PREDICTING BANKRUPTCY OF SHIPBUILDING COMPANIES ON THE BASIC OF FINANCIAL STATEMENT DATA

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ABSTRACT

Companies in their operation often face problems in meeting their financial obligations and are unable to settle their trade liabilities owed to creditors. As their liabilities exceed their assets, the bankruptcy is initiated. The relevance of bankruptcy prediction is a frequent topic of research by many authors. Shipbuilding in the Republic of Croatia was one of key industry sectors in light of a large number of workers, a high share in exports, and numerous sub-contractors who were directly or indirectly participating in production. Business operations of major Croatian shipbuilding companies have deteriorated in recent years. The objective of this paper is to examine if it is possible to predict company bankruptcy on the basis of data presented in shipbuilding companies' financial statements by using mathematical methods and bankruptcy prediction models.

Key words: *bankruptcy, accounting information, shipbuilding companies, prediction models*

1. INTRODUCTION

Bankruptcy proceedings have become a daily occurrence in our economy and therefore are the subject of frequent captions in the media. During the last economic crisis, a large number of companies went bankrupt as a result of the insolvency and indebtedness of the company. According to data published on the FINA website in March 2019, 18,843 business entities were blocked at the time, 38.6% of which were legal entities who were related with more than 3/4 of the total outstanding basis for payment or 78.4% of the total amount. The total value of outstanding basis for payment of business entities was 6.48 billion HRK (www.fina.hr/). „The legislation prescribes sufficiently detailed methods and conditions for initiating bankruptcy proceedings and compliance with the law would also ensure the achievement of the basic purpose of the bankruptcy proceedings - maximum settlement of creditors as the primary objective and ensuring normal conditions for business as a secondary objective." (Botić, 2017).

Financial reporting involves the preparation and publication of financial statements that have to be prepared in accordance with accounting principles and standards. " Accounting is not only an end in itself, it is one of the tools that helps achieving business success and meeting the requirements of the tax authorities in accordance with that success" (Dunković, 2010). The financial statements prepared by the companies are: balance sheet or statement of financial position, profit and loss account or statement of comprehensive income, statement of cash flows, notes to the financial statements and statement of changes in equity, relating to the period during the year or to the business year. The form and content of the financial statements should be in accordance with the provisions of International Financial Reporting Standards (large enterprises) or Croatian Financial Reporting Standards (micro, small and medium-sized enterprises). (Narodne novine, 2015). They should primarily meet the information requirements of external users - current and future investors, creditors, suppliers and other creditors, customers, the state and the public.

There are various complaints to the fact that the preparation of the basic financial statements sometimes uses "creative accounting" which means that the financial statements do not present completely accurate or that a data that benefit the company are presented. Despite these complaints, accounting has proven to be a system that, even from incomplete or falsified reports can be read much more than is apparent to the eye. (Belak, 2014).

During the past period, Croatian shipyards have been in financial distress, even though the state aids were used to deal with liquidity. Žužul states «that EU accession required restructuring and privatization of shipyards, which was necessary for their sustainability» (Žužul, 2016). A public opinion is same to

the opinion of many authors such as Karačić and Bazina who indicate in their papers that "shipbuilding is a sector of particular strategic importance for the national economy" (Karačić, 2013; Bazina, 2015). Bajo, Primorac and Hanich think otherwise and they assume that "Croatian shipbuilding industry is one of the examples of public money incinerators, with taxpayers' 30 billion HRK invested in rehabilitation and restructuring from 1992 to 2015." (Bajo, Primorac, Hanich, 2016).

The subject of this study are the financial statements of three large Croatian shipyards for the period 2013-2017. The aim was to determine, through various mathematical methods and models used in the prediction of bankruptcy, whether bankruptcy could be predicted on the basis of the information contained in the financial statements. The theoretical part gives a brief overview of the position of shipbuilding in the Republic of Croatia, financial reporting as well as a description of the models used in prediction of bankruptcy. According to certain aims of the paper, a research question was also raised: *Can bankruptcy be foreseen based on the information from the financial statements of the observed shipyards?* In the empirical part of the paper, attempt will be made to answer the afore-mentioned research question.

After the introductory part, the paper describes theoretical thesis and previous research on financial reporting in the shipbuilding industry. Bankruptcy forecasting models that were applied in the empirical part of the paper are also described. The third chapter defines the sample and methodology of the research, while the fourth chapter gives the results of the research. The concluding chapter synthesizes the results obtained.

2. THEORETICAL THESIS

Bajo, Primorac and Hanich believe that the economic operations of Croatian shipyards have not been sufficiently analysed in Croatian professional and scientific literature (Bajo, Primorac, Hanich, 2016). Bazina wrote about the impact of the shipbuilding industry on the economy of the Republic of Croatia (Bazina, 2016), while Bendeković wrote in her paper   Business performance of the shipbuilding industry in the Republic of Croatia, about the importance of shipbuilding within the national economy and the success of the shipbuilding industry after restructuring in the Republic of Croatia. (Bendeković, 2015).

Three large shipyards 3. MAY, Uljanik d.d. and Viktor Lenac d.d. have been the subject of research by many authors over the past decade. Therefore, analysis of the financial statements for 2009 for three large Croatian shipyards (MAY 3, Uljanik and Viktor Lenac) showed poor performance on the operating activities and there was also noticed that the turnover coefficients indicated a

slow circulation of assets in the business process, which indicates poor quality management. Bendeković and Vuletić stated in their research that "shipyards should work on the more frequent usage of exchange rate hedging instruments and on the meeting delivery times in order to improve the financial results of their operations" (Bendeković, Vuletić, 2011).

Matić, in her paper Comparative Business Analysis of Shipbuilding Companies in the Republic of Croatia, has used financial analysis techniques to evaluate the financial position and performance of selected shipyards in the period 2011-2104. She claims that the business is not satisfactorily, that there is low liquidity, a decrease in profitability, and that activity indicators show that there is insufficient volume of business. She also claims that changes in the shipbuilding industry began with the start of negotiations on Croatia's accession to the European Union because the EU requires that companies "should do business without receiving sectoral aid from the treasury" (Matić, 2016). Karačić claims that, with Croatian accession to the EU, as the solution "imposed the privatization of each individual shipyard and the issue of state subsidies in the process, which would bring the financial condition of the shipyard to a state of positive growth." (Karačić, 2013) .

Pavicic also analyzed business operations of following shipyards: 3. MAJ Shipyard d.d., Viktor Lenac d.d. and Uljanik Shipyard d.d. for 2014 and 2015, indicating high indebtedness and poor liquidity of the observed companies. He also points out that the Uljanik Shipyard operates with the risk of bankruptcy even though it produces quality products (Pavičić, 2018).

Researches made by many scientists and experts have shaped different aggregated indicators models known as forecasting models for predicting financial instability such as Altman's Z-score model, BEX index, Kralicek's DF indicator, Zmijewski model, Springate model, Ohlson model. This paper will explore whether the data in the financial statements of the selected shipyards predicted bankruptcy using Altman's Z-score model, Zmijewski model and BEX model, and will give a brief overview of these models below.

One of the most famous synthetic indicators is certainly Altman's Z - Score model, which was conducted and named after Edward I. Altman. He conducted the first multivariate research of the relations between financial ratios and the likelihood of bankruptcy of companies anticipating bankruptcy within one or two years (Altman, 1968). He selected five indicators while the process of selecting indicators consisted of four steps: observing the statistical characteristics of different combinations of indicators, correlative analysis between indicators, analysis of predicted accuracy of different combinations between indicators and analytical evaluation. (Žager i sur. 2008.):

This model is represented by the following discriminant function:

$$Z = 1{,}2X_1 + 1{,}4X_2 + 3{,}3X_3 + 0{,}6X_4 + 0{,}999X_5$$

with:

Z – value of discriminant function,

X_1 – working capital / total assets,

X_2 – retained earnings / total assets,

X_3 – earnings before interest and taxes / total assets,

X_4 – the market value of the principal

X_5 – sales revenue / total assets.

Limit values are defined, with companies with a Z-score below 1.8 facing bankruptcy, while companies with a Z-score above 3 are financially stable, and the financial stability of companies with a value between 1.8 and 2.99 is endangered, but they have the ability to heal. Thirty years later, Altman revised the original model and developed a model for unlisted companies by replacing market value in variable X4 with accounting value

$$Z' = 0{,}717X_1 + 0{,}847X_2 + 3{,}107X_3 + 0{,}420X_4 + 0{,}998X_5$$

New limiting values were also set, namely ≤1.23 (very high bankruptcy risk) and ≥2.90 (very low bankruptcy risk).

The Zmijewski model (Zmijewski, 1984) for bankruptcy forecasting was developed in 1984. He includes indicators that measure business performance, indebtedness and corporate liquidity in his calculation. Zmijewski model is based on data from 800 non-bankrupt companies and 40 bankrupt companies, and a probit analysis was used in development of the model.

$$Y = -4.336 - 4.513\,X_1 + 5.679X_2 - 0.004X_3$$

with:

X_1 – net income / total assets

X_2 – total debt / total assets

X_3 – current assets / current liabilities

After calculating the value of Y, it is necessary to calculate whether the company is near bankruptcy on the basis of the expression: P = 1/(1+e -adjusted score). „If the gained probability is greater than 0.5 then the company has a high chance of bankruptcy" (Šarlija, 2008).

The BEX Index (Business Excellence) is a model used to evaluate the business excellence of companies, created in 2007 and designed by prof. dr. sc. Vinko Belak and dr. sc. Željana Aljinović Barać. The purpose of the indicator is to enable the assessment of current and future business excellence so that, based on the results obtained, there can be made an assessment of the present and

future financial position of the company. The BEX index is constructed in accordance with the operating conditions in the Croatian economy and applies to all capital markets and to unlisted companies (Belak, Aljinović Barać, 2008).

The BEX index is based on four indicators with fixed impact weights:

$$BEX = 0,388 \: ex_1 + 0,579 \: ex_2 + 0,153 \: ex_3 + 0,316 \: ex_4$$

The ex_1 indicator represents the profitability of the company and is calculated as the ratio between interest and earnings before taxes (EBIT) and total assets. The ex_2 indicator is based on economic benefit and represents value creation. It is calculated as the ratio of net operating profit to equity capital. The value of equity capital is calculated from the multiplication of equity and the cost of equity that owners could earn from relatively risk-free investments. The ex_3 indicator measures the liquidity of the company, which is calculated as the ratio of working capital to total assets, while the ex_4 indicator is based on the ratio of theoretically free money from all activities, which is the profit increased by amortisation and depreciation of the coverage of all liabilities with that money.

The business excellence of company is evaluated using the BEX index as follows: BEX index greater than 1 - good companies; BEX index between 0 and 1 - improvements required; BEX Index less than 0 (negative) - endangered existence (Belak, Aljinović Barać, 2008).

3. DEFINITION OF SAMPLE AND RESEARCH METHODOLOGY

Croatian shipyards have increasingly poor operating results and have recently been the subject of frequent titles in the media. Three shipyards were selected for this research, the main activity of which is the construction of ships and floating structures (NKD-30.11). These are: 3. MAY Shipyard d.d. (subsidiary in ULJANIK Group), Uljanik Shipyard d.d. and Shipyard Viktor Lenac d.d.

This study used the accounting data from the financial statements publicly disclosed on the FINE website (http: // rgfi.fina.hr/Public Announcement-Web / pSubjektTrazi.do) of observed companies for the period 2013-2017. In the case of Viktor Lenac Shipyard d.d. non-consolidated financial statements were used for the study. The financial ratios (to six decimal places) that are present in the bankruptcy forecasting models for each shipyard by year were calculated first, and at the end an appropriate model for each year was calculated to assess whether the models provided likelihood of bankruptcy for the observed companies. Altman's Z'-score model was calculated on the basis of equation:

$$Z' = 0,717 X_1 + 0,847 X_2 + 3,107 X_3 + 0,420 X_4 + 0,998 X_5$$

In the case of indicator x_4, the market value of the equity was replaced by the accounting value, and for the BEX index indicator ex_2 the capital price is

related to the average interest rate on kuna depositing at banks 3.39% (2013 4,55%, 2018. 2 , 22%).

Table 1 shows the results of bankruptcy forecasts according to the Altman model Z '- score, BEX index and Zmijew model for the period from 2013 to 2017. year for 3. MAJ Shipyard d.d.

Table 1. 3. MAY Shipyard d.d. Altman's Z'-Score Model, Zmijewski Model and BEX Index for period 2013-2017

Bankruptcy Forecasting Results	Year				
	2013	2014	2015	2016	2017
1. Z'-score	2,762058	1,02216	2,249054	2,389694	1,231279
2. BEX index	0,059695	-0,46405	0,379946	-0,42936	0,436386
3. Zmijewski Model (y)	-3,071131	-0,69219	-3,36536	-0,84709	-2,23597
Bankruptcy probability (1/1+exp(-y)	0,04431	0,33354	0,03339	0,30000	0,096557

Source: Author's calculation according to data from the annual reports and reports of the independent auditor for years 2013, 2014, 2015, 2016 and 2017 (http://rgfi.fina.hr/JavnaObjava-web/pSubjektTrazi.do)

The results obtained by Altman's Z'-score model indicate that shipyard 3. MAJ was in the "gray zone" through all observed periods, or that it was in risk of bankruptcy (2.90> Z '> 1.23). In 2017, the situation worsened and there was a high likelihood that they would end up in bankruptcy (Z '≤1,23). The BEX index is less than 0 throughout all the observed periods and indicates that the shipyard's business is at risk, as shown also by the results of Zmijewski model which indicates bankruptcy, since the values obtained from the calculation of the probability of bankruptcy are less than 0.5.

Table 2 shows the results of bankruptcy forecasts according to the Altman Z '-score model, the BEX index and the Zmijewski model for the period 2013-2017. year for Uljanik Shipyard d.d.

Table 2. Uljanik Brodogradilište d.d.: Altmanov Z' –score model, Zmijewski model i BEX indeks za razdoblje 2013.-2017. godina

Bankruptcy Forecasting Models	Year				
	2013	2014	2015	2016	2017
1. Z'-score	0,526821	-0,46193	-0,32585	-1,01061	0,8116335
2. BEX index	-0,33314	-0,21493	-0,22779	-0,32557	0,297225
3. Zmijewski Model (y)	3,750472	4,988272	7,208794	8,972224	15,83888
Bankruptcy probability ((1/1+exp(-y)	-0,210505	0,166993	0,121821	0,100279	0,059386

Source: Author's calculation according to data from annual reports and reports of the independent auditor for years 2013, 2014, 2015, 2016 and 2017 (http://rgfi.fina.hr/JavnaObjava-web/pSubjektTrazi.do)

According to the results obtained, it can be concluded that in all observed years, all three models predicted bankruptcy. The BEX index is less than 0, the Zmijewski model predicts bankruptcy because values are less than 0.5, as well as Altman's Z'score model where Z'≤1.23.

Table 3 shows the results of bankruptcy forecasts by Altman's Z'-score model, the BEX index and the Zmijewski model for the period 2013-2017. year for Shipyard Viktor Lenac d.d.

Tablica 3. Brodogradilište Viktor Lenac d.d. : Altmanov Z' –score model, Zmijewski model i BEX indeks za razdoblje 2013.-2017. godina

Bankruptcy Forecasting Models	Year				
	2013	2014	2015	2016	2017
1. Z'-score	1,39593	1,312781	2,277161	1,250488	2,524249
2. BEX index	0,207464	0,179124	0,555063	0,22199	0,894913
3. Zmijewski Model (y)	-1,92503	-1,36379	-2,352955	-1,49133	-2,52326
Bankruptcy probability (1/1+exp(-y))	0,127302	0,203625	0,086831	0,183722	0,074244

Source: Author's calculation according to data from the annual reports and reports of the independent auditor for years 2013, 2014, 2015, 2016 and 2017 (http://rgfi.fina.hr/JavnaObjava-web/pSubjektTrazi.do)

The results obtained from the Altman's Z'-score model indicate that Shipyard Viktor Lenac was in the "gray zone" during all the observed periods or that it is susceptible to bankruptcy, but they also show that there is a there is a possibility of avoiding bankruptcy (Z '2,68-1,24). A BEX index between 0.18 and 0.89 indicates that serious improvements are needed, while the Zmijewski model indicates bankruptcy as values are less than 0.5.

4. CONCLUSION

Through the financial reporting regulatory framework and the calculations in bankruptcy forecasting models, appropriate analytical procedures were applied using mathematical methods to answer the research question posed: *Can bankruptcy be foreseen based on the information in the financial statements of the observed shipyards?* The results of the research showed that the predictions of all forecasting models applied indicate a decrease in value over the observed periods which means they indicate bankruptcy or the possibility of bankruptcy.

The contribution of this paper is based on the application of the bankruptcy forecasting models on selected shipyards in the period from 2013 to 2017, and the research should be continued by analyzing the impact of the selected shipyards business on GDP, as well as on the total exports of the Republic of Croatia.

LITERATURE

1. Altman, E. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. Journal of Finance. V XXIII. N 4. str. 589-609.
2. Bajo, A., Primorac, M., Hanich, M. (2016). *Restrukturiranje i privatizacija brodogradilišta u Hrvatskoj.* Institut za javne financije – FISCUS razborito i odgovorno upravljanje financijama javnog sektora 2/2016, str.1-24.
3. Belak, V., Aljinović Barać Ž. (2008). Tajne tržišta kapitala. Zagreb: Belak Excellens d.o.o.
4. Bazina, B. (2016). *Uloga brodogradnje u gospodarstvu Republike Hrvatske s posebnim osvrtom na ishode procesa restrukturiranja.* Dostupno*: https://bib.irb.hr/datoteka/860607.bazina_branimir_efzg_2016_diplo_sveuc.pdf*
5. Bendeković, M. (2015.) *Uspješnost poslovanja brodograđevne industrije u Republici Hrvatskoj.* Zbornik radova Računovodstvo i menadžment –RiM. 16.međunarodna znanstvena i stručna konferencija, Svezak II, str. 1-10.
6. Bendeković, J., Vuletić, D. (2010*.) Financijska analiza poslovanja hrvatske brodograđevne industrije.* Poslovna izvrsnost, Vol. 5, Br. 1, str. 125-154.
7. Belak, V. (2014). *Analiza poslovne uspješnosti.* Zagreb: Zgombić&Partneri.
8. Botić, A. (2017). *Stečajni postupak dioničkog društva.* Dostupno: *https://repozitorij.svkst.unist.hr/islandora/object/efst:1495/preview*.
9. Dunković, D. (2010). *Kako unaprijediti upravljanje troškovima u poslovanju.* RRIF, 8/2010, str.92.
10. Financijska agencija. Objavljeni financijski izvještaji za 3.MAJ Brodogradilište d.d., Uljanik Brodogradilište d.d., BRODOGRADILIŠTE VIKTOR LENAC DD. dostupno: *http://rgfi.fina.hr/JavnaObjava-web/pSubjektTrazi.do*
11. Financijska agencija. *Informacija o neizvršenim osnovama poslovnih subjekata- ožujak 2019.* Dostupno: //www.fina.hr/-/informacija-o-neizvrsenim-osnovama-za-placanje-poslovnih-subjekata-za-prosinac-201-1 (23.4.2019)
12. Karačić, T. (2013). *Analiza i ocjena stanja razvijenosti hrvatske brodogradnje nakon pristupanja Europskoj uniji.*, str 7-17).
13. Matić, A. (2016). *Usporedna analiza poslovanja poduzeća iz brodograđevne djelatnosti u RH.* Dostupno*: https://zir.nsk.hr/islandora/object/efst:568/preview*
14. Narodne novine (2015). *Odluka o objavljivanju HSFI.* Dostupno:
15. https://narodne- novine.nn.hr/clanci/…/2015_08_86_1709.html
16. Pavičić, M. (2018). *Komparativna analiza financijskih izvještaja poduzeća iz sektora brodogradnje.*
17. Dostupno: https://zir.nsk.hr/islandora/object/vern%3A430
18. Šarlija N. (2008). Modeli ocjene rizičnosti poduzeća, predavanja. Dostupno:
19. *http://www.efos.unios.hr/kreditna-analiza/wp-content/uploads/sites/252/2013/04/7_modeli-ocjene- rizicnosti.doc.pdf*
20. Zakon o nacionalnoj klasifikaciji, Narodne novine 58/07
21. Zakon o računovodstvu, Narodne novine 78/2015.
22. Zmijewski, M.E. (1984). Methodological issues related to the estimation of financial distress prediction models, Journal of Accounting Research, Vol. 22, pp. 59 – 82
23. Žager, K. i dr. (2008). Analiza financijskih izvještaja. Masmedia.
24. Žužul, V. (2016). *Razvoj i buduće perspektive hrvatske brodogradnje.* Dostupno: https://repozitorij.efzg.unizg.hr/islandora/object/efzg%3A150

PREDVIĐANJE STEČAJA PODUZEĆA IZ SEKTORA BRODOGRADNJE NA TEMELJU PODATAKA IZ FINANCIJSKIH IZVJEŠTAJA

SAŽETAK RADA:

U poslovanju poduzeća često imaju problema u ispunjenju novčanih obve-za i nisu u mogućnosti podmirivati svoje obveze prema vjerovnicima. Njihove obveze su veće od imovine i dolazi do pokretanja stečaja. Aktualnost predvi-đanja steča-ja često je tema istraživanja mnogih autora. U Republici Hrvatskoj brodogradnja je predstavljala jednu od glavnih industrijskih grana zbog velikog broja zaposlenih, visokog učešća u izvozu, te velikog broja kooperanata koji su na izravan ili neizravan način sudjelovali u proizvodnji. Poslovanje najvećih hr-vatskih brodogradilišta se tijekom proteklog razdoblja pogoršavalo. Cilj ovog rada je istražiti na temelju poda-taka iz financijskih izvještaja poduzeća iz sektora brodogradnje putem matematičkih metoda i modela u predviđanju stečaja da li su izložena stečaju.

Ključne riječi: *stečaj, računovodstvene informacije, poduzeća iz sektora brodograd-nje, prognostički modeli*