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DETECTING FINANCIAL FAILURE WITH THE ASSISTANCE OF FINANCIAL STATEMENTS: AN IMPLEMENTATION IN BORSA ISTANBUL

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ABSTRACT

The Z-score model developed by Edward I. Altman is one of the most preferred models for measuring financial failure by companies, When the studies on this subject are examined, it is seen that the predictive power of the Z-score model is quite high. Because of the concept of financial failure is related to the balance sheet and income statement in terms of accounting so to the financial statements, the Altman Z-Score model, which is one of the accounting-based bankruptcy estimation methods, is used in this study. In this study, with the financial data obtained from audited financial statements of the companies that continued their activities in Borsa Istanbul Sustainability Index between 2014 - 2019 have been tried to predict the failure levels of these companies by using Altman Z-score model. The Z-Score value and the values determined by Altman of each company were compared and the financial failure levels of these companies were determined over the years. Companies that Z-Score's below 1.81 are considered financially risky, Z-Score's upper than 2.99 are financially risk-free and Z-Score's between these two values are financially uncertain and uncritical.

Keywords: Financial Failure, Financial Statements, Altman Z-Score

MALİ TABLOLAR YARDIMIYLA FİNANSAL BAŞARISIZLIĞIN TESPİTİ: BORSA İSTANBUL'DA BİR UYGULAMA

ÖZET

Edward I. Altman tarafından geliştirilen Z-Skor modeli işletmeler tarafından finansal başarısızlığın ölçülmesinde sıkça tercih edilen modellerden biridir. Bu konu ile ilgili yapılan çalışmalar incelendiğinde Z-Skor modelinin tahmin gücünün oldukça yüksek olduğunu görülmektedir. Finansal başarısızlık kavramı, muhasebe açısından bilanço ve gelir tablosuyla yani mali tablolarla ilgili olması nedeniyle bu çalışmada muhasebe temelli iflas tahmin yöntemlerinden olan Altman Z-Skor modeli kullanılmıştır. Çalışmada, Borsa İstanbul Sürdürülebilirlik Endeksinde faaliyetlerine devam eden işletmelerin 2014 - 2019 yılları arasında ki denetlenmiş mali tablolarından elde edilen finansal verilerle, bu işletmelerin başarısızlık düzeyleri Altman Z-Skor modeli yardımıyla tahmin edilmeye çalışılmıştır. Her işletmenin Z-Skor değeri ile Altman'ın belirlediği değerlerler karşılaştırılmış ve yıllar itibariyle işletmelerin finansal başarısızlık düzeyleri ortaya konulmuştur. Z-Skoru, 1,81'in altında kalan işletmeler finansal açıdan riskli, Z-Skoru, 2,99'dan büyük olan işletmeler finansal açıdan risksiz ve Z-Skoru bu iki değerin arasında olan işletmeler ise finansal açıdan belirsiz ve tehlikesiz olarak ifade edilmiştir.

Anahtar Kelimeler: Finansal Başarısızlık, Mali Tablolar, Altman Z-Skor

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INTRODUCTION

The concept of financial failure entered the literature in the 1960s and has remain up-to-date since it is an essential concept for companies. Therefore, there are serious studies on the factors that affect the financial failures of companies, and specifically on the topics of predicting financial failure. These studies have provided significant benefits to companies in predicting financial failure, taking necessary precautions and sustaining their activities. In the studies, the Altman Z-Score model stands out as the most preferred model. The main reason for this is that the model is based on accounting data, namely financial statements, and the success ratio of the results obtained is quite high. Altman conducted a study in 1968 by taking into account the bankrupt companies and used financial ratios and discriminant analysis together to predict the financial failures of the companies, thus revealing the Z-Score model. In this model, Altman used the financial data of 66 companies and determined the Z-Score values of each company separately. As a result of the study, if the Z-Score value of the companies is greater than 2,99, the companies are "risk-free", if the values are between 1,81 and 2,99, these companies are "uncertain and uncritical", and finally, if the values are below 1,81, these companies are classified as "high risk of financial failure".

The purpose of this study is to determine the financial failure levels of the companies included in the BIST Sustainability Index with the help of the Altman Z-Score model. In this context, the Z-Score value of each company was determined, compared with the Z-Score values determined by Altman, and the financial failure levels of the companies over the years were revealed.

1. LITERATURE REVIEW

In his study, Beaver (1966) determined 30 financial ratios using the financial statements of companies and applied discriminant analysis by summing these ratios into 6 basic groups. The primary purpose of the model he developed is to identify the levels of the financial failure of companies and the risks of bankruptcy. Altman (1968) revealed the Z (Zeta) model through his work.

Altman (1968) revealed the Z (Zeta) model through his studies. Afterwards, he developed his model with his new studies in 1977 and 2000. Multiple discriminant analysis constitutes the content of this model. Primarily, 22 financial ratios belonging to companies were determined, and then the number of these ratios was reduced to 5. He tried to put forward estimates of the financial failure of companies with these ratios that he determined. Springate (1978), in his research, used the financial data of manufacturing companies operating in Canada with the help of discriminant analysis and aimed to determine the financial failure levels of companies.

Springate (1978), in his research, used the financial data of manufacturing companies operating in Canada with the help of discriminant analysis and aimed to determine the financial failure levels of companies. As a result of these studies, the Springate model emerged.

Ohlson (1980), in his study, examined the financial data of 205 operating companies and 205 bankrupt companies between 1970 and 1976 using the multiple discriminate analysis methods and revealed the O - score model in terms of predicting the financial failure processes of companies.

Fulmer (1984), in his research, used multivariate discriminant analysis to determine the financial failure levels of companies and revealed his own Fulmer model.

Poyraz et al. (2006), in their study, tried to determine the financial failure levels of companies, which are among the main exporting sectors (tourism, textile, agricultural products-food, transportation vehicles), using the financial data covering the 1994 and 2001 financial crisis periods, with the help of the Altman Z-Score model. In addition, in this study, the financial failure levels of the companies in the specified sectors, both in the normal economy and in crisis environments, were tried to be estimated by comparing them.

Terzi (2011) main purpose of his study is to reveal the most appropriate model in determining the financial failure risks of companies. For this purpose, it used the data of food companies listed on the Istanbul Menkul Kıymetler Borsası. First of all, using the Altman Z-Score model, it was determined that the companies were financially successful or unsuccessful, then 19 financial ratios were determined using the financial data of the companies in the food sector, and discriminant analysis was applied. As a result of the application, it found that the debt-equity ratio and the active profitability ratio were effective.

Yi (2012) used the financial data of real estate companies operating in China with the help of the Altman Z-Score model and tried to determine the financial failure and financial uncertainties of the companies. The accuracy ratio obtained as a result of the study was below 90%.

Tokat et al. (2012), using financial data from the technology sector and transport, communication and storage sector in Borsa Istanbul in their study, revealed the financial failure levels and portfolio performance of companies with the help of the Altman Z-Score model. As a result of the study, they concluded that the increased financial risks of companies did not have an impact on stocks.

Samkin et al. (2012) used the financial data of 45 financing companies operating in New Zealand between 2006 and 2010 in their study. Altman Z-Score model was used in the study to estimate the bankruptcy risks of companies. As a result of the study, it was determined that the bankruptcy level of 20 of these companies was higher than the others.

Yasser and Mamun (2015), in their study, aimed to measure the performance of companies from different sectors (service and industry, retailing, mining and real estate investment) operating in Malaysia between the years 2006-2010. Altman Z-Score was used as a model in the study. As a result of the study, the idea that each sector has different risks has emerged.

Spatacean (2015) determined about 20 investment companies operating in Romania as a sample in his study. In the study, the financial risks of companies were measured by using Altman Z-Score and Conan-Holder models. It has been determined that all companies that are the subject of the study carry risks.

Selimoglu et al. (2015), in their study, used financial data of 25 companies operating in the textile sector in Borsa Istanbul. The financial failures of these companies were measured using the Altman Z-Score model. Afterwards, discriminant analysis was carried out using specific financial ratios. As a result of the study, it was found that 11 companies were financially successful, and 14 companies were financially unsuccessful.

Shahwan (2015), in his study, discussed the financial failure level of 86 companies operating in Egypt with the financial ratios obtained by using the financial data of the companies and the Altman Z-Score model. As a result of the study, it was seen that the financial failure levels of the companies were worse than the expected level.

Yilmaz et al. (2015) determined the main purpose of their study as both to determine the financial failure levels of companies and to reveal the predictive power of the Altman Z-Score model. In this context, financial data of 36 companies (18 operating, 18 bankruptcies) in Borsa Istanbul were used between 2001 and 2006. With the help of the Altman Z-Score model, the financial failure levels of these companies were measured. As a result of the study, the model they used correctly estimated 16 of the companies that continued their activities and 10 of the bankrupt companies. Afterwards, discriminant analysis was performed to determine which of the financial ratios used in the model were more effective in detecting failure. It was determined that four of the five financial ratios used were more effective.

Kulalı (2016), in his study, revealed the financial failure levels of the bankrupt companies in Borsa Istanbul between the years 2000-2013 by using the Altman Z-Score model. As a result of the study, it was concluded that the model used was quite effective in practice.

Soba et al. (2016), in their study, examined nine companies operating in the field of large companies in Borsa Istanbul. The financial information of these companies between the years 2011-2015 was used in the study. With the Altman Z-Score model, the financial failure levels of the companies were determined. By interpreting the results obtained, they tried to determine the level of being affected by the possible crisis situations that the companies may encounter in the future.

Toraman et al. (2016), in their study, used the financial data of the companies in the Chemical sector in Borsa Istanbul between the years 2010-2013 in the Altman Z-Score model and the financial failure levels of the companies were determined. With the regression analysis made afterwards, it was determined that the increase in working capital, stocks and total debts had a significant effect on the financial success of the companies.

Kürklü et al. (2017), in their study, aimed to determine the financial failure levels of 166 companies in 7 different sectors in Borsa Istanbul between 2014-2016 using Altman Z-Score and Springate s-Score models and to compare them on a year-by-year basis. As a result of the analysis, the Springate model showed that 95 of 166 companies and the Altman model showed that 115 of 166 companies were not at risk of financial failure.

Çelik (2018), in his study, tried to predict the financial failure levels of the manufacturing companies in the BIST-30 index with the help of the Altman Z-Score Model, using the financial data between 2015 and 2017. As a result of the study, it was determined that two companies in the manufacturing sector that he examined were at the critical threshold.

Çalış et al. (2018), in their study, the financial data of the companies operating in the Restaurants and Hotels sector in Borsa Istanbul for the years 2013-2017 were used. While the Altman Z-Score model was used to determine the financial failure levels of the companies, financial ratios were used to determine the financial changes of the companies.

Kisakurek et al. (2018), the main purpose of their study is to create a reliable model in order to determine the financial failure risks of companies. In this context, they applied the 2008 data of the companies in the manufacturing sector in Borsa Istanbul to the Altman Z-Score Model and tried to determine the financial failure risks of the companies. Afterwards, factor analysis was applied to the financial ratios obtained, and the results obtained were used as an independent variable in the discriminant analysis. As a result of the analysis, it was determined that the developed model had a successful classification of 91.1%.

Gör (2019), in his study, determined the financial failure levels of the companies in the Borsa Istanbul-100 index by using the financial data between 2009 and 2016 in the discriminant analysis. The margin of error in identifying unsuccessful companies identified by Z-Score was below 6%. In addition, the main ratios to be considered for companies to make the right decision are net profit margin, return on assets ratio and return on equity.

Karadeniz et al. (2019) The aim of their study is to determine the statistical difference between the companies with and without the risk of financial failure by using the financial data of the tourism companies operating in Borsa Istanbul between the years 2012-2017. In this context, the financial failures of these companies were tried to be determined by using the data of the companies in question with the help of the Altman Z-Score model. Afterwards, it was tried to select whether there was a difference between the financial ratios by applying the Mann Whitney U Test to the companies that did and did not carry financial risk.

Say (2021), In his study, investigated the consistency of the results by determining the risk of financial failure with the help of both the German Z-Score model and the Bankometer model, with the help of the financial statement data and the data taken from the annual reports of a participation bank operating in Borsa Istanbul during the 2015-2019 period.

When the findings obtained in the research are examined, it is stated that the participation bank has a high solvency with the help of the results obtained with the Bankometer model. However, the results of the Altmnn Z-Score model revealed the opposite findings in 2015 and 2016.

2. FINANCIAL FAILURE

The most important purpose that companies set during the establishment phase are to continue their existence that is, continuity. However, companies are not always able to act in line with this purpose. While some companies continue their activities, some companies end their activities due to financial failure. Financial failure occurs after certain stages, and companies face this process. Generally, companies first start to experience the financial pressure process; if the necessary precautions are not taken during the financial pressure process or if the companies are insufficient in the implementation of the measures taken, financial failure occurs in companies. This situation ends with the termination of the activities of the companies. For this reason, "financial failure" remains a vital concept for companies.

In the studies on financial failure, there is no common definition accepted by everyone. However, it is accepted that any of the following four situations will be sufficient to understand that the companies are financially unsuccessful. (Altman and Hotchkiss, 2006: 4).

- Company cessation or bankruptcy,
- Encountering situations such as pledge, foreclosure and enforcement,
- Initiation of liquidation processes or appointment of a trustee by the state as a result of the decisions taken by company managers,
- Initiating the settlement process with the creditor in cases where companies cannot make their short-term and long-term payments,

From this point of view, it is possible to define the concept of financial failure as “the inability of the company to fulfil its financial obligations” (Beaver, 1966: 71). In other words, “the financial situation that occurs when a company experiences the process of not making its payments with the assets it holds while continuing its activities” (Hua et al., 2007, p.435). Financial failure prediction models have generally emerged as a result of the use of mathematical and other analyzes together and have been used to predict the financial failure levels of companies.

- Beaver Model
- Altman Z-Score Model
- Springate S-Score Model
- Ohlson Model
- Fulmer Model

- Zmijwski Model
- Canada Score Model

Altman Z - Score Model:

In 1968, Altman analyzed the financial data of 66 companies for the first time with the help of the Z-Score model. Then, in his study "Zeta Analysis, A New Model to Identify Bankruptcy Risk of Corporation", which he carried out in 1977, this time he discussed the 13-year process of 111 companies, and finally in 2000, he gave the final shape to the model in question in his study "Predicting Financial Distress Companies: Revisiting The Z-Score And Zeta Models". The content of the Z-Score model consisted of multiple discriminant analyses. First, he determined 22 financial ratios belonging to companies and used them in his model, and then reduced the number of these ratios to 5.

The Z-Score model, which Altman developed as a result of his studies, led to an essential start in determining the credit risks of the companies through their financial statements and estimating their future financial situations (Hayes et al., 2010: 122-134).

Financial ratios are one of the most appropriate tools that summarize the financial information of the companies and are used to compare the performances of the companies in question (Say, 2022: 35). The Altman Z-Score model consists of five financial ratios obtained from the financial statements of a company. Each ratio it creates reveals different views of the operations of the company. These ratios measure the liquidity situation, total profitability, efficiency of assets, market-based financial borrowing (leverage) and adequacy of the capital of the company (Miller, 2009: 3). The ratios that Altman used in his formula are multiplied by various coefficients (Altman, 2000: 9);

Z - Score = 1,2 X1 + 1,4 X2 + 3,3 X3 + 0,6 X4 + 1,0 X5

The ratios here are explained as follows (Chios, 2017: 285-286).

X1= Working Capital / Total Assets: It shows the intercourse between the size of a company and its liquid assets. Working capital is obtained by subtracting short-term debts from current assets.

X2 = Retained Earnings / Total Assets: It measures the earning power of the company and its ability to generate income.

X3= Earnings Before Interest and Tax/ Total Assets: It gives information about operating profit, which is closely related to the profitability of the company.

X4= Market Value of Equity (Company Market Value) / Total Liabilities: This ratio actually appears as an indicator of financial leverage. It shows the changes in the value of the current and fixed assets of a company.

X5= Sales / Total Assets: It shows the asset turnover ratio of the company. It differs according to the sectors in which the companies are located.

The results obtained from this function measure the financial failure risk of the company (Hayes et al., 2010:126);

- Companies with a Z-Score below 1.81 have extremely risky loan payments and are also noted as having a high probability of bankruptcy.
- Companies with a Z-Score greater than 2.99 are also reported to have risk-free loan payments and a low probability of bankruptcy.
- It is stated that if the Z-Score is between these two values, it is difficult to reveal the profiles of the companies, but the value of 2.67 is the limit, and this ratio is the point of separation of successful and unsuccessful companies. In addition, companies with a Z-Score between $1.81 < Z < 2.99$ can be expressed as uncertain and safe (Gritta et al., 2008:133).

The model described above is designed to be valid only for listed manufacturing companies. With the study carried out in 1977, the Zeta Model, which is a model in which financial failure predictions can be made for manufacturing companies that are not traded in the stock market, was developed, and changes were made in the coefficients and X4 variable in this new model.(Altman, 2000: 25-26);

X4=Current Value of Equity / Book Value of Debts

Z' - Score = 0,717 X1 + 0,847X2 + 3,107X3 + 0, 420X4 + 0,998X5

- Companies with a Z' Score below 1,23 are insecure
- Companies with a Z' Score above 2,9 are safe,
- Companies with a Z' score between $1,23 < Z' < 2,9$ were also considered to be in normal condition.

A new model (Z") was created by Altman in 1993 to make financial failure predictions for companies operating in the service sector. In this model, unlike the Z-Score model, the coefficients were changed and the X5 variable was removed from the formulation (Hayes et al., 2010:125):

Z" - Score = 6,56X1 3,26X2 + 6,72X3 + 1,05X4

- Companies with a Z" Score below 1,1 are insecure
- Companies with a Z" Score above 2,6 are safe,
- Companies with a Z" score between $1,1 < Z" < 2.6$ were also considered to be in average condition.

Altman's Z-Score model pioneered the financial failure prediction studies in the following years and has been the most cited study among the studies conducted in this field to date. (Thevnin, 2003:8). In addition, the Z-Score financial failure prediction model is preferred by many companies because of its high reliability (Özdemir, 2014: 152). For these reasons, the Altman Z-Score model, which is Altman's first model, will be used in the study.

3. METHODOLOGY

Objective: This study was carried out to determine the financial failure risks of companies traded in the Borsa Istanbul Sustainability Index over the years.

Sample Selection: The data used in this study were obtained from the audited financial statements of 34 companies operating in the Borsa Istanbul Sustainability Index between 2014 and 2019. Firms and holdings in the financial sector are excluded from the study because their financial statements are different. In addition, the data of Enerjisa Enerji A.Ş, Anadolu Cam Sanayii A.Ş, İskenderun Demir Çelik A.Ş, Şok Marketler Ticaret A.Ş and Trakya Cam Sanayii A.Ş. for the period covered in the study were not evaluated because they were not complete.

Table 1: Companies in the Sustainability Index included in the study

AKENR	AKENERJİ ELEKTRİK ÜRETİM A.Ş.
AKSA	AKSA AKRİLİK KİMYA SANAYİİ A.Ş.
AKSEN	AKSA ENERJİ ÜRETİM A.Ş.
AEFES	ANADOLU EFES BİRACILIK VE MALT SANAYİİ A.Ş.
ANELE	ANEL ELEKTRİK PROJE TAAHHÜT VE TİCARET A.Ş.
ARCLK	ARÇELİK A.Ş.
ASELS	ASELSAN ELEKTRONİK SANAYİ VE TİCARET A.Ş.
AYGAZ	AYGAZ A.Ş.
BRISA	BRİSA BRIDGESTONE SABANCI LASTİK SANAYİ VE TİCARET A.Ş.
CCOLA	COCA-COLA İÇECEK A.Ş.
CIMSA	ÇİMSA ÇİMENTO SANAYİ VE TİCARET A.Ş.
DOAS	DOĞUŞ OTOMOTİV SERVİS VE TİCARET A.Ş.
ENKAI	ENKA İNŞAAT VE SANAYİ A.Ş.
EREGL	EREĞLİ DEMİR VE ÇELİK FABRİKALARI T.A.Ş.
FROTO	FORD OTOMOTİV SANAYİ A.Ş.
KERVT	KEREVİTAŞ GIDA SANAYİ VE TİCARET A.Ş.
KORDS	KORDSA TEKNİK TEKSTİL A.Ş.

LOGO	LOGO YAZILIM SANAYİ VE TİCARET A.Ş.
MGROS	MİGROS TİCARET A.Ş.
NETAS	NETAŞ TELEKOMÜNİKASYON A.Ş.
OTKAR	OTOKAR OTOMOTİV VE SAVUNMA SANAYİ A.Ş.
SODA	SODA SANAYİİ A.Ş.
TATGD	TAT GIDA SANAYİ A.Ş.
TOASO	TOFAŞ TÜRK OTOMOBİL FABRİKASI A.Ş.
TCELL	TURKCELL İLETİŞİM HİZMETLERİ A.Ş.
TUPRS	TÜPRAŞ-TÜRKİYE PETROL RAFİNERİLERİ A.Ş.
THYAO	TÜRK HAVA YOLLARI A.O.
TTKOM	TÜRK TELEKOMÜNİKASYON A.Ş.
TTRAK	TÜRK TRAKTÖR VE ZİRAAT MAKİNELERİ A.Ş.
SISE	TÜRKİYE ŞİŞE VE CAM FABRİKALARI A.Ş.
ULKER	ÜLKER BİSKÜVİ SANAYİ A.Ş.
VESBE	VESTEL BEYAZ EŞYA SANAYİ VE TİCARET A.Ş.
VESTL	VESTEL ELEKTRONİK SANAYİ VE TİCARET A.Ş.
ZOREN	ZORLU ENERJİ ELEKTRİK ÜRETİM A.Ş.

Method: Within the scope of the study, the financial statements of the companies were obtained from Kamuyu Aydınlatma Platformu (KAP), and the necessary financial data were obtained. The Z-Score model developed by Altman and applied for publicly traded companies was used to determine the financial failure risks of companies. Companies that Z-Score's below 1.81 are considered financially risky, Z-Score's upper than 2.99 are financially risk-free, and Z-Score's between these two values are financially uncertain and uncritical.

Findings: The annual "X1" values obtained by applying the Altman Z-Score model to the companies included in the Sustainability Index within the scope of the study are given in Table 2.

The value "X1" is obtained by dividing Working Capital by Total Assets. This ratio is an indicator of the share of the working capital of the company in total assets.

Table 2: "X1" Values of Companies

	2014	2015	2016	2017	2018	2019
AKENR	-0,10	0,17	-0,45	-0,08	-0,20	-0,03
AKSA	0,38	0,14	0,11	0,10	0,09	0,03
AKSEN	-0,11	-0,13	-0,15	-0,13	-0,06	-0,03
AEFES	0,10	0,11	0,13	0,11	0,06	0,07
ANELE	0,21	0,20	0,23	0,32	0,32	0,20
ARCLK	0,33	0,30	0,26	0,25	0,24	0,24
ASELS	0,22	0,24	0,33	0,29	0,36	0,24
AYGAZ	0,00	0,05	0,08	0,06	0,03	0,02
BRISA	0,27	0,16	0,06	0,09	0,11	-0,02
CCOLA	0,11	0,13	0,16	0,12	0,13	0,12
CIMSA	0,11	0,12	-0,13	-0,07	-0,14	-0,08
DOAS	-0,03	0,05	-0,11	-0,12	-0,11	-0,12
ENKAI	0,24	0,24	0,21	0,14	0,21	0,23
EREGL	0,27	0,29	0,29	0,33	0,35	0,31
FROTO	0,00	0,02	0,04	0,06	0,01	0,09
KERVT	-0,31	-0,39	-0,09	0,05	0,35	0,34
KORDS	0,10	0,15	0,12	0,09	0,10	0,06
LOGO	0,28	0,20	-0,03	0,12	0,17	0,17
MGROS	-0,19	-0,12	-0,14	-0,17	-0,20	-0,16
NETAS	0,21	0,17	0,24	0,28	0,29	0,15
OTKAR	0,03	0,15	0,21	0,28	0,41	0,34

SODA	0,38	0,38	0,37	0,32	0,24	0,56
TATGD	0,37	0,44	0,50	0,37	0,46	0,49
TOASO	0,06	0,07	0,05	0,06	0,08	0,07
TCELL	0,35	0,10	0,19	0,14	0,15	0,15
TUPRS	-0,07	-0,01	0,03	0,07	0,13	0,00
THYAO	-0,06	-0,04	-0,05	-0,04	-0,03	0,05
TTKOM	0,11	0,00	0,03	0,07	-0,07	-0,04
TTRAK	0,30	0,26	0,35	0,32	0,35	0,29
SISE	0,30	0,27	0,21	0,22	0,16	0,23
ULKER	0,43	0,45	0,07	0,34	0,43	0,15
VESBE	0,32	0,32	0,36	0,19	0,07	0,04
VESTL	0,04	0,04	0,07	-0,09	-0,20	-0,26
ZOREN	-0,27	-0,21	-0,15	-0,15	-0,16	-0,22
Total	4,39	4,30	3,41	3,98	4,08	3,68

As seen in Table 2, when the Working Capital / Total Assets ratio of the companies included in the Sustainability Index between 2014-2019 is analyzed on an annual basis, it is seen that the year with the highest is 2014, then 2015, then 2018, and the lowest year is 2016. In 2014, the company with the highest ratio was ULKER, with 43%. In 2015, ULKER again reached the highest ratio of 45%. 2016 stands out as the year with the lowest ratio. TATGD reached the highest ratio with 50% in 2016 and 37% in 2017. TATGD reached the highest ratio with 46% in 2018 and SODA with 56% in 2019. In addition, in 2014, it is seen that the ratio of eight companies is negative and twenty-six companies are positive. When the ratios are examined respectively, the following results are seen: in 2015, 6 companies are negative and 28 companies are positive, in 2016, 9 companies are negative, 25 companies are positive, in 2017, 8 companies are negative, 26 companies are positive, in 2018, 9 companies are negative, 25 companies are positive and finally in 2019 9 companies are negative, 25 companies are positive.

Table 3 includes the "X2" values of the companies. The value "X2" is obtained by dividing Retained Earnings by Total Assets. This ratio shows the long-term profitability of companies.

Table 3: "X2" Values of Companies

	2014	2015	2016	2017	2018	2019
AKENR	0,00	0,00	0,00	0,00	0,00	0,00
AKSA	0,22	0,21	0,15	0,14	0,11	0,11
AKSEN	0,03	0,00	0,00	0,00	0,00	0,02
AEFES	0,20	0,16	0,14	0,13	0,10	0,11
ANELE	0,10	0,12	0,16	0,23	0,23	0,12
ARCLK	0,15	0,19	0,20	0,18	0,16	0,16
ASELS	0,26	0,00	0,20	0,24	0,24	0,25
AYGAZ	0,41	0,44	0,39	0,34	0,30	0,33
BRISA	0,01	0,01	0,03	0,05	0,06	0,07
CCOLA	0,23	0,19	0,16	0,13	0,12	0,15
CIMSA	0,41	0,32	0,27	0,26	0,28	0,26
DOAS	0,08	0,00	0,04	0,04	0,06	0,00
ENKAI	0,52	0,59	0,52	0,72	0,61	0,67
EREGL	0,16	0,13	0,09	0,08	0,05	0,10
FROTO	0,21	0,00	0,22	0,19	0,21	0,21
KERVT	0,00	0,24	0,05	0,13	0,13	0,00
KORDS	0,02	0,20	0,20	0,21	0,16	0,14
LOGO	0,24	0,37	0,34	0,42	0,41	0,41
MGROS	0,00	0,00	0,00	0,06	0,00	0,00
NETAS	0,16	0,11	0,12	0,11	0,13	0,05
OTKAR	0,04	0,00	0,03	0,04	0,07	0,00
SODA	0,31	0,00	0,28	0,33	1,25	0,06

TATGD	0,15	0,22	0,25	0,25	0,27	0,33
TOASO	0,12	0,13	0,16	0,16	0,21	0,23
TCELL	0,39	0,43	0,30	0,27	0,23	0,27
TUPRS	0,20	0,21	0,18	0,15	0,14	0,11
THYAO	0,15	0,16	0,12	0,12	0,11	0,11
TTKOM	0,02	0,02	0,00	0,04	0,00	0,04
TTRAK	0,08	0,04	0,10	0,10	0,17	0,18
SISE	0,22	0,00	0,19	0,20	0,21	0,23
ULKER	0,05	0,10	0,09	0,00	0,14	0,26
VESBE	0,12	0,11	0,13	0,12	0,08	0,16
VESTL	0,00	0,00	0,00	0,01	0,03	0,06
ZOREN	0,00	0,00	0,00	0,00	0,00	0,00
Total	5,25	4,70	5,09	5,46	6,27	5,19

As can be seen in Table 3, the year with the highest Retained Earnings / Total Assets ratio was determined as 2018 and the lowest year as 2015. Considering the years, the highest ratio belongs to SODA company in 2018 and then to ENKAI company in 2017.

Table 4 includes the "X3" values of the companies. This value is obtained by dividing Earnings Before Interest and Tax by Total Assets. This ratio shows us how much profit the companies have without using foreign resources, that is, without financing expenses, and the percentage they receive in total assets.

Table 4: "X3" Values of Companies

	2014	**2015**	**2016**	**2017**	**2018**	**2019**
AKENR	-0,02	0,07	0,01	-0,01	-0,01	0,01
AKSA	0,11	0,13	0,11	0,13	0,13	0,12
AKSEN	0,06	0,08	0,04	0,16	0,10	0,12
AEFES	0,02	0,04	0,03	0,04	0,04	0,06
ANELE	0,05	0,06	0,05	0,08	0,03	0,03

ARCLK	0,08	0,10	0,12	0,09	0,09	0,08
ASELS	0,07	0,03	0,10	0,11	0,11	0,12
AYGAZ	0,07	0,12	0,12	0,13	0,08	0,00
BRISA	0,17	0,14	0,08	0,07	0,09	0,07
CCOLA	0,09	0,07	0,05	0,06	0,09	0,10
CIMSA	0,17	0,16	0,13	0,12	0,11	0,06
DOAS	0,15	0,13	0,11	0,11	0,13	0,00
ENKAI	0,11	0,09	0,09	0,10	0,05	0,09
EREGL	0,13	0,09	0,09	0,17	0,18	0,10
FROTO	0,07	0,12	0,12	0,14	0,17	0,15
KERVT	0,02	0,02	0,04	0,08	0,11	0,16
KORDS	0,06	0,08	0,10	0,10	0,11	0,09
LOGO	0,18	0,20	0,16	0,15	0,12	0,13
MGROS	0,04	0,01	0,05	0,14	0,03	0,00
NETAS	0,01	0,02	0,02	0,04	-0,05	-0,03
OTKAR	0,10	0,09	0,09	0,11	0,10	0,00
SODA	0,20	0,15	0,16	0,17	0,19	0,35
TATGD	0,09	0,11	0,10	0,09	0,07	0,11
TOASO	0,07	0,07	0,07	0,08	0,09	0,13
TCELL	0,14	0,14	0,11	0,11	0,14	0,14
TUPRS	0,02	0,11	0,08	0,13	0,15	0,04
THYAO	0,06	0,06	-0,57	0,07	0,07	0,04
TTKOM	0,16	0,12	0,08	0,11	0,12	0,16
TTRAK	0,16	0,19	0,22	0,17	0,14	0,10

SISE	0,05	0,07	0,07	0,10	0,14	0,09
ULKER	0,12	0,17	0,14	0,14	0,23	0,17
VESBE	0,10	0,15	0,17	0,16	0,13	0,00
VESTL	0,02	0,03	0,04	0,03	0,02	0,05
ZOREN	0,01	0,02	0,04	0,04	0,08	0,08
Total	2,94	3,24	2,38	3,55	3,41	2,90

As can be seen in Table 4, the highest Earnings Before Interest and Tax/ Total Assets ratio is 2017 and the lowest is 2016. In terms of years, SODA has the highest ratio with 35% in 2019.

Table 5 includes the "X4" values of the companies. The value "X4" is obtained by dividing Market Value of Equity by Total Liabilities. This ratio gives the information about how many times the companies can pay their own funds and their total debts.

Table 5: "X4" Values of Companies

	2014	**2015**	**2016**	**2017**	**2018**	**2019**
AKENR	0,19	0,44	0,28	0,45	0,09	0,16
AKSA	1,26	1,24	0,90	0,70	0,53	0,00
AKSEN	0,42	0,24	0,10	0,47	0,39	0,82
AEFES	1,43	1,33	1,37	1,14	1,21	1,11
ANELE	0,50	0,56	0,47	0,72	0,75	0,57
ARCLK	0,55	0,52	0,55	0,51	0,41	0,39
ASELS	1,00	0,83	0,75	0,86	1,09	1,12
AYGAZ	2,24	2,00	1,84	1,43	1,00	1,00
BRISA	0,62	0,44	0,25	0,25	0,25	0,20
CCOLA	0,88	0,86	0,92	0,68	0,85	0,86
CIMSA	3,31	1,87	1,15	0,78	0,71	0,65
DOAS	0,78	0,52	0,30	0,35	0,37	0,37
ENKAI	2,01	2,63	3,08	3,60	3,83	3,95

EREGL	1,83	2,06	1,96	2,10	2,34	2,03
FROTO	0,61	0,57	0,52	0,44	0,42	0,40
KERVT	0,06	0,04	0,19	0,29	0,35	0,55
KORDS	1,23	1,27	1,37	1,35	0,94	0,65
LOGO	1,11	1,20	1,00	1,20	1,30	1,04
MGROS	0,19	0,10	0,03	0,17	0,06	0,02
NETAS	0,56	0,48	0,67	0,71	0,78	0,36
OTKAR	0,25	0,18	0,16	0,16	0,20	0,31
SODA	2,83	3,48	3,64	4,64	3,25	3,22
TATGD	1,11	1,77	2,00	1,68	1,38	1,20
TOASO	0,46	0,35	0,33	0,35	0,40	0,51
TCELL	2,39	1,22	1,03	0,79	0,60	0,65
TUPRS	0,40	0,49	0,35	0,38	0,33	0,31
THYAO	0,40	0,42	0,38	0,42	0,40	0,38
TTKOM	0,46	0,24	0,14	0,19	0,26	0,31
TTRAK	0,58	0,48	0,44	0,37	0,27	0,36
SISE	1,42	1,54	1,45	1,58	1,51	0,98
ULKER	0,63	0,72	0,36	0,48	0,53	0,63
VESBE	0,75	0,71	0,67	0,50	0,63	0,57
VESTL	0,23	0,20	0,24	0,20	0,23	0,24
ZOREN	0,12	0,15	0,07	0,18	0,16	0,10
Total	32,69	31,16	28,99	30,13	27,82	26,01

As seen in Table 5, the highest Market Value of Equity / Total Debts ratio was determined as 2014 and the lowest year as 2019. Looking at the years, the SODA company had the highest ratio in 2017. The lowest ratio belongs to MGROS company in 2016.

Table 6 includes the "X5" values of the companies. The value "X5" is obtained by dividing Sales by Total Assets. This ratio shows how much sales the company has made against the assets it owns.

Table 6: "X5" Values of Companies

	2014	2015	2016	2017	2018	2019
AKENR	0,35	0,56	0,28	0,32	0,39	0,27
AKSA	1,05	0,90	0,74	0,83	0,84	0,87
AKSEN	0,57	0,57	0,77	0,69	0,73	0,66
AEFES	0,50	0,46	0,41	0,44	0,48	0,51
ANELE	0,72	0,57	0,66	1,09	1,22	0,73
ARCLK	1,01	1,03	0,95	1,02	0,95	0,92
ASELS	0,50	0,45	0,44	0,49	0,46	0,51
AYGAZ	2,07	1,64	1,60	1,71	1,91	2,06
BRISA	1,07	0,85	0,62	0,66	0,66	0,67
CCOLA	0,83	0,75	0,67	0,63	0,76	0,77
CIMSA	0,73	0,59	0,46	0,46	0,49	0,46
DOAS	2,72	2,74	2,46	2,56	2,23	2,11
ENKAI	0,70	0,60	0,40	0,35	0,34	0,22
EREGL	0,72	0,64	0,49	0,66	0,45	0,59
FROTO	1,65	1,99	1,97	2,11	2,53	2,39
KERVT	0,71	0,58	0,76	0,71	0,80	0,92
KORDS	0,80	0,80	0,75	0,87	0,82	0,72
LOGO	0,63	0,64	0,58	0,67	0,57	0,54
MGROS	1,46	1,63	1,76	1,49	1,72	1,60
NETAS	0,82	0,75	0,71	0,72	0,56	0,66
OTKAR	1,00	0,89	0,92	0,89	0,73	0,91

SODA	0,76	0,63	0,62	0,63	0,54	1,11
TATGD	1,23	1,39	1,42	1,37	1,34	1,11
TOASO	1,04	1,01	1,20	1,26	1,43	1,48
TCELL	0,51	0,49	0,45	0,50	0,48	0,52
TUPRS	1,81	1,45	1,12	1,41	2,21	1,61
THYAO	0,76	0,60	0,45	0,58	0,58	0,51
TTKOM	0,68	0,56	0,60	0,62	0,56	0,59
TTRAK	1,42	1,54	1,50	1,51	1,26	1,31
SISE	0,56	0,47	0,45	0,53	0,56	0,47
ULKER	0,91	0,78	0,70	0,58	0,56	0,61
VESBE	1,51	1,47	1,33	1,27	1,22	1,40
VESTL	1,06	0,99	0,99	0,87	0,88	0,88
ZOREN	0,16	0,10	0,18	0,34	0,39	0,45
Total	33,01	31,10	29,38	30,83	31,61	31,12

As seen in Table 6, the highest Sales / Total Assets ratio was determined as 2014 and the lowest the year 2016. Considering the years, the highest ratio belongs to the DOAS company in 2015. The lowest ratio was determined to belong to ZOREN company in 2015.

Table 7 shows the average Z-Scores of the companies included in the Sustainability Index, both by years and by the four-year average.

Table 7: Altman Z-Score Analysis of Companies Included in the Sustainability Index

	2014	**2015**	**2016**	**2017**	**2018**	**2019**	**Average**
AKENR	0,29	1,25	-0,06	0,47	0,17	0,37	**0,42**
AKSA	2,93	2,54	1,99	1,98	1,85	1,44	**2,12**
AKSEN	0,93	0,82	0,78	1,36	1,22	1,51	**1,10**
AEFES	1,81	1,75	1,69	1,57	1,56	1,61	**1,67**

ANELE	1,59	1,50	1,59	2,47	2,46	1,59	**1,87**
ARCLK	2,21	2,28	2,26	2,17	2,01	1,92	**2,14**
ASELS	1,95	1,34	1,87	2,05	2,26	2,24	**1,95**
AYGAZ	4,22	3,92	3,73	3,56	3,20	3,48	**3,68**
BRISA	2,33	1,76	1,15	1,25	1,33	1,10	**1,49**
CCOLA	2,10	1,93	1,81	1,57	1,89	1,95	**1,87**
CIMSA	3,99	2,86	1,80	1,60	1,51	1,33	**2,18**
DOAS	3,76	3,55	2,93	3,05	2,84	2,76	**3,15**
ENKAI	3,28	3,59	3,52	4,04	3,92	4,11	**3,74**
EREGL	2,80	2,68	2,43	2,99	2,95	2,63	**2,75**
FROTO	2,56	2,76	3,03	3,18	3,65	3,52	**3,12**
KERVT	0,36	0,53	0,96	1,40	1,96	2,17	**1,23**
KORDS	1,88	2,30	2,33	2,42	2,09	1,67	**2,11**
LOGO	2,57	2,77	2,15	2,63	2,52	2,36	**2,50**
MGROS	1,48	1,58	1,77	1,92	1,61	1,61	**1,66**
NETAS	1,67	1,45	1,61	1,79	1,40	1,02	**1,49**
OTKAR	1,55	1,47	1,61	1,74	1,78	2,27	**1,74**
SODA	4,00	3,66	4,17	4,81	5,17	4,94	**4,46**
TATGD	2,84	3,65	3,91	3,48	3,34	3,24	**3,41**
TOASO	1,81	1,71	1,90	2,02	2,36	2,62	**2,07**
TCELL	3,38	2,40	2,06	1,90	1,81	1,92	**2,25**
TUPRS	2,31	2,40	1,89	2,38	3,26	2,10	**2,39**
THYAO	1,31	1,24	-1,11	1,17	1,15	1,09	**0,81**
TTKOM	1,64	1,13	0,99	1,25	1,04	1,30	**1,23**

TTRAK	2,77	2,82	3,04	2,82	2,55	2,44	**2,74**
SISE	2,27	1,94	2,06	2,35	2,40	1,95	**2,16**
ULKER	2,27	2,44	1,60	1,74	2,35	2,09	**2,08**
VESBE	2,82	2,94	2,90	2,50	2,20	2,40	**2,63**
VESTL	1,31	1,27	1,34	1,00	0,89	0,97	**1,13**
ZOREN	-0,05	0,02	0,15	0,41	0,54	0,51	**0,27**

Companies with a Z-Score below 1,81 and defined as risky in 2014; AKENR, AKSEN, ANELE, KERVT, MGROS, NETAS, OTKAR, THYAO, TTKOM, VESTL ve ZOREN. Companies defined as uncertain and uncritical with a Z-Score between 1,81 and 2,99; AKSA, AEFES, ARCLK, ASELS, BRISA, CCOLA, KORDS, LOGO, TOASO, TTRAK, SISE, ULKER ve VESBE. Companies with a Z-Score Value above 2,99 and defined as risk-free; AYGAZ, CIMSA, DOAS, ENKAI, SODA ve TCELL.

Companies with a Z-Score below 1,81 and defined as risky in 2015; AKENR, AKSEN, AEFES, ANELE, ASELS, BRISA, KERVT, MGROS, NETAS, OTKAR, TOASO, THYAO, TTKOM, VESTL ve ZOREN. Companies defined as uncertain and uncritical with a Z-Score between 1,81 and 2,99; AKSA, ARCLK, CIMSA, EREGL, FROTO, KORDS, LOGO, TCELL, TUPRS, TTRAK, SISE, ULKER ve VESBE. Companies with a Z-Score Value above 2,99 and defined as risk-free; AYGAZ, DOAS, ENKAI, SODA ve TATGD.

Companies with a Z-Score below 1,81 and defined as risky in 2016; AKENR, AKSEN, AEFES, ANELE, BRISA, CIMSA, KERVT, MGROS, NETAS, OTKAR, THYAO, TTKOM, ULKER, VESTL ve ZOREN. Companies defined as uncertain and uncritical with a Z-Score between 1,81 and 2,99; AKSA, ARCLK, ASELS, CCOLA, DOAS, EREGL, KORDS, LOGO, TOASO, TCELL, TUPRS, SISE ve VESBE. Companies with a Z-Score Value above 2,99 and defined as risk-free; AYGAZ, ENKAI, FROTO, SODA, TATGD ve TTRAK.

Companies with a Z-Score below 1,81 and defined as risky in 2017; AKENR, AKSEN, AEFES, BRISA, CCOLA, CIMSA, KERVT, NETAS, OTKAR, THYAO, TTKOM, ULKER, VESTL ve ZOREN. Companies defined as uncertain and uncritical with a Z-Score between 1,81 and 2,99; AKSA, ANELE, ARCLK, ASELS, KORDS, LOGO, MGROS, TOASO, TCELL, TUPRS, TTRAK, SISE ve VESBE. Companies with a Z-Score Value above 2,99 and defined as risk-free; AYGAZ, DOAS, ENKAI, EREGL, FROTO, SODA ve TATGD.

Companies with a Z-Score below 1,81 and defined as risky in 2018; AKENR, AKSEN, AEFES, BRISA, CIMSA, MGROS, NETAS, OTKAR, THYAO, TTKOM, VESTL ve ZOREN. Companies defined as uncertain and uncritical with a Z-Score between 1,81 and 2,99; AKSA, ANELE, ARCLK, ASELS, CCOLA, DOAS, EREGL, KERVT, KORDS, LOGO, TOASO,

TCELL, TTRAK, SİSE, ULKER ve VESBE. Companies with a Z-Score Value above 2,99 and defined as risk-free; AYGAZ, ENKAI, FROTO, SODA, TATGD ve TUPRS.

Companies with a Z-Score below 1,81 and defined as risky in 2019; AKENR, AKSA, AKSEN, AEFES, ANELE, BRİSA, CİMSA, KORDS, MGROS, NETAS, THYAO, TTKOM, VESTL ve ZOREN. Companies defined as uncertain and uncritical with a Z-Score between 1,81 and 2,99; ARCLK, ASELS, CCOLA, DOAS, EREGL, KERVT, LOGO, OTKAR, TOASO, TCELL, TUPRS, TTRAK, SİSE, ULKER ve VESBE. Companies with a Z-Score Value above 2,99 and defined as risk-free; AYGAZ, ENKAI, FROTO, SODA ve TATGD.

Considering the average of the six-year Z-Score values of the companies;

- Companies with a Z-Score below 1.81 and defined as risky;AKENR, AKSEN, AEFES, BRISA, KERVT, MGROS, NETAS, OTKAR, THYAO, TTKOM, VESTL ve ZOREN.
- Companies defined as uncertain and uncritical with a Z-Score between 1,81 and 2,99; AKSA, ANELE, ARCLK, ASELS, CCOLA, CIMSA, EREGL, KORDS, LOGO, TOASO, TCELL, TUPRS, TTRAK, SİSE, ULKER ve VESBE.
- Companies with a Z-Score Value above 2,99 and defined as risk-free; AYGAZ, DOAS, ENKAI, FROTO, SODA ve TATGD

Based on the averages of the Z-Score values of the companies; The company with the lowest Z-Score was determined as ZOREN and the company with the highest Z-Score was determined as SODA company.

RESULT

The Z-score model developed by Altman and the financial data of 34 companies between 2014 and 2019 were used in this study, which was carried out to measure the financial failure estimation on the companies that continue their activities in the Borsa Istanbul Sustainability Index. Considering the six-year average values, according to the result of the Altman Z - Score model; 12 companies are in the risky group, 16 companies are in the uncertain and uncritical group, and 6 companies are in the risk-free group. The Z-Score model, which was revealed by Altman, is known as the most preferred and used model for financial failure prediction of companies. However, the use of other failure prediction models is thought to be important for companies. In addition, the companies' regular and controlled financial restructuring processes, the time taking and implementation of the necessary financial measures, and the use of financial failure forecasting models in specific periods will make significant contributions to the companies.

The reason why companies with a Z-Score above 2.99 are in the risk-free zone is because their financial ratios, defined as X, are high. These companies, regarding the variables used in the Altman Z-Score model, it was observed that the X1 variable, which is expressed as the ratio of working capital to total assets, has a positive and very high value for all years.

When we look at risky companies, not only X1 but all ratios are low. Therefore, these companies are located in the risk zone. For example, when we look at the AKENR company, it is striking that its financial ratios are less than 1 in almost all years. This explains why the company is in the risk zone.

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