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Predicting farm performance: do indicators of farm economic viability and efficiency signify of probability of bankruptcy?

J. Savickienė* and A. Miceikienė

Vytautas Magnus University Agriculture Academy, Faculty of Bioeconomy Development, Research Institute for Bioeconomy, Universiteto Str. 10-321, LT-53361 Akademija, Kauno r., Lithuania
*Correspondence: jurate.savickiene@vdu.lt

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Abstract. Following the analysis of the indicators characterising the economic viability, efficiency and bankruptcy probability of farms proposed by researchers and employed in practice, the relationships between the indicators and their capacity to predict the prospects of farm activities as well to assess whether or not the indicators are indicative of the same patterns of farm activity, several different researchers' approaches have been identified. Certain researchers have been claiming that all of the indicators provide the same farm performance prospects, while others consider economic viability and efficiency to provide long-term farm performance prospects, while bankruptcy probability-negative profitability in the short term. The methods of convergent and discriminant validation employed allowed for analysis of the risk of potential overlap between the index of economic viability of a family farm and farm economic efficiency coefficient with the already available bankruptcy probability prediction models. For this purpose, categorical regression analysis was employed. This enabled the authors to determine that the index of economic viability of a family farm and coefficient of farm economic efficiency did not repeat the already available and used bankruptcy probability prediction models. Summarizing the results, it could be claimed that the index of economic viability of a family farm and coefficient of farm economic efficiency are not suitable as an alternative for assessment of the bankruptcy probability.

Key words: farm economic viability; farm economic efficiency; bankruptcy prediction models; family farms.

INTRODUCTION

As the global commercial market of agricultural products and competition is becoming more robust, and agricultural manufacturers from previously inactive countries enter the global market, agribusiness entities have been acknowledging the importance of survival in the competition struggle and of the long-term economic prospects (Christensen & Limbach, 2019). Recently, the issues of competitiveness, viability and efficiency have been propelling discussions among farmers, policy makers, and researchers in this regard (Rivza et al., 2017; Dinterman et al., 2018; Kovalova et al., 2020). These issues include the amount and value of the support allocated to agriculture, the moral values of people engaged in farming in terms of preservation of natural resources for future generations, the implications pertaining to the tax systems applied to the entities engaged in agriculture, the prospects of viable farming, and a number of other issues. Two approaches to agribusiness prospects may be identified. Researchers (Gūvenir & Cakir, 2010; Hu & Sathye et al., 2015; Dinterman et al., 2018; Kovalova et al., 2020) predict a decrease in economic viability of farmers and agribusiness companies and an increase in the number of bankruptcies as a result of natural hazards and economic changes taking place worldwide (such as Brexit, etc.). Nonetheless, the public opinion prevailing in the EU is that agribusiness has already been receiving considerable support and gaining substantial profits. This creates polarisation between society and the people working in agriculture, thereby shaping negative views towards farming (Rivza et al., 2017). For these reasons, young people are becoming increasingly reluctant to engage in agricultural activity or establish new farms.

Given the differing views, it is important to explore the actual situation, as it determines the economic prospects of agribusiness and performance results in the long run (Christensen & Limbach, 2019).

Assessment of agribusiness prospects is relevant not only for communities, but for governments as well. Hence, increasing attention has been directed towards the method of assessment of the economic viability, efficiency and long-term prospects of farms, differences between the indicators, identification of the indicators which are more important for economic substantiation of the prospects of farm performance (Scotti et al., 2011; Morel et al., 2017; Savickiene et al., 2017), with the view to both receiving support funds and developing farming activity in the long-term perspective. The guidelines of the EU Common Agricultural Policy 2021–2027 stipulate promotion of the long-term economic viability of farmer's farms, because farmer's farms provide not only for their families, but also for their environment: rural communities and landscape; in other words, social and environmental sustainability. Researchers (Koleda & Lace, 2010; Rivza et al., 2016; Savickiene, 2016; Hosaka, 2019) have different views regarding the indicators which characterise the long-term prospects of farms: some consider economic viability to be the key indicator, others refer to efficiency, while yet others refers to bankruptcy probability. Nonetheless, all of them share the position that similar indicators should be used for assessment of the long-term prospects in agriculture and comparison of individual farms and enterprises.

The present research explores the properties of the indicators characterising the economic viability, efficiency and bankruptcy probability of farms with the view to assessment of positive long-term prospects or bankruptcy of farms.

Research problem: are the indicators of economic viability and efficiency of farms indicative of bankruptcy probability, and what are the methods for verifying this?

Research aim: following identification of the indicators characterising the economic viability, efficiency and bankruptcy of farms, to identify the relationships between these indicators and the ability to predict the prospects of farm performance as well as to assess whether these indicators show the same performance trends of farms.

The family farms engaged in agricultural activities that managed the accounting and provided the information on their production and financial activities were used in the empirical study. The accounting data of Lithuanian family farms for the years 2015 and 2017 were used. The accounting data of family farms were collected with the assistance of Lithuanian Agricultural Advisory Service. Indicators from three groups were analysed as part of the research: the indicators defining economic viability, economic efficiency, and bankruptcy probability of farms. The methods of convergent and discriminant validation (Catreg) and correlation analysis were employed in the research.

MATERIALS AND METHODS

Researchers (Jurkėnaitė 2015; Karas et al., 2017; Spicka et al., 2019) exploring the economic indicators of farms and dynamics thereof have been claiming that the economic viability of farms has been decreasing, while the number of farmer's farms incapable of covering production and general expenses has been increasing as shown by the empirical studies conducted in the recent years; researchers have also noted that the long-term economic attractiveness of agricultural activity has decreased even more significantly. Farming is a very specific and particular industry requiring particular knowledge and specific conditions: the activity is difficult to plan due to unstable natural conditions and imposed stricter environmental, animal welfare and food quality requirements. It is important that the farmer's farms identify the long-term prospects of their own performance not only when planning long-term investments such as purchase of land, buildings, and agricultural equipment, but also when seeking support from the state or EU funds, or applying to lenders for funding.

Assessment of any business prospects is, as a standard, performed by applying the bankruptcy probability prediction models. According to various research findings, assessment of prospects of an agribusiness using these models is a complex task due to its specifics. Although researchers (Václav & David, 2017; Dinterman et al., 2018; Mimra et al., 2018; Hosaka, 2019) and others did apply the discriminant analysis method using the developed Altman (Altman 1, Altman 2, Altman 3), Springate, Liss, Taffler equations for assessment of farm prospects, they have come to the conclusion that these methods have a lot of weaknesses. Hosaka (2019) presented the weaknesses of the Altman, Springate, Liss, Taffler methodology. According to the researcher, where the analysis aims at assessing the probability of the life cycle stage of economic viability of farms, the financial indicators included in the model may differ significantly not only due to the specialisation and specifics of economic activity of the farm, but also due to the accounting methods used. Hence, in the subsequent research, the researchers analysed the indicators of economic viability and efficiency of farms.

By following the Altman, Springate, Liss, Taffler methodologies, (Rajin et al., 2016) performed a comprehensive analysis of the issues encountered by farms in the decline stage of the economic viability life cycle (Rajin et al., 2016). The essential idea of the models is that various areas of farm activity are assessed using financial indicators, which are used to derive the Z-score, a common complex ratio. To substantiate this model, Altman, Springate, Liss, Taffler used the discriminant analysis method involving identification of the linear correlation function parameters. Having explored the reasons behind the decline stage of farm economic viability life cycle, Altman, Springate, Liss, Taffler proposed the system of indicators, a toolkit enabling classification of farms by value as those with high probability of entering the decline stage of the farm life cycle and those with the stability or growth stage of the economic viability life cycle of the farm. Based on this classification, they dealt with the value of the probability of decline of economic viability of farms. However, the findings of this research work do not allow assessment of the current situation of farms and long-term prospects, as only financial indicators are used in the Altman, Springate, Liss, Taffler bankruptcy probability methodologies.

Whereas agribusiness is claimed to be very risky, dependent on a number of different external factors such as natural conditions, agriculture support policy, etc., in their subsequent research work, researchers (Hu & Sathye, 2015; Savickiene 2016; Spicka et al., 2019) have referred to the majority of economic indicators (competitiveness, profitability, solvency, economic viability, negative profitability, etc.) in risk assessment and identification of farm prospects. The analysis of previous studies has shown that, according to the majority of findings, the indicators of economic viability and efficiency are the most frequently used for assessment of the performance prospects. The arguments are the following: both indicators may be calculated for non-trade farms as well; they are referred to as the most appropriate for assessment of the long-term prospects, and cover other indicators mentioned, hence providing a wider context. However, the question is which of the indicators is the most appropriate for assessment of a long-term prospect of farms, and whether or not they can be used to forecast the probability of bankruptcy?

The majority of researchers usually provide a multi-criteria holistic approach towards farm performance prospects (Tisdell, 1996; Scotti et al., 2011; Morel et al., 2017; Jedik & Stalgienė, 2018; Savickienė & Miceikienė, 2018; Spicka et al., 2019).

Research efforts in assessment of farm economic viability can be traced back to over 40 years ago (Savickienė & Miceikienė, 2018), and farm economic viability has become the most relevant field of the studies in viability of agriculture in the recent decades (Savickiene, 2016), and is important both for communities and governments (Rajin et al., 2016). According to Jurkėnaitė (2015), application of the viability theory to practice enables improvement of decision making and provides valuable insights.

According to researchers (Jurkėnaitė, 2015; Christensen & Limbach, 2019), farm viability is determined by three key areas: economic, environmental, and social. Farm viability is often perceived as the dynamics and sustainability covering both current and future generations, taking care of the future generations without defining any future limits. The broad approach enables identification of the key indicators which allow for determination of the lack of resources and issues related to changes in the environment. **It can therefore be claimed that** the concept of viability of farms covers not only the profitable activity of a farm, but also the capacity to differentiate the activity thereby adapting to climate change, the possibilities to maintain family using the farmer's income, stable farm growth, positive return on capital, and investment in farm modernisation. Only farm economic viability has the capacity to show the financial prospects of the farm activity. In the present study, the economic viability of a farm is defined as the capacity of the farm to survive and develop using own and external resources (Savickienė et al., 2017). The purpose of trade family farms is pursuit of farm operations as a business entity, while for other farms, it is satisfaction of the household food needs or expression of an advocated lifestyle.

According to the concept of farm economic viability, the present study employs the index of economic viability of a family farm assessing the economic viability of farms (I_{FEV}) (Savickienė & Miceikienė, 2018) and calculated using the following methodology:

$$I_{FEV} = \frac{GO + A_{CA+}A_{NA}}{INT_{CONS} + D + EXT_{COST} + FFW + D_{ST} + D_{LT}} \quad (1)$$

where GO – gross output (at basic prices); A_{CA} – current farm assets; A_{NA} – fixed farm assets; INT_{CONS} – intermediate consumption; D – depreciation; EXT_{COST} – costs of external resources; FFW – farmer and family members' wage; D_{ST} – short-term debt; D_{LT} – long-term debt.

Researchers investigating economic viability and prospects of farms agree that the indicators of economic viability of farms describe long-term economic prospects of farms, but fail to assess the short-term prospects and current financial situation, which are important in assessment of farm performance.

Studies conducted previously (Tisdell, 1996; Savickiene 2016; Morel et al., 2017) have demonstrated that farm economic efficiency is an important indicator in the long-term perspective. In the present study, economic efficiency is considered as the farmer's ability to mobilise capital, labour, and natural resources for the organisation of farm activity with the purpose of receiving income and assuming the associated risks. To perform the comparative analysis of the indicators listed above, complex economic efficiency coefficient has been chosen for assessment of economic efficiency of a farm (Tisdell, 1996; Scotti et al., 2011).

$$FEE = \frac{GO}{INT_{cons} + D + EXT_{COST} + FFW} \quad (2)$$

where FEE – farm economic efficiency; GO – gross output (at basic prices); INT_{CONS} – intermediate consumption; D – depreciation; EXT_{COST} – costs of external resources; FFW – farmer and family members' wage.

Comparison of the specific indicators of economic viability and economic efficiency of farms to the conventional indicators used in assessment of bankruptcy probability will help answer the question of which indicators should be calculated and analysed by farmers and agricultural policy makers to assess the prospects of farm performance.

The studies conducted previously have shown that prediction of farm prospects could be applied to farm bankruptcy prevention. Nonetheless, there is lack of research which would allow for assessment of the risk of bankruptcy of farmer's farms. The aspiration is that not only large-sized farmer's farms or agribusiness companies, but also small and mid-sized farmer's farms operate efficiently. Although subsidies and other support are allocated to farms from the European Agricultural Fund for Rural Development and other sources, the losses incurred by farms and bankruptcies have become common, particularly in recent years, when natural risks emerge along with the business risk.

The findings of the analysis of research works on the topic considered have shown contradictory views towards assessment of farm performance prospects; hence, a holistic approach towards assessment of farm performance prospects based on the economic information on the farm is required (Christensen & Limbach, 2019).

Therefore, it is reasonable to compare three groups of complex indicators integrating different financial and economic information on the farms: the groups of indicators of farm economic viability, farm economic efficiency, and bankruptcy probability.

The developed index of economic viability of a family farm (Savickiene, 2016; Savickiene & Miceikienė, 2018) has shown the efforts to earn and accumulate the assets for the family farm to remain sustainable and viable in the future. The numerator is reflected by the accumulation factor (ability to create added value), while the denominator is reflected by the consumption factors (the efforts necessary to create the value). The farm's economic efficiency coefficient is important for all family farms as it shows the condition determined by the farm's current activity (Tisdell, 1996). The size of the assets held reflects the farm's prospects by the types of development of economic viability. The assets held at the family farm may be pledged or unpledged. The pledged share of the assets should ensure the economic growth of the farm, while the unpledged share shows the possibility for the farm to borrow and create added value.

Certain researchers (Koleda & Lace, 2010; Klepac & Hampel, 2017; Václav & David, 2017 and others) claim that economic viability overlaps with other already known bankruptcy prediction models. Hence, the verification of authenticity of the index of economic viability of a family farm and of the coefficient of farm economic efficiency, the bankruptcy probability prediction models as well as the distinctness of the measurement properties has been conducted. Verification of the content authenticity and distinctness of the measurement properties has been conducted on the basis of the convergent and discriminant validation.

Convergent and discriminant validation has been conducted to empirically assess whether or not the index of economic viability of a family farm, created in theory, measures the probability of bankruptcy of family farms, and whether or not the results allow for substantiation of suitability of the index for assessment of economic viability of a family farm. In the dissertation, the convergent and discriminant validation of the index of economic viability of a family farm consists of three stages (Fig. 1).

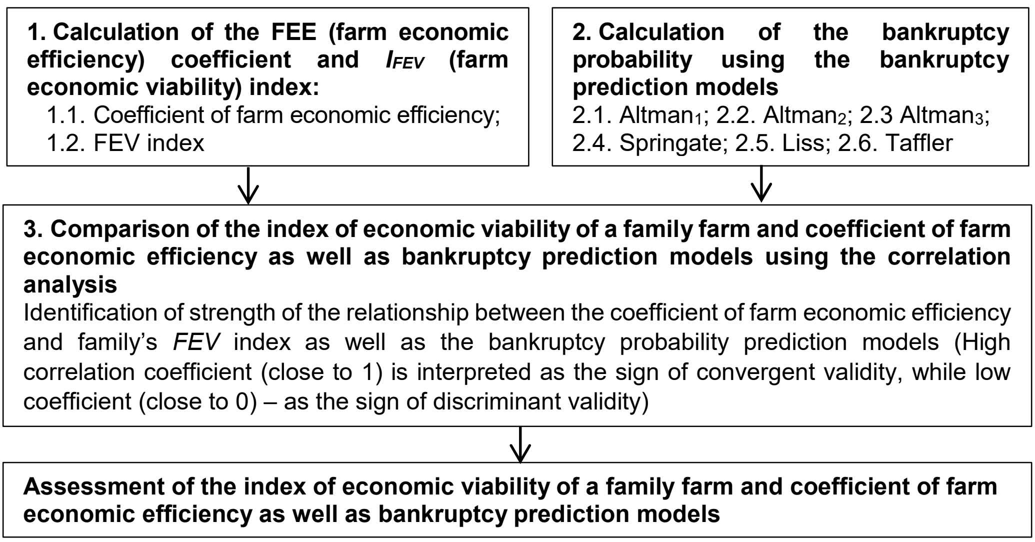

Figure 1. Model for comparison of the indicators assessing long-term prospects of farms.

Convergent Validity describes the degree that the indicators of one formula (in the article: economic viability of a family farm and farm economic efficiency) correlate to the indicators of another formula (in the article: $Altman_1$ (describes different aspects of financial performance), $Altman_2$ (the farms not listed on the stock exchange), $Altman_3$

(intended for individual and service companies), Springate, Liss and Taffler), which has been developed for measurement of the same construct. For example, if the correlation of the index of economic viability of a family farm to the values of $Altman_1$ indicators was equal to 1, the test would be interpreted to have high convergent validity (Vaitkevičius et al., 2013).

According to S. Vaitkevičius et al. (2013), Discriminant Validity is the degree to which the indicators obtained as a result of application of one formula do not correlate to the indicators obtained as a result of another formula, not created for assessment of the same context. Discriminant validity is interpreted as high if the correlation of the index of economic viability of a family farm to the bankruptcy indicators approaches 0. This shows that, at the level of constructs, economic viability of a family farm is not a variety of the bankruptcy probability.

RESULTS AND DISCUSSION

The first stage of convergent and discriminant validation of the index of economic viability of a family farm involves calculation of the index of economic viability of a family farm and coefficient of farm economic efficiency (Fig. 1). To verify the indicators, family farm data for the years 2015–2017 have been used to verify the indicators (3,917 farms). The risk of potential overlap of the index of economic viability of a family farm and coefficient of farm economic efficiency with other already known indicators assessing the financial and economic condition of the farm, has been analysed.

The second stage of empirical formation of convergent and discriminant validation of economic viability of a family farm has involved calculation of the bankruptcy probability using the bankruptcy prediction models: $Altman_1$, $Altman_2$, $Altman_3$, Springate, Liss, Taffler. Farm bankruptcy prediction is the method to assess farm economic efficiency, identify the negative patterns in farm economic efficiency, and the probability of its bankruptcy using quantitative parameters (Garškaitė & Mackevičius, 2010). The aim behind investigation of the bankruptcy probability is to determine whether or not the index of economic viability of a family farm is identical to the indicators of bankruptcy probability. For this purpose, six bankruptcy prediction models have been used. The indicators have been calculated for all the farms studied.

The third stage has involved correlation analysis of the obtained results following the calculation of the index of economic viability of a family farm and coefficient of farm economic efficiency, and bankruptcy probability, in order to determine whether or not the developed index of farm economic viability and coefficient of farm economic efficiency are indicative of the farm bankruptcy probability. The *Pearson* correlation analysis conducted has not shown the presence of any strongly correlating indicators between the economic viability of a family farm and bankruptcy probability. The values of the correlation coefficient varying from 0.038 to 0.041 indicate that the correlation is weak. Hence, this correlation could be interpreted as an indicator of weak convergence and relatively strong indicator of discriminant validity. Therefore, it could be claimed that the developed index of economic viability of a family farm and coefficient of farm economic efficiency do not measure the bankruptcy probability, and thus, are not suitable for use as the indicators in farm bankruptcy prediction (Table 1). Hence, the developed index of economic viability of a family farm potentially measures a different context, i.e. economic viability of family farms, which may be indicative of the farm development prospects.

Table 1. Matrix of the correlation coefficients of the index of economic viability of a family farm and coefficient of farm economic efficiency as well as bankruptcy prediction models

Criteria		I_{FEV}	FEE	$Altman_1$	$Altman_2$	$Altman_3$	Springate	Liss	Taffler
I_{FEV}	Pearson correlation	1	0.383^{**}	0.040^{*}	0.040^{*}	0.040^{*}	0.038^{*}	0.041^{*}	0.038^{*}
	Significance		0.000	0.011	0.011	0.011	0.017	0.011	0.018
FEE	Pearson correlation	0.383^{**}	1	0.012	0.012	0.012	0.016	0.012	0.015
	Significance	0.000		0.460	0.460	0.460	0.313	0.436	0.362
$Altman_1$	Pearson correlation	0.040^{*}	0,012	1	1.000^{**}	1.000^{**}	0.998^{**}	1.000^{**}	0.999^{**}
	Significance	0.011	0.460		0.000	0.000	0.000	0.000	0.000
$Altman_2$	Pearson correlation	0.040^{*}	0.012	1.000^{**}	1	1.000^{**}	0.998^{**}	1.000^{**}	0.999^{**}
	Significance	0.011	0.460	0.000		0.000	0.000	0.000	0.000
$Altman_3$	Pearson correlation	0.040^{*}	0.012	1.000^{**}	1.000^{**}	1	0.998^{**}	1.000^{**}	0.999^{**}
	Significance	0.011	0.460	0.000	0.000		0.000	0.000	0.000
Springate	Pearson correlation	0.038^{*}	0.016	0.998^{**}	0.998^{**}	0.998^{**}	1	0.998^{**}	0.999^{**}
	Significance	0.017	0.313	0.000	0.000	0.000		0.000	0.000
Liss	Pearson correlation	0.041^{*}	0.012	1.000^{**}	1.000^{**}	1.000^{**}	0.998^{**}	1	0.999^{**}
	Significance	0.011	0.436	0.000	0.000	0.000	0.000		0.000
Taffler	Pearson correlation	0.038^{*}	0.015	0.999^{**}	0.999^{**}	0.999^{**}	0.999^{**}	0.999^{**}	1
	Significance	0.018	0.362	0.000	0.000	0.000	0.000	0.000	

The correlation is significant if the significance level: *0.05; **0.01.

Regression analysis (Catreg) as the indicator of convergent and discriminant validity

Catreg analysis has been conducted as an additional indicator of convergent and divergent validation. In contrast to correlation analysis, categorical regression (Catreg) has enabled integrated comparison of the constructs of farm economic viability and economic efficiency to all bankruptcy indicators at the same time. In this case, different from the majority of studies is that poor characteristics of the regression model are the key indicator showing that the hypothesis of convergent validity is rejected, while the hypothesis of discriminant validity is confirmed.

The measurement has been performed by determining the optimal scaling level - spline ordinal, the degree = 2, and the number of interior knots = 2. The categorical regression ranking discretisation method has been applied. Two categorical regression models have been developed: one describes the index of economic viability of a family farm, and the other - the coefficient of farm economic efficiency (see Tables 2–5).

The analysis of characteristics of the index of farm economic viability and coefficient of economic efficiency has shown that the bankruptcy indicators are not very effective (Table 2). This is suggested by the corrected coefficient of determination which, in the case analysed, shows that, when used together, all bankruptcy indicators could explain the index of economic viability of a family farm by only 16.8%, information about variation in the economic viability of a family farm and the coefficient of farm economic efficiency - by 27.9%.

Table 2. Indicators generalising the assessment of economic viability of a family farm

Indicators	Multi-dimensional R	R^2	Corrected R^2	Predictive error probability
I_{FEV}	0.413	0.170	0.168	0.830
FEE	0.529	0.280	0.279	0.720

Dependent variables: coefficient of the index of economic viability of a family farm and farm economic efficiency. Bankruptcy prediction models: $Altman_1$, Z < 2.8; $Altman_2$, Z < 2.9 $Altman_3$, Z < .59; Springate Z < 0.862; Liss Z < 0.037 Taffler Z < 0.2.

Analysis of the developed quality indicators (for FEV index and economic efficiency coefficient) (Table 3) has shown that the sum of squares of the error factor is much higher than the sum of squares of the regression factor. The relationship between the sums of square shows that the regression models is essentially more erroneous than correct. Hence, it is interpreted as failing to explain the relationship between the dependent and independent variables of the model.

Table 3. Description (ANOVA) of the index of economic viability of a family farm and coefficient of farm economic efficiency as well as bankruptcy prediction models

Indicators	Models	Sum of squares	df	Mean of squares	F	Statistical significance level *(p)*
I_{FEV}	For the regression factor	666.900	12	55.575	66.753	0.000
	For the error factor	3,251.100	3,905	0.833		
	Common factor	3,918.000	3,917			
FEE	For the regression factor	1,096.532	6	182.755	253.328	0.000
	For the error factor	2,821.468	3,911	0.721		
	Common factor	3,918.000	3,911			

Dependent variables: coefficient of the index of economic viability of a family farm and farm economic efficiency. Bankruptcy prediction models: $Altman_1$, Z < 2.8; $Altman_2$, Z < 2.9 $Altman_3$, Z < .59; Springate Z < 0.862; Liss Z < 0.037 Taffler Z < 0.2.

It should also be noted that the properties of the index of economic viability of a family farm and farm economic efficiency are also not too correct on the level of individual variables as well (Table 4). In this case, the analysis of the statistical significance level shows unsuitability of certain variables to the developed index of economic viability of a family farm and coefficient of farm economic efficiency. This is another proof that the bankruptcy prediction models, in general, do not characterise the economic viability of a family farm.

The analysis of the significance of the effect of independent variables on the dependent variable has shown that, in the case of the index of economic viability of a family farm, Liss is relatively more significant. However, the individual Liss correlations and the index of economic viability of a family farm have rejected the hypothesis on the existence of Liss effect in economic viability of a family farm during the earlier analysis; hence, an individual regression model of these variables has not been designed additionally. A similar situation can be observed in relation to the economic efficiency coefficient and relationship under the Springate prediction model, whereas the common model identifies the importance of relationship between them. Nonetheless, the hypothesis of the interaction between them has also been rejected by the analysis of individual relationship (Table 5).

Table 4. Coefficients of the index of economic viability of a family farm and coefficient of farm economic efficiency as well as bankruptcy prediction models

Indicators	Bankruptcy prediction models	Standardised coefficients		df	F	Statistical significance level *(p)*
		Beta	Bootstrap (,1000) standard error indicator			
I_{FEV}	$Altman_1$	0.095	0.060	1	2.485	0.115
	$Altman_2$	0.100	0.067	2	2.271	0.103
	$Altman_3$	0.121	0.022	2	29.796	0.000
	Springate	0.049	0.022	2	5.185	0.006
	Liss	0.223	0.033	4	46.258	0.000
	Taffler	0.125	0.016	1	61.721	0.000
FEE	$Altman_1$	0.060	0.018	1	11.121	0.001
	$Altman_2$	0.082	0.017	1	21.940	0.000
	$Altman_3$	0.022	0.017	1	1.757	0.185
	Springate	0.350	0.031	1	124.793	0.000
	Liss	0.025	0.040	1	0.405	0.524
	Taffler	0.207	0.067	1	9.655	0.002

Dependent variables: the index of economic viability of a family farm and coefficient of farm economic efficiency.

Table 5. Correlation and tolerance of the index of economic viability of a family farm and coefficient of farm economic efficiency as well as bankruptcy prediction models

Indicators	Bankruptcy prediction models	Correlations			Significance coefficient	Tolerance	
		Zero	Partial	of a part		After transformation	Before transformation
I_{FEV}	$Altman_1$	0.206	0.095	0.087	0.115	0.826	0.785
	$Altman_2$	0.189	0.094	0.086	0.111	0.739	0.745
	$Altman_3$	0.134	0.124	0.114	0.096	0.886	0.974
	Springate	0.187	0.050	0.046	0.054	0.863	0.649
	Liss	0.334	0.215	0.201	*0.438*	0.808	0.731
	Taffler	0.254	0.123	0.113	0.187	0.815	0.609
FEE	$Altman_1$	0.207	0.065	0.055	0.044	0.860	0.785
	$Altman_2$	0.217	0.090	0.076	0.063	0.874	0.745
	$Altman_3$	0.102	0.025	0.022	0.008	0.959	0.974
	Springate	0.465	0.349	0.316	*0.581*	0.817	0.649
	Liss	0.218	0.027	0.023	0.020	0.842	0.731
	Taffler	0.383	0.211	0.183	0.283	0.783	0.609

Dependent variables: the index of economic viability of a family farm and coefficient of farm economic efficiency.

Summarising the convergent and discriminant validation results, it could be claimed that the index of economic viability of a family farm and coefficient of farm economic efficiency are not suitable as an alternative for assessment of the bankruptcy probability. It is therefore concluded that the index of farm economic viability and farm economic efficiency constructs comprising their theoretical basis are of a voluntary nature, measuring the particular context of the farm economic viability, while bankruptcy probability is described by other indicators generated using the respective bankruptcy prediction models.

The researchers (Garškaitė & Mackevičius, 2010; Dinterman et al., 2018; Hosaka, 2019) have discussed the purpose of the indicators of farm economic viability, efficiency, and bankruptcy probability; differing views regarding their purpose have been advocated in their studies. Several scientific approaches could be identified: certain researchers have claimed that all of the indicators provide the same farm performance prospects, while others consider economic viability and efficiency to provide long-term farm performance prospects, while bankruptcy probability - negative profitability in the short term.

Koleda & Lace (2010), Scotti et al. (2011), Christensen & Limbach (2019) accentuate the need of the assessment of the economic viability of farms, since the family farms take decisions related to the preservation of economic viability and determination of activity perspectives. As pointed out by Spicka et al. (2019), recently, the number of measures and methods for the assessment of economic viability of agriculture increases. One of the most frequently used methods for the research of economic viability of farms is based on the indicators of economic viability, but the assessment yet shows that the indicators used are not sufficiently practical and do not reflect the prospects of economic viability of family farms. Rivza et al. (2017) pointed out the assessment of economic viability of family farms is still developing and has not reached the maturity yet. We also should agree to the thoughts of Tisdell (1996), Václav & David (2017) that when forming a comprehensive assessment of the economic viability of the family farm, the aspects related to its feasibility and economic validity are essential.

CONCLUSIONS

The correlation analysis has shown that the indicators of economic viability and economic efficiency of family farms as well as the bankruptcy probability forecasting models do not correlate to each other but measure different phenomena. The *Pearson* correlation analysis has shown that there are no indicators of the economic viability and bankruptcy probability of a family farm that would correlate strongly to each other. The correlation coefficient values vary from 0.038 to 0.041, indicating weak correlation. This correlation may therefore be considered as the identifier of weak convergence and relatively strong indicator of discriminant validity. It can therefore be claimed that the indicators of economic viability and economic efficiency of a family farm do not measure the bankruptcy probability and are not applicable to forecasting of farm bankruptcy. The indicators of economic viability and efficiency of a family farm measure a different context, namely, economic viability of the family farm which may show the development prospects of the farm.

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