Application of Kralicek DF test for predicting financial troubles of small and medium enterprises in Bosnia and Herzegovina

Примена Кралицековог ДФ теста за предвиђање финансијских неприлика малих и средњих предузећа у Босни и Херцеговини

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Abstract: There are more models in the world to predict the financial stability of the enterprise. One of the models that proved successful in forecasting financial troubles is a Kralicek DF test, developed and used in developed countries of the West. Given the diversity of legal systems, the degree of development of the countries where this model was used has proved to be less or more successful. In this survey, a sample of 398 small and medium-sized enterprises in the Central Bosnia region tested the Kralicek DF test for financial stability assessment in order to determine the eligibility of the Kralicek DF test in Bosnia and Herzegovina. Data from the financial statements of the managed companies 2014. Model showed as successful as they were successful and some other models tested by other authors in this area, which proved to be partially usable.

Keywords: Kralicek DF test, financial failure prediction, financial statements, financial indicators, small and medium enterprises.

Introduction

Given that MSP is a very sensitive segment of a single economy, which constantly needs institutional support when viewed as a part of the economy, but also a careful overview of individual MSAs, the aim of this research is to find out which model of
enterprise instability estimation can be applied to small and medium markets of one of the transition countries. Below are given the basic characteristics of SMEs as well as their advantages and disadvantages.

- SMEs have more adaptability to market changes, and often initiate changes themselves;
- In small companies the path from the idea to the realization of the new product is significantly shorter, which also affects the emergence of new and higher quality products;
- Small business starts with people who has great enthusiasm, motivation to hard work, creative, and entice the enthusiasm and motivation;
- Promote private ownership and entrepreneurial skills;
- In case of extinction, MSPs do not cause major social disturbances because they employ relatively few people;
- The owner of MSP is most often the director of the company, which further encourages the rational and conscientious use of capital;
- In MSP most of the owners also employ family members, and very often that's a family business, which are the most stable part of every economy;
- Direct contact is a great asset of the MSA, because the owner of the company keeps everything under control and can quickly get in touch with another entrepreneur;
- Bureaucracy in SMEs is considerably lower; the owner / manager simultaneously performs multiple functions;
- Interpersonal relationships in small systems are healthier, more human, due to everyday common confrontation with the same problems and most often, commonly solving them;
- Small enterprises, through their participation in the total number of companies, have a significant influence on the elasticity of the economic system of a country, since with its adaptability they leave the existing business easier and begin production of new products;
- An increasing number of MSPs apply new and high technology;
- Although they are still mainly focused on the local market, an increasing number of SMEs have a significant role in international trade.

On the other hand, a MSP’s business may be in distress by the following shortcomings:

- Possibility of a faster shutdown compared to large companies. 30-40% of small firms cease to operate during the first three years of their establishment, and even 60% in the period of eight to ten years since its inception. When it comes to family firms, as many as 95% do not survive the third generation;
- Productivity in SMEs may be lower, as employees often carry out a large number of different jobs which prevent their specialization and training;
Insufficient information;

There are no unions, so workers are often unprotected, and the risk of dismissal and loss of business is considerably higher than for large companies;

Small companies are not competitive on the international market unless they are jointly owned or under large corporations.

Non-recognition of SMEs that will not be able to meet their contractual obligations on time can lead to the following consequences:

The company projects its liquidity on the basis of expected cash inflows. If they are absent, they will not be able to comply with their financial obligations, so the illiquidity of a company, such as domino effect, will be transferred to other companies and ultimately lead to worsening liquidity in the economy.

The next aspect concerns the nonfulfillment of obligations to banks, which, in the context of bad experience of loans to the economy, introduce restrictive credit policies, that disrupting the necessary financing of the economy, thereby slowing down or collapsing the economic stability of the country.

On the other hand, conservative policies in lending through deferred payment by other companies as well as by banks, according to the financially sound MSP, lead to a reduction in the lender’s profitability, which again leads to lower levels of economic activity.

The limited ability to identify early signs of SME deterioration in transitional countries, using the models and analysis that exist in the world, stems from:

- Relatively low level of enterprise capital;
- Slow payments and execution of liabilities to SMEs, and total business environment;

Legislative and executive regulations in developed countries in relation to countries in transition, i.e. faster elimination from economic flows of less-performing participants in developed countries compared to countries in transition.

By examining the results of the research conducted in the last few years, it can be seen that researchers, due to the SME in particular countries and regions, who are linked to the business environment of the country or region concerned, have been analysed and researching with emphasis on their own markets, companies that do business there. Legal regulations, business practices, country development and other parameters have created the prerequisites for creating a model that can be predicted with the highest degree of instability in SME operations. For this reason, there is a need to conduct research in transition countries, which will result in a certain level of security being able to identify those models and financial parameters that are strong signals to creditors, banks and business partners of SMEs, business of a small or medium enterprise.
According to the research presented further in the paper, we see that models for forecasting business disturbances used in large companies as well as in developed countries are not fully adequate for predicting insolvency of SMEs, as other researchers have previously identified, and this research will be explored causal relationship between the financial indicators of the Kralicek DF model and future potential financial distortion but also the degree of security that this model could further address MSPs in transition countries.

1. Review of earlier researches

There are many researches which are done in the world and that has found a model with financial indicator which detects financial problems of one enterprise with less or more success. Meanwhile similar researches are not represented in the region. Some of the researches are given below.

According to researches taken by Skeljo in 2000 (Salkic, 2013) possibility of implementation Altman’s model in Croatian economic environment is not adequate and certainty of predicting the bankruptcy is quite low than in the USA.

Research which has been done in Serbia was taken for the enterprises that were at stock exchange. The results have showed that Altman’s model cannot be used successfully for bankruptcy prediction in countries which are in transition (Muminović, 2011).

There was also a research which took place in Croatia on 28 enterprises which had bankrupt and 78 healthy enterprises by using discrimination analyses and logical regression (Pervan et al., 2011). It is established that using the first technique by 79.5% of certainty can be predicted bankruptcy while other technique by 85.9% of certainty can predict bankruptcy. Model included production enterprises and wholesales.

Additionally in Croatia, Šarlija and Jeger (2011) are found out that financial indicators treated through method of logical regression has got different meanings in predictions of failure of small and medium enterprises during the recession period.

In Bosnia and Herzegovina, Salkić (2011) has done the research on 40 enterprises divided into two groups: enterprises which regularly fulfil their credit obligations and enterprises which are late in fulfilling their credit obligations over 90 days. Model includes small and medium enterprises with not more than 20 employees and less than 3 million KM yearly income. The research has shown that ZETA model and revised ZETA model are not adequate for grading credit ability of enterprises in Federation of Bosnia and Herzegovina.

The same author has tested Kralicek model over financial indicators of 40 small and medium enterprises divided into two groups ‘healthy’ which regularly deal with their credit obligations with maximum delay of 30 days and ‘bad’ which has registered delays over 90 days. She has got that results that Kralicek model is very good in
estimation of ‘healthy’ enterprises but it is not reliable for bankruptcy prediction for enterprises early marked as ‘bad’.

Alihodžić (2013) has tested Kralicek DF indicator at Belgrade exchange stock and he concluded that accomplished financial results positively correlate with DF financial indicator.

Vidimlić (2015) tested Chesser model for predicting dealing with obligations small enterprises to banks and discovered that the model is not adequate for market of Bosnia and Herzegovinia.

2. Research sample

As a sample in this survey, firms from the Federation of Bosnia and Herzegovina, Zenica-Doboj Canton were taken. In this region there are registered 3500 companies of all sizes, small, medium and large. The region is industrial, and in the sample are represented various business activities. Of the total number of enterprises, small and medium-sized enterprises are taken as a sample - those companies with an annual income of more than two million convertible marks, employ more than 10 employees and have assets of more than one million convertible marks. In this way, there were a total of 398 companies that were treated with this research. Enterprises from this region have been taken into consideration due to the author's sphere of influence.

The data for these companies are taken from the Balance Sheet and the Statement of Cash Flows. The data were obtained from the AFIP agency (Federal Agency for Financial and Accounting). All companies are legally obliged to submit their annual reports to this agency.

During 2016, for each of these firms, it was determined whether they had a transaction account blocked by the state, banks or suppliers, that is, whether they are in financial problems. It was found that out of the sample, a total of 398 companies, 70 with a blocked transaction account in 2016, and 328 without a blocked transaction account.

This is how we got two groups of companies, 70 companies with financial problems and 328 without any apparent financial difficulties. For each of these groups, we took earlier financial reports, from 2014, and applied the Kralicek DF test to discover the possible success in predicting financial problems on the managed companies, especially for a group of blocked companies and especially for a group of unblocked companies.

A similar method was applied by Salkić (2011) and Vidimlić (2015) in their research.
3. Kralicek DF model

Looking for the financial indicators that will best make the gap between companies that will succeed in the future and the one that will not succeed, Kralicek has made two models, which he has made on the financial indicators of Swiss, German and Austrian companies. The first was Quick test, which, as his name suggests, could, at first glance, approximate the firm's prudence, and another, who called the DF indicator, which included six financial indicators, different weights, expressed through weights. The value of a function that is negative, immediately shows the insolvency of the enterprise. Higher values show a better financial position of the company.

The following financial indicators were found in function.

\[ X_1 = \frac{\text{Clear Cash Flow}}{\text{Total Liabilities}} \]
\[ X_2 = \frac{\text{Total Assets}}{\text{Total Liabilities}} \]
\[ X_3 = \frac{\text{Profit before interest and tax (EBIT)}}{\text{Total assets}} \]
\[ X_4 = \frac{\text{Profit before interest and tax (EBIT)}}{\text{Total income}} \]
\[ X_5 = \frac{\text{Inventories}}{\text{Total Revenues}} \]
\[ X_6 = \frac{\text{Business Revenues}}{\text{Total Assets}} \]

\[ \text{DF} = 1.5\cdot X_1 + 0.08\cdot X_2 + 10\cdot X_3 + 5\cdot X_4 + 0.3\cdot X_5 + 0.1\cdot X_6 \]

<table>
<thead>
<tr>
<th>THE VALUES OF DF INDICATOR</th>
<th>FINANCIAL STABILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;3.0</td>
<td>EXCELLENT</td>
</tr>
<tr>
<td>&gt;2.2</td>
<td>VERY GOOD</td>
</tr>
<tr>
<td>&gt;1.5</td>
<td>GOOD</td>
</tr>
<tr>
<td>&gt;1.0</td>
<td>AVERAGE</td>
</tr>
<tr>
<td>&gt;0.3</td>
<td>BAD</td>
</tr>
<tr>
<td>≤0.3</td>
<td>BEGINNING OF INSOLVENCY</td>
</tr>
<tr>
<td>≤0.0</td>
<td>MODERATE INSOLVENCY</td>
</tr>
<tr>
<td>≤-1.0</td>
<td>THE STRIKING INSOLVENCY</td>
</tr>
</tbody>
</table>

Source: [www.kralicek.at/pdf/quickbreak](http://www.kralicek.at/pdf/quickbreak)
3.1. Kralicek DF model on the sample

Using the data from the Balance Sheet, Cash Flow Statement, with the Kralicek formula, we have obtained the following results:

**Table 2: Results of calculations**

<table>
<thead>
<tr>
<th>KRALICEK DF MODEL</th>
<th>X1</th>
<th>X2</th>
<th>X3</th>
<th>X4</th>
<th>X5</th>
<th>X6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BLOCKED</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAXIMUM</td>
<td>0.03773</td>
<td>16.33568</td>
<td>0.80592</td>
<td>0.74184</td>
<td>18.05712</td>
<td>16.81150</td>
</tr>
<tr>
<td>MINIMUM</td>
<td>-0.07336</td>
<td>1.00000</td>
<td>-0.28019</td>
<td>-0.94084</td>
<td>0.00000</td>
<td>0.01231</td>
</tr>
<tr>
<td>RANGE</td>
<td>0.11109</td>
<td>15.33568</td>
<td>1.08611</td>
<td>1.68268</td>
<td>18.05712</td>
<td>16.79919</td>
</tr>
<tr>
<td>AVERAGE</td>
<td>-0.00175</td>
<td>2.67424</td>
<td>0.02391</td>
<td>-0.05923</td>
<td>0.77270</td>
<td>1.16701</td>
</tr>
<tr>
<td>STANDARD DEVIATION</td>
<td>0.01206</td>
<td>3.14511</td>
<td>0.13047</td>
<td>0.26908</td>
<td>2.71751</td>
<td>2.22323</td>
</tr>
<tr>
<td>MEDIANA</td>
<td>0.00000</td>
<td>1.49636</td>
<td>0.00787</td>
<td>0.00860</td>
<td>0.09753</td>
<td>0.57608</td>
</tr>
<tr>
<td><strong>UNBLOCKED</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAXIMUM</td>
<td>1.60626</td>
<td>120.39932</td>
<td>0.98272</td>
<td>1.25082</td>
<td>3.56566</td>
<td>6.25821</td>
</tr>
<tr>
<td>MINIMUM</td>
<td>-0.57731</td>
<td>1.00000</td>
<td>0.00000</td>
<td>0.00000</td>
<td>0.00000</td>
<td>0.04116</td>
</tr>
<tr>
<td>RANGE</td>
<td>2.18358</td>
<td>119.39932</td>
<td>0.98272</td>
<td>1.25082</td>
<td>3.56566</td>
<td>6.21705</td>
</tr>
<tr>
<td>AVERAGE</td>
<td>0.01850</td>
<td>5.12878</td>
<td>0.07563</td>
<td>0.07471</td>
<td>0.22050</td>
<td>1.19922</td>
</tr>
<tr>
<td>STANDARD DEVIATION</td>
<td>0.15883</td>
<td>11.86579</td>
<td>0.10656</td>
<td>0.11872</td>
<td>0.36389</td>
<td>0.86814</td>
</tr>
<tr>
<td>MEDIANA</td>
<td>0.00000</td>
<td>2.17013</td>
<td>0.04389</td>
<td>0.03895</td>
<td>0.12376</td>
<td>0.97602</td>
</tr>
</tbody>
</table>

*Source: Calculations of Author*

It is noticeable large range for the value X2 for both groups especially for the unblocked group so as for X5 and X6 in the blocked group. The other characteristic of this model is a great number of values of zeros for parameter X1 in the blocked group.
The next table is overview of classification of frequency by theoretical model.

**Table 3: The grade of accessibility of Kralicek DF model**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Gr1</th>
<th>Gr2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>16 (22.86%)</td>
<td>0 (00.00%)</td>
<td>16</td>
</tr>
<tr>
<td>1</td>
<td>5 (7.14%)</td>
<td>1 (0.31%)</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>6 (8.57%)</td>
<td>26 (8.07%)</td>
<td>32</td>
</tr>
<tr>
<td>3</td>
<td>18 (25.71%)</td>
<td>101 (31.37%)</td>
<td>119</td>
</tr>
<tr>
<td>4</td>
<td>7 (10.00%)</td>
<td>64 (19.88%)</td>
<td>71</td>
</tr>
<tr>
<td>5</td>
<td>8 (11.43%)</td>
<td>55 (17.08%)</td>
<td>63</td>
</tr>
<tr>
<td>6</td>
<td>5 (7.14%)</td>
<td>28 (8.70%)</td>
<td>33</td>
</tr>
<tr>
<td>7</td>
<td>5 (7.14%)</td>
<td>47 (14.60%)</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>70</td>
<td>322</td>
<td>392</td>
</tr>
</tbody>
</table>

*Source: Calculations of Author*

The mark Gr1 is for blocked and Gr2 for unblocked enterprises. Grades from 0 to 7 are given toward corresponding scale for classification. The value 0 corresponds to worst position in classification.

The value of the statistical test (p = 0.000346) shows that there is a statistically significant difference in the classification frequency range between blocked and unblocked firms.

The sample does not contain reference grades (1 to 7) to compare with those obtained from the theoretical model, which would lead to a conclusion on the adequacy of the assessment.

**Table 4: Values of statistics**

<table>
<thead>
<tr>
<th>Kralicek DF model</th>
<th>X1</th>
<th>X2</th>
<th>X3</th>
<th>X4</th>
<th>X5</th>
<th>X6</th>
<th>Z-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>p-value</td>
<td>0.775313</td>
<td>0.001405</td>
<td>0.00275</td>
<td>0.000109</td>
<td>0.098428</td>
<td>0.906053</td>
<td>0.077976</td>
</tr>
</tbody>
</table>

*Source: Calculations of Author*

Test statistic values indicate that there is a statistically significant difference in the values for X2, X3 and X4 but not for X1, X5 and X6. The difference is not detected for z-score, which does not seem logical. The reason for this may be to significantly increase the influence of X1, X5 and X6 on the model as a whole.
4. Discussion and conclusion

What is inherent to countries in transition is that the forces predictors are expressed through the percentages somewhat weaker than developed countries, where these models are tested, first and used through work. The reason is certainly in the development of these economies, where companies with worse performance are excluded from market games. The disagreement of payments between prospective entities would already be unduly disciplined by economic operators by declaring bankruptcy. The same case is with the capital of the company. If, due to the losses of previous years, the capital of the company was fully spent, even with a record of the amount of accumulated loss above the amount of capital, the legal entity would no longer have the ability to survive on the market. However, in transitional countries still, although there are legal regulations that we consider to be solid, with the possibility of improvement, in practice, laws are still not up to the end or just in a particular country. However, this method leaves bad business subjects in life for years, and they represent a brake in the development of other business entities, resulting in chain illiquidity, lapse of payment, nonfulfillment, or execution with huge delays.

Potential creditors, creditors, business entities, legal entities mislead you into bad business. As a major obstacle to the identification of financial indicators that may be indicative of a successful or unsuccessful business of a business entity at a certain stage of the business, the fact is that a large number of companies actually consider it to be successful if they pay even though with delays, or "wield" problems to others they create illiquidity. The perception of successful business in the transition countries is different from the one created in the developed countries. This is the result of the fact that companies in the transition countries in the economy have tolerated delays in order to deal with obligations, although the same law is not allowed. In the legislation of Bosnia and Herzegovina, in both Entities, it is stated that a company can declare bankruptcy if it has a delay in the execution of an obligation and also blocking the transaction account for at least one month or two months, the fact is that we have such companies more tens of thousands, for which no one even mentions leaving bankruptcy. After some time, these firms will succeed in partially organizing to meet their burning obligations and will continue to work, though the problems will remain pile up. And so for years. Tolerance in the execution of tax obligations is a special example of tolerance towards unstable companies, which is allowed by the state. This leads to business problems in healthy firms. In a situation where a bad company would have filed bankruptcy after a month of nonfulfillment, and with the statutory obligation to add a "bankrupt" to the company name, existing buyers, suppliers, business partners would look for other business partners and probably have a smaller percentage of the problem. However, as bad business entities remain in business, the problems of illiquidity remain, which are then incorporated into good business societies. All this
leads to the inability to recognize those financial indicators that will signal potential creditors, partners, and others about what business it is about.

Although the law foresees the existence of trades that the owner of a trade could profit from all the profits without any legal disturbance, a large number of companies that are registered in "doo" use various types of "creative" accounting that damage the ownership of a business entity. The ways in which the property of the company can be damaged are very different, so it can be seen through a whole balance, affecting all the financial indicators that have been explored. There is a real possibility that a firm can perform its current obligations without any problems, and has formal difficulties in doing business. The owner of the company is prepared to sacrifice the company fully in order to satisfy the personal material goals.

Nevertheless, it should be stressed that there is a difference between the financial indicators of micro, small, medium and large enterprises. That is why there is some advocate's commitment to micro companies to have a completely different form of financial statements, although for other reasons, which do not relate to financial ratios, but above all to simplicity for the understanding of the owners and ease of control of certain organs. However, earlier research shows that any forecasts for small companies are impossible to make based on their financial indicators. Accounting function is allocated only to small and smaller companies in medium size. The efforts of individual authors to introduce audit control by authorized persons, believe that it would lead to a better crystallization of financial indicators that could undermine the stability of the business of one business entity.

One of the key factors influencing the ability to use financial indicators as safe indicators of future business operations is the barrier that comes from the existence of a grey economy, as mentioned in the paper, as a characteristic of transition countries. Given the high level of grey economy, this height is an essential element in reducing the strength of financial indicators. Developed countries are considerably lower, and financial predictors are stronger.

Here it would be important to note that a different picture would be obtained, i.e. some other financial indicators when data processing by industry was used, which is also the limitation of research. As is well known, different activities have different ways of doing business, which affects financial indicators. E.g. the gross merchandise records the rebates at the end of the year, which are given by contractors on the basis of the amount of goods received as extraordinary revenue, although these activities make profitability on the basis of these approved rebates. Different bookstores would receive a different "blood picture" of companies, observing these indicators solely on the same criteria. Similarly, some businesses have a statutory obligation to book potential losses, guarantee dates, and the like, which is reflected in the revenue earned on the release of these provisions, which are part of the regular activity of the company in question.
example has different. Sampling by activity would bring better quality ratios, and they would be better predictors of financial success or failure of one enterprise.

**Literature**


**Summary**

The paper analyses the possibility of applying the Kralicek DF test to small and medium-sized enterprises in Bosnia and Herzegovina. In a sample of 398 companies, a formula has been tested to predict the financial failure of a company in certain developed countries with certainty. However, on the tested sample it is proved that Kralicek's DF test is not reliable for forecasting the financial difficulties of small and medium enterprises. The reasons for this are at the level of national economy development, the level of grey economy, the improper application of adopted laws and regulations, deliberate misrepresentation of balance positions and the participants' perceptions. However, looking at each financial indicator separately, it is noticed that the three financial indicators are stronger predictors of financial failure.