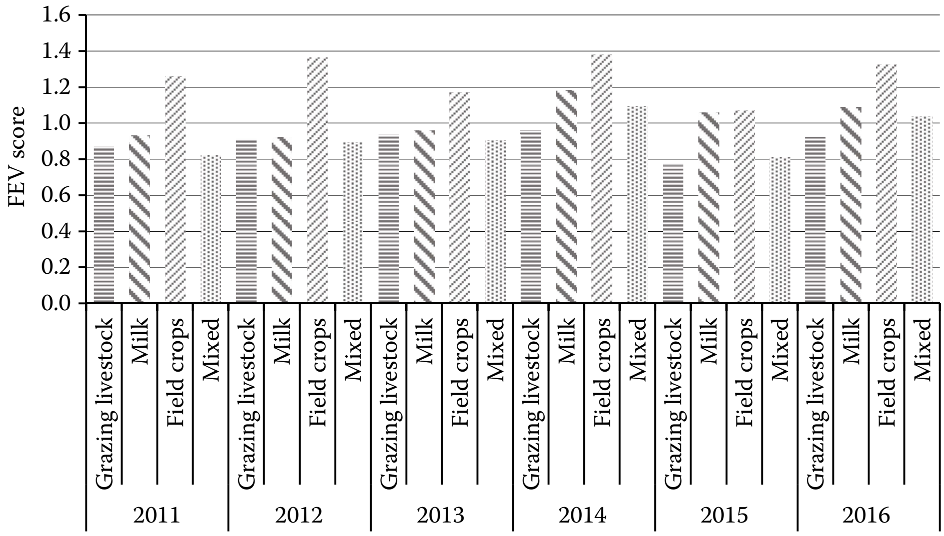

Figure 2. Score of Farm Economic Viability (FEV) by farm specialisation

Source: IAEI (2019) – FADN CZ database, 2011–2016; own calculation

of *FEV* over the observed period 2011–2016 can be considered stable (Figure 2). *FEV* values equal to or greater than 1 indicate that Modified Farm Net Valued Added covers not only the paid labour costs of employees but also the considered opportunity costs of unpaid labour. These farms can be described as more viable than those with an *FEV* less than 1.

The share of farms with an *FEV* of less than 1 in ANCs (Table 2) is around 28–30% and in areas outside of an ANC around 24%. In terms of specialisation, the share of *FEV* lower than 1 is for grazing livestock (35%), mixed (28%), milk (26%) and crop production (24%). We consider these farms to be non-viable in the long-term period. ANC-M and grazing livestock farms face higher costs (Table 1), with 1 EUR of production based on EUR 1.39 of costs; that is to say, for every 1 EUR of production, grazing livestock farms require EUR 1.66 of cost support. These enterprises have a relatively high share of unpaid labour and are more likely to have smaller UAA acreage (Table 1).

The core of the *FEV* indicator is based on farm net value added (FNVA). This indicator consists of total production, i.e. plant, animal and other, including the balance of current subsidies and taxes, adjusted according to specific costs and farming overheads. Net value added is used to cover external factors including wages, profits and expanded business reproduction. After the accession of the Czech Republic to the EU, the share of current subsidies on FNVA has been increasing. Based on Figures 3–4, current subsidies, including ANC payments, represent an important part of the Farm Net Value Added. In areas outside the ANC, current subsidies cover more than 50% of the FNVA; in addition, the mountain ANC farms would show a negative FNVA without current subsidies (Figure 3). Considering FNVA in farms classified by speciali-

Table 2. Descriptive statistics of Farm Economic Viability (FEV) indicator for selected farm types

Measure	ANC			Farm specialisation			
	M	O	non	grazing livestock	milk	field crops	mixed
FEV mean	0.96	0.96	1.18	0.90	1.02	1.26	0.92
FEV std. deviation	0.71	0.74	0.76	0.71	0.66	0.74	0.68
FEV min	–0.90	–0.99	–1.31	–0.99	–0.87	–1.31	–1.28
FEV max	2.93	3.02	3.83	3.02	3.20	3.83	3.72
Share of farms with *FEV* < 1 (%)	30.23	28.49	24.18	35.13	26.25	23.74	27.70

ANC – areas facing natural constraints; ANC-M – mountain ANC; ANC-O – other than mountain ANCs; non-ANC – agricultural land situated outside the ANC

Source: IAEI (2019) – FADN CZ database, 2011–2016; own calculation

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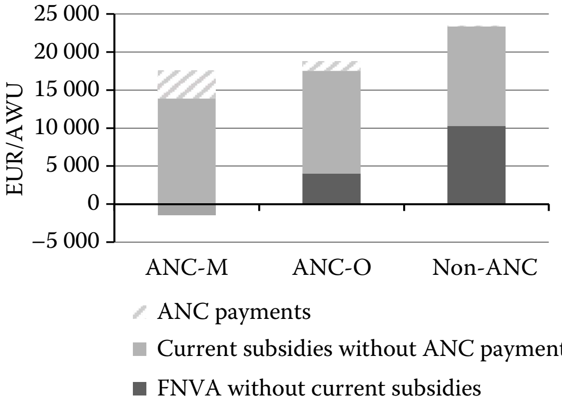

Figure 3. Structure of Farm Net Value Added (FNVA) by ANC categorization

ANC – areas facing natural constraints; ANC-M – mountain ANC; ANC-O – other than mountain ANCs; non-ANC – agricultural land situated outside the ANC; AWU – Annual Working Unit

Source: IAEI (2019) – FADN CZ database, 2011–2016; own calculation

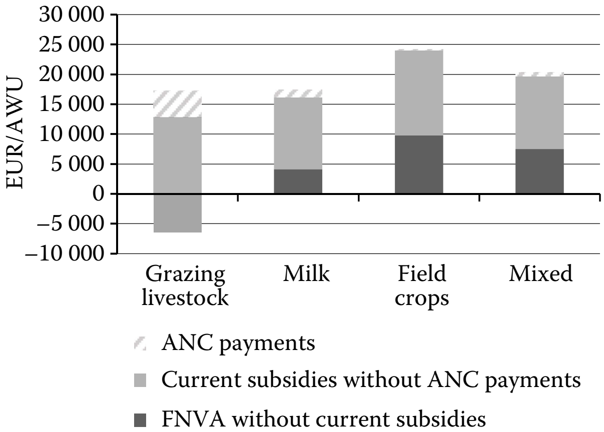

Figure 4. Structure of Farm Net Value Added (FNVA) by farm specialisation

ANC – areas facing natural constraints; AWU – Annual Working Unit

Source: IAEI (2019) – FADN CZ database, 2011–2016; own calculation

sation, in all four groups, it exceeds share of current subsidies on FNVA 50%. The most significant impact of current subsidies is evident in the grazing livestock group, along with a significant share of ANC payments and environmental subsidies. These are mostly smaller enterprises mainly operating in ANCs that are economically dependent upon subsidies (Table 1). This group shows the highest percentage (35%; Table 2) of enterprises threatened by non-viability.

Table 3 shows the results of the analysis of variance and a *post-hoc* assessment of the differences in Farm Economic Viability indicator between groups of farms. Two criteria have been employed: ANC type and farm specialisation. Significant differences (significance level of 5%) in viability between enterprises of different specializations were found in all ANC types (Table 3; for ANC-M is F = 3.38 and P = 0.018, for ANC-O is F = 14.5 and P = 0.001 and for non-ANC

Table 3. Test of differences in Farm Economic Viability between groups of farms

ANC type	Compared groups	Mean ± SD	F statistic	P-value
M	grazing livestock	$0.94^{a} \pm 0.74$	3.380	0.018
	milk	$1.02^{ab} \pm 0.66$		
	field crops	$1.28^{b} \pm 0.75$		
	mixed	$0.88^{a} \pm 0.70$		
O	grazing livestock	$0.88^{a} \pm 0.73$	14.500	0.001*
	milk	$1.05^{b} \pm 0.71$		
	field crops	$1.09^{b} \pm 0.72$		
	mixed	$0.88^{a} \pm 0.69$		
Non	grazing livestock	$0.71^{a} \pm 0.69$	34.429	0.001*
	milk	$0.88^{a} \pm 0.65$		
	field crops	$1.33^{b} \pm 0.73$		
	mixed	$0.99^{a} \pm 0.69$		

*P-value is less than 0.001; ANC – areas facing natural constraints; ANC-M – mountain ANC; ANC-O – other than mountain ANCs; non-ANC – agricultural land situated outside the ANC; detailed comparison was made by *post-hoc* Scheffee's test; means denoted with the same letter ("a" or "b") are not statistically significantly different

Source: IAEI (2019) – FADN CZ database, 2011–2016; own calculation

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is $F = 34.429$, $P = 0.001$). In general, field crops (Table 3 based on the *post-hoc* Scheffe method denoted by letters a) and b) showed a significantly higher *FEV* average, which exceeded 1 in both ANCs and non-ANCs. Specialisations with livestock production, then, have significantly lower viability in all ANC types. This corresponds to findings in a Lithuanian study (Vitunskiene and Novikova 2013). When analysing *FEV* values across ANC types, the following can be stated: grazing livestock enterprises did not show significantly different average values of viability, neither in ANC-M, ANC-O or outside ANC (Table 4; $F = 2.615$, $P = 0.074$). The level of *FEV* is generally lower in this type of specialisation.

Significant differences in average *FEV* were not found in field crops farms (Table 4; $F = 2.536$, $P = 0.079$). Although a difference in the average *FEV* values can be observed in Table 2, due to the higher variability in the groups, there was not sufficient evidence to show significant differences. A higher average *FEV* may be found within milk and grazing livestock specialisation in ANC areas, as opposed to non-ANC areas. In contrast, the mixed specialisation has significantly lower viability in ANCs and higher in non-ANCs. Mountain ANCs are characterised by rather smaller farms with a focus on grazing livestock. Due to natural constraints, ANC farms achieve lower total production. Farms also show a higher share of unpaid AWUs, and thus this group of farms is also characterised by higher opportunity costs calculated for unpaid labour. The relatively lower viability of ANC-M is also influenced by higher costs per unit of production. The lower indebtedness of enterprises (roughly 25% and 20%, respectively) can be evaluated positively in mountain ANCs and for the grazing livestock specialisation. The ANC and grazing livestock enterprises are highly dependent upon subsidies, which supports the conclusions of Lososova and Zdenek (2013, 2014). On the other hand, current subsidies, including ANC payments, have an impact on income stability and viability, which is consistent with the claims of Spicka et al. (2009) or Foltyn et al. (2013).

Field crops are the least dependent upon subsidies, which is consistent with the results of Lososova and Zdenek (2014). At the same time, our results can be confirmed by the conclusions in Lososova and Zdenek (2014), namely, that the most threatened farms are those in ANC-M and are focused on grazing livestock, based on a higher share of farms with *FEV* less than 1. More intensive enterprises with higher labour inputs in the milk specialisation (3.82 AWU/100 ha) show relatively favourable viability with a lower percentage of threatened enterprises compared to the other groups of specialisation. This corresponds to the conclusions of Vrolijk et al. (2010). In addition, Slovenian study (Prisenk et al. 2016) shows positive economic viability of dairy farms which are part of the value-based food chain and which are located in ANC-M. ANC-M and grazing livestock farms showing lower *FEV* have

Table 4. Test of differences in Farm Economic Viability between groups of farms

Specialisation	Compared groups	Mean ± SD	*F* statistic	*P*-value
Grazing livestock	ANC-M	0.94 ± 0.78	2.615	0.074
	ANC-O	0.88 ± 0.82		
	non-ANC	0.71 ± 0.83		
Milk	ANC-M	1.02^{ab} ± 0.58	3.574	0.028
	ANC-O	1.05^{b} ± 0.61		
	non-ANC	0.88^{a} ± 0.63		
Field crops	ANC-M	1.27 ± 0.98	2.536	0.079
	ANC-O	1.09 ± 0.94		
	non-ANC	1.33 ± 1.02		
Mixed	ANC-M	0.88^{a} ± 0.58	6.986	0.001
	ANC-O	0.88^{a} ± 0.63		
	non-ANC	0.99^{b} ± 0.66		

ANC – areas facing natural constraints; ANC-M – mountain ANC; ANC-O – other than mountain ANCs; non-ANC – agricultural land situated outside the ANC; detailed comparison was made by *post-hoc* Scheffee's test; means denoted with the same letter ("a" or "b") are not statistically significantly different

Source: IAEI (2019) – FADN CZ database, 2011–2016; own calculation

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a relatively smaller average of UAA compared to other groups of farms. Farms cultivating larger UAA showed, on average higher *FEV* values, which corresponds to the conclusions of Davidova et al. (2005) or Slavickiene and Savickiene (2014a).

CONCLUSION

This article deals with the estimation of economic viability in Czech areas facing natural constraints. The article follows the previous work of the team of authors (Spicka et al. 2019), which reflects on procedures for estimating and measuring economic viability and sustainability. For assessment of viability in ANCs, the authors propose a Modified Farm Net Value Added per AWU. This indicator is based on Farm Net Value Added and also considers opportunity costs on unpaid labour and own land. Based on these data, the Farm Economic Viability ratio was constructed to assess economic viability. In the monitored period of 2011–2016, the economic viability of farms was stable, or, more specifically, growing slightly. Significantly lower viability can be seen in ANCs that show higher dependence upon current subsidies, including ANC payments, a higher share of unpaid labour, lower production and higher costs per one unit of production. It is evident that subsidies for ANCs, including ANC payments, represent significant support and stabilising element of income and support for viability. In terms of specialisation, the most vulnerable group of farms are grazing livestock, a third of which type of farm is threatened by non-viability, according to the estimated Farm Economic Viability indicator. These are mainly extensive farms with smaller acreage in mountain ANCs. A relatively successful group of farms are field crops, regardless of whether they are in an ANC or outside of one. These farms show significantly higher viability values and net value added in the monitored period 2011–2016. These results can be used to support the design of a new Common Agricultural Policy that emphasises smaller farms with livestock production that are in ANCs.

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Received: October 23, 2019
Accepted: January 23, 2020