The Impact of Investments and Changes in the Production Regime on the Results of Creditworthiness Assessment and Bankruptcy Prediction Models - Case Study: company Bulgari Filati d.o.o.*

Summary: Although they can be a subject of criticism and have been challenged from its beginnings, bankruptcy prediction models have often been used in practice for more than four decades. The following models for predicting bankruptcy are applied in this issue: Altman's Z'-Score, Zmijewski model, Taffler's model and Sandin and Porporato model. Out of the creditworthiness assessment models (solvency analysis), the following models have been applied: Z''-Score (Altman, Hartzell and Peck) and the BEX model. A significant shortcoming of the observed models is their failure to take investment into account. Beside, some models have inadequately assessed the transition of operations to lohn production, while others have not.

Key words: bankruptcy prediction models, ratio analysis, Z-Score

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1. INTRODUCTION

The use of a ratio analysis as an analytic technique for a bankruptcy prognosis originates from the 1930s. Nevertheless, it is Altman's paper from 1968 which drew significant attention both amongst theorists and practitioners. Despite numerous denials, bankruptcy prediction models based on a ratio analysis are still popular among practitioners, and this fact encourages many researchers both in the developed and developing world, to make models adjusted to different needs and users. After the Enron and Worldcom downfall, the prediction of bankruptcy has once again become a subject of a big interest. (See more in: [1], [11], [15], [26]) The newly adopted methodology of Basel II also testifies to the popularity of predictive methods based on financial analysis [1], [14] The current importance of these problems is testified by the fact that a renowned academic journal called the “Journal of Banking and Finance” published a special issue on this topic in 2001.

During the past years, numerous and more sophisticated models of bankruptcy prediction have been developed. A part of them are based on the cash flow and fund flow concepts (See: [5]); some others are based on the technical analysis, while predictive models, based on neuron networks, have been getting more and more popular in academic circles during the last years. Neuron networks have widely been used (Tam and Kiang, 1992; Wilson and Shard, 1994; Back et al., 1996; Zhang et al., 1999; Tan and Poh, 2002) in the last decade. All of them claim a certain degree of success in terms of predictive accuracy. ([32], pp. 492 according to: [9],)

Apart from the bankruptcy prediction models based on balance sheets, models for credit rating based on data from balance sheets have also been developed. There is, for example, Moody’s rating agency, which developed a model based on the ratio analysis, whose purpose is to estimate the credit rating of bonds issuing companies.

In spite of good results which some bankruptcy prediction models based on the multiple discriminant analysis achieve, the criticism of this model is not unfounded. Gambling’s criticism of Altman’s model is basically related to all models based on ratio indicators. Gambling induces that the Z-Score model suffers from a lack of a theoretical basis, i.e. it does not explain insolvency causes. The Z-score models are also commonly censured for their perceived lack of theory. The Z-Score model provides no theory to explain insolvency. ([1], pp. 298) Agarwal and Taffler mention the specific nature of the Z-score model, which consists of a possibility of the model implementation only in companies based on which it was developed. The specific nature of the z-score models is that which can only be appropriately applied to the population of firms from which they were developed. ([1], pp.299) Taffler even denies the very possibility of bankruptcy prediction, indicating that numerous factors, most of which represent stochastic events for the company itself, determining whether the company is facing bankruptcy or it is going to declare bankruptcy. In any case, the actual occurrence of bankruptcy is determined by the actions of a firm's bankers, trade creditors and/or debenture holders, etc., which may be most accurately considered as the stochastic events that finally pull the rug away from under the tottering firm ([28], pp. 354)

What prediction models based on the discriminant analysis also lack is their disregard of non-financial information. The truth is that stock exchange activities, which are taken into consideration by certain models, account for non-financial information as well, but the
question of the “reality” of stock exchange values arises. Nevertheless, models
developed in emerging and transition economies usually do not take into consideration
stock exchange activities, which is absolutely reasonable. (See: [16], [20])

The insufficient reliability of predictive methods based on the rational analysis, which
excluded non-financial information, encouraged Argent to formulate models of multiple
administrative errors, in which non-financial information is given due weight. ([9], [31])

During the last few years, numerous models have been developed. Business Excellence
(BE) models have been developed in previous years The role of the BE model is twofold,
namely as a means of assessing what a company has, and what the results achieved for
its main stakeholders are, and as a means to explain and predict how the results will be
achieved for stakeholders. ([12], pp. 617-652; [13], pp. 715-728)

2. DESIGN / APPROACH / METHODOLOGY

In this paper, some bankruptcy prediction models are used, namely Altman’s Z’ score
model, (since Bulgari Filati Ltd. is not listed), a model developed by Mark E. Zmijewski,
Taffler’s model and a model developed by Ariel Sandin and Marcela Porporato. The
decision to use Altman’s model came from its popularity; we opted for the Zmijewski
model because of the fact that, in Croatia, it appears to be adequate; Sandin/Porporato’s
model was chosen because it was developed for emerging economies, while Taffler’s
model was chosen because of its simplicity (all indicators are based on liabilities) and
attention which it attracted during its testing in the 25-year time period. Regarding the
credit rating assessment models, the following were used: the modified version of the Z-
score model and the BEX model – one of the newest models developed for the Croatian
capital market.

The paper, therefore, does not test the appropriateness of these models in a determined
period of time, based on an eligible sample, as usual, but they are applied to the listed
company well-known to the authors, because it was available for all information, both
financial and non-financial. The company Bulgari Filati d.o.o. (Ltd.) Oroslavje, Croatia,
was founded in October 2001, and represents an investment of the Italian-Slovenian
capital. Its basic activity is the production of raw materials for the textile industry, namely
the production of textured, air covered yarn and conventional covered yarn. The company
is a part of Aquafil (http://www.aquafil.com).

The aim of the paper is to determine the influence of investments and a move from
individual to lohn production on results of the monitored models for solvency assessment
as well as for bankruptcy prediction models, i.e. to determine how the observed models
would evaluate events which occurred in a period of time, which should point out the
shortcomings of individual models. The contribution of this paper is in the pointing out of
limits of the bankruptcy prediction models and models for the credit rating assessment,
which are exclusively based on accounting data, when it concerns companies in the
investment circle or/and which are changing the production regime, without changing
other parameters. The possible limits consist of neglecting the influence of transfer
prices, which is done based on the fact that financial statements are revised and that
transactions with associated companies are fully disclosed. The transfer prices policy is
also disclosed and is based on clear and precise formulas which take into consideration
the cost of production.
In [18], the influence of investments and change in the production regime on Altman's model, Sandin Porporato Model, Z''-Score and BEX model have been researched. In this paper, the research has been expanded to Taffler's model, which is specific because it does not contain a single classical profitability indicator, and the Zmijewski model, which is unlike the other tested models based on the profit analysis. Besides the above mentioned, the weaknesses of the analyzed models have further been elaborated, especially the issue of investment. The paper also highlights changes in business operations that are reflected in the balance sheet, such as a regime change in production, and have the same effect on the results of the observed models.

3. THEORETICAL STARTING POINTS OF THE SELECTED MODELS

3.1 Altman’s Model

Altman’s Z-Score model represents a pioneer bankruptcy prediction model based on the multiple discriminant analysis, which inspired numerous researchers to develop similar models adjusted to a specific ambient and economic performances for different needs and users.

Z- Score is calculated according to the following formula:

\[
Z = 0.012 X_1 + 0.014 X_2 + 0.033 X_3 + 0.006 X_4 + 0.999 X_5
\]

Where,

- \(X_1\) = working capital/total assets
- \(X_2\) = retained earnings/total assets
- \(X_3\) = earnings before interest and taxes/total assets
- \(X_4\) = market value of equity/book value of total liabilities
- \(X_5\) = sales/total assets

\(Z\) = overall index.

Over the years, many individuals have found out that a more convenient specification of the model is the following one: \(Z = 1.2 X_1 + 1.4 X_2 + 3.3 X_3 + 0.6 X_4 + 1.0 X_5\)

Given the fact that the original model requires stock price data, it could not be applied to companies in the private sector. In the revised model, the book value of the equity was substituted for the Market Value in \(X_4\).

The result of the revised Z-Score model with a new \(X_4\) variable is:

\[
Z' = 0.717(X_1) + 0.847(X_2) + 3.107(X_3) + 0.420(X_4) + 0.998(X_5)
\]

Private companies with \(Z'\)-Scores less than 1.23 are predicted to go bankrupt, and companies with \(Z'\)-Scores higher than 2.9 are predicted not to go bankrupt. The area between 1.23 and 2.9 is defined as the zone of ignorance or the gray area [3].
3.2 Sandin & Porporato's Model

Ariel Sandin and Marcela Porporato developed a model of bankruptcy prediction using the multiple discriminant analysis technique for Argentinean companies in the 1990s. The original aim was to develop a classification method that could easily and freely be used by all investors and creditors in Argentinean companies. The model creators suggest the ability of their model being used to assist investors, creditors, and regulators in Argentina and other emerging economies to predict a business failure [24].

Sandin & Porporato's as an index is calculated according to the following formula:

\[ A_S = 15.06 \frac{R_5}{S_3} + 16.11 \frac{S_3}{S_3} - 4.14 \]

Where:
- \( R_5 \) = operative income/net sales
- \( S_3 \) = shareholder's equity/total assets

Companies with negative \( A_S \) index are predicted to go bankrupt, and companies with positive \( A_S \) index are predicted not to go bankrupt. This shows that the most important factors determining bankruptcy are deterioration in the earning margins along with high levels of leverage.

3.3 Zmijewski's Model

The model is presented by: [33]

\[ Y = -4.3 - 4.5X_1 + 5.7X_2 - 0.004X_3 \]

Where:
- \( X_1 \) = net income to total assets (return on assets),
- \( X_2 \) = total debt to total assets (financial leverage),
- \( X_3 \) = current assets to current liabilities (liquidity).

The model defines a possibility of a company's bankruptcy in the following way: [27]

\[ P = \frac{1}{1 + e^{-y}} \]

Where constant e is 2.71828

A possibility higher than 0.5 means that the company has big chances to go bankrupt.

The model has been tested on Croatian companies within the “Models for the evaluation of a company's business operations” project. As a result of modeling, we obtained a completely new coefficient, i.e. weights for each used variation for Croatian companies. New cut-off points were determined as well. In the original version, the cut-off point was set up at 1 ([33], pp.65). The effectiveness of the model was tested by counting average hits (correct classifications) for successful and unsuccessful companies. The rate of matches for unsuccessful companies accounts for 72.03%. The average rate of matches for all tested companies accounts for 66.62%.
3.4 Taffler's model

The model is presented by:

\[ Z = 3.20 + 12.18X1 + 2.50X2 - 10.68X3 + 0.029X4 \]

Where:

\( X1 = \) profit before tax/current liabilities,
\( X2 = \) current assets/total liabilities
\( X3 = \) current liabilities/total assets
\( X4 = \) no-credit interval

The negative Z-score means that the company is being faced with a potential bankruptcy.

3.5 Z"- score model

Based on the previously developed model for non-manufacturers, which did not contain the sales /total assets ratio in order to minimize the potential industry effect, Altman, Hartzell, and Peck (1995) created the emerging market scoring (EMS) model to assess the financial health of non-U.S. companies, specifically Mexican companies, that issued Eurobonds denominated in the U.S. dollars.[4]

The new Z"-Score model is:

\[ Z'' = 6.56 (X1) + 3.26 (X2) + 6.72 (X3) + 1.05 (X4) \]

Companies with Z"-Scores less than 1.1 are predicted to go bankrupt, and companies with Z"-Scores greater than 2.6 are predicted not to go bankrupt. The area between 1.1 and 2.6 is defined as the zone of ignorance or the gray area. In the emerging market model, Altman, Hartzell, and Peck added a constant term of +3.25 so as to standardize the scores with a score of zero (0) equated to a D (default) rated bond.

3.6 Business Excellence Model- BEX index

The Business Excellence Model – BEX index – represents models based on balance indicators developed for the capital market in Croatia. The model tends to enable a fast and simple evaluation of a company's solvency. ([7], pp.17).

The BEX index is calculated according to the following formula: ([7], pp.18)

\[ BEX = 0.388 \text{ex1} + 0.579 \text{ex2} + 0.153 \text{ex3} + 0.316 \text{ex4}, \]

Where:

\( \text{ex1} = \) Earnings Before Interest and Taxes/Total assets
\( \text{ex2} = \) Net Operating Profit /Equity Capital x capital price
\( \text{ex3} = \) Net Working Capital /Total assets
\( \text{ex4} = 5 \) (Net Profit + Depreciation + Amortization) /Total Debt
In an additional interpretation, there were some changes of parameter ex2 in the model, when Net Profit was replaced by Net Operating Profit ([8], pp.31-33).

According to the above mentioned, the solvency border measured by the BEX index makes 1. Companies with the BEX index higher than 6.01 are classified as the world class companies, between 4.01 and 6.00 as excellent – a candidate for the world class, between 2.01 – 4.00 as very good, 1.01 – 2.00 as good, 0.00 – 1.00 are in the border area, and companies with the BEX index lower than 0 as companies whose existence is endangered. ([8], pp.34)

Opting for the BEX model is a consequence of the satisfying results of the model in Croatia, for whose needs the model was developed, and Bulgari Filati doo operates in Croatia. Regarding the appropriateness of the use of the BEX model for the evaluation of the credit rating of Serbian companies, see [9].

4. RESULTS INTERPRETATION

4.1 Results of the implementation of the bankruptcy prediction models

The corporate bankruptcy prediction models in the observed time period provided us with the following results:

Table 1: Values of Z'Score, Model Zmijewski and As index for company Bulgari Filati d.o.o.

<table>
<thead>
<tr>
<th>Year</th>
<th>As</th>
<th>Altman Z'-Score</th>
<th>Zmijewski</th>
<th>Taffler</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>-13.44</td>
<td>-0.16</td>
<td>0.4</td>
<td>-106.2</td>
</tr>
<tr>
<td>2003</td>
<td>0.45</td>
<td>0.73</td>
<td>0.5</td>
<td>-14.3</td>
</tr>
<tr>
<td>2004</td>
<td>1.63</td>
<td>1.25</td>
<td>0.3</td>
<td>-1.0</td>
</tr>
<tr>
<td>2005</td>
<td>1.87</td>
<td>0.57</td>
<td>0.3</td>
<td>-5.8</td>
</tr>
<tr>
<td>2006</td>
<td>5.36</td>
<td>1.00</td>
<td>0.2</td>
<td>13.1</td>
</tr>
<tr>
<td>2007</td>
<td>4.36</td>
<td>0.78</td>
<td>0.2</td>
<td>-1.1</td>
</tr>
<tr>
<td>2008</td>
<td>0.41</td>
<td>0.44</td>
<td>0.4</td>
<td>-9.2</td>
</tr>
<tr>
<td>2009</td>
<td>1.65</td>
<td>1.62</td>
<td>0.4</td>
<td>-4.3</td>
</tr>
<tr>
<td>2010</td>
<td>6.36</td>
<td>1.58</td>
<td>0.1</td>
<td>0.6</td>
</tr>
</tbody>
</table>

Authors’ calculations

According to Altman’s formula for non-listed companies, the results from the observed period show that not in a single year was it in the zone higher than 2.9. Despite all the improvements in 2004, 2009 and 2010, the company was in the gray area. In the rest of the years, the results show that the company was a serious candidate for a failure. The
highest negative impact was the one made by parameter X1 (working capital/total assets), as a consequence of the negative working capital. The second cause of the Z’-score decrease was a fall in indicator X5 (sales/total assets), as a consequence of decreased sales.

The inadequacy of the Z’-Score model is not surprising since the studies themselves, carried out on Serbian companies, showed a high rate of error type II. (See: [19]) Nevertheless, the problem is not in the fact whether the company was categorized in the distress zone, gray area or safe zone. If the model is suitable for the observed economy, it is a matter of redefinition of the cut-off point and a potential recalculation of the coefficients. Besides that, if the model is suitable, one can expect that cut-off points cannot be the same for the company operating in different economies characterized by different business conditions and different company performances. The basic question is: Does the coefficient change also reflect changes in a company’s performances?

A significant improvement of the As index and Z’-Score is noticeable in 2004 in comparison to 2003. Nevertheless, parameters X2, X3 and X4 show the tendency of deterioration in 2003, also as a result of significant investments (initial investments in 2003). As an investment lead to an increase in the value of the assets in 2003, the first effects of the investments came to surface in 2004. In 2005, there was, again, a dramatic decrease in the Z’-Score value. However, the fall in 2005 was not a consequence of the deterioration of the company’s performances, but the consequence of a move to lohn production.

As a matter of fact, the company’s sales drastically fell in 2005 and 2010 in comparison to the previous years 2004 and 2009, as a consequence of the change in the production regime, but not for other reasons. In Graphic no. 1, we can follow the relation of the revenue from lohn production and other operation revenues. The fall in the cost of production also corresponds to this fall due to the shown income statements. In the same way, the changes are visible in the balance sheets, due to the inventories decrease, of both materials and goods, also through a decrease in receivables and VAT at import, as
well as a decrease in accounts payable. Own production has been transferred to lohn production. It means that the company provides services of the raw material processing and after that, it returns the final product abroad, charging for its own services. The move to lohn production is motivated by a decrease in the custom duties during the import of this kind of products in the EU, but also due to a lower engagement of money for VAT at the raw materials import.

The move to lohn production brought about a significant fall in indicator X5, as a consequence of the fall in sales, but also the fall in indicator X1, as a consequence of the negative working capital. In 2007, investments led to a decrease in Z'-Score. The lowest Z'-Score was in 2008. That is the year in which the biggest loss was made. The model responded in that it ranked the company into the bankruptcy group. Nevertheless, in 2008, the company made significant investments, i.e. it opened a completely new plant. Since the effects of investments appeared in 2009, there was an increase in Z'-Score by 1.18.

The Sandin-Porporato model gave the best results since the As index indicates that the company's existence was only endangered in 2002. On the example of the analyzed company, the Sandin and Porporato model showed a good prediction power, i.e. a better one compared to Altman's Z'-Score. The results were also confirmed by the results of the adequacy of the use of the Sandin-Porporato model on Serbian companies, which indicated a lower error type II for As, compared to the Z'-Score model. [19] It is important to emphasize the fact that the Sandin-Porporato model responded excellently to the company's move to lohn production. The move to lohn production led to a significant increase in indicator "R" and a decrease in indicator "S", where the weight assigned to indicator "R" was higher, which resulted in the improvement of the As index in 2005 and 2006. The investment also had a lower impact on this model. Indicator "S" decreases if investments are mostly financed from liabilities, while indicator "R" responds slightly for the amortization costs, which do not include the cost of goods (if a building, machinery and equipment are put in use).

The Zmijewski model gave the best results since, in the observed time period, it did not classify the company Bulgari Filati d.o.o. within the candidates for failure. Similar to the Sandin-Porporato, the Zmijewski model, in the years 2006, 2007, and 2010, also evaluated the company according to the values which were far above the cut-off point that marked the failure zone, which was not surprising having in mind that, in those years, a profit was made. Nevertheless, it is more important that neither of the two models predicted a failure in the years when the loss was made. Actually, those models "see behind" the loss of and fall in revenues. In fact, the loss of and fall in revenues are often the first (sometimes even the only ones) parameters for the assessment of a company, without taking into consideration what is behind these numbers, hereby coming to the wrong conclusions. For example, as a consequence of the decreases in the revenues in 2010, the company Bulgari Filati d.o.o. was not classified within 1000 highest companies on the Finance Agency’s (FINA) List – (a leading Croatian company from the field of financial intermediation), despite the fact that, in comparison to 2009 (when the company was ranked in 801st place), not only did it make a profit, but had also already increased its capacities and number of employees. (See Table 3)

On the other hand, Taffler's model appears to be inadequate. Nevertheless, Taffler's Z-score is negative due to the presence of parameter X4, as a result of much higher current liabilities from the available cash and cash equivalents. Except in the years 2006 and 2010, in the observed time period, the company was classified as a candidate for a failure. The negative difference between the current liabilities and cash and cash equivalents in the 4th parameter was in the rank from -0.8 mil. EUR to -6.3 mil. EUR
(except in 2006, when it was positive), i.e. -2.5 mil. EUR on average. The negative difference was increased as a consequence of the financial investments from the current liabilities, despite the minimal inventory, as a consequence of the transfer to lohn production. Due to the fact that in the calculation of indicator X4 much bigger significance was given to making revenue rather than profit, the model inadequately responded to the change in the production regime, as well as to all other cases that brought about a fall in the revenue.

### 4.2 Results of the use of solvency evaluation models

The models for solvency evaluation accounted for the following results:

<table>
<thead>
<tr>
<th>Year</th>
<th>BEX index</th>
<th>Z&quot;-Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>-0.82</td>
<td>-2.80</td>
</tr>
<tr>
<td>2003</td>
<td>3.07</td>
<td>-2.56</td>
</tr>
<tr>
<td>2004</td>
<td>-0.78</td>
<td>0.51</td>
</tr>
<tr>
<td>2005</td>
<td>-0.15</td>
<td>0.04</td>
</tr>
<tr>
<td>2006</td>
<td>1.38</td>
<td>1.92</td>
</tr>
<tr>
<td>2007</td>
<td>1.14</td>
<td>0.64</td>
</tr>
<tr>
<td>2008</td>
<td>-0.42</td>
<td>-1.05</td>
</tr>
<tr>
<td>2009</td>
<td>1.07</td>
<td>-1.65</td>
</tr>
<tr>
<td>2010</td>
<td>4.67</td>
<td>0.89</td>
</tr>
</tbody>
</table>

Authors' calculations

According to the Emerging Market Model (Z"-Score), the results were lower than the ones with Z'-Score. The company had the highest Z"-Score in 2006, when it was classified into the gray zone. In that year, the company was evaluated with "CCC-", while in the other years, it was evaluated with "D" (According to [3]). So, the Emerging Market Model did not enable the solvency evaluation since it indicated the bankruptcy in all the years, except in 2006. Nevertheless, as it has already been noted, cut-off points are not of a crucial importance. They can be differently defined for different markets. That is a tendency of indexes which are deemed important. One can note that excluding indicator X5, i.e. the coefficient of the turnover of the total assets, significantly brings about a more adequate response of the Model to the change in the production regime. The exclusion of the X5 indicator leads to a smaller impact of investments on the evaluated credit rating whose effects are expected within the following years. However, there is still a negative impact of the investments on indicator X3.

The BEX index also negatively responded to the investments which still did not discard a gain as a result of a fall in indicator X1. However, X1 has a relatively small weight/significance in comparison to X3. Indicator X3 takes the equity instead of the total...
assets, and therefore it does not have a deterioration tendency since the consequence is that the investments are mostly financed from liabilities, which is obvious in the majority of the cases.

In accordance with this, the BEX index responded to the improvements in operations, especially to the energy efficiency and waste management, through the implementation of a paradigm of sustainable development and a decrease in some production costs. (See more in: [17]) It was expected that the mentioned institutions would give results in the coming calculation periods, while the effect was low in the investment year. This model classified the company Bulgari Filati in 2010 within excellent companies – a candidate for the world class with the BEX index value of 4.67.

A bad ranking, according to the BEX index with a value lower than zero in 2002, 2004, 2005 and 2008, also corresponded to the negative indicators of ROE and ROA. A good ranking in 2006 and 2009 corresponded to the positive ROE and ROA indicators (ROE from 0.2 to 5.5% and ROA from 2.7 to 4.9%). A very good ranking had ROE 19.9% and ROA 6.5% in 2003, while an excellent ranking in 2010 corresponded to the values of ROE 34% and ROA 18.2%. There was no correlation between this kind of ROE and ROA indicators and the values of As, Taffler, Zmijewski, Z'Score and Z''Score indices in this example.

Table 3: Chosen indicators of company Bulgari Filati d.o.o.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total revenue</th>
<th>EBITDA</th>
<th>Net profit</th>
<th>ROE</th>
<th>ROA</th>
<th>debt/equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>866,089</td>
<td>-433,191</td>
<td>-1,198,811</td>
<td>-11.1%</td>
<td>-2.4%</td>
<td>1.80</td>
</tr>
<tr>
<td>2003</td>
<td>53,383,771</td>
<td>8,454,781</td>
<td>2,782,367</td>
<td>19.9%</td>
<td>6.5%</td>
<td>3.83</td>
</tr>
<tr>
<td>2004</td>
<td>64,900,447</td>
<td>5,410,929</td>
<td>-2,246,278</td>
<td>-8.8%</td>
<td>-3.5%</td>
<td>1.54</td>
</tr>
<tr>
<td>2005</td>
<td>20,966,020</td>
<td>5,664,502</td>
<td>-1,611,320</td>
<td>-6.8%</td>
<td>-1.1%</td>
<td>1.46</td>
</tr>
<tr>
<td>2006</td>
<td>21,746,114</td>
<td>8,242,520</td>
<td>1,382,869</td>
<td>5.5%</td>
<td>4.9%</td>
<td>1.10</td>
</tr>
<tr>
<td>2007</td>
<td>23,691,579</td>
<td>8,006,538</td>
<td>1,072,189</td>
<td>4.1%</td>
<td>3.8%</td>
<td>1.30</td>
</tr>
<tr>
<td>2008</td>
<td>62,052,765</td>
<td>6,298,290</td>
<td>-3,915,312</td>
<td>-9.2%</td>
<td>-1.4%</td>
<td>2.19</td>
</tr>
<tr>
<td>2009</td>
<td>107,993,367</td>
<td>13,919,905</td>
<td>37,187</td>
<td>0.2%</td>
<td>2.7%</td>
<td>1.92</td>
</tr>
<tr>
<td>2010</td>
<td>66,954,991</td>
<td>24,727,301</td>
<td>12,054,451</td>
<td>34.0%</td>
<td>18.2%</td>
<td>1.24</td>
</tr>
</tbody>
</table>

SOURCE: Financial reports of the company Bulgari Filati d.o.o. and authors' calculations

Nevertheless, none of the models took into consideration investments in an appropriate manner. If a company is in the investment cycle, which means the replacement of the equipment, or the relocation of the equipment from one organizational unit to another, one should expect a deterioration of the result of that time period (if a company has a
possibility to sell the whole production, it is not logical to presume a failure in a situation when the company has big investments, unless there is a danger of its indebtedness or insolvency. From CAPEX (net investments were observed), it is noticeable whether it is the investment year, which can justify other weaker performances. Table 4 accounts for the fact that, in every ear in the observed time period, the company had significant investments. Especially in 2003 (25.2 mil. HRK, i.e. 37.34% in comparison to the total assets), 2007 (1.8 mil. HRK, i.e. 19.49% in comparison to the total assets) and 2008 (28.5 mil. HRK, i.e. 21.14% in comparison to the total assets).

Table 4: Investment of the activities of company Bulgari Filati d.o.o. 2002-2010

<table>
<thead>
<tr>
<th>Year</th>
<th>Total assets</th>
<th>CAPEX</th>
<th>CAPEX/ Total assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>30,214,719</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>2003</td>
<td>67,696,348</td>
<td>25,280,596</td>
<td>37.34%</td>
</tr>
<tr>
<td>2004</td>
<td>64,682,888</td>
<td>3,888,367</td>
<td>6.01%</td>
</tr>
<tr>
<td>2005</td>
<td>58,637,984</td>
<td>1,690,272</td>
<td>2.88%</td>
</tr>
<tr>
<td>2006</td>
<td>52,810,578</td>
<td>1,292,137</td>
<td>2.45%</td>
</tr>
<tr>
<td>2007</td>
<td>60,561,573</td>
<td>11,805,309</td>
<td>19.49%</td>
</tr>
<tr>
<td>2008</td>
<td>135,102,719</td>
<td>28,561,208</td>
<td>21.14%</td>
</tr>
<tr>
<td>2009</td>
<td>68,384,726</td>
<td>2,338,156</td>
<td>3.42%</td>
</tr>
<tr>
<td>2010</td>
<td>79,613,479</td>
<td>5,933,608</td>
<td>7.45%</td>
</tr>
</tbody>
</table>

SOURCE: Financial reports of the company Bulgari Filati d.o.o.

During the evaluation of a company, it is necessary that we monitor trends and the business activity, not only results themselves. Just there, BEX indicates a better sensitivity to changes being made (improvements). This is the key when it concerns a certain company – a several-year-observed trend.

The conclusions which are made regarding change in the production regime also refer to the other activities that have an increase or stagnation of the profit, with a simultaneously decreasing revenue, as their consequences.

A situation similar to the lohn production is often seen at construction companies. The amount of the revenue and expenses depends on the structure of contracted works. If a contracted obligation of a construction company is to purchase construction material, then its revenue will be higher; however, on the other hand, expenses will be higher as well. For a construction company, sometimes, it pays off better to purchase material from the investor, i.e. to contract works without material.

In developed economies, the trend of outsourcing some activities has already been present for a while. When multinational companies entered the Serbian market, the outsourcing of certain activities was more present in domestic companies. For example, a company which outsources transportation will not only make lower revenue, but a lower cost as well. Companies outsource some activities in order to increase their profitability.
5. CONCLUSION

In this paper, the sensibility of the parameters of different models which are founded on accounting indicators on the example of the company Bulgari Filati d.o.o. is given an account of. It is especially interesting to apply models based on accounting indicators in the example of the company Bulgari Filati d.o.o. since that is a company which, during the observed time period, made significant investments in new capacities and increasing the energy efficiency, changed the way of business doing (moving on to lohn production), and, in certain years, operated at a loss.

It should be mentioned that all the conclusions are universal, i.e. they are not conditioned by individual characteristics of the Croatian economy. None of the parameters from the observed models took into consideration either macroeconomic variables, or stock exchange data, which also had specificities of the environment embedded in themselves. According to this, the research results would be the same if they were tested on a Serbian company.

It is noticeable that Z’-Score and Taffler Z-score responded unfavorably to the transfer to lohn production, as well as to more significant investments, which did not have effects in the year which they were made in as a consequence. On the other hand, the Sandin/Porporato model and the Zmijewski model adequately responded to the transfer to lohn production, while they negatively responded to the investments which did not decline income in the year when they were made, but to a lesser extent, compared with the Z-Score model.

On the observed example, it is noticeable that the Sandin/Porporato Model and the Zmijewski model showed a satisfactory predictability power, despite the fact that, for the duration of several years, the company had been operating at a loss, and the fact that there was a dramatic fall in its revenue.

When the solvency assessment model is in question, it is noticeable that Z”-Score adequately responded to the transfer to lohn production. On the other hand, BEX more adequately responded to the transfer to lohn production. It is noticeable that the BEX index values, unlike other used methods, had a positive correlation with ROE and ROA. Nevertheless, BEX did not recognize a loss as a temporary phenomenon, either, and, within three years, classified the company within candidates for bankruptcy.

Although BEX shows a better sensitivity to improvements in business operations, none of the mentioned models takes into consideration investments in an adequate way, which can lead to wrong conclusions during the results interpretation.

Due to the above mentioned, the inadequate consideration of investments represents an irreversible lack of the models based on the discriminant analysis. The investment represents not only a condition for the growth and development of the company, but also a necessary condition for the company’s existence. An investment in increasing the capacities should have an increase in production and sales, as well as a profit, as a consequence. However, any investment is inseparably connected to a risk of an impossibility of selling produced goods at an adequate price. In insolvent economies, such as the Serbian or Croatian economies are, the risk of an impossibility of paying for sold goods is especially present. Besides that, there is also a risk of discrepancies between the inflows and outflows of cash and cash equivalents. It often happens that a
good company is in serious problems, even to fail, as a result of investing. Besides that, a company is also endangered during the realization of a good investment decision if the investment is not financed from adequate sources. A fall in the economic cycle, and especially a crisis, affects those companies which have had significant investments. A kind of paradox is that investing in Serbia resulted in the deterioration of the financial position of many companies. This is because the prescribed model of privatization requires investing in a company, rather than a pre-repair and restoration of the financial position. [23] Interest rates and exchange rate policies and the instability of the domestic currency may also significantly contribute to the worsening of the financial position of companies financed through borrowing in foreign investments (cross border loans) or loans indexed in a foreign currency. In fact, the policy of the overvalued dinar-favored loans indexed in EUR and cross-border loans, while the subsequent weakening of the dinar constantly deteriorated the financial position and profitability of the Serbian economy (until the end of 2001, the euro was valued at under 60 RSD, and by 2004 it did not exceed 80 RSD, only to be worth more than 100 RSD today). ([21], pp.43)

Companies that took loans in Swiss francs went much worse. On the other hand, companies in Serbia did not have any other choice, since commercial banks disapproved long term credits denominated in dinars, while a possibility of issuing bonds and shares is minimal. (See [21]) The assessment of the impact of investments in increasing energy efficiency is far more reliable than estimates of the impact of investments in new plants. However, in this case, models based on discriminant analysis showed deterioration as well.

In any case, investing results in changing the financial position and profitability of a company, and the direction and intensity of any upcoming changes cannot be predicted by any model; especially, they could not be predicted by a model based on the discriminant analysis. In general, no one can predict the effects of investments with certainty. However, unlike models based on neuron networks, models based on the discriminant analysis cannot take into consideration changes in macroeconomic variables, in which way there is a significant reduction in the ability to predict the effects of completed investments. However, on the other hand, it is important to say that models based on the discriminant analysis a priori do not estimate investments as negative, because it is reasonable to expect that, in most cases, they will have a positive effect.

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