

FINANCIAL LENS TO REAL SECTOR VIA THE CBRT'S COMPANY ACCOUNTS

Bekir EREN¹, Harun Türker KARA²

Gönderim tarihi: 02.10.2022

Kabul tarihi: 23.01.2023

Abstract

The aim of this paper is to depict the financial performance of firms and sectors and show the effectiveness of the different financial support mechanism in Turkey via Central Bank's company accounts. By the help of this wide data set of more than 1.3 million firms and 17 sub-sectors, this paper employs Altman Z" score methodology to find out the credit ratings of the firms and sectors for the period 2009-2020. Then, the study tries to give a link between credit rating, support mechanism and sectoral output growth. The main findings are that the average credit rating of all firms is in decline, there are significant differences in sectoral credit ratings and the required amount of equity support to raise the Z" Scores of firms to threshold level is less than the amount of the loan support. In addition, there is bilateral link between sectoral growth and sectoral rating.

Keywords: Z score, financial performance, loan, equity, company accounts

JEL Classification: E44, E51, G32, G33, G38

TCMB SEKTÖR BİLANÇOLARINDAN REEL SEKTÖRE FİNANSAL MERCEK

Öz

Bu çalışmanın amacı, Merkez Bankasının sektör bilançolarını kullanarak Türkiye'deki firmaların ve sektörlerin finansal performansını ölçmek ve farklı finansal destek mekanizmalarının etkinliğini göstermektir. 1,3 milyondan fazla firma ve 17 alt sektörü kapsayan geniş veri seti yardımıyla, firma ve sektörlerin 2009-2020 dönemi için kredi notlarını bulmak için Altman Z" skoru metodolojisi kullanılmıştır. Daha sonra çalışmada kredi notu, destek mekanizması ve sektörel çıktı büyümesi arasında bir bağlantı kurulmaya çalışılmıştır. Temel bulgular, tüm firmaların ortalama kredi notunun düştüğünü, sektörler arasında kredi notlarında önemli farklılıklar olduğunu ve firmaların Z" skorunu eşik seviyesine yükseltmek için gerekli özkaynak desteği miktarının kredi destek tutarından daha az olduğunu göstermektedir. Ayrıca sektörel büyüme ile sektörel kredi notları arasında çift yönlü bir bağlantı bulunmaktadır.

Anahtar kelimeler: Z skoru, finansal performans, kredi, özkaynak, sektör bilançoları.

JEL Sınıflaması: E44, E51, G32, G33, G38

¹ Assist. Prof., Department of International Trade and Finance, Ankara Medipol University, Ankara, Türkiye, bekir.eren@ankaramedipol.edu.tr, <https://orcid.org/0000-0001-6993-7617>

² Turkish Energy, Nuclear and Mineral Research Agency, Ankara, Türkiye, dr.harunkara@gmail.com, <https://orcid.org/0000-0003-1613-3572>

1. Introduction

Assessing financial strength of companies and predicting financial failure are important for all economic actors, such as bankers, investors, financial analysts, rating agencies, and also for companies themselves. Some leading indicators are used to measure the financial position or risk level of companies, and Altman Z Score is one of them. These indicators can be especially decisive to access bank loans and to shape investors' decisions. They can be helpful to predict whether companies may have difficulties in repaying their debts or whether they may face problems in financing. In addition, financing need of companies can be evaluated, and their growth performance can be predicted by using some leading financial risk indicators.

Companies need finance to make new investments, meet their working capital and roll over their debts. Financing needs can be met through internal and external funding channels, in other words, by equity and debt. Having difficulty in accessing finance can increase the financial risk of companies, or high-risk level of companies can make it difficult to find finance. Also, the difficulties faced by companies in obtaining financing increase in times of stress and crisis. In this case, the support mechanisms of the governments come to the fore in order to prevent the problem in the real sector from growing and to prevent the deterioration in the supply chain.

In the period of the Covid-19 pandemic, government supports have been seen intensely to prevent the spread of problems in the real sector and financial sector and to ensure continuity in the supply chain. Gourinchas et al. (2021), through the large firm level data set, reveal that without government support, the financial failure rate of SMEs will increase by 9.1 percentage points and accordingly the Tier -1 capital ratio of banks will decrease by 2.1 percent. They also emphasize that policies such as interest rate amnesty, tax and rent deferrals have only a minor effect on firm failures, while cash grants can reduce business failures at high cost. In addition, according to Gourinchas et al. (2021) and Cirera et al. (2021) firm size can be an important factor for the success of the supports.

Governments have two simple mechanisms to support a company. One is to provide loans and the other is equity support. While the important thing for the borrower is the quantity of support, the role of the government, which allocates its budget to various activities, is to ensure that the desired target is achieved with the minimum amount of support. Therefore, governments should understand the financial position of companies or sectors correctly to develop an efficient support mechanism.

This study employs Altman Z Score as an indicator of financial performance for different sectors rather than measuring financial failure. Firstly, the financial situation of different sectors is analyzed by using the Altman credit rating approach, and their financial needs is figured out. Later, different support mechanisms are designed obtained through external finance channel. Previous empirical studies that assessed the financial position of companies have some shortcomings. They have mainly used credit rating approach only to show existing financial positions with different methodologies and they do not offer any solution to improve financial position of companies. The main contribution of this study is that it is the first paper that covers a large number of firms and makes a comprehensive sectoral comparison for Turkey. In addition, this paper tries to give a link between credit rating, support mechanism and sectoral growth. Also, this study is striking with its dynamic modular structure. On the other hand, there are some limitations such as externalities. To illustrate, support mechanism may create negative or positive externalities for different companies or sectors that are not considered in this study.

The rest of the paper is structured as follows. Section 2 reviews the literature, and Section 3 provides details of the credit rating methodology and fundamental analysis. Section 4 reports the empirical results, and Section 5 offers the conclusion and policy suggestions.

2. Literature Review

Predicting financial failure, which is a concept related with financial risk, and taking necessary precautions are vital for the continuity of companies. For this purpose, examining the tendency of some ratios of the companies may be helpful, but it is not sufficient. One of the methods developed for this shortcoming is the Altman Z-Score model. The Altman Z-Score model is expressed as a multivariate discriminant analysis that shows the financial failures of companies and their probability of going bankrupt (Aksoy and Göker, 2018). Z-Score is basically based on credit rating methodology. Altman's approach has become widespread spread worldwide among the researchers who evaluate the financial health of firms. Since the initial model, many different models from a multivariate to machine learning mechanism have been developed, but the aim is still to understand firms' financial position (Novotná, 2012; Altman, 2018).

Credit ratings are important for the decisions of economic actors and are valuable as they allow companies to evaluate their own performance and bankruptcy probabilities. Each credit rating agency has a ranking system which shows good to bad firms. In fact, the rating is intended to summarize the creditworthiness of the financial instrument. Therefore, the top

ratings imply virtually no default risk for the foreseeable future, whereas bottom line ratings imply significantly high default risks (Jewell and Miles, 1999). Companies, banks, and governments need a credit rating issued by a recognized rating agency specially to benefit from funds in international markets. Some institutional investors cannot invest in low- or relatively low-rated securities (Aksoy et al, 2021). Thus, credit ratings are one of the key elements for easy external financing.

Firms are in close relationship with banks due to their financing needs. The banking sector which is the main provider of financing pay attention to the non-performing loans to maximize its profit (Altman et al, 2017). The non-performing loans are sign of financial problems in both real sector (non-financial) and the financial sector. Indeed, the deterioration in the quality of the loan portfolio of banks has been the main cause of problems in the financial system and triggers financial crises in economies. In addition, increase in non-performing loan portfolio indicates the link between the friction in the financial market and the risk of financial instability (Messai and Jouini, 2013). If a firm does not pay its loan debt to a bank due to problem in its balance sheet, it will create a problem in the bank's balance sheet. Therefore, non-performing loans are an outstanding indicator to evaluate the fragility in financial system and the Bank for International Settlements (BIS) and the national regulators developed new rules to assess the credit risk for the banks. Hence, the rating of the banks and firms are important to sustain loans, literally financing process.

Altman's Z Score can predict in advance whether businesses may have problems in repaying their debts or whether they may face difficulties in financing. The Z Score model, which gives successful results in practice, is easy to implement and understand, and can be applied quickly and reliably based on the financial information obtained from the accounts of firms and independent audit reports. Although the Altman Z score model was developed to predict possible bankruptcy situations of businesses, it is also accepted as an approach that can help firms evaluate their financial performance and that can be guiding an indicator for creditors and lenders (Hauschild, 2013). The model has been accepted by many researchers because the basic ratios that consists of model focus on financial management such as liquidity, profitability, asset efficiency and leverage ratio (Kulali, 2016). Although the model was introduced in 1968, studies conducted to test the validity of the model today confirm that it still has a high performance to find out probability of financial failure (Sherbo and Smith, 2013; Salimi, 2015).

Altman states that the negative criticisms of the financial ratios stem from the contradictory results that arise from the single evaluation of these ratios, rather than the inadequacy of the ratios. He suggested that the ratios should be combined, considering the interactions

between them, rather than dealing with them one by one (Altman, 1968). Therefore, Z-Score combined selected ratios using different weights for each ratio. This paper employs the Z''-Score model built by Altman (1983) for private and public firms. Altman Z''-Score formula to calculate credit rating is given below:

$$\text{Altman Z''-Score} = 3.25 + 6.56 X_1 + 3.26 X_2 + 6.72 X_3 + 1.05 X_4 \text{ (Formula I)}$$

where:

X_1 is Net Working Capital / Total Assets

X_2 is Retained Earnings / Total Assets

X_3 is Earnings Before Interest and Tax / Total Assets

X_4 is Book Value of Equity / Total Liabilities

The initial Z-Score or the original Z-Score introduced by Altman (1968) considered the market value of companies. Therefore, it was only valid for the publicly traded firms. In his first study, Altman (1968) covered a total of 66 companies operating in the manufacturing industry, 33 of which were financially successful and 33 of which were in the process of filing for bankruptcy, as a sample. He classified the 22 ratios in the literature into five main groups as liquidity, profitability, leverage, solvency and operating efficiency. Then Altman formed the Z-Score model using the most appropriate 5 basic ratios. He weighted the variables related to the discriminant coefficient and accepted the sum of the computed values as the Z-Score value of the firm. Altman assessed the company's financial success, considering the reference range he determined. Altman (1983) revised the original model to apply all firms, by replacing the market value of equity for the book value that is used in X_4 component. This version called as Z'-Score model, keeping other variables same with the original Z-Score model, X_4 component substituted as Book value of equity/Book value of total liabilities. Also, in Z'-Score model, the coefficients have changed and the effects of X_1 and X_4 components on the Z-Score value have decreased. The original Z-Score model and Z'-Score model had five variables where X_5 represented the Sales/ Total Assets ratio. In addition, Altman (1983) re-estimated four-variable model by dropping Sales/ Total Assets ratio and labelled as Z''-Score model. The reason was that X_5 component was industry-sensitive variable. Then the Z''-Score model was widely accepted in the literature, applied to both manufacturing firms and non-manufacturing firms. This study also uses Z''-Score version of Altman.

There are many studies in the literature that include the Z-Score model. In addition to the studies carried out to calculate and interpret the Z-Score only, there are also studies that deal

with the Z-Score together with other variables. Studies that use the Z-Score as a variable define it as an indicator of financial risk and evaluate it together with other variables (Aksoy and Göker, 2018; Aneja and Makkar, 2013). In the literature, Altman's Z-Score has been verified or modified, and sometimes, it has been applied for the robustness check.

Altman approach is mainly used for evaluating the financial state at firm level. Begley et al. (1996), in their study for US companies using the Altman Z-Score model, conclude that the model outperformed in the 1980s than in the 1990-1995 period. Grice and Ingram (2001) show that the Altman model performs better in measuring the financial positions of manufacturing companies. Gerantonis et al. (2009) find out that Altman score can be used as an early warning indicator for Greek companies, and the financial problems of companies can be detected at least one year in advance. Cihak and Hesse (2010) show that the Z-Score of banks is inversely related to the probability of banks' insolvency. Yi (2012) analyzes that accuracy rate of the Z-Score model is 90% for real estate companies in China.

Most recently, Altman et al. (2017) assess the performance of the Z''-Score to predict the bankruptcy and other firm distresses using large international sample of companies, and empirically demonstrate the widespread usability of the approach. The study that evaluates the performance of the Z''-Score model for companies from 31 European and three non-European countries is the first to exhibit a comprehensive international analysis. Same model is used for manufacturing and non-manufacturing companies and private and public enterprises. It provides evidence that Z''-Score model works quite well for most countries, and it is claimed that prediction accuracy is about 0.75.

Furthermore, Pindado et al. (2008) point out that Altman's Z-Score has been also used for different aims such as the assessing the costs and benefits of bonds, preferring the debt type of firms and measuring the link between own funds of firms and investment.

Regarding with Turkey, the Altman approach has been used to predict the failure of the limited number of firms from the different sectors. Özdemir (2014) assesses 80 publicly traded and 62 non-public businesses with the Altman Z-Score for the period 2009-2011. It is stated that the general success of the Z-Score in estimating the real financial situation of the enterprises in publicly traded enterprises is high. Yıldız (2014) finds that there is a statistically significant relationship between the investment status of the enterprises and the Altman Z- Scores. Kulalı (2016) reveals that the Z-Score model predicted bankruptcy companies by 95% one year ago and 90% two years ago. It is stated that the Altman Z-Score model has a high predictive power of financial failure, especially in the short-run. Aksu (2019) assesses the financial position of 8 enterprises operating in energy sector for the period 2009-2012

with Altman Z''-Score. It has been concluded that the effect of financial leverage ratio on financial distress for energy companies is negative, while the effect of liquidity and return on assets is positive.

To sum up, current studies have been done with a small number of companies in the limited sectors and the Z''-Score usually performs well in catching financial failure. Considering the studies in literature, it can be claimed that Altman's Z-Score, as an accounting-based model, performs well specially to predict short-run distress for both manufacturing and manufacturing companies (Grice and Ingram, 2001; Reisz and Perlich, 2007; Gerantonis et al., 2009; Kulalı, 2016). In literature Altman's Z-Score has been used as a proxy to detect financial failure or as a measure of financial strength. In this study, the Z score is used as a measure of financial performance rather than measuring financial failure. There are a few international studies that make a sectoral comparison using limited sectors with the Altman Z''-Score, and there is no specific study for Turkey. Therefore, this study is first that covers a large number of firms and makes a comprehensive sectoral comparison. Moreover, while the performance of the Z''-Score has been measured in the current studies, scenario studies have not been conducted to raise the score above the threshold level. In addition, although there are studies associating Z''-Score with different variables, there is no study associating Z''-Score with sectoral output growth.

3. Data and Analysis

This section consists of three subparts. In the first part, data set is explained then "Analytical Balance Sheet" is built and the Altman Z'' Score is calculated. At the last subpart the differences between sectors are described.

3.1. Data

CBRT's Company Accounts compiled by the Central Bank of Republic of Turkey (CBRT) have been employed in this paper. The objective of this data is monitoring developments in the real sector firms and providing the public with comprehensive and systematic information (CBRT's Company Accounts, 2022). The paper uses the annually financial data of all companies and covers more than 1.3 million firms listed in the Company Accounts. The period covers 2009 to 2020, literally from Global Financial Crisis to the Global Pandemic.

3.2. The Analytical Balance Sheet of All Companies and Altman Z'' Score

In order to understand Companies' Balance Sheet easily, Analytical Balance Sheet is employed. The Analytical Balance Sheet is obtained from regular CBRT Company Accounts via the help of calculating the below items:

- *Net Working Capital* = Current Assets - Short Term Liabilities
- *Other Assets* = Total Assets - Current Assets
- *Total Liabilities* = Total Long- Term Liabilities
- *Shareholders' Equity* = *Shareholders' Equity*

At the end of the year 2020, the total asset of all Turkish Companies is 10.60 trillion Turkish Liras. 14% of total asset is net working capital; 27% of the total assets stems from shareholders' equity and others come from total liabilities (Table 1).

Table 1: Analytical Balance Sheet (All Companies-2020) (Trillion TL)

Assets		Liabilities	
Net Working Capital	1.45	Total Liabilities	7.74
Other Assets	9.14	Shareholders' Equity	2.86
		Retained Earnings	0.70
Total	10.60	Total	10.60

Note: Earnings Before Interest and Tax is 0.7 obtained from Income Statement

The link between the components of "Altman Z'' Score Formula" and "Company Accounts of CBRT" is given below. The calculation of each of the Altman Z Score pillars is given below:

- *Net Working Capital* = Current Assets - Short Term Liabilities (from Balance Sheets)
- *Retained Earnings* = Reserves from Retained Earnings + Profit Brought Forward + Loss Brought Forward (-) + Net Profit or Loss for the Financial Year (from Balance Sheets)
- *Earnings Before Interest and Tax* = Profit or Loss Before Taxes + Financing Expenses (-) (from Income Statements)

- *Total Liabilities* = Short-Term Liabilities + Long-Term Liabilities (from Balance Sheets)
- *Total Assets* can be seen explicitly in the Company Accounts (from Balance Sheets)

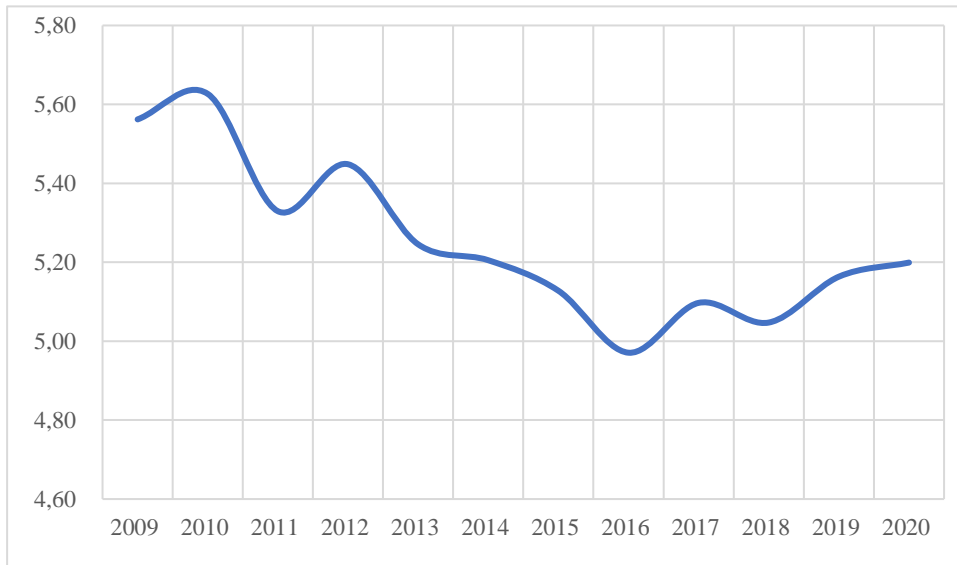
2020's Altman Z'' Score can be calculated with the following formula which is explicit version of Formula I:

$$Z'' \text{ Score} = 3.25 + 6.56 \frac{\text{Net Working Capital}}{\text{Total Assets}} + 3.26 \frac{\text{Retained Earnings}}{\text{Total Assets}} + 6.72 \frac{\text{Earnings Before Interest and Tax}}{\text{Total Assets}} + 1.05 \frac{\text{Book Value of Equity}}{\text{Total Liabilities}}$$

$$Z'' \text{ Score} = 3.25 + 6.56 \frac{1.45}{10.60} + 3.26 \frac{0.70}{10.60} + 6.72 \frac{0.70}{10.60} + 1.05 \frac{2.86}{7.74}$$

So, Z'' Score = 5.20

Figure 1: Z'' Score of All Companies



Source: CBRT and Authors' Calculations

The average Altman Z'' Score of all companies from different sectors for the period 2009-2020 is illustrated the figure above (Figure 1). The Altman Z'' Score in 2009 is 5.56 and this is the maximum value for the examined period. On the other hand, in 2016 the Altman Z''

Score is 4.97, and this is the minimum value for the examined period. The mean and the standard deviation of the period is 5.25 and 0.20 respectively. The lower score implies lower credit rating and vice versa.

According to Altman (2018), the threshold Z" Score for emerging market companies is 5.52 and companies must have a Z" Score equal to or greater than this level in order to have an "investment grade" score. The figure indicates that there is a decreasing trend in the Z" Score calculated for all companies from 2009 to 2016. Since 2011, the average of all sectors has been below the threshold level. The biggest contribution to the decrease is due to the decline in "book value of equity / total liabilities" and "net working capital/total assets". Since liquidity was ample in the world and in Turkey during this period, it can be claimed that in general companies enlarged their balance sheets by borrowing and did not hold much liquidity on their hands. After the year 2016, a moderate recovery is observed in the average Z" Score of all companies. "Earnings before interest and tax / total assets" and "net working capital/total assets" make the biggest contribution to this increase. In this period, with the tightening of liquidity conditions in the world and domestically, it is seen that companies generally prefer to stay more liquid.

3.3. Comparison of Sectors

In this part, Z" Score is computed for each sector in Turkey. Nace-2 classification is employed for sectoral distinction. The average Altman Z" Score for the period of 2009-2020 is listed in Table 2 for 17 sectors in Turkey.

	Z Score
Table 2: Sectoral Z' Scores Average of 2009-2020	
All Companies	5.25
A-Agriculture, forestry, and fishing	4.91
B-Mining and quarrying	5.97
C-Manufacturing	6.05
D-Electricity, gas, steam, and air conditioning supply	3.25
E-Water supply; sewerage; waste management and remediation activities	5.70
F-Construction	4.83
G-Trade	5.52
H-Transporting and storage	4.39
I-Accommodation and food service activities	3.61
J-Information and communication	5.65
L-Real estate activities	4.25
M-Professional, scientific, and technical activities	5.72
N-Administrative and support service activities	4.13
P-Education	3.23
Q-Human health and social work activities	4.81
R-Arts, entertainment, and recreation	2.76
S-Other services activities	3.79

In the Table 2, darker red colors show the lower credit ratings while the darker yellow colors show the higher credit ratings. According to Table, “R-Arts, entertainment and recreation” sector has the lowest value whereas “C-Manufacturing” sector highest. In addition to this, “R-Arts, entertainment and recreation”, “P-Education”, “I-Accommodation and food service activities”, “S-Other services activities”, “D-Electricity, gas, steam and air conditioning supply”, “L-Real estate activities”, “H-Transporting and storage”, “Q-Human health and social work activities”, “F-Construction”, “A-Agriculture, forestry and fishing” sectors average Altman Z’ Score is below the average of all companies whereas the others, namely “G-Trade”, “J-Information and communication”, “E-Water supply; sewerage; waste management and remediation activities”, “M-Professional, scientific and technical activities”, “B-Mining and quarrying”, “C-Manufacturing”, “N-Administrative and support service activities” is above the all companies’ average. To summarize seven out of seventeen sectors is above the average Altman Z’ Score.

One of the methods frequently used in academic literature when performing cross-sector analysis is to classify sectors as tradable and non-tradable. Tradable sectors are considered to be more productive sectors because they are open to international competition and are more prone to technological developments and innovations. In addition, productivity and innovation are spreading from tradable sectors, especially the manufacturing sector, to other sectors, and these sectors are the main determinants of long-term sustainable growth (Ahrend et al., 2006; WB, 2019). On the other hand, since non-tradable sectors are more dependent on external financing, cyclical movements and volatility in these sectors are high (Braun and Larrain, 2005). When sectors are classified as tradable or non-tradable, unsurprisingly, main tradable sectors, namely “manufacturing” and “mining and quarrying” have been performed better than non-tradable sectors such as, “arts, entertainment, and recreation”, “education” and many other service sectors. Higher net working capital/total assets ratio and higher share of equity in total liabilities, in other words, lower dependence on external financing, ensures a better financial position for tradable sectors. Furthermore, Z-Scores of the information and communication and agriculture sectors, which have high tradable potential, are close to the average of all sectors.

In the Appendix B, the movement of the sectoral Altman Z’ Score can be seen. Although, the tendency of sectors does not change, there are some minor differences in the examined period. To illustrate, “A-Agriculture, forestry and fishing” sector is above the average in most of the years except for 2012-2013 period.

4. Empirical Results

This section consists of two main subparts. In the first part, there is a discussion about support mechanism. In the second part the relationship between sectoral growth and credit rating is examined.

4.1. Support Mechanism

According to the Altman (2018) the threshold Z’ score for emerging market companies is 5.52 and any score equal or greater than this level indicates an “investment grade” score. In the following sections, scenario analyses are done to achieve this threshold level for the sectors in Turkey.

4.1.1. Equity Support: Cash Injection

In the cash injection scenario, a certain amount of cash is added to the working capital and to the shareholders equity item. The optimal amount of cash injection is 0.55 trillion TL to achieve the threshold Z'' score. The changes in the analytical balance sheet are depicted with red colored fonts (Table 3).

Table 3: Equity Support and Analytical Balance Sheet of All Companies (2020)
(Trillion TL)

Assets		Liabilities	
Net Working Capital	1.45 + 0.55	Total Liabilities	7.74
Other Assets	9.14	Shareholders' Equity	2.86 + 0.55
		Retained Earnings	0.70
Total	10.60 + 0.55	Total	10.60 + 0.55

$$Z'' \text{ Score with Equity Support} = 3.25 + 6.56 \frac{2.00}{11.15} + 3.26 \frac{0.70}{11.15} + 6.72 \frac{0.70}{11.15} + 1.05 \frac{3.73}{7.74}$$

So, Z'' Score = 5.52

4.1.2. Debt Support: Loan

In the non-dynamic credit support scenario, a certain amount of credit is added to the working capital and to the total liabilities item. The optimal amount of credit support is 0.83 trillion TL to achieve the threshold Z'' score. The changes in the analytical balance sheet are depicted with red colored fonts (Table 4).

Table 4: Debt Support and Analytical Balance Sheet of All Companies (2020)
(Trillion TL)

Assets		Liabilities	
Net Working Capital	1.45 + 0.83	Total Liabilities	7.74 + 0.83
Other Assets	9.14	Shareholders' Equity	2.86
		Retained Earnings	0.70
Total	10.60 + 0.83	Total	10.60 + 0.83

$$Z'' \text{ Score with Debt Support Case} = 3.25 + 6.56 \frac{2.28}{11.43} + 3.26 \frac{0.70}{11.43} \\ + 6.72 \frac{0.70}{11.43} + 1.05 \frac{3.73}{8.57}$$

So, Z'' Score = 5.52

4.1.3. A More Realistic Turkish Case (V.A.T. Carried to the Next Period Problem)

An Analytical Balance Sheet which includes "Value Added Tax Carried to the Next Period" item initially is given in Table 5.

Table 5: V.A.T. Carried to the Next Period and Initial Analytical Balance Sheet
(2020) (Trillion TL)

Assets		Liabilities	
Net Working Capital	1.45	Total Liabilities	7.74
Other Assets	9.14	Shareholders' Equity	2.86
V.A.T. Carried to the Next Period	0.17	Retained Earnings	0.70
Total	10.60	Total	10.60

In this scenario, 0.11 trillion TL, which is the short-term liability, is added to the net working capital as minus, and 0.6 trillion TL, which is the long-term debt, is subtracted from

the total liability and balance sheet equality is achieved. The rationale behind this calculation bases on a simple assumption that the ratio of average short-term liabilities to long-term liabilities is 68 % for the examined period (Table 6).

Table 6: V.A.T. Carried to the Next Period and Its Effects on Balance Sheet (2020) (Trillion TL)

Assets		Liabilities	
Net Working Capital	1.45	Total Liabilities	7.74
Other Assets	9.14	Shareholders' Equity	2.86
V.A.T. Carried to the Next Period	0.17	Retained Earnings	0.70
Total	10.60 – 0,06	Total	10.60 – 0,06

The diagram illustrates the adjustments to the balance sheet. A blue arrow labeled '0.11' points from the 'Other Assets' row to the 'Net Working Capital' row, indicating a decrease in other assets and an increase in net working capital. Another blue arrow labeled '0.06' points from the 'Shareholders' Equity' row to the 'Total Liabilities' row, indicating a decrease in equity and a decrease in total liabilities.

Therefore, at the initial phase the Altman Z'' Score is 5.28. The calculation is given below:

$$Z'' \text{ Score with VAT Case} = 3.25 + 6.56 \frac{1.56}{10.54} + 3.26 \frac{0.70}{10.54} + 6.72 \frac{0.70}{10.54} + 1.05 \frac{2.86}{7.68}$$

Here the nominator of X_1 component is 1.56 because of decline in short-term liabilities and its denominator is in decrease because of same amount decline in other assets and 0.6 trillion drop in long-term liabilities. Besides, nominator of X_4 component is 2.80 because of decline in shareholders' equity and its denominator is 7.68 because of decline in total liabilities.

To make clear, 0,11 trillion TL V.A.T. Carried to the Next Period goes to "Net Working Capital", and this is in the right side of the original "Balance Sheet" as a "Short-Term Liability" hence the sign of this amount is negative in the "Analytical Balance Sheet". Therefore, the "Net Working Capital" increases but "Total Liabilities" does not change. The remaining amount 0,06 trillion TL is in the "Total Liabilities" in the right side of "Analytical Balance Sheet" and in the "Other Assets" in the left side of "Analytical Balance Sheet". As a result, both total assets and liabilities declines 0,06 trillion TL by government intervention.

The calculation of raising Z'' Score to investment grade Z'' score level, which is 5.52, via equity support in the case of V.A.T. Carried to the Next Period is given in Table 7.

Table 7: V.A.T. and Equity Support Case (2020) (Trillion TL)

Assets		Liabilities	
Net Working Capital	1.56 + 0.41	Total Liabilities	7.68
Other Assets	8.98	Shareholders' Equity	2.86 + 0.41
Total	10.54 + 0.41	Total	10.54 + 0.41

$$Z'' \text{ Score with VAT Equity Support Case} = 3.25 + 6.56 \frac{1.97}{10.95} + 3.26 \frac{0.70}{10.95} + 6.72 \frac{0.70}{10.95} + 1.05 \frac{3.27}{7.68}$$

So, Z'' Score = 5.52

The calculation of reaching investment grade Z'' score via debt support with the dynamic loan support is explained in Table 8.

Table 8: V.A.T. and Debt Support Case (2020) (Trillion TL)

Assets		Liabilities	
Net Working Capital	1.56 + 0.15 - 0.15 + 0.62	Total Liabilities	7.68 + 0.62
Other Assets	8.98	Shareholders' Equity	2.86
		Retained Earnings	0.70
Total	10.54 + 0.62	Total	10.54 + 0.62

In the dynamic credit support case, some operations are done for working capital and total liabilities item. If it is assumed that the loan life period 5 year, the 1/5 of the total credit amount is reflected to the net working capital amount via short term liabilities and this amount also can be seen as cash. In addition to this amount, the remaining part of the loan

can be seen in total liabilities and in the net working capital. So, the total credit support is 0.77 trillion.

$$Z'' \text{ Score for VAT Debt Support Case} = 3.25 + 6.56 \frac{2.18}{11.15} + 3.26 \frac{0.70}{11.15} \\ + 6.72 \frac{0.70}{11.15} + 1.05 \frac{2.86}{8.30}$$

$$\text{So, } Z'' \text{ Score} = 5.52$$

To wrap up, it is concluded that 0.55 trillion TL cash injection, 0.83 trillion TL debt support or loan support is enough for “good” credit rating for all the Turkish real sector companies. However, if one focus on more realistic case which is, Value Added Tax Carried to the Next Period, 0.41 trillion TL cash injection, 0.77 trillion TL debt support is needed. Meanwhile, the financial pecking order theory states that the cost of financing increases with asymmetric information from the borrower’s perspective. In the view of corporate finance, there is a tax benefits of debt. On the other hand, despite the tax benefit, the difference between equity support and loan support is still huge. On the other hand, the results of equity support are different from loan support. Once a party gives an equity support, it becomes a partner of the company. The responsibilities of the partnership are more sophisticated than the direct debt case, but government can manage it by designing different kinds of support mechanism. To illustrate, wealth funds are good explain of this kind of mechanism, they can provide equity support to companies and also subordinated debt can be preferable for support mechanism.

4.2. Credit Rating and Sectoral Output Growth

It is rational to expect that higher sectoral output can lead to better financial position for companies. The higher output growth implies higher net capital working and higher profits. On the other hand, higher financial strength leads to sustainable and higher sectoral output growth. Sectors in better financial position have lower risk and lower financial failure probability that accelerate the growth. In addition, some companies or sectors can grow rapidly in short run with excessive borrowing, but it cannot be sustainable. Although there are studies in the literature that define Z'' Score as a risk indicator and investigate its relationship with other variables (Aneja and Makkar, 2013; Aksoy and Göker, 2018), its relationship with output is discussed for the first time in this study. In this part, the empirical link between credit rating and sectoral growth is examined by the help of the Panel VAR (PVAR) model.

According to literature, PVAR models have distinctive features (Ouyang and Li, 2018; Canova and Ciccarelli, 2013):

- PVAR model is an endogenous system so each of the variables can be used in the model in an unrestricted way.
- PVAR model reflects cross-sectional heterogeneities and dynamic interaction of variables.
- PVAR model reflects the dynamic structure of coefficients in a given time.

In addition, PVAR models have an identical structure similar to the classical time series VARs, with a cross-sectional dimension (Holtz-Eakin et al., 1988). The p-order VAR panel only composes of endogenous variables and can be shown as:

$Y_{it} = A_i(I)Y_{t-1} + \mu_i + \epsilon_{it}$ $t = 1, \dots, T \quad i = 1, \dots, N$	(Eq. 1)
------------------------------------------------------------------------------------------	---------

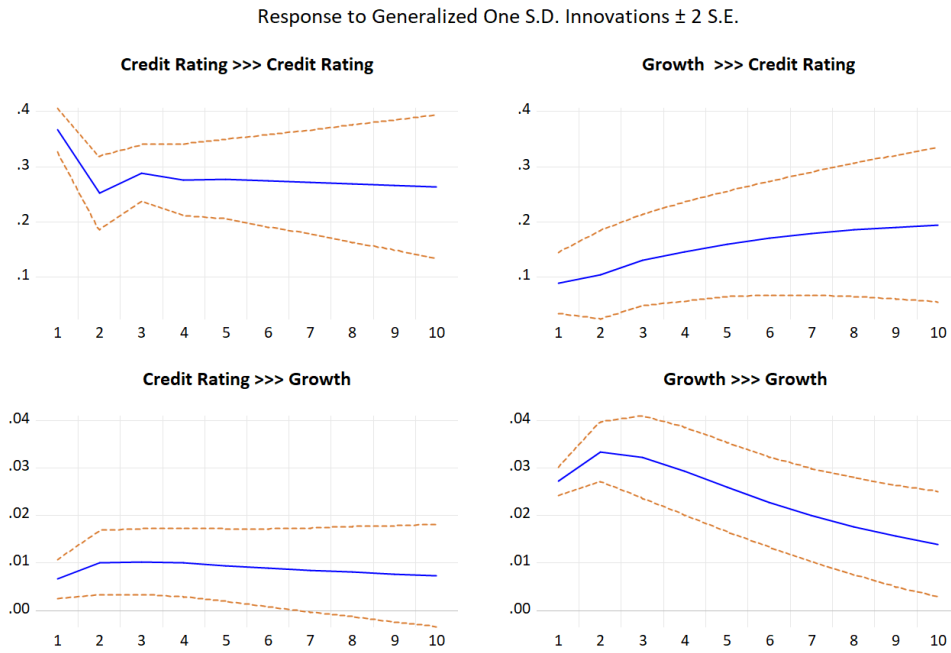
In this equation, the vector of endogenous variables Y_{it} consists of credit rating of each sector and sectoral growth rate. μ_i is a vector representing fixed effects, the $A_i(I)$ is the matrix of coefficients and ϵ_{it} is the composite vector of innovations. The model covers the period 2009-2020 using annual data of 17 sub-sectors. Credit rating indicates the Z'' Scores of sectors which are computed in the part 3.3 using CBRT company accounts. Data of sectoral output is obtained by Turkish Statistical Institution.

In the empirical analysis, firstly the diagnostic and pre-tests of PVAR models are done. After confirming the validity of the model, two variables PVAR model with one lag is estimated. The optimal lag degree selection for the PVAR model is done by the GMM method. In the lag selection criterion, the first 3 lags of the variables are used in the PVAR model. Since it minimizes Akaike and Schwarz information criterion, the lag is chosen as 1 in the PVAR model. A VAR is said to be stable when all its roots are inside the unit circle (Lütkepohl, 2005).

In the PVAR model impulse analysis consists of determining the impact of a shock to one of the variables on the dynamics of the other variables. In this study, impulse-responses functions to trace the responses of the variables to shocks are employed and the results are presented in Figure 2. The responses of credit rating to a shock in the sectoral growth rate are positive and statistically significant in ten periods. In addition, the responses of the sectoral growth to a shock in the sectoral credit rating are positive and statistically significant in seven periods. The difference in these two responses is that the impact of the sectoral output growth is bigger than credit rating, but two variables have an important effect on each other.

These results imply that being less indebted, less in need of support and having high equity affects sectoral output growth positively. These are the features of productive tradable sectors such as manufacturing, mining. On the other hand, higher output growth can decrease financial risks of sectors by increasing net working capital, leading higher returns and supporting equity.

Figure 2: Link Between Credit Rating and Sectoral Output Growth



5. Conclusion and Discussion

Altman Z" Score can be used to measure the financial risks and financial strength of companies or sectors. Employing data of 1.3 million companies Z" Score is calculated for Turkey covering period 2009-2020. Results indicate that decreasing trend in the Z" Score from 2009 to 2016 may stem from ample liquidity conditions, which may cause companies to expand their balance sheets by borrowing. There is a moderate recovery period in Z" Score after the year 2016 where it can be argued that with the tightening of liquidity conditions companies start to hold more liquid assets.

According to the average Altman Z" Score of 17 sectors in Turkey for the period of 2009-2020, tradable sectors, namely "manufacturing" and "mining and quarrying" have been performed better than non-tradable sectors such as, "arts, entertainment, and recreation",

“education” and many other service sectors. It can be claimed that lower dependence on external financing, ensures a better financial position for tradable sectors. This result is parallel to previous studies that compare the tradable and non-tradable sectors (Braun and Larrain, 2005; Ahrend et al., 2006; WB, 2019). The findings of this study indicates that to raise the Z Scores of sectors to threshold level the required amount of equity support is less than the amount of the loan support in any case. This paper empirically demonstrates this result for the first time in the literature.

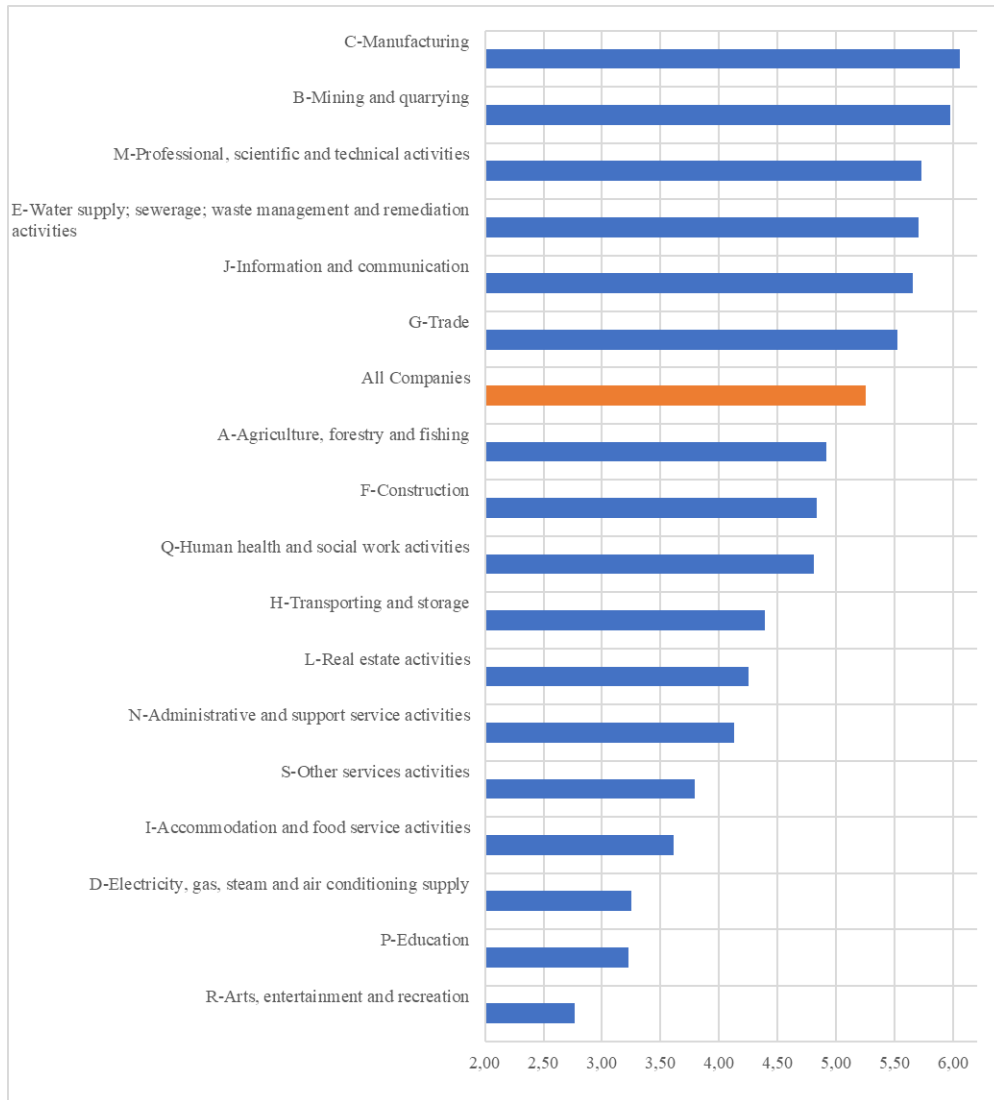
The other important conclusion of the paper is the bilateral link between sectoral growth and sectoral rating which is discussed for the first time in the literature. The higher output growth can increase Z Score and strength financial position of sectors. The higher Z Score means lower financial risk and less need of support, and it can also affect sectoral output growth positively. In addition, it can be argued that promoting sectors by support mechanism that have a Z Score lower than threshold level, may trigger sectoral output growth and per-tain supply chain.

There is also a suggestion for the comparability of the Z Score formula. If the constant term, which is 3.25, can be adjusted for the different countries, sectors or companies, it may give more robust results. To illustrate, CDS level may be used instead of a constant term.

Declaration of competing interest

There is no conflict of interest.

Appendix A: Comparison of Sectoral Z” Scores (2009-2020 Average)



Appendix B: Comparison of Yearly Z-Scores

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
All Companies	Green	Green	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
A-Agriculture, forestry and fishing	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
B-Mining and quarrying	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
C-Manufacturing	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
D-Electricity, gas, steam and air conditioning supply	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
E-Water supply, sewerage, waste management and remediation activities	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
F-Construction	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
G-Trade	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
H-Transporting and storage	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
I-Accommodation and food service activities	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
J-Information and communication	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
L-Real estate activities	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
M-Professional, scientific and technical activities	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
N-Administrative and support service activities	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
P-Education	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
Q-Human health and social work activities	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
R-Arts, entertainment and recreation	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
S-Other services activities	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown

References

- AHREND, Rudiger, Donato ROSA and William TOMPSON; (2006), "Russian Manufacturing and the Threat of Dutch Disease: A Comparison of Competitiveness Developments in Russian and Ukrainian Industry", OECD Economics Department Working Papers 540, <https://www.oecd-ilibrary.org/docserver/322823013852.pdf?expires=1664639756&id=id&accname=guest&checksum=7A4B898FF837EEE9113F941128876625>, 03.05.2022.
- AKIN AKSOY, Emine, E. and İlknur E. KANDIL GÖKER; (2018), "Bankacılık Sektöründe Finansal Risklerin Z-Skor ve Bankometer Metodları ile Tespiti, BIST'te İşlem Gören Ticari Bankalar Üzerine Bir Araştırma, Muhasebe Bilim Dünyası Dergisi, 20 (2), pp. 418-438, doi: 10.31460/mbdd.377424.
- AKSOY, Barış, Talip TORUN and Veli AKEL; (2021), "Mevduat Bankalarının Kredi Derecelendirmesinde Veri Madenciliği Yöntemleri Tahmin Performansının Ölçülmesi: Türkiye Örneği. Finans Politik & Ekonomik Yorumlar", 58(656), pp. 25-55.
- AKSU, Melek; (2019), "Türkiye'de enerji şirketlerinde finansal sıkıntının belirleyicileri", ICOAEF VI International Conference on Applied Economics and Finance Extended with Social Sciences, Balıkesir, pp. 21-32, <https://www.icoaef.com/wp-content/uploads/2020/01/ICOAEF-VI.-Full-paper-proceeding-with-ISBN-1.1.20-1.pdf>, 14.06.2022.
- ALTMAN, Edward I.; (1968), "Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy", The Journal of Finance, 23(4), pp. 589-609, <https://doi.org/10.2307/2978933>.
- ALTMAN, Edward I.; (1983), Corporate Financial Distress. A Complete Guide to Predicting, Avoiding, and Dealing with Bankruptcy, A Wiley-interscience Publication, New Jersey.
- ALTMAN, Edward I.; (2018), "A fifty-year retrospective on credit risk models, the Altman Z-score family of models and their applications to financial markets and managerial strategies", Journal of Credit Risk, 14(4), pp. 1-34, DOI: 10.21314/JCR.2018.243.
- ALTMAN, Edward I., Małgorzata IWANICZ-DROZDOWSKA, Erkki K. LAITINEN and Arto SUVAS; (2017), "Financial distress prediction in an international context: A review and empirical analysis of Altman's Z-score model", Journal of International Financial Management & Accounting, 28(2), pp. 131-171, <https://doi.org/10.1111/jifm.12053>.
- ANEJA, Ranjan and Anita MAKKAR; (2013), "A Comparative Study of Book Value Insolvency of Indian Commercial Banks, An Application of Z-Score Model", The IUP Journal of Financial Risk Management, 10 (2).

- BEGLEY, Joy, Jin MING and Susan WATTS; (1996), "Bankruptcy classification errors in the 1980s: An empirical analysis of Altman's and Ohlson's models", *Review of Accounting Studies*, pp. 267-284.
- BRAUN, Matias, and Borja LARRAIN; (2005), "Finance and the Business Cycle: International, Inter-Industry Evidence", *Journal of Finance*, 15 (3), pp. 1097-1128.
- CANOVA, Fabio, and Matteo CICCARELLI; (2013), "Panel Vector Autoregressive Models: A Survey", ECB Working Paper, No:507, <https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1507.pdf>
- CIHAK, Martin and Heiko HESSE; (2010), "Islamic Banks and Financial Stability, An Empirical Analysis", IMF Working Paper, 38, <https://www.imf.org/external/pubs/ft/wp/2008/wp0816.pdf>, 12.07.2022.
- CIRERA, Xavier, Marcio CRUZ, Elwyn DAVIES, Arti GROVER, Leonardo IACOVONE, Jose E. L. CORDOVA, Denis MEDVEDEV, Franklin OKECHUKWU MADUKO, Gaurav NAYYAR, Santiago REYES ORTEGA and Jesica TORRES; (2021), "Policies to Support Businesses through the COVID-19 Shock: A Firm Level Perspective", *The World Bank Research Observer*, 36(1), pp. 41-66.
- CBRT; (2022), *Company Accounts Statistics*. <https://www.tcmb.gov.tr/wps/wcm/connect/EN/TCMB+EN/Main+Menu/Statistics/Real+Sector+Statistics/Company+Accounts/>, 15.01.2022.
- GERANTONIS, Nikolaos, Konstantinos VERGOS and Apostolos G. CHRISTOPOULOS; (2009), "Can Altman Z-score Models Predict Business Failures in Greece?", *Research Journal of International Studies*, 12(10), pp. 21-28.
- GOURINCHAS, Pierre-Olivier, Şebnem KALEMLI-ÖZCAN, Veronika PENCIAKOVA and Nick SANDER; (2020), "Covid-19 and SME failures", *National Bureau of Economic Research*, No: w27877, <http://www.nber.org/papers/w27877>, 10.03.2022.
- GRICE, John S. and Robert W. INGRAM; (2001), "Test of the Generalizability of Altman's Bankruptcy. Prediction Model", *Journal of Business Research*, 54(1), pp. 53-61.
- HAUSCHILD, Dan; (2013), *Altman Z-Score: not just for bankruptcy: from z-score to "green zone" survivability*. Amros Corporation.
- HOLTZ-EAKIN, Douglas, Whitney NEWWEY and Harvey S. ROSEN; (1988), "Estimating vector autoregressions with panel data", *Econometrica: Journal of the econometric society*, pp. 1371-1395.
- JEWELL, Jeff and Livingston MILES; (1999), "A comparison of bond ratings from Moody's S&P and Fitch IBCA", *Financial Markets, Institutions & Instruments*, 8(4), pp. 1-45.

- KULALI, İhsan; (2016), “Altman Z-skor modelinin BİST şirketlerinin finansal başarısızlık riskinin tahmin edilmesinde uygulanması”, *Uluslararası Yönetim İktisat ve İşletme Dergisi*, 12(2), pp. 283-291.
- LUTKEPOHL, Helmut; (2005), *New introduction to multiple time series analysis*, Springer Science & Business Media.
- MESSAI, Ahlem S. and Fathi JOUINI; (2013), “Micro and macro determinants of non-performing loans”, *International journal of economics and financial issues*, 3(4), pp. 852.
- NOVOTNA, Martina; (2012), “The use of different approaches for credit rating prediction and their comparison.” In *Proceedings of the 6th International Conference on Managing and Modelling of Financial Risks*, pp. 448-457, <https://ssrn.com/abstract=2867849>, 04.01.2022.
- ÖZDEMİR, Fevzi S.; (2014), “Halka açık ve halka açık olmayan işletmeler yönüyle tekdüzen muhasebe sistemi ve Altman z skor modellerinin uygulanabilirliği”, *Ege Akademik Bakış*. 14 (1), pp. 147-161.
- PINDADO, Julio, Luis RODRIGUES and Chabela de la TORRE; (2008), “Estimating Financial Distress Likelihood”, *Journal of Business Research*, 61, pp. 995-1003.
- OUYANG, Yaofu and Peng LI; (2018), “On the nexus of financial development, economic growth, and energy consumption in China: New perspective from a GMM panel VAR approach”, *Energy Economics*, 71, pp. 238-252.
- SALIMI, Anwar Y.; (2015), “Validity of Altman’s Z-Score Model in Predicting Bankruptcy in Recent Years”, *Academy of Accounting & Financial Studies Journal*, 19 (2).
- SHERBO, Andrew J. and Andrew J. SMITH; (2013), “The Altman Z-Score Bankruptcy Model at Age 45, Standing the Test of Time?”, *American Bankruptcy Institute Journal*, 32 (11).
- WB; (2019), “Firm Productivity and Economic Growth in Turkey, Turkey Productivity Report”, *Country Economic Memorandum*. Washington, DC: World Bank, <https://openknowledge.worldbank.org/handle/10986/31931>, 12.03.2022.
- YI, Wang; (2012), “Z-score model on financial crisis early-warning of listed real estate companies in China: A financial engineering perspective”, *System Engineering Procedia*, 3, pp. 153-157.
- YILDIZ, Ayşe; (2014), “Kurumsal yönetim endeksi ve Altman z skoruna dayalı lojistik regresyon yöntemiyle şirketlerin kredi derecelendirmesi”, *Süleyman Demirel Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 19 (3), pp. 71-89.