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Approaches to estimation the farm-level economic viability and sustainability in agriculture: A literature review

Jindrich Spicka, Tomas Hlavsa, Katerina Soukupova, Marie Stolbova*

Institute of Agricultural Economics and Information, Prague, Czech Republic
**Corresponding author: spicka.jindrich@uzei.cz*

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Abstract: Estimation of farm economic sustainability and viability became more topical when redesigning the Common Agricultural Policy which should stabilise farm income and make agribusiness more viable and sustainable (typically in Czech areas facing natural constraints). The key question is how to calculate the income of farms or farm households not only to survive but also to grow sustainably. The article summarises and compares knowledge from 51 studies to provide a comprehensive discussion on different ways how to measure economic viability and sustainability to set income support for farms in the areas with natural constraints optimally. The authors found family farms and off-farm income as important limitations of FADN database (Farm Accountancy Data Network) for evaluation of the economic sustainability of farm household. Moreover, some financial ratios (Return on Assets – 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. The average wage in the economy or region is a better proxy for opportunity labour costs of unpaid work rather than average agricultural wage.

Keywords: agriculture; autonomy; economic sustainability; economic viability; Farm Net Value Added; household income

Many stakeholders discuss sustainability development from various viewpoints. Agricultural economists have focused on economic, environmental and social issues of sustainability for a long time. Especially economic sustainability is one of the main concerns when considering areas with natural constraints (ANC) which have been recently redesigned.

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, contribute 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 being able to keep the countryside in mountain areas. The question is how to define and measure the economic viability of small farms with a lot of opportunity costs compared to large farms relying on external factors (labour, land, capital). Economic viability is closely related to the economic sustainability and risk of business failure. Literature provides a lot of definitions and indicators. The review article provides a comprehensive discussion based on 51 relevant professional studies and formulates critical views on different ways how to measure

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economic viability and economic sustainability to set income support for farms in the ANC optimally. The findings can use not only stakeholders in the agribusiness but also in other sectors when leaving agricultural particularities (e.g. land, livestock) aside.

DEFINITIONS OF ECONOMIC VIABILITY AND SUSTAINABILITY

Economic viability has no universal definition. The recent study (O'Donoghue et al. 2016) compares different definitions of economic viability in previous literature. The crucial finding is a difference between the U.S. and the European concept of economic viability. Whereas the U.S. and Canadian experts define viability regarding meeting the income needs of the farm family, the European definitions understand the viability as an opportunity cost measure. One of the older but comprehensive cash flow-based definition by U.S. authors says 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).

Later definition of economic viability (Hennessy et al. 2008) does consider not only minimum consumption needs of family but also extra risk-free revenue in the form of 5% return on non-land assets which include the machinery, livestock and production quotas (not land which has low liquidity, especially in the 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 Ireland with the specific land market. Moreover, the return on non-land assets should be much lower at present, assuming current generally low bank interest rates.

Recent studies (Koleda and Lace 2010; Barnes et al. 2015) underline meeting business goals and accumulation of capital for future growth as an important assumption of economic viability. To meet them requires the implementation of business strategy and strategic planning.

Economic viability based on the opportunity cost defines the Dutch study on farm viability in the European Union (Vrolijk et al. 2010). Authors distinguish between five different levels of economic (financial) viability according to the relationship between income and opportunity costs.

The Vrolijk's approach complies with the economic value-added theoretical approach (Chen and Dodd 1997), which was adopted later for the INFA Performance Indicator Diagnostic System (Neumaierova and Neumaier 2014). The INFA works with the economic profit which compares the return on equity (ROE) achieved by an enterprise (ROE = net income/equity) and the opportunity cost of equity, meaning the required return on equity with respect to the risk run. Theoretically, Vrolijk's Category 1 corresponds to the situation when a company generates positive economic value added, i.e. the ROE exceeds the opportunity cost of equity. Category 2 expresses lower ROE (but still positive) than the opportunity cost of equity when the company generates positive accounting profit but negative economic profit.

Economic sustainability has some common and different aspects of economic viability. It is "viewed as economic viability, namely whether a farming system can survive in the long term in a changing economic context" (Latruffe et al. 2016). In other words, economic sustainability is the long-term viability of the farm. Especially family farms concern economic sustainability as a problem of economic durability, which is defined as "the capacity of a farm to be transferred to a successor" (Latruffe et al. 2016). Thus, the family business commitment is an important emotional driver of farm sustainability.

Economic sustainability relates to the farm household rather than business (farming). Economic sustainability is close to the term "livability" which "focuses on analysing whether the farming activity provides a decent professional and personal life for the farmers and their families" (Zahm et al. 2008). Farms that are not economically viable may be economically sustainable due to the off-farm income of the household members (Hennessy et al. 2008). Farm operators decide about on-farm and off-farm income as a portfolio, which is a tool of risk management farm strategy. Low off-farm employment is typical for more experienced and older farmers, larger farms (Mishra and Holthausen 2002), farms with higher debt-to-asset ratio (signal of farmer's business involvement) and farms located far from the urban areas which results from less alternative job opportunities (Mishra et al. 2004).

Some studies also refer to "autonomy" (or freedom) as an indicator of economic sustainability (Bossel 1999). Autonomy can be viewed in terms of independence on external inputs, debt, subsidies and the need for off-farm income (Latruffe et al. 2016).

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WAYS OF MEASURING ECONOMIC VIABILITY

Financial statement analysis

Economic viability is mainly measured by profitability, liquidity, stability and productivity (Latruffe et al. 2016). The first three categories have been frequently used in the financial statement analysis (Gibson 2013). Research studies used the financial ratios as indicators of firm economic viability such as return on investment, debt to net income ratio, 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 own land, labour and capital. Authors suggest that viability assessment through financial indicators is rather financial viability than economic viability because it does not consider productivity and opportunity costs. Some studies combined productivity and financial ratios (Argiles 2001).

Return on assets (ROA) and assets turnover are the most problematic indicators of farm economic viability because assets include only own but not hired assets. The large agricultural enterprises with approximately 1 600 ha on average in the Czech Republic have more than 80% of hired agricultural land, which is not included in long-term assets (Hanibal 2018). Thus, the results of the indicators would be significantly distorted. Return on Equity (ROE), Return on Invested Capital (ROIC) and Return on Sales (ROS) are more suitable indicators for assessment farm viability because they measure profitability for owners (ROE), profitability for owners and long-term creditors (ROIC) and profit margin (ROS), respectively. It is possible to use net farm income after taxes in all indicators (Spicka 2017). The ROE should be compared to the opportunity cost of equity, the ROA and ROIC should be compared to the weighted average costs of capital (WACC) which includes the opportunity cost of equity and cost of debt (Brealey et al. 2011). Profit margin (ROS) is not a common indicator of firm-level profitability, but it serves as one of the determinants of ROA and ROE.

Since the 1960s, financial ratios grouped in the multivariate credit scoring models experienced a boom (Beaver 1966; Altman 1968). They measure the financial condition of the company using multidimensional analysis and predict the risk of business failure. The score puts the companies to one of the (usually) three zones – "safe" zone, "grey" zone and "distress" zone. In fact, the score value in the "safe" zone evaluates the company as economically viable, the "distress" zone indicates the business failure of the company. The credit scoring models could be classified into several groups (Klepac and Hampel 2017): statistical data analysis like multivariate discrimination analysis (Altman and Hotchkiss 2005), probability theory (Wilcox 1973) or logistic regression models (Zmijewski 1984), the artificial intelligence or the data mining techniques like the support vector machines, the neural networks (Huang et al. 2004) or decision trees (Klepac and Hampel 2017) and, finally, the theoretical models like expert evaluation or market risk models (Pollak 2003).

Nevertheless, the credit scoring models have not been widely used in agriculture because of the subsidy bias. Farms receive not only income support but also payments for multifunctional roles and joining in the production of private and public goods (Doucha et al. 2012). Credit scoring models designed for agricultural enterprises were developed in Slovakia (Chrastinova 1998; Gurcik 2002). The biggest problem of Gurcik's index (G-index) is that four of five indicators evaluate profitability. There is a lack of information about capital structure, solvency, liquidity and networking capital management. Thus, the G-index could be suitable for impact evaluation of changes in farm payments but not for impact evaluation of farm investments using external debt. The major weakness of Gurcik's and Chrastinova's index is that they do not provide reliable predictions because the majority of farms were classified in the grey zone which does not reliably assess the financial viability (Camska 2013). More experts applied credit scoring models for evaluation of financial viability in agriculture, but they have not been commonly used so far (Argiles 2001; Dietrich et al. 2005).

Productivity

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

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productivity (Davidova et al. 2005) or technical efficiency (Latruffe and Desjeux 2016).

Since the economic viability measures the capability of a farm to survive and grow, the key productivity indicators focus on labour operating the farm. It is meaningful to calculate key performance indicators (KPIs) per land acreage in the specialist crop farms or relative to the livestock unit in the specialist livestock farming. Calculation of KPIs to labour input easily allows for comparison of both different types of farming. The labour input is often measured by the Annual Work Unit (AWU), total, paid or unpaid. The methodology enables to express labour input either as the total number of AWU (full-time equivalent of workers) or as hours worked on the farm. The labour input in AWU is used by official statistical authorities, e.g. Eurostat or FADN (Farm Accountancy Data Network). However, when the farm owner is not involved in farming, AWU does not capture him/her. Such a case is not typical for the family farms, but it can sometimes happen in the investor-owned large farms or holding companies.

In case of family farms, the FADN methodology provides indicator "Family Farm Income per FWU" (as defined by SE430 FADN Standard Results database; FWU = Family Work Unit). It takes into account the differences in the family labour force to be remunerated per farm. Experts (O'Donoghue et al. 2016) suggest a broad model of viability which compares threshold wage with Family Farm Income (FFI) per hours worked on the farm. The FFI should not include the cost of equity. FFI equals to adjusted Farm Net Income (FADN code SE420) for farms with unpaid labour input.

Cost of equity is defined as a fixed percentage of all own assets, i.e. total assets minus total liabilities, based on long-term interest rates provided by the European Central Bank (O'Donoghue et al. 2016) or 10-year government bonds by Eurostat (Vrolijk et al. 2010). Nevertheless, long-term interest rates or government bonds are close to the risk-free rate rather than considering the risky nature of agriculture. So, the cost of equity should be higher than the risk of investments in bonds (Alekneviciene et al. 2018; Franc-Dąbrowska et al. 2018). The opportunity cost of own land can be measured as regional land rent paid. This is opportunity cost-based approach on how to measure farm economic viability. Threshold wage is defined either as an average agricultural wage (Ryan et al. 2016) or average wage in the economy or region (Vrolijk et al. 2010). The high average wage in the economy compared to paid wages in agriculture impedes farms being viable. Thus, many workers leave agriculture and farmers search for off-farm jobs. Authors of the article suggest that the average wage in the economy or region better complies with opportunity costs as a value of choice in terms of the best alternative while making a decision."Family Farm Income per FWU" is not suitable for the evaluation of large agricultural companies with predominantly paid labour input and professional management. Thus, authors recommend applying another income indicator "Farm Net Value Added per AWU" (as defined by SE425 FADN Standard Results methodology).

FNVA per AWU is a key indicator for assessing the economic level of farms in time and between farm categories. The economic viable farm is able to cover labour cost, land and capital cost by the FNV. But the indicator does not express the real economic viability of farm workers. Moreover, the FNVA should be modified to measure potential income per AWU. Modified FNVA (MFNVA) is a key indicator for assessing the income level on AWU, and it is suitable for comparison with threshold wage. The MFNVA can be expressed as FNVA minus interest paid and rent paid.

MFNVA should cover not only paid wages of employees but also expected income for unpaid labour force, including owners (opportunity cost of equity).

Neither FFI nor (M)FNVA represents the disposable income of the entrepreneur because it does not take income taxes into account. Legal entities like joint stock companies, limited liability companies or cooperatives can use fixed tax rate at 19% of accounting profit. Family farms often calculate farm income as a part of farm household disposable income (common taxation of both income sources in one income tax return). These different tax schemes complicate the calculation of disposable farm income.

Besides Farm Income and Farm Net Value Added, cash-flow based indicators can measure the farm economic viability. It is possible to calculate cash flow directly (cash revenues – cash expenditures) or indirectly from Farm Net Income (International Accounting Standard 7). The FADN methodology (FADN RICA 2010) provides two indicators – Cash Flow 1 (SE526) and Cash Flow 2 (SE530). Cash Flow 1 considers balance of current subsidies and taxes (including investments). The indicator Cash Flow 2 adds balance of operations of liabilities and assets to the Cash Flow 1.

Figure 1 shows the difference between average Farm Net Value Added, Farm Net Income and Cash Flow in the Czech Republic. Farm Net Income is lower than

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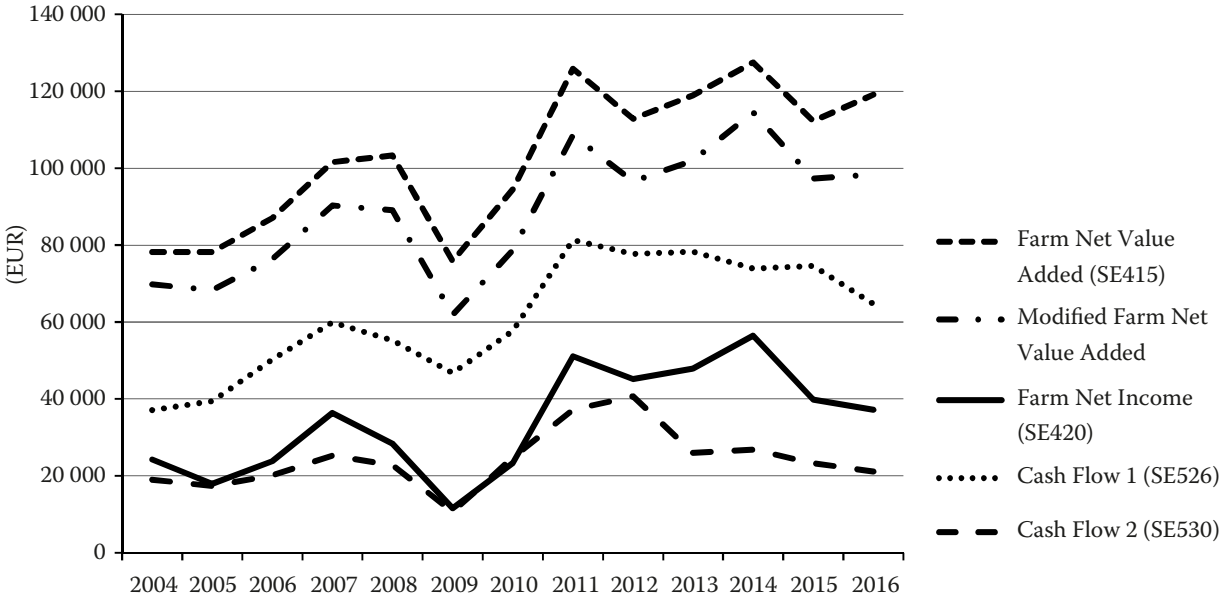

Figure 1. Average Farm Net Value Added, Modified Farm Net Value Added, Farm Net Income and Cash Flows in the Czech Republic (2004–2016)

Source: FADN RICA (2010), own calculation

Cash Flow 1. Nevertheless, Cash Flow 2 is mostly lower than Farm Net Income because of the balance of operations on assets (the investments exceed the sales of assets).

The methodical approach of Cash Flow 2 is close to the European Investment Bank indicator of economic sustainability related to the concepts of cash flow and liquidity (European Investment Bank 2016). The indicator measures, however, rather farm economic viability than sustainability.

The FADN indicators at a farm level do not include calculated labour input for investment activities, calculated farmhouse consumption of farm products and calculated rent for the dwelling house. For example, in the Swiss FADN, farm assets include the farmhouse; the family 'rents' the house from the farm (Meier 2005). The official FADN indicators are suitable for calculation of farm economic viability, not sustainability because they do not include households' private consumption, off-farm income and farmers' lifestyle benefits (Kelly et al. 2018).

WAYS OF MEASURING ECONOMIC SUSTAINABILITY

Economic sustainability is long-term economic viability at the farm household level, as discussed earlier. Thus, economic sustainability indicators must consider private consumption and off-farm income of farm household. Family Farm Income should remunerate the family's input of unpaid labour and capital. Estimation of the economic sustainability of family farms differs from the non-family agricultural enterprises because family farm income includes both on-farm income and off-farm income of the family members.

According to the Eurostat Farm Structure Survey 2013, "family labour represented 76.5% of the total (44.1% sole holders and 32.4% family members), 15.4% were regular non-family workers, and 8.1% were non-regular non-family workers" (Forti 2017). Family farming was dominant in most EU with family labour accounting for over 90% of agricultural work in Poland, Slovenia, Croatia and Ireland. "In contrast to family labour, there was a small number of countries where non-family labour accounted for more than 50% of the labour force. These included the Czech Republic (74.2%), Slovakia (72.4%), France (59.0%) and Estonia (53.6%)" (Forti 2017). Thus, family farming is really a phenomenon in the EU and must be taken into consideration when measuring economic viability and sustainability.

The Organisation for Economic Co-operation and Development (OECD) calculates disposable income as follows (Figure 2). "Total household income

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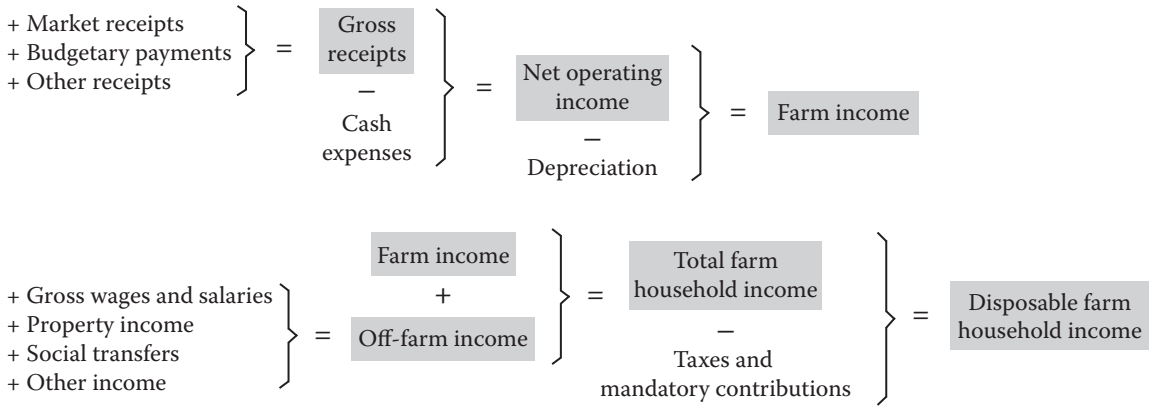

Figure 2. Calculation of disposable farm household income

Source: OECD (2003)

includes all earned income both from farming and non-farm activities, property income from investments, and social transfers from pension, health, unemployment schemes and various social safety nets. Disposable income is the total income available to households after taxes have been deducted" (OECD 2003).

The analysis of a time series carried out by the Swiss Farm Accountancy Data Network (FADN) showed that, over a long period, family farm income is considerably lower than private consumption (Meier 2005). If we include opportunity costs of own land, labour and capital, the gap even increased. Author Meier (2005) explained the income gap by the difference between true opportunity costs and estimated opportunity costs, non-economic factors that allow individuals to become or to continue as farmers (tradition, affection to the profession, independence) and the difference between income and cash flow. The off-farm income is really a crucial issue when estimating farm economic viability. Results of the Eurostat Farm Structure Survey 2013 provides interesting findings. "Around 22 million people worked regularly in agriculture in the EU-28, but only 16.4% of them worked on a farm full time. The proportion varied from slightly over 50% in the Czech Republic, France, Luxembourg and Belgium to less than 10% in Malta, Austria and Cyprus. Romania had the lowest proportion, with only 1.5% of people engaged in agricultural work full-time" (Forti 2017).

At the farm household level, "adding operating non-farm sources of cash flow from self-employed and employed activities, pensions, to the operating farm cash flow, we obtain the operating cash flow before private expenses. If the private expenses are deducted, the result is the net operating household cash flow" (Meier 2005). The net operating household cash flow is the indicator of farm household economic sustainability as the family use it for future investments or savings.

Private expenses are lower than the private consumption because of the deduction of the calculated values for farm products and the calculated farmhouse rent.

The biggest problem with FADN households' economic sustainability indicators is a lack of data about off-farm income. Off-farm income and off-farm employment are sensitive personal information. One of the possible solutions is to match FADN with tax records to provide information on household income (Latruffe and Mann 2015).

Literature provides an alternative way of how to measure economic sustainability in agriculture through the IDEA (Indicateurs de Durabilité des Exploitations Agricoles) method (Zahm et al. 2008). Authors used six indicators grouped into the four components in the economic sustainability scales:

i) *Economic viability*. "Economic independence guarantees the medium-term future of the farms by making it possible for production systems to have the capacity to invest and to adapt more easily to reductions in public subsidies" (Zahm et al. 2008).

– Available income per worker compared with the national legal minimum wage.

– Economic specialisation rate.

ii) *Independence*

– Financial autonomy.

– Reliance on direct subsidies from CAP and indirect economic impact of milk and sugar quotas.

iii) *Transferability*. "Transferability analyses the long-term ability to carry on from one generation to the next. In cases of succession, the amount of capital required

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to run and take over can end up leading to the farm being broken up." (Zahm et al. 2008)

– Total assets minus lands value by non-salaried worker unit.

iv) *Efficiency*. Efficiency is related to autonomy, which means the capacity of the production systems to make optimum use of their own resources as inputs.

– Operating expenses as a proportion of total production value.

The later study (Benidir et al. 2013) criticised the use of national legal minimum wage because its level is far from ensuring ideal survival compared to the current national purchasing power. Moreover, the national legal minimum wage does not consider the number of family members whose support is the responsibility of the farmer. Another problematic indicator is transferability measured by the monetary value. Successful transfer of a family farm to the next generation is a complex mix of issues, most of them are rather qualitative (Lobley et al. 2010). Finally, there is a problem of interannual variability of economic indicators. Thus, authors recommend using, for example, a three-year average for the income indicators, reducing the assessing long-term viability (O'Donoghue et al. 2016).

CONCLUSION

The review article focused on comprehensive discussion and critical views on different ways how to measure economic viability and economic sustainability to set income support for farms optimally. Based on a review of 51 relevant studies, the authors suggest possible solutions.

There is no unified definition of economic viability and sustainability. Recent studies agree that economic sustainability is the long-term viability of farm household, whereas the economic viability measures farm-level capability to grow. The capability to grow is determined mainly by the long-term amount of profit generated and exploitation of opportunities for farm development as well as by the level of farm strategy. Farms which are neither viable not sustainable are vulnerable. Some authors refer to autonomy or independence as an important prerequisite for economic sustainability. The indicators of economic sustainability should be measured in multi-year average (e.g. three-year average) because it better reflects the interannual variability of determinants of the economic viability and principles of sustainability.

The 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 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. Family farms stress more cash flow than income, unlike (usually larger) non-family agricultural enterprises which focus on income (economic or accounting profit). Authors suggest that operating farm cash flow together with off-farm household cash flow must cover all private expenses and cover expected household cash surplus. The households use the surplus for future investments and private savings. Nevertheless, available FADN data do not contain personal economic data of family, and FADN-based farm-level sustainability studies have limitations. Authors of recent studies matched FADN with tax records administered by the Financial Administration, which extends the information potential for household-level research.

The advantage of legal entities like joint stock companies, limited liability companies and cooperatives is the availability of financial statements. This enables to measure economic viability and sustainability through financial ratios of profitability, liquidity and stability or multivariate scoring models. However, some profitability ratios (ROA, assets turnover) provide misinterpretation because the assets do not include hired land, which takes more than 80% of the utilised agricultural land of Czech large farms.

When joining family farms and legal entities together (typically in Czech areas facing natural constraints), the productivity indicators are the best solution for calculation of economic viability and sustainability despite some bias in the family farms' evaluation. Authors recommend using modified Farm Net Value Added (MFNVA) allowing for opportunity costs of own land and non-land assets. The MFNVA must be higher than a sum of wages and expected income for unpaid labour input. Authors of the article suggest using average wage in the economy or region as opportunity labour costs of unpaid work units as a value of choice in terms of the best alternative while an entrepreneur makes a decision.

The literature review will contribute to a more detailed analysis of the viability and sustainability of farms in less favourable areas in the Czech Republic. Scores representing a multidimensional view on viability and sustainability will be based on the comprehensive

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analysis of individually selected indicators. At the same time, suitable predictors of viability will be identified and used for policy modelling of the ANC regions.

REFERENCES

Alekneviciene A., Stareviciute B., Alekneviciute E. (2018): Evaluation of the efficiency of European Union farms: a risk-adjusted return approach. Agricultural Economics – Czech, 64: 241–255.

Altman E.I. (1968): Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. The Journal of Finance, 23: 589–609.

Altman E.I., Hotchkiss E. (2005): Corporate financial distress and bankruptcy. John Wiley & Sons, Inc. Hoboken, NJ, USA.

Argiles J.M. (2001): Accounting information and the prediction of farm non-viability. European Accounting Review, 10: 73–105.

Barnes A.P., Hansson H., Manevska-Tasevska G., Shrestha S.S., Thomson S.G. (2015): The influence of diversification on long-term viability of the agricultural sector. Land Use Policy, 49: 404–412.

Beaver W.H. (1966): Financial ratios as predictors of failure. Journal of Accounting Research, 4: 71–111.

Benidir M., Ghozlane F., Bousbia A., Belkheir B. (2013): The use of a critical analysis of a multicriterion method (IDEA) for assessing the sustainability of sedentary sheep rearing systems in the Algerian steppe areas. African Journal of Agricultural, 8: 804–811.

Blazkova I., Dvoulety O. (2018a): Investigating the differences in entrepreneurial success through the firm-specific factors: Microeconomic evidence from the Czech food industry. Journal of Entrepreneurship in Emerging Economies, 63: 667–690.

Blazkova I., Dvoulety O. (2018b): The causes of firm performance variation in the Czech food processing industry in the context of the outlier effect. Management Research Review, 41: 968–986.

Bossel H. (1999): Indicators for Sustainable Development: Theory, Method, Applications: a Report to the Balaton Group/Hartmut Bossel. International Institute for Sustainable Development, Winnipeg.

Brealey R.A., Myers S.C., Allen F. (2011): Principles of Corporate Finance. McGraw-Hill Higher Irwin, New York.

Camska D. (2013): Predicting financial distress of companies in the agricultural sector. In: Eglite A. (ed.): Economic Science for Rural Development: Finance and Taxes. Economic Science for Rural Development: Finance and Taxes, Latvia, Jelgava, April 25–26, 2013: 257–262.

Davidova S., Gorton M., Ratinger T., Zawalinska K., Iraizoz B. (2005): Farm productivity and profitability: a comparative analysis of selected new and existing EU member states. Comparative Economic Studies, 47: 652–674.

Dietrich J., Arcelus F.J., Srinivasan G. (2005): Predicting financial failure: Some evidence from new brunswick agricultural co-ops. Annals of Public and Cooperative Economics, 76: 179–194.

Doucha T., Foltyn I., Humpal J. (2012): Profitability of dairy and suckler cows breeding on Czech farms. Agricultural Economics – Czech, 58: 397–408.

European Investment Bank (2016): Methodological Handbook for Implementing an Ex-Ante Assessment of Agriculture Financial Instruments under the EAFRD. European Investment Bank, Luxembourg.

European Parliament and the Council of the European Union (2013): Regulation (EU) No. 1305/2013 of the European Parliament and of the Council of December 17, 2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) and repealing Council Regulation (EC) No. 1698/2005. In: Official Journal of the European Union.

FADN RICA (2010): Standard Results Indicators. Available at http://ec.europa.eu/agriculture/rica/annex003_en.cfm#cf (accessed Aug 24, 2018).

Franc-Dąbrowska J., Mądra-Sawicka M., Bereżnicka J. (2018): Cost of agricultural business equity capital – a theoretical and empirical study for Poland. Economies, 6: 15.

Forti R. (2017): Agriculture, Forestry and Fishery Statistics: 2017 Edition. Publications Office, Luxembourg.

Gibson C.H. (2013): Financial Statement Analysis. Cengage Learning, Andover.

Gurcik L. (2002): G-index – the financial situation prognosis method of agricultural enterprises. Agricultural Economics – Czech, 48: 373–378.

Hanibal J. (ed.) (2018): Výběrové šetření hospodářských výsledků zemědělských podniků v síti FADN CZ za rok 2016: Samostatná příloha ke Zprávě o stavu zemědělství ČR za rok 2016. Institute of Agricultural Economics and Information, Prague. (in Czech)

Hennessy T., Shrestha S., Farrell M. (2008): Quantifying the viability of farming in Ireland: Can decoupling address the regional imbalances? Irish Geography, 41: 29–47.

Huang Z., Chen H., Hsu C.J., Chen W.H., Wu S. (2004): Credit rating analysis with support vector machines and neural networks: A market comparative study. Decision Support Systems, 37: 543–558.

Chen S., Dodd J.L. (1997): Economic Value Added (EVA™): An empirical examination of a new corporate performance measure. Journal of Managerial Issues, 9: 318–333.

Chrastinova Z. (1998): Metódy hodnotenia ekonomickej bonity a predikcie finančnej situácie poľnohospodárskych podnikov. National Agricultural and Food Centre, Re-

https://doi.org/10.17221/269/2018-AGRICECON

search Institute of Agricultural and Food Economics, Bratislava. (in Slovak)

Kelly E., Latruffe L., Desjeux Y., Ryan M., Uthes S., Diazabakana A., Dillon E., Finn J. (2018): Sustainability indicators for improved assessment of the effects of agricultural policy across the EU: Is FADN the answer? Ecological Indicators, 89: 903–911.

Klepac V., Hampel D. (2017): Predicting financial distress of agriculture companies in EU. Agricultural Economics – Czech, 63: 347–355.

Koleda N., Lace N. (2010): Dynamic factor analysis of financial viability of Latvian service sector companies. Economics and Management, 15: 620–626.

Latruffe L., Desjeux Y. (2016): Common agricultural policy support, technical efficiency and productivity change in French agriculture. Review of Agricultural, Food and Environmental Studies, 97: 15–28.

Latruffe L., Diazabakana A., Bockstaller C., Desjeux Y., Finn J., Kelly E., Ryan M., Uthes S. (2016): Measurement of sustainability in agriculture: A review of indicators. Studies in Agricultural Economics, 118: 123–130.

Latruffe L., Mann S. (2015): Is part-time farming less subsidised? The example of direct payments in France and Switzerland. Cahiers Agricultures, 24: 20–27.

Lobley M., Baker J., Whitehead I. (2010): Farm succession and retirement: some international comparisons. Journal of Agriculture, Food Systems, and Community Development, 1: 49–64.

Meier B. (2005): The role of cash flow indicators in understanding farm households. In: Moreddu C., Poppe K.J. (eds): Proceedings of the OECD/PACIOLI Workshop on Information Needs for the Analysis of Farm Household Income Issues. Agricultural Economics Research Institute, Den Haag, 2004: 51–60.

Miceikiene A., Girdžiute L. (2016): Farmers' economic viability assessment in the context of taxation and support. In: Proceedings International Scientific days 2016. The Agri-Food Value Chain: Challenges for Natural Resources Management and Society, Nitra, Slovakia, May 19–20, 2016: 350–360.

Mishra A.K., El-Osta H.S., Sandretto C.L. (2004): Factors affecting farm enterprise diversification. Agricultural Finance Review, 64: 151–166.

Mishra A.K., Holthausen D.M. (2002): Effect of farm income and off-farm wage variability on off-farm labor supply. Agricultural and Resource Economics Review, 31: 187–199.

Neumaierova I., Neumaier I. (2014): INFA Performance indicator diagnostic system. Central European Business Review, 3: 35–41.

O'Donoghue C., Devisme S., Ryan M., Conneely R., Gillespie P., Vrolijk H. (2016): Farm economic sustainability in the European Union: A pilot study. Studies in Agricultural Economics, 118: 163–171.

OECD (2003): Farm Household Income: Issues and Policy Responses. OECD, Paris.

Pollak H. (2003): Jak obnovit životaschopnost upadajících podniků. C.H. Beck, Prague. (in Czech)

Ryan M., Hennessy T., Buckley C., Dillon E.J., Donnellan T., Hanrahan K., Moran B. (2016): Developing farm-level sustainability indicators for Ireland using the Teagasc National Farm Survey. Irish Journal of Agricultural and Food Research, 55: 112–125.

Slavickiene A., Savickiene J. (2014a): Comparable analysis of farm viability assessment methodologies. European Scientific Journal, 10: 130–150.

Slavickiene A., Savickiene J. (2014b): The evaluation of small and medium farms' economic Viability in the new EU countries. Economy & Business, 8: 843–855.

Smale M., Saupe W.E., Salant P. (1986): Farm family characteristics and the viability of farm households in Wisconsin, Mississippi, and Tennessee. Agricultural Economics Research, 38: 11–27.

Spicka J. (2017): Finanční analýza organizace z pohledu zájmových skupin. C.H. Beck, Prague. (in Czech)

Vrolijk H.C.J., de Bont C.J.A.M., Blokland P.W., Soboh R.A.M.E. (2010): Farm Viability in the European Union: Assessment of the Impact of Changes in Farm Payments. LEI Wageningen UR, Den Haag.

Wilcox J.W. (1973): A prediction of business failure using accounting data. Journal of Accounting Research, 11: 163–179.

Zahm F., Viaux P., Vilain L., Girardin P., Mouchet C. (2008): Assessing farm sustainability with the IDEA method – from the concept of agriculture sustainability to case studies on farms. Sustainable Development, 16: 271–281.

Zmijewski M.E. (1984): Methodological issues related to the estimation of financial distress prediction models. Journal of Accounting Research, 22: 59–82.

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