Abstract: There are many methods for the financial health assessment of a company; the most utilized include statistical methods that evaluate the business from multiple perspectives simultaneously. Since each model has been formed under different conditions and on a different date, it may not be suitable for the assessment of all businesses. In this article six models are assessed, some designed for the field of agriculture. The selected models are IN99, IN05, the Gurčík-index, the CH-index, the Taffler index and the Řezbová OP model. In the analysis, their reliability in identifying healthy companies and businesses with financial problems are compared.

None of the models have achieved good results in both analyses simultaneously, which leads to the question: Why is this so? The cause may be the specifics of agriculture that are not taken into account in the models and thus they can influence the outcome of the assessment. The specifics are the value of the land that is not determined by its quality, but by the locations, the value of the leased land, which is not included in the value of assets, as well as the work of nature, the value of the subsidies, which affects the amount of assets and the net profit or costs of fertilizer, which has an effect even for three years.

Is there the ability to include these specifics into some of the methods of assessment and thus achieve greater reliability and the efficiency of allocation not only of private investors’ resources but also the subsidies? This will be the subject of the further analysis.

Key words: Financial Health Assessment · Agriculture · Risk · Explanatory Power

JEL Classification: M41 · Q1 · G3

1 Introduction

This paper is focused on the financial health assessment of the farm. Financial health assessment through the credibility and bankruptcy model is widely-used. It has many advantages but the outcome of these models can be untruthful. These models use information from financial statements. Since agriculture is a rather specific field of business, it is assumed that the specifics are reflected in the results of this assessment. For example Kouřilová, Pšeničk & Kopta (2009), Valder, Dvořáková (2015) or Kouřilová & Drábková (2009) deal with some specifics of agriculture. Kouřilová, Pšeničk & Kopta (2009) follow up on subsidies in agriculture, Kouřilová & Drábková (2009) describe problems with calculations, Valder deals with land and its valuation and Dvořáková (2015) delineates problems in Czech accounting legislation, for example, with leasing (for example of land). These specifics are also the subject of this research. The fact that the actual rating through bankruptcy and credibility models is not enough, is also said by Šindelářová (2006) in her work. Gustafson (1989) also notes that not only financial indicators but also other information, for example the environment surrounding the agricultural enterprise, should be included in the financial health assessment.

This article evaluates the reliability of the selected models in recognizing enterprises that are in trouble. The second part establishes significant indicators and their impact on the outcome of financial health assessment using these models. For example Kopta (2009), Maňasová (2008), or Sušický (2011 I., II.) deal with the evaluation of the reliability of credibility and bankruptcy models. For example Kopta (2009), Sušický (2011 I., II.) or Maňasová (2008) deal with the evaluation of the reliability of credibility and bankruptcy models. Kopta (2009) evaluated the reliability. He focussed on financial problems caused by two factors: profitability and cash flow. In his analysis of the prediction of problems due to profitability, the model for Rural Development Programme and the Gurčík index came out as the best. The CH-index and IN95 responded best to threats arising from cash flow. He also did an analysis of the reliability by determining the thriving enterprises. The Řezbová OP model for the Operational Programme Rural Development came out as the best (reliability of 89.68%). The second was the Grünwald index (62.90%) and the third the Gurčík index (only 33.23%). Sušický (2011, I. II.) assessed bankruptcy models and their reliability by the recognizing thriving and bankruptcy companies. He assessed models from Altman, Neumaiers and the Taffler model. Model IN99 was the second best (after the ZETA model) in recognizing bankruptcy companies. By recognizing thriving companies the first was Taffler model with the reliability of 98%. Maňasová (2008) first evaluated the success rate of bankruptcy prediction models on enterprises that actually got into troubles in the following years. With no distinction between

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sectors, the IN05 index was the best. She also dealt with the same evaluation depending on specific sectors. In the field of agriculture, the ZETA and Z-Score models generated the best results. The IN models of the Neumaiers also achieved very good results.

The aim of this article is to define the reliability of models for recognizing companies with problems and thriving companies.

2 Methods

The first part includes an analysis of the reliability of the selected models in identifying thriving companies and an analysis of the reliability in predicting problems. For the analysis, the data set from the Albertina Gold database was used. The financial statements from 2010 to 2014 of enterprises which were in bankruptcy or liquidation in 2015 were used to determine the reliability by predicting the companies’ financial problems. The same amount of data records of companies which were not in liquidation or in bankruptcy were used for the analysis of thriving companies. This data set was selected by random sampling in order to better representation. On selected dates, a test of normality - Shapiro-Wilk test was performed, which proved the normality of this data set. All available data records from the years 2010 to 2015 were used to analyse the most significant indicators by the financial standing assessment of companies. For this analysis the Generalized linear models, concretely the multinomial logit model is used. There is used the Wald statistic which is computed as the generalized inner product of the parameter estimates with the respective variance-covariance matrix, is an easily computed, efficient statistic for testing the significance of effects.

This included companies from all 14 regions, with the most prominent being the regions of South Moravia, Central Bohemia and South Bohemia. 70.4% of the financial statements are full, in their entirety. The number of employees ranges from 11 to 44. The most represented is the number 12, with almost 31%.

The analysis examined six selected models of financial health assessment, namely: IN99, IN05, the Gurčík model, the CH-index, the Taffler index and the ‘Řezbová OP model’ index for the Operational Programme Rural Development. The Gurčík model, the CH-index and the ‘Řezbová OP model’ index for the Operational Programme Rural Development were chosen because they were created within the context of the Czech Republic and Slovakia (which is very similar) and because they were intended for the assessment of enterprises in agriculture. Another three models were chosen for the comparison of the results of the analysis.

2.1 Index IN99

Index IN99 is creditworthy model constructed from the perspective of the owner by the Neumaiers in Czech Republic in 1999. To create this new index the discriminant analysis has been used. Due to this analysis, the weights of the index IN95 were revised. During the revision their importance for achieving positive economic profit was taken in view.

\[
IN99 = 0.017 \times \frac{\text{Assets}}{\text{External capital}} + 4.573 \times \frac{\text{EBIT}}{\text{Assets}} + 0.481 \times \frac{\text{Revenue}}{\text{Assets}} + 0.015 \times \frac{\text{Current assets}}{\text{Current liabilities}}
\]

According to the resulting value, companies are classified as follows:

- \(IN99 > 2.07\) the company creates a new value for the owner
- \(1.42 \leq IN99 < 2.07\) the company rather creates a new value for the owner
- \(1.089 \leq IN99 < 1.42\) Unable to determine whether the company creates the value for the owner or does not
- \(0.684 \leq IN99 < 1.089\) the company does not rather creates a new value for the owner
- \(IN99 < 0.684\) the company does not creates a new value for the owner (Neumaierová, Neumaier; 2002)

2.2 IN05

This model was created by the Neumaiers in the Czech Republic in 2005. It also takes into account the viewpoint of the owner.

The index equation is as follows:

\[
IN05 = 0.13 \times \frac{\text{Assets}}{\text{Liabilities}} + 0.04 \times \frac{\text{EBIT}}{\text{Interest payable}} + 3.97 \times \frac{\text{EBIT}}{\text{Assets}} + 0.21 \times \frac{\text{Revenue}}{\text{Assets}} + 0.09 \times \frac{\text{Current assets}}{\text{Current liabilities}}
\]

According to the resulting value, companies are classified as follows:

- \(1.6 < \text{IN05} < 1.6\) enterprise creates value
- \(0.9 < \text{IN05} < 1.6\) grey zone
- \(\text{IN05} < 0.9\) enterprise does not create value (Lososová & Zdeněk, 2014)
2.3 **Gurčík model**

The Gurčík model was created by Professor Gurčík in Slovakia and is designed to assess the financial health of Slovak agricultural enterprises. This is a credibility-property index that classifies businesses as thriving or ailing.

\[
G = 3,412 \times \frac{RE}{A} + 2,226 \times \frac{P}{A} + 3,277 \times \frac{P}{REV} + 3,149 \times \frac{CF}{A} - 2,063 \times \frac{INV}{REV}
\]

Where: 
- A assets
- RE retained earnings
- P profit
- REV revenues
- CF cash flow
- INV inventories

According to the resulting value of the Gurčík index, enterprises are classified as follows:

- \(1.8 < G\) thriving enterprises
- \(-0.6 < G < 1.8\) grey zone
- \(G < -0.6\) enterprises going bankrupt (Gurčík, 2002)

2.4 **CH-index**

The CH-index (Chrastinová index) is a bankruptcy model. It was created by Zuzana Chrastinová for Slovak agricultural enterprises in 1998. The equation is as follows:

\[
CH = 0.37 \times \frac{P}{A} + 0.25 \times \frac{P}{REV} + 0.21 \times \frac{CA}{CL} - 0.1 \times \frac{CL}{REV} - 0.07 \times \frac{EC}{A}
\]

They are: 
- A assets
- P profit
- REV revenues
- CA current assets
- EC external capital
- CL current liabilities

Evaluation of the result of CH-index calculation:

- \(2.5 < CH\) thriving enterprises
- \(-5 < CH < 2.5\) grey zone
- \(CH < -5\) enterprises going bankrupt

2.5 ‘Řezbová OP model’ for the Operational Programme Rural Development (hereinafter ‘Řezbová OP model’)

This model was specifically designed for the Operational Programme Rural Development by the State Agricultural Intervention Fund of the Czech Republic Řezbová (Rosochatecká & Řezbová, 2004). It contains 10 indicators of financial analysis. Points are allocated according to the result achieved in the individual indicators. Financial health assessment is carried out for the last three closed accounting periods.

The calculation is made for every year and the final score is the arithmetic average of the results from individual years. Enterprises can achieve a score of 0 to 30 points. If the company obtains a minimum of 9.01 points, it is assessed as financially healthy. In the table below you can see the resulting assessment based using the index for the Operational Programme Rural Development Řezbová OP model.

<table>
<thead>
<tr>
<th>Table 4 Resulting assessment of Řezbová OP model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category A</td>
</tr>
<tr>
<td>Category B</td>
</tr>
<tr>
<td>Category C</td>
</tr>
<tr>
<td>Category D</td>
</tr>
<tr>
<td>Category E</td>
</tr>
</tbody>
</table>

Source: State Agricultural Intervention Fund, 2016

The applicants in categories A – C meet the conditions for subsidy.
This model includes the indicators of return on assets and long-term profitability, return on performance from cash flow, added value / inputs, total debt, interest coverage, coverage of stocks by net working capital, maturity of debt from cash flow, overall liquidity and investment activity.

### 2.6 Taffler model

Taffler model is a bankruptcy model, which gives the probability of bankruptcy. The indicator was published in 1977 and contains four indicators.

\[ TM = 0.53 \times \text{earnings before taxes/ current liabilities} + 0.13 \times \text{current assets/ external capital} + 0.18 \times \text{current liabilities/assets} + 0.16 \times \text{Revenue/Assets} \]

According to the resulting value, companies are classified as follows:

- \( TM > 0.3 \) Low probability of the bankruptcy of the company
- \( 0.2 < TM < 0.3 \) the grey zone of undefined results
- \( TM < 0.2 \) increased probability of the bankruptcy of the company (Taffler, 1984)

### 3 Research results

This paper contains three analyses. Two analyses were performed on the selected models, while the third used more than 10,000 data records to identify the statistically significant indicators. One chapter is devoted to specifics of agriculture, which can influence the results of financial health assessment through the selected models.

#### 3.1 Analysis

The first analysis was performed on the data of companies which had no problems in the years of the data records. The results of this analysis are shown in table 2. There are percentages for the correct classification, for inclusion in the grey zone and for a wrong classification.

<table>
<thead>
<tr>
<th>Classification by models</th>
<th>Correctly classified as successful</th>
<th>Grey zone</th>
<th>Incorrectly classified as threatened</th>
</tr>
</thead>
<tbody>
<tr>
<td>Úrzelová OP model</td>
<td>98.62</td>
<td>-</td>
<td>1.38</td>
</tr>
<tr>
<td>Gurčík index</td>
<td>15.9</td>
<td>59.34</td>
<td>24.1</td>
</tr>
<tr>
<td>CH–Index</td>
<td>7.5</td>
<td>91.71</td>
<td>0.79</td>
</tr>
<tr>
<td>IN05</td>
<td>29.65</td>
<td>38.89</td>
<td>36.46</td>
</tr>
<tr>
<td>Taffler model</td>
<td>69.5</td>
<td>15</td>
<td>15.2</td>
</tr>
<tr>
<td>IN99</td>
<td>6.5</td>
<td>8.5</td>
<td>7.5</td>
</tr>
</tbody>
</table>

Source: Own processing

The Úrzelová OP model was the most successful in identifying thriving companies. The Taffler model had a success rate of 70%. The CH-index classified more than 90% of businesses into the grey zone. The biggest error rate in the classification of the thriving enterprises was exhibited by IN05.

According to the results of the analysis of Kopta (2009), the Úrzelová OP model for the Operational Programme Rural Development is the best one, with the next being the Gurčík index. The Gurčík model achieved a success rate of only 33.23%. According to the analysis of Sušický (2011), the best model for recognizing thriving companies is the Taffler model with a reliability of 98%. Neumaiers’ models had a success rate below 50%.

By creating the Gurčík model, companies with a profit between 1988 and 2000 and with profitability higher than 8 percent were included among the thriving companies. This can be the cause why the Gurčík model achieved poor results.

The next part includes an analysis of the reliability of the selected models in predicting financial problems. The reliability in identifying problematic enterprises were evaluated. Table 3 shows the results with a success rate in percentage.
Table 3 Reliability (in percentage) of the selected models in predicting the enterprise’s financial problems

<table>
<thead>
<tr>
<th>Classification by models</th>
<th>Correctly classified as threatened</th>
<th>Grey zone</th>
<th>Incorrectly classified as successful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Řezbová OP model</td>
<td>17.65</td>
<td>-</td>
<td>82.35</td>
</tr>
<tr>
<td>Gurčík index</td>
<td>50.27</td>
<td>44.97</td>
<td>4.76</td>
</tr>
<tr>
<td>CH – Index</td>
<td>86.08</td>
<td>6.19</td>
<td>7.73</td>
</tr>
<tr>
<td>IN05</td>
<td>63.46</td>
<td>23.08</td>
<td>13.46</td>
</tr>
<tr>
<td>Taflerív model</td>
<td>19.74</td>
<td>22.37</td>
<td>57.89</td>
</tr>
<tr>
<td>IN99</td>
<td>72.37</td>
<td>24.34</td>
<td>0</td>
</tr>
</tbody>
</table>

Source: Own processing

The analysis shows that the IN99 is the best for the prediction of the financial problems of a company, with a 96% success rate. The second was the CH-index with a success rate of 86.08%. In addition, only 7.73% of the companies were improperly ranked among successful businesses. The IN05 and Gurčík index achieved a reliability of over 50%. The Gurčík index also had the lowest error rate (4.76%). Conversely, the Řezbová OP model shows the highest error rates. It included 82.35% of businesses in liquidation or bankruptcy among the successful businesses.

IN99 and IN05 also came out as the suitable models for recognizing enterprises in difficulties in the analysis of Sušický (2011, II.). According to the analysis of Kopta (2009), the Gurčík index was evaluated as the best at recognizing problems due to profitability and the Řezbová OP model for cash flow.

My results are different from the results of other researchers as Kopta, Řezbová or Rosochatecká. The differences with the Řezbová OP model can be caused by the changing of the conditions of this model. This model was changed in April of this year. One indicator was added and the minimum number of points for the inclusion of the company among successful companies was reduced from 15 to 9.

Since neither of these models has achieved good results in both analyses at the same time, statistically significant indicators of the financial situation were determined in the next step. The analysis of generalized linear models was used to set the relationship between the actual state of the company and the individual indicators, both absolute and relative. Major indicators are highlighted in red in table 4.

Table 4 The analysis of individual and ratio indicator (red are statistically significant)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute term</td>
<td>262.0441</td>
<td>0.000</td>
<td>Retained profit/assets</td>
<td>1.497</td>
<td>0.221135</td>
</tr>
<tr>
<td>Total assets</td>
<td>262.0441</td>
<td>0.355</td>
<td>Profit/assets</td>
<td>23.56</td>
<td>0.0000</td>
</tr>
<tr>
<td>Current assets</td>
<td>0.8716</td>
<td>0.8060</td>
<td>Profit/revenues</td>
<td>0.0122</td>
<td>0.9120</td>
</tr>
<tr>
<td>Inventories</td>
<td>0.0063</td>
<td>0.7825</td>
<td>Cash flow/assets</td>
<td>12.0963</td>
<td>0.000505</td>
</tr>
<tr>
<td>Short-term receivables</td>
<td>0.0762</td>
<td>0.3091</td>
<td>Inventories/revenues</td>
<td>0.0176</td>
<td>0.8944</td>
</tr>
<tr>
<td>Financial assets</td>
<td>3.8303</td>
<td>0.050</td>
<td>Assets/net profit</td>
<td>0.0010</td>
<td>0.9749</td>
</tr>
<tr>
<td>Liabilities</td>
<td>0.00</td>
<td>0.9875</td>
<td>EBIT/interest expenses</td>
<td>0.4935</td>
<td>0.4897</td>
</tr>
<tr>
<td>Equity</td>
<td>0.7767</td>
<td>0.3781</td>
<td>EBIT/assets</td>
<td>14.8661</td>
<td>0.0001</td>
</tr>
<tr>
<td>Registered capital</td>
<td>0.5132</td>
<td>0.4737</td>
<td>Revenues/assets</td>
<td>7.8078</td>
<td>0.0052</td>
</tr>
<tr>
<td>External capital</td>
<td>0.4646</td>
<td>0.4954</td>
<td>Current assets/short-term liabilities</td>
<td>1.4,002</td>
<td>0.2366</td>
</tr>
<tr>
<td>Long-term liabilities</td>
<td>0.8095</td>
<td>0.368</td>
<td>Short-term liabilities/revenues</td>
<td>0.1019</td>
<td>0.7495</td>
</tr>
<tr>
<td>Revenues</td>
<td>5.7779</td>
<td>0.016239</td>
<td>External capital/assets</td>
<td>7.0074</td>
<td>0.0081</td>
</tr>
<tr>
<td>Cost of sales</td>
<td>9.0489</td>
<td>0.002629</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depreciation</td>
<td>3.8906</td>
<td>0.048556</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profit of current reporting period</td>
<td>3.4178</td>
<td>0.1653</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest expenses</td>
<td>1.9245</td>
<td>0.5132</td>
<td>EBIT</td>
<td>6.5199</td>
<td>0.01066</td>
</tr>
<tr>
<td>CASH FLOW</td>
<td>5.5310</td>
<td>0.01868</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Own processing

Among the most important indicators are the EBIT and cash flow; revenues from sales of products, goods and services; the cost of these products, goods and services and depreciation of tangible and intangible assets. Among the
ratio indicators the indicators of return on assets in various forms and the total debt are significant. These indicators will be used in the next step in setting up a model that would achieve greater success.

3.2 Specific of agriculture

The specifics of agriculture can also play a role in the not too big success rate of the evaluated models. These specifics may affect the final value models. We can include subsidies among the important specifics. The posting of investment subsidies according to Czech accounting standards is specific. The value of investment subsidies is not charged to income, but it reduced the value of the acquired assets. This leads to a distortion of the values of assets. The actual amount of the valuation of the acquired assets is shown in the balance sheet accounts, which are not part of mandatory disclosure requirements. Operating subsidies are posted to income. The profit or loss is contained in each model for financial health assessment.

For the valuation of animals from own breeding, the calculations are used. Each entity chooses the calculation formula. It can contain different items. It is the choice of the entity which product it determines as the primary and which as a by-product. The same animal can be valued by each entity in a different amount. (Kouřilová, Drábková, 2012)

In the field of agriculture, the valuation of land also plays a role. The land is valued at cost, which is determined by its location, not by the quality of the land. This can lead to improper valuation at the time of acquisition. In our conditions, it is impossible to revaluate assets upwards. It may also lead to a distortion of asset values.

A very frequent phenomenon is also the renting of the land on which the farmer farms. Land renting is charged just like any other rental. The rented assets are the property of the lessor. Only the payments for the rent are in the statements of the lessee, posted as costs. So it may happen that the main asset used in agriculture is not included in the assets of the farmer.

Another specific is the work of nature. It is very difficult to determine its value, but to see the actual image of the company would be advisable to take it into account in the financial statements. One of the ways is listed in the Austrian text book ‘Betriebswirtschaft und Buchführung’. This is calculated as the difference between revenues and variable costs. Changing costs, for example the costs of food, energy, health care, in the case of pig breeding on the meadow or dairy breeding with green feeding are calculated there.

Even the value of some indicators may be characteristic for some sectors. In agriculture, the value of current liquidity is especially high. This indicator is included in the indicators IN or in the Taffler model. Some non-standard indicators such as the ratio of assets / foreign sources (included IN95) can take extreme values and thus affect the overall value of the model. This should just be overridden by the scoring model Řezbová OP. Its results are not positive.

All of the above-mentioned specifics may negatively affect the outcome of the financial health assessment through models, if the specifics are not taken into account in this model. In models intended for agriculture, the influence of these specifics should be limited, but even they have not reached good results in analysis.

The aim of the next step of my research will be the possibility to take these specifics into account by financial health assessment.

4 Conclusions

This article is focused on the specifics and financial health assessment of agricultural companies. In the analysis of thriving companies, the Řezbová OP model was the most successful. The Taffler model had a success rate of 70%. The CH-index classified more than 90% of businesses into the grey zone. The analysis of companies with financial problems shows that the IN99 is the best for the prediction of financial problems of a company with a 96% success rate. The second was the CH-index with a success rate of 86.08%. Based on the analysis of the selected models, no model is suitable for the assessment of the financial situation of businesses and thus there is an analysis of statistically significant indicators.

Among the most important indicators are the EBIT and cash flow; revenues from sales of products, goods and services; the cost of these products, goods and services and depreciation of tangible and intangible assets. Among the ratio indicators the indicators of return on assets in various forms and the total debt are significant. These indicators will be used in the next step in setting up a model that would achieve greater success.

The cause of the poor results of the selected models may be the specifics of agriculture. Among the specific we can include subsidies, land evaluation, land renting, calculation or the work of nature. For models designed for farms, these specifics should be partly eliminated, but their results are not good in any way. The possibility of including the specifics of agricultural areas into financial health assessment models will be one aim of the further research.
Acknowledgement

This work was performed with the support of the grant GAJU 149/2014/S.

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