



## PREDICTING BANKRUPTCY USING ALTMAN'S Z-SCORE AND ZMIJEWSKI MODELS

**Yayu Kusdiana\*<sup>1</sup>**

<sup>1</sup>STIE Mahaputra Riau, Indonesia

DOI: 10.58330/prevenire.v2i1.93

Accepted: 24 January 2023. Approved: 16 February 2023. Published: 28 February 2023.

### ABSTRACT

Oil and natural gas (oil and gas) are strategic natural resources and have an important role in national development. The need for oil and gas is expected to continue to increase in line with economic and population growth. Therefore, oil and gas business activities must be managed as well as possible to meet current and future supplies. Financial crises (financial distress) can occur in various companies and can be a signal of bankruptcy that the company may experience. The purpose of this study is to determine the bankruptcy prediction of Sub-Oil and Gas companies in Indonesia that are listed on the IDX in 2017 - 2020 using Altman's Z - score and Zmijewski models. The Altman Z-Score in predicting bankruptcy has a low accuracy rate of 22.72% with an error of 56.82%, while companies that are in a critical condition or gray area are not included in the calculation of the accuracy or type of error, due to the gray area cannot be determined whether the company is bankrupt or healthy, in other terms, namely the gray area. The Zmijewski in predicting bankruptcy is more accurate than the Altman Z-Score, which is 63.63% with a type error of 36.37%.

Research Paper

**PREVENIRE: Journal of Multidisciplinary Science**

**Keywords:** Financial Distress, Model Altman's Z - Score, Model Zmijewski.

### INTRODUCTION

It is no longer a secret that oil and natural gas (oil and gas) resources are increasingly limited. However, the need for oil and gas is still very dominant in various sectors of life, so its existence remains crucial. This is a big challenge for Indonesia, especially for oil and gas companies operating in Indonesia. Oil and natural gas (oil and gas) are strategic natural resources and have an essential role in national development. The need for oil and gas is expected to continue to increase in line with economic and population growth. Therefore, oil and gas business activities must be managed as well as possible to meet current and future supplies. The

government continues to make efforts to increase oil and gas production. The methods used include increasing oil and gas exploration activities to obtain new oil and gas reserves. Without discoveries, Indonesia's oil reserves will run out.

Department of Energy (DOE), United States of America, showed a decline in demand for world oil (and the supply that accompanies it) as a result of Covid - 19. The DOE estimates show that demand for crude oil, which started in the first quarter of 2020, will continue to decline until it reaches its lowest point is at the end of the 2nd quarter, then it is estimated that it will rise again and reach a balance point with oil supply at the end of the 3rd quarter of 2020 (Widyastuti &

\* Correspondence Address

E-mail: [yayu0677@gmail.com](mailto:yayu0677@gmail.com)



Nugroho, 2020). Roziqin (2015) argues that Indonesia has poor governance of petroleum. This causes the rate of production of petroleum to continue to decline. In contrast, the consumption rate continues to increase every year, resulting in an imbalance between the production and consumption of petroleum, which continues to grow year after year.

Thus, if oil and gas companies cannot survive in these conditions, it is very likely that oil and gas companies in Indonesia will suffer losses that will affect their financial position and will eventually face financial distress or be threatened with bankruptcy. Financial crises (financial distress) can occur in various companies and can be a signal of bankruptcy that the company may experience. Usually, a company's bankruptcy is marked by financial distress, which is a situation where the company is weak in generating profits or tends to experience a deficit. If the company is in financial distress, management must be careful because it could enter the bankruptcy stage.

The earlier the signs of bankruptcy are known, the better it will be for management because it allows company management to improve from the start (Peter et al., 2021). The management of a company experiencing financial distress must take action to overcome these financial problems and prevent bankruptcy. The emergence of various bankruptcy prediction methods can be used for anticipation and an early warning system for the possibility of bankruptcy, including using Altman's Z-score and Zmijewski models.

The results of research conducted by Prihantini and Sari (2013) show that the accuracy of the Altman model is 80% and Zmijewski is 90% in predicting bankruptcy in food and beverage companies listed on the Indonesia Stock Exchange (IDX 2008 - 2012 period). A condition in which a company faces financial difficulties, followed by doubts about its going concern, is called financial distress (Carolina, Marpaung and Pratama, 2018). Maulidia and Fun (2020) argued that financial distress is a condition in which a company is experiencing financial difficulties or is experiencing financial problems before

bankruptcy occurs. According to Annuri and Ruzikna (2017), the negative effects of financial distress are terrible. Therefore, an early warning system is needed in the form of information that can anticipate the occurrence of financial distress.

Based on the phenomenon above, researchers are interested in exploring Altman's Z-score model. Zmijewski can predict bankruptcy in Sub-Oil and Gas companies in Indonesia listed on the IDX in 2017-2020.

## LITERATURE REVIEW

### Model Altman's Z - score

Bankruptcy Analysis Z was examined by Edward I. Altman in 1984 against private manufacturing companies and going public as objects of the bankruptcy model, with the aim that not only manufacturing and non-manufacturing companies that have gone public can be sampled, but also manufacturing companies. closed so that it is used to predict the level of bankruptcy of a company by calculating the value of several ratios and then entering it into a discriminant equation.

The Z-Score was also developed with the aim of being able to predict the bankruptcy of companies in developing countries and those engaged in the non-manufacturing industrial sector (Pekerti and Yovita, 2019). The Z''-Score formula is as follows:

$$Z = 6,56 X1 + 3,26 X2 + 6,72 X3 + 1,05 X4$$

Where,

X1 = Ratio of working capital to total assets (Working Capital / Total Assets)

X2 = Ratio of retained earnings to total assets (Retained Earning / Total Assets)

X3 = Ratio of earnings before interest and tax to total assets (EBIT / Total Assets)

X4 = Ratio of book value of equity to book value of total debt (Book Value of Equity / Book Value of Total Liabilities)

The results of research conducted by Cipta (2021), Hikmah (2018), state that the Altman's Z-score model can predict bankruptcy in companies. However, the results of research conducted by Kurniawati (2017), show that the altman method cannot be

used as a tool to indicate a tendency towards bankruptcy.

### Zmijewski model

The Zmijewski model was developed by Mark E. Zmijewski in 1984 and resulted in a formula known as the Zmijewski X-Score. This method uses profitability ratios (ROA), leverage (Debt Ratio), and liquidity (Current Ratio) to analyze whether the company is experiencing financial disruption or not. The Zmijewski model has an accuracy of 94.9% (Fahma and Setyaningsih, 2021).

The model that was successfully developed is:  $X = -4.3 - 4.5X_1 + 5.7 X_2 - 0.004X_3$   
Information:

X = Overall Index

X1 = ROA (Return on Asset)

X2 = Leverage (Debt Ratio)

X3 = Liquidity (Current Ratio)

The results of research conducted by Januri et al. (2017), Salim & Sudiono (2017), Krusita & Wiagustini (2019) & Saputro and Hendayana (2022), state that the zmijewski model can be used to predict company bankruptcy. From the research results of Wulandari & Emrinaldinet (2014), Altman's Z-score and Zmijewski models can predict bankruptcy in companies. Research conducted by Fahma and Setyaningsih (2021), states that the Altman model has an accuracy and type of error of 80% and 10%, the Zmijewski method has an accuracy and type of error of 60% and 40%, so it can be concluded that the Altman model is the most accurate in predicting bankruptcy in retail companies.

Similar to the research by Melissa and Banjarnahor (2020), it shows that the Altman Z-score model has an accuracy rate of 90%. The Zmijewski model has an accuracy rate of 80%. However, this research is not in line with the research conducted by Prihanthini and Sari (2013), which states that the Altman Z-Score model has an accuracy rate of 80%, and the Zmijewski model is 90%, which means that the Zmijewski model is the most accurate in predicting bankruptcy.

### Accuracy Level Calculation

To find out the level of accuracy (LOA) and type of error (ET) in the bankruptcy prediction analysis, it can be seen through the company's financial reports, namely by

looking at the negative profits of a company (an indication of bankruptcy in a company) using the following formula Permatasari and Yunita, (2019):

$$LOA = \frac{\text{Number of Correct Predictions}}{\text{Number of Samples}} \times 100\% \quad (1)$$

$$ET = \frac{\text{Number of Incorrect Predictions}}{\text{Number of Samples}} \times 100\% \quad (2)$$

The results of calculating the level of accuracy and type of error can be concluded which method is the most accurate or the most appropriate to use in predicting bankruptcy (Fahma & Setyaningsih, 2021).

## METHODS

This research is a quantitative-explanative type of research. The research will be conducted at Oil and Gas Mining Sub-Sector companies listed on the Indonesia Stock Exchange (IDX) for 2017-2020. Using the purposive sampling method, 11 oil and gas mining sub-sector companies were listed on the Indonesia Stock Exchange in 2017 - 2020, which published their complete financial reports from a total population of 44 companies obtained from the website www.idx.co.id as secondary data.

This study analyzes the potential for company bankruptcy with the Altman Z-Score model and the Zmijewski X-Score. Each of these models uses ratio analysis calculations to determine a company's bankruptcy level. This type of research uses a comparative method with a quantitative approach. Data collection techniques using documentation and literature study techniques. This study analyzes the ratios and scores of each model calculated mathematically with the Microsoft Excel Office 2019 application. Descriptive statistical analysis uses SPSS software and then performs calculations to find the most accurate bankruptcy prediction model.

## RESULTS AND DISCUSSION

### Altman Z-Score Calculation Results

The Altman model is used to predict bankruptcy and determine the company's financial condition in the future using the ratio components in the Z Score formula as a bankruptcy predictor. The ratios are Working Capital to Total Assets, Retained Earnings to

Total Assets, Earnings Before Interest and Taxes to Total Assets and Market Value of Equity to Total Debt (Carunia Mulya

Firdausy, 2019). The results of the calculation of the Altman Z-Score are presented in Table 1.

**Table 1. Bankruptcy Prediction using the Altman Z-Score Model**

Code	2017		2018		2019		2020	
Company	Z-Score	predictions	Z-Score	predictions	Z-Score	predictions	Z-Score	predictions
APEX	-3,589	Bankrupt	-6,600	Bankrupt	0,181	Bankrupt	0,803	Bankrupt
ARTI	4,063	Healthy	3,447	Healthy	0,653	Bankrupt	-14,646	Bankrupt
BIPI	-1,877	Bankrupt	-1,083	Bankrupt	0,475	Bankrupt	-1,275	Bankrupt
ELSA	3,588	Healthy	4,631	Healthy	4,328	Healthy	4,220	Healthy
ENRG	-4,748	Bankrupt	-5,370	Bankrupt	-4,236	Bankrupt	-2,819	Bankrupt
ESSA	0,370	Bankrupt	1,900	Gray Area	1,939	Gray Area	1,109	Gray Area
MEDC	2,268	Gray Area	2,527	Gray Area	2,385	Gray Area	1,591	Gray Area
MITI	-1,457	Bankrupt	-0,547	Bankrupt	-14,388	Bankrupt	-34,220	Bankrupt
MTFN	-21,088	Bankrupt	-13,113	Bankrupt	-12,264	Bankrupt	-12,926	Bankrupt
PKPK	1,329	Gray Area	1,278	Gray Area	-2,553	Bankrupt	-2,231	Bankrupt
RUIS	9,546	Healthy	3,409	Healthy	2,780	Healthy	2,757	Healthy

Source: Processed Data (2022)

From Table 1, it can be seen that the calculation results of the Altman Z-Score model predict that 5 Sub-Oil and Gas companies in Indonesia listed on the IDX in 2017 - 2020 will experience financial distress, namely APEX, BIPI, ENRG, MITI and MTFN with results score less than 1.1 ( $Z < 1.1$ ). 2 (two) companies are categorized as healthy, namely ELSA and RUIS with a Z-Score value of more than 2.60. 1 (one) company is in a grey area position (financial condition is in a critical position), namely PKPK, the resulting Z-Score value is more significant than 1.1 and lower than 2.60, so it cannot be stated in a healthy and safe company condition.

The categories that have been defined in the Altman Z-Score model for non-manufacturing companies are if the Z value is  $< 1.1$ , the company is in a state of bankruptcy or distress if the Z value is  $> 2.60$ , the company is in good health or non-distress, and if it is  $2.60 > Z > 1.1$  companies are in critical condition or a grey area. Bankruptcy analysis using the Altman Z-Score Model can be seen that the greater the results of the Altman Z-

Score calculation, the better the performance of the company or the company will be said to be healthy and obtain a minimal possibility of bankruptcy (Saptani, 2018).

The results of this study support research conducted by Annuri and Ruzikna (2017), Hikmah (2018) Cipta (2021), who states that Altman's Z-score model can predict bankruptcy in companies.

#### Zmijewski Model Calculation Results (X-Score)

Zmijewski states that a company is distressed or will go bankrupt if the probability is greater than 0. So, the cut-off value that applies in this model is 0. If the X-score is negative or less than 0 ( $X\text{-Score} < 0$ ), the company is said to be healthy or not bankrupt. Conversely, if the X-score results are positive or more than equal to 0 ( $X\text{-Score} \geq 0$ ), the company can be classified as in an unhealthy condition or tends to lead to bankruptcy (Dahni, 2019). The results of calculations using the Zmijewski model (X-Score) are presented in Table 2.

**Table 2. Prediction of Company Bankruptcy using the Zmijewski Model (X-Score)**

Code	2017		2018		2019		2020	
Company	X-Score	prediction	X-Score	prediction	X-Score	prediction	X-Score	prediction
APEX	2,67	Bankrupt	3,95	Bankrupt	0,58	Bankrupt	-1,38	Healthy
ARTI	-2,66	Healthy	-2,42	Healthy	1,35	Bankrupt	7,47	Bankrupt
BIPI	-0,22	Healthy	-0,40	Healthy	-0,35	Healthy	-0,34	Healthy

ELSA	-2,51	Healthy	-2,14	Healthy	-1,85	Healthy	-1,53	Healthy
ENRG	1,71	Bankrupt	-9,27	Healthy	0,31	Bankrupt	-0,34	Healthy
ESSA	-0,10	Healthy	-0,73	Healthy	-0,55	Healthy	-0,65	Healthy
MEDC	-0,28	Healthy	-0,04	Healthy	0,1	Bankrupt	0,33	Bankrupt
MITI	-0,20	Healthy	-1,74	Healthy	9,47	Bankrupt	2,60	Bankrupt
MTFN	1,31	Bankrupt	1,35	Bankrupt	1,24	Bankrupt	1,79	Bankrupt
PKPK	-0,75	Healthy	-1,36	Healthy	2,29	Bankrupt	-1,98	Healthy
RUIS	-0,97	Healthy	-1,08	Healthy	-0,73	Healthy	-0,63	Healthy

Source: Processed Data (2022)

In upper information, it can be seen that the calculation results of the Zmijewski model (X-Score) predict that 1 (one) company will experience financial distress (financial crisis or bankruptcy) in Indonesia, which is listed on the IDX, namely MTFN. 4 (four) companies are categorized as healthy, namely BIPI, ELSA, ESSA and RUIS. Calculations in the Zmijewski model, if the value of  $X > 0$ , the company is in a state of bankruptcy or financial distress (financial crisis). If the value of  $X < 0$ , the company is in good health or non-financial distress; if  $X = 0$ , the company is in a critical condition or a grey area.

The results of research conducted by Januri, Sari and [Diyanti \(2017\)](#), [Salim and Sudiono \(2017\)](#), [Krusita and Wiagustini \(2019\)](#) and [Saputro and Hendayana \(2022\)](#) state that the Zmijewski model can be used to predict company bankruptcy.

### Calculation of the Accuracy Level of the Altman Z-Score and Zmijewski Models

**Table 3** explains that during 2017 - 2020 companies predicted to experience bankruptcy with the Altman Z-Score model 44 companies, with the category of 10 companies in healthy condition, nine companies in a critical condition or a grey area were not included in the calculation of the level of accuracy or type of error, because the grey area cannot be determined whether the company is bankrupt or healthy, in other terms. Namely, the grey area, and 25 companies are predicted to experience financial distress (financial crisis or bankruptcy). The level of accuracy produced by the Altman Z-Score model is 22.72%, with an error type of 56.82%. The Altman Z-Score model in predicting bankruptcy has a low level of accuracy.

**Table 3. Accuracy Level Recapitulation of the Altman Z-Score and Zmijewski Models**

Model	Prediction Results			Level of accuracy	Type Error	
	Healty	Grey area	Bankrupt			Total
<b>Model Altman Z-Score</b>	10	9	25	44	22,72%	56,82%
<b>Model Zmijewski</b>	28	0	16	44	63,63%	36,37%

Source: Processed Data (2022)

During 2017 - 2020 companies predicted to experience bankruptcy using Zmijewski (X-Score) predicted that 28 Sub-Oil and Gas companies in Indonesia listed on the IDX were in good health, and 16 companies were predicted to experience financial distress (financial crisis or bankruptcy). The accuracy level produced by the Zmijewski model is 63.63%, with a type error of 36.37%. The Zmijewski model in predicting bankruptcy is more accurate than the Altman Z-Score model.

In line with research conducted by [Prihanthini and Sari \(2013\)](#) and [Salim and Sudiono \(2017\)](#) that the Altman Z-Score model

in predicting bankruptcy has a lower accuracy rate than the Zmijewski model (X-Score). In contrast, research conducted by [Fahma and Setyaningsih \(2021\)](#) and [Melissa and Banjarnahor \(2020\)](#) states that the Altman Z-Score model in predicting bankruptcy has a higher level of accuracy than the Zmijewski model (X-Score). The results of the bankruptcy prediction analysis are not entirely accurate in predicting bankruptcy. However, the results of the analysis are still essential to provide early warnings about the presence of signals of financial distress in a company so that managers can take corrective steps that are deemed necessary for companies that are

experiencing financial difficulties so that the company does not go bankrupt (Prihanthini & Sari, 2013).

According to Dahni (2019), not all bankruptcy prediction methods have the same results and directions in predicting a company's bankruptcy. The aspects seen are internal to the company and external to the company. They are also determining factors for the company's condition, situation and performance. The currently widely used bankruptcy prediction methods certainly do not produce 100% accurate results in predicting corporate bankruptcy. Based on the results of research conducted by Komarudin et al. (2019), the use of very different financial ratios makes the Altman Model and the Zmijewski model significantly different.

### CONCLUSION

Based on the results of the study it can be concluded that the Altman Model with the Zmijewski model can be used in predicting the bankruptcy of Sub-Oil and Gas companies listed on the IDX in 2017 - 2020. The Altman Z-Score model in predicting bankruptcy has a low accuracy rate of 22.72% with a type of error 56.82%, while companies that are in a critical condition or gray area are not included in the calculation of the level of accuracy and type of error, because the gray area cannot be determined whether the company is bankrupt or healthy, in other terms, namely the gray area. The Zmijewski model in predicting bankruptcy is more accurate than the Altman Z-Score model, which is 63.63% with a type error of 36.37%.

#### Author's declaration

#### Authors' contributions and responsibilities

The authors made substantial contributions to the conception and design of the study. The authors took responsibility for data analysis, interpretation and discussion of results. The authors read and approved the final manuscript.

#### Funding

Write down the research funding, if any.

#### Availability of data and materials

All data are available from the authors.

#### Competing interests

The authors declare no competing interest.

### REFERENCES

- Annuri, I.F. Al and Ruzikna (2017) 'Analisis Penggunaan Metode Altman (Z-Score) Dalam Memprediksi Terjadinya Financial Distress Pada Perusahaan Minyak Bumi dan Gas (Migas) yang Tedaftar di Bursa Efek Indonesia (BEI) Periode 2010-2014', *Jom FISIP*, 4(2), pp. 1-13.
- Carolina, V., Marpaung, E.I. and Pratama, D. (2018) 'Analisis Rasio Keuangan untuk Memprediksi Kondisi Financial Distress (Studi Empiris pada Perusahaan Manufaktur yang Terdaftar di Bursa Efek Indonesia Periode 2014-2015)', *Jurnal Akuntansi Maranatha*, 9(2), pp. 137-145. Available at: <https://doi.org/10.28932/jam.v9i2.481>.
- Carunia Mulya Firdausy, A.B.K.D. (2019) 'Kinerja Keuangan Dan Potensi Kebangkrutan Dari Perusahaan Transportasi Pelayaran Pada Tahun 2013-2017', *Jurnal Manajemen Bisnis dan Kewirausahaan*, 2(6), pp. 89-96. Available at: <https://doi.org/10.24912/jmbk.v2i6.4913>.
- Cipta, R.S. (2021) 'Analisa Financial Distress Menggunakan Metode ALTMAN', *JIMEN (Journal Inovatif Mahasiswa Manajemen)*, 1 No 2(2), pp. 124-138.
- Dahni, F. (2019) 'Altman Z-Score Vs Zmijewski X-Score Dalam Memprediksi Kebangkrutan Perusahaan ( Studi Kasus PT Tiga Pilar Sejahtera Food , Tbk ( AISA) Tahun 2015-2017
- Pendahuluan Sektor makanan dan minuman Indonesia Indo Beras Unggul terlilit skandal kasus', *Jurnal Administrasi Bisnis*, 8(September), pp. 65-74.
- Fahma, Y.T. and Setyaningsih, N.D. (2021) 'Analisis Financial Distress Dengan Metode Altman, Zmijewski, Grover, Springate, Ohlson Dan Zavgren Untuk Memprediksi Kebangkrutan Pada Perusahaan Ritel', *Jurnal Ilmiah Bisnis dan Ekonomi Asia*, 15(2), pp. 200-216. Available at: <https://doi.org/10.32815/jibeka.v15i2.398>.
- Hikmah (2018) 'Metode Altman Z-Score Untuk Memprediksi Kebangkrutan Perusahaan Manufaktur di Kota Batam', (1), pp. 85-90.
- Januri, Sari, E.N. and Diyanti, A. (2017) 'The Analysis of the Bankruptcy Potential Comparative by Altman Z-Score, Springate And Zmijewski Methods at Cement Companies Listed In Indonesia

- Stock Exchange', *IOSR Journal of Business and Management*, 19(10), pp. 80–87. Available at: <https://doi.org/10.9790/487X-1910068087>.
- Komarudin, Syafnita and Ilmiani, A. (2019) 'Analisis Komparasi Prediksi Financial Distress Metode Grover, Altman, Springate, Zmijewski, dan Ohlson Pada Perusahaan Pertambangan di BEI', *Jurnal Ekonomi dan Bisnis*, 22(2), pp. 36–44.
- Krusita, N.W.Y. and Wiagustini, N.L.P. (2019) 'Prediksi Financial Distress Menggunakan Model Zmijewski Dan Model Grover Pada Perusahaan Migas Di Bei', *E-Jurnal Manajemen Universitas Udayana*, 8(5), p. 2891. Available at: <https://doi.org/10.24843/ejmunud.2019.v08.i05.p11>.
- Kurniawati, S. (2017) 'Analisis Kebangkrutan Dengan Model Altman Z - Score Pada Perusahaan Sektor Industri Dasar Dan Kimia di BEI Periode 2013 - 2014', 26(01), pp. 136–162.
- Maulidia, L. and Asyik, N.F. (2020) 'Pengaruh Profitabilitas, Leverage, Dan Likuiditas Terhadap Financial Distress Pada Perusahaan Food and Beverage Di Bursa Efek Indonesia', *Jurnal Ilmu dan Riset Akuntansi*, 9(2), pp. 1–15. Available at: <http://jurnalmahasiswa.stiesia.ac.id/index.php/jira/article/view/2788/2798>.
- Melissa, P. and Banjarnahor, H. (2020) 'Analisis Prediksi Kebangkrutan Menggunakan Model Altman Z-Score, Springate Dan Zmijewski Yang Terdaftar Di Bursa Efek Indonesia', *Jurnal EMBA: Jurnal Riset Ekonomi, Manajemen, Bisnis dan Akuntansi*, 8(1), pp. 903–912.
- Pekerti, V.S. and Yovita, L. (2019) 'Aplikasi Model Altman Z"-Score Pada Perusahaan-Perusahaan Agrikultur Di Bursa Efek Indonesia (Periode 2010-2017)', *Jurnal Penelitian Ekonomi dan Bisnis*, 4(1), pp. 1–8. Available at: <https://doi.org/10.33633/jpeb.v4i1.2319>.
- Permatasari, P.I. and Yunita, I. (2019) 'Analisis Kebangkrutan Dengan Menggunakan Metode Altman Z- Score, Springate, Dan Zmijewski Pada Perusahaan Subsektor Minyak Dan Gas Bumi Yang Terdaftar Di Bursa Efek Indonesia Periode 2012-2017', *e-Proceeding of Management*, 6(1), pp. 122–130.
- Peter, P., Herlina, H. and Wiraatmaja, J. (2021) 'Analisis Kebangkrutan Perusahaan Melalui Perbandingan Model Altman Z-Score, Model Springate's, Dan Model Fulmer Pada Industri Semen Di Indonesia', *Ultima Manajemen*, 13(2), pp. 369–378.
- Prihanthini, N.M.E.D. and Sari, M.M.R. (2013) 'Z-Score , Springate Dan Zmijewski Pada Perusahaan Food Fakultas Ekonomi dan Bisnis Universitas Udayana ( UNUD ), Bali , Indonesia Fakultas Ekonomi dan Bisnis Universitas Udayana ( UNUD ), Bali , Indonesia ABSTRAK Perkembangan zaman yang diikuti dengan per', *E'jurnal Akuntansi Universitas Udayana*, 2, pp. 417–435.
- Roziqin (2015) 'ISSN 2460-3937 Penanggung Jawab Pemimpin Redaksi JURNAL TATA KELOLA & AKUNTABILITAS Dewan Redaksi dan Mitra Bestari Redaksi Pelaksana Alamat Redaksi Desain Grafis / Layout Pengelola Website Produksi / Pemasaran', 2.
- Salim, M.N. and Sudiono (2017) 'an Analysis of Bankruptcy Likelihood on Coal Mining Listed Firms in the Indonesian Stock Exchange: an Altman, Springate and Zmijewski Approaches', *Eurasian Journal of Economics and Finance*, 5(3), pp. 99–108. Available at: <https://doi.org/10.15604/ejef.2017.05.03.008>.
- Saptani, W. dan (2018) 'Akurasi Potensi Memprediksi Kebangkrutan Metode Altman Z-Score dan Metode Ohlson o-Score', 3(2).
- Saputro, D.A. and Hendayana, Y. (2022) 'Analisis prediksi kebangkrutan model zmijewski x-score pada perusahaan subsektor minyak dan gas periode 2019-2021', *Fair Value: Jurnal Ilmiah Akuntansi dan Keuangan*, 4(11), pp. 5292–5300. Available at: <https://doi.org/10.32670/fairvalue.v4i11.1994>.
- Widyastuti, N.L. and Nugroho, H. (2020) 'Dampak Covid-19 terhadap Industri Minyak dan Gas Bumi: Rekomendasi Kebijakan untuk Indonesia', *Jurnal Perencanaan Pembangunan: The Indonesian Journal of Development Planning*, 4(2), pp. 166–176. Available at: <https://doi.org/10.36574/jpp.v4i2.116>.
- Wulandari, et al (2014) 'Analisis Perbandingan Model Altman, Springate, Ohlson, Fulmer, CA-Score dan Zmijewski Dalam Memprediksi Financial Distress (studi empiris pada Perusahaan Food and Beverages yang Terdaftar di Bursa Efek Indonesia Periode 2010-2012)', *Jurnal Online Mahasiswa Fakultas Ekonomi Universitas Riau*, 1(2), pp. 1–18. Available at: [https://jom.unri.ac.id/index.php/JO\\_MFEKON/article/view/4364](https://jom.unri.ac.id/index.php/JO_MFEKON/article/view/4364).