MEASUREMENT OF INCOME RISK AS BENCHMARKING TOOL FOR DAIRY FARMS

Gašper Petelin [1] and Jaka Žgajnar [2]

[1] Datalab Tehnologije d.d., Hajdrihova ulica 28c, SI-1000 Ljubljana, Slovenia

[2] University of Ljubljana, Biotechnical Faculty, Department of Animal Science, Groblje 3, SI-1230, Domžale, Slovenia

gasper.petelin@datalab.eu, jaka.zgajnar@bf.uni-lj.si

ABSTRACT

With increasing risks in agriculture, their management is becoming increasingly topical. Climate changes, price fluctuations and changes of institutional measures increase variability of farms' income, which can have a negative effect. Effective risk management strategy can help farmers protecting themselves from such events and help stabilize their income. Given that we are talking about various factors that influence the risks, a multistep approach is required. First, layers of risks should be considered separately. Normal risks are usually managed on the farm with different costs strategies by farmers (OECD, 2011) while market and catastrophic risks are managed by the private sector or the state. Additionally, an effective risk measurement tool should be established. On top of that benchmarking could be an effective approach for increasing farm efficiency. The present paper therefore presents a conceptual approach to use the farm management information system PANTHEON Farming as a risk measurement and benchmarking tool. It is presented on the case of Slovenian dairy farms. First goal of such tool is to use farm level data, created through bookkeeping and accounting, to measure volatility of individual financial parameters. In such a manner, farmers would get a detailed overview of the income variability on his/her farm as well as an insight to what actually causes such variability. In the next step, tool would enable user to compare their results to benchmarks or to similar results of other farms. Farms that use PANTHEON Farming could share information about risk measurement and some additional details like production type, production intensity, location, etc. Such insight would enable farmers to compare (benchmark) their results and see, if their variability in some way stands out from benchmarks of sector or from farms in same location, intensity of production, feed usage, etc. These results would also indicate to the farmer some additional information like which type of production, feed or animal breed could help reduce income variability in similar condition. An important step of risk measurement is also time frame, selected for analysis, which can have a significant impact on results. Therefore, developed tool would enable farmer to choose either he wants to review only last year, last three years or Olympic average results which would properly recalculate the variability of each parameter. Such functionality as well as whole benchmarking tool could help farmers with their business. For farmers to be able to cope with increasing risks, adequate information should be provided as well as individual risk sources should be identified. This could also increase production optimization and risk management on farm level and could therefore increase resilience of farms to exposure risk. Policy makers could also benefit on the long run, as risk management on farm level would increase and could on the one hand minimize the need for policy interference with risk management and on the other minimize the exposure of individual farms to catastrophic risks.

Keywords*:* Benchmarking, Income risk, Dairy farm, Risk measurement*.*

1. INTRODUCTION

Due to its close connection with nature, agriculture has always been a risky business (Chapman, et al., 2007). Factors like weather (Tangermann, 2011) or disease outbreaks (Aimin, 2010; Meuwissen et al. 2001) already present important drivers of farm uncertainties with additional increase in recent period. Additional elements like price risks of products (Antón, et al., 2011) as well as outputs (Aimin, 2010; Schaffnit-Chatterjee, 2010) pose another major threat for individual farm. Institutional risks must also be considered. Changes in legislation (Berg and Kramer, 2008), late payment of subsidies or environmental restrictions (Agrosynergie, 2011; Schils et al., 2007) can also make an important contribution to the income variability. Additional smaller, but not at all negligible risk elements combine factors like exchange rate and farm workforce (Hardaker, et al., 2004).

However, to be able to effectively tackle on farm risks, they first have to be identified and measured. According to Meuwissen et al. (2001), livestock producer are seeing more importance in production, price and institutional risks and hence our focus is on these groups. Additionally, on farm risk strategies should consider risk layers. Farmers are only able to manage normal risks for themselves whereas other risks, like market or catastrophic, are usually covered by other stakeholders (OECD, 2011). The main problem with this fact is that, according to Meuwissen et al. (2008), there is no clear dividing line between layers, which makes it difficult to determine when to include external tools to on farm risk management. To overcome this issue risk management tools or different researches use 15% of income drop as a threshold value for normal risks Tangermann (2011).

Within layers of normal risks that farmer can and should manage for himself (Tangermann, 2011; Lipińska, 2016), some additional characteristics have to be considered. Systemic risks (like price or institutional risks) are very hard to manage on farm level (Girdžiute, 2012; Matthews, 2010). Nevertheless, even if the farm recognizes increased exposure to such risks, they usually affect the wider area and indirectly affect functioning of such farm. Additionally, connections between risk groups should also be considered as ignoring such connections could jeopardize the relevance of the model (Lien, 2003). Positive correlation usually increases variability and, according to El Benni in Finger (2014), it usually appears in regional markets without significant impact to world markets (like Slovenia). Negative correlation is on the other hand desirable to some extent as, according to Benni in Finger (2014), it can decrease variability. Still, no matter how we consider each group of risks, it should be clear that the characteristics of the individual farm have the greatest impact on income variability.

Measured parameters, in our case variability of financial parameters, do not tell much by themselves if we do not have some values to compare them with. There are many methods of data comparison (Ronan and Cleary, 2000; Torun et al., 2018) with benchmarking being one of them. Method is simply described as comparison of ones performance with the performance of other engaged in similar activity (European Commission, 2017). Concept uses systematic approach to business improvement where best practice is sought and implemented to improve desired process (Torun, et al., 2018). Since its first efforts in the 1960, it was formally incorporated into the corporation-wide improvement efforts in 1983 (Ronan and Cleary, 2000). Nowadays, benchmarking is a very well-known concept also in agriculture. Calculating and comparing technological parameters to benchmarks or experiences of other farmers to improve performance, so called horizontal benchmarking (Franks and Haverty, 2005), is already implemented in many agricultural sectors (European Commission, 2017), especially sectors like granivore sector, arable sector and dairy production.

Despite benchmarking for the financial analysis has been identified as a tool that helps farmers identify excessive costs and inefficiencies that can solidify and stabilize the financial structure of farms (Franks and Haverty, 2005) its application is very diverse. Although it is a widespread practice in some environments, like Australia (Wilson, et al., 2005), its spread in the EU is only around 30% - 40% (European Commission, 2017). There are several reasons for this situation. One of the most important is insufficient knowledge of the benchmarking method. There is often said that benchmarking is a tool for large firms and not for small farmers. The reason for this is that key performance indicators (KPIs) should be defined by experts and that only large farms can find acceptable benchmarking partners,

which could also be associated with trust issues regarding sharing of financial data (Franks and Haverty, 2005). On top of that, data collecting still represent a huge burden as over 40% of data in the EU are still sent in a non-electronic way. However, we are seeing some improvement in this area. With adoption of ICT, farmers are getting more relevant data easier, which enables better insight in an individual farm (European Commission, 2017).

Hence our motivation lies within the fact that financial data in the EU are not sufficiently used to analyze the actual state of the farm. To improve this, our analysis contains an approach that measures income risk from financial data and uses them in a benchmarking tool to compare data with other farms or defined benchmarks. The remainder of this paper is thus structured as follows: section 2 presents methodology on how the income risk measurement model was established and unified as well as how data are obtained. Section 3 represents the results of benchmarking between selected farm samples, which are further discussed in section 4. Section 5 at the end draws conclusions and describes some possibilities for future development in this area.

2. METHODOLOGY

To be able to effectively benchmark income variability, we first had to establish income risk measurement model. The model was developed from bookkeeping and accounting data of an individual farm. Standardized chart of accounts, which enables simplified implementation (Argilés and Slof, 2001) that are used for accounting, have been recognized as a useful tool to measure and analyze risks (Antón, et al., 2011). The construction of such module was made possible by the adopted chart of accounts, established by Slovenian accounting and agriculture experts (MKGP, 2014). Detailed chart of account is based on Farm Accountancy Data Network (FADN) accounting methodology and combines FADN methodology with accounting (MKGP, 2012). As a result, we can get detailed financial structure of individual farm that is comparable to FADN results.

Primary data source in our analysis are bookkeeping data from PANTHEON Farming (Datalab, 2019). As farm management information system (FMIS) software enables recording of farm events (animal birth, insemination, treatment, etc.) as well as bookkeeping (received/issued invoices, stock management, personnel records, etc.). How data are obtained and prepared was thoroughly presented by Petelin and Žgajnar (2016). On the basis of this approach we then developed a model to measure and analyze risks. In this part we used combination of chart of account and FADN methodology to prepare a hierarchical structure of variables (Figure 1). This approach and combination of different methodologies would theoretically enable farmer to compare their bookkeeping data with FADN results. Variables were then grouped and summarized to calculate revenues, variable costs, fixed costs and income.

Key	Value self	Value total
Family Farm Income		228.130,46
Revenue		696.919,29
Farm revenues	46.561,62	46.561,62
Non-farm revenue	17.618,11	17.618,11
Subsidies	173.494,69	173.494,69
Sold calves	10.162,11	10.162,11
Sold dairy cows	26.628,10	26.628,10
Sold other animals	15.516,87	15.516,87
Milk value	406.937,79	406.937,79
Variable cost	-52.893,97	-368.844,74
Livestock costs	-71.226,55	-71.226,55
Concentrated feed	-70.856,93	-70.856,93
Fresh feed	-95.332,74	-95.332,74
Home grown feed	-59.150,84	-59.150,84
Insurance costs	-19.383,71	-19.383,71
Fixed cost	-50.282,94	-99.944,09
Rent	-49.661,15	-49.661,15

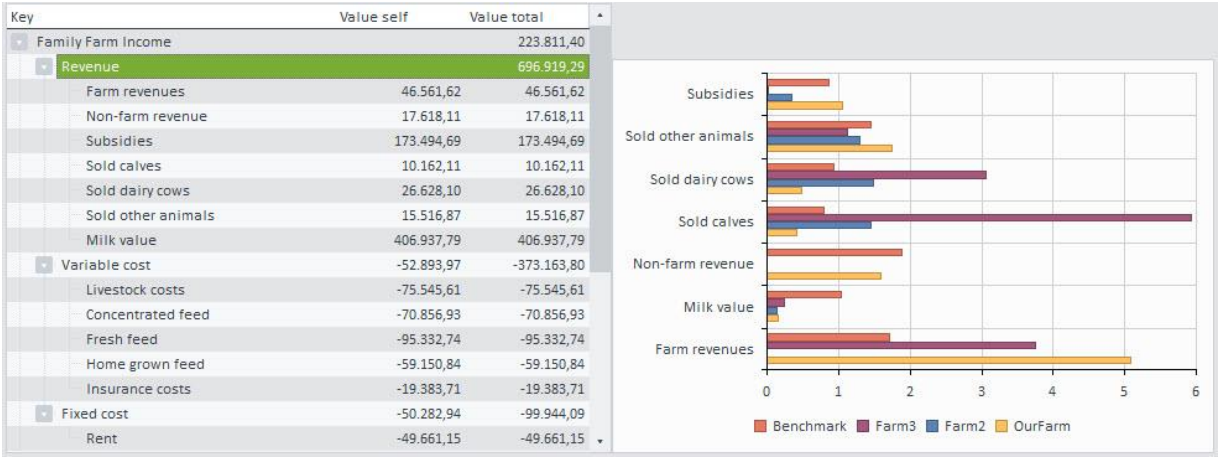
Key
VitaminsMinerals
Protein_Feed
Milk_Substitute

Figure 1: Hierarchical structure of income risk measurement variables (Datalab, 2019)

The last step of model construction was adapting the existing model for benchmarking. First, we calculated parameters that will serve to measure risk. As it has been previously indicated (Hardaker, et al., 2004), coefficient of variation (CV) is an appropriate measure of risks as its relative value enables comparison of different values. Benchmarking on the level of CV also brings another important advantage. As it is calculated from actual values as a relative measure, it does not disclosure any actual financial information. This is why we calculate CVs for each variable from historical data from PANTHEON Farming and share them through web service to other PANTHEON Farming users. The final result of this approach is a graphical comparison of CVs for the whole hierarchical structure of variables. Results of such analysis are described in the next chapter.

3. RESULTS

This section presents results of our analysis. Based on previously established risk measurement model, we managed to develop an approach that would enable comparison of CV from different farms. Figure 2, therefore, shows benchmarking of financial parameters. The left section of the picture shows the hierarchical structure of income that is calculated from selected variables with calculated result of selected farm. In our case, we are looking ad fixed structure of income that enables comparison of results from different farms. As was previously already described, we constructed variables based on chart of accounts and FADN variable structure.



Key	Value self	Value total
Family Farm Income		223.811,40
Revenue		696.919,29
Farm revenues	46.561,62	46.561,62
Non-farm revenue	17.618,11	17.618,11
Subsidies	173.494,69	173.494,69
Sold calves	10.162,11	10.162,11
Sold dairy cows	26.628,10	26.628,10
Sold other animals	15.516,87	15.516,87
Milk value	406.937,79	406.937,79
Variable cost	-52.893,97	-373.163,80
Livestock costs	-75.545,61	-75.545,61
Concentrated feed	-70.856,93	-70.856,93
Fresh feed	-95.332,74	-95.332,74
Home grown feed	-59.150,84	-59.150,84
Insurance costs	-19.383,71	-19.383,71
Fixed cost	-50.282,94	-99.944,09
Rent	-49.661,15	-49.661,15

Figure 2: Benchmarking of CV from different farms (Datalab, 2019)

The right section of Figure 2 shows the result of benchmarking for revenue from sale of animals. Selected parameter (Revenue) on the right is further divided on variables subsidies, sold other animals, sold dairy cows, sold calves, non-farm revenue, milk value and farm revenues. Diagram shows the CV for a farm that is using PANTHEON Farming (OurFarm), two individual farms (Farm2 and Farm3) as well as benchmark sample (Benchmark). For latest variable, we selected data from FADN sample and includes all dairy farms in Slovenia. Although we cannot draw any firm conclusions, developed approach provides an insight into the analysis that the approach enables. On the one hand we can see that variability of sale of calves and dairy cows is very high on Farm3. This indicates that flow of animals (arrivals and departures) on farm is very diverse in a sense that different animal groups are bred on farm. If farm would wand to better control its risks, it should focus more on milk production and bred animals mainly for that purpose. However, milk value shows significantly low variability. In comparison with other farms, OurFarm shows significantly lower variability of sale of calves, but a bit higher variability of sale of dairy cows. As we are seeing also with other farms, some are expressing high variability for sale of calves (Farm3) and some farm revenues (Farm3 and OurFarm) which indicates on diversity of selected sample.

4. DISCUSSION

As has been repeatedly established before, risk management is becoming ever more topical. To be able to manage risks, they must be measured, analyzed and presented in a comprehensible manner. Since farmers do not favor the use of computer equipment (of do not have time to use it) and usually sees is as appropriate for larger farm enterprises (European Commission, 2017) the latter is probably the most important. FMIS in connection with enterprise resource planning (ERP) could prove as a useful tool for such measurement and analysis since it includes not only technical information of individual farm, but also financials. Benchmarking of these results is an additional step of risk management. To be able to follow income variability of farms from a similar environment and adopt useful practices for risk management could improve the resilience of smaller farms. Since data structure is compatible with other data sources like FADN methodology, benchmarks could be established on external data sources and included in analysis, which would enable farmers to compare their results with expected values within their sector. Nevertheless, presented results just indicate the possibility of using such a tool and require further research and development in this field.

5. CONCLUSIONS

The developed approach shows possibilities in how to use FMIS to analyze risks on individual farm and to benchmark those risks either with other farms or with benchmarks, established by public organizations or other stakeholders. This would provide benefit for all stakeholders. Farmers itself would get clear insight in risk structure in their farm which is a first step into risk management. Other stakeholders like expert organizations or state could also benefit from it on a long run as tool could provide depth insight into the structure of risk either in specific sector, location, etc., which could help to develop risk management tools.

Nevertheless, it is clear that presented contribution is only the first step towards an effective risk benchmarking tool. As stated before, characteristic of individual farm are very important in risk management hence such tool should share more information regarding specifics of individual farm. Data series should be clearly marked, possibly with option to exclude individual year, which would enable to either exclude individual bad year or analyze only specific period. Most important tool should provide long data series for risks, which would provide relevant analysis of risk. Therefore such tools should be developed and put in use rather sooner than later.

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