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IS FINANCIAL STABILITY EFFECTIVE ON INVESTMENT DECISIONS IN EMERGING MARKETS?

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ABSTRACT

The aim of this study is to determine to what extent Altman's (1967) Z score, which shows bankruptcy proximity of the companies, is effective in stock selection of the investors and the role of using Z score and Cash Return Period together in correct investment decision. Comparing with Z score, the affectivity of the results gathered via Data Envelopment Analysis is analyzed. The findings of the study show that the investors use the conclusions of these three models but they also use cash flow data, too because they do not find Z score alone sufficient. At this point, the fact that DEA gives the information required as a whole and that it enables to realize the reasons why Z score is good or bad becomes prominent as the superior side.

Key Words: *Altman Z score, Cash Return Period, Company Efficiency, Data Envelopment Analysis (DEA), BIST Manufacturing Industry*
JEL Classification: *G11, G33, G34*

GELİŞMEKTE OLAN PİYASALARDA FİNANSAL SAĞLAMLIK YATIRIM KARARLARINDA ETKİLİ MİDİR?

ÖZET

Bu çalışmanın amacı, şirketlerin iflasa yakınlığını gösteren Altman (1967)'nın Z Skorunun yatırımcıların hisse senedi seçiminde ne ölçüde etkili olduğunu ve Z skoru ile Nakit Dönüş Süresinin bir arada kullanımının doğru yatırım kararı vermedeki rolünü belirlemektir. Veri Zarflama Yöntemi ile elde edilen sonuçlar, Z Skoru ile karşılaştırılarak etkinlikleri araştırılmıştır. Elde edilen bulgular, yatırımcıların üç modelin sonuçlarını da kullandığını, ancak sadece Z skorunu yeterli görmedikleri için nakit akımı verilerini de kullandıklarını göstermektedir. Bu noktada VZA'nın istenen bilgileri bir bütün olarak vermesi ve Z skorunun iyi ya da kötü olmasının nedenlerini görmeyi sağlaması üstün yönü olarak öne çıkmaktadır.

Anahtar Kelimeler: *Altman Z Skoru, Nakit Dönüş Süresi, Şirket Etkinliği, Veri Zarflama Analizi (VZA), BIST İmalat Sanayi.*
JEL Sınıflandırma: *G11, G33, G34*

1. Introduction

The capability of an investor to invest in stock depends on the significance of the sector in which that stock is located, after the analysis on a global and country basis. Upon analysing the sectoral developments in medium and long term, investor can have an idea on the performance of the stocks. And then by benefiting from the criterion that he determines on financial strength as a final step, he can make a decision to invest in one or more than one stocks.

In this study, the stocks that take part in manufacturing industry sector producing mid-technology product and product groups having a role in medium level development are used. For this purpose, financial statements between the years of 2010-2014 that belong to companies are used. The data mentioned that belong to companies are obtained from the official website of Public Disclosure Platform.

The data of financial strength of companies are produced via three different models in the study. Z scores that were firstly produced by Altman (1968 and 1993) and that are used for the measurement of bankruptcy proximity (in other words financial strength) are obtained. At this phase, Altman' equation, which is valid for Emerging Markets, is used. Secondly, a new model is formed, thereby using balance items, located in the denominator of the financial ratio used for the measurement of Z scores, as input while balance items, located in the numerator, as output. The reason why this model is formed is to examine whether there appears negativity that can derive from Altman's model or not. Finally, Data Envelopment Model is formed by benefiting from already obtained Z scores and cash return period of the companies. The aim of the foundation of this model is to prevent the use of incorrect data caused by manipulation risk of the financial data forming Z score. The fact that profit number is substantially used in the numerator of the ratios used to measure Z score indicates that the obtained result is vulnerable to manipulation of the executives. Therefore with the use of a data belonging to cash flow, it is aimed to remove that risk. In the event that Z score really shows the financial strength of the company, it is set out from the hypothesis that the result of Data Envelopment Model, in which cash return period is used as input and Z score as output, will be consistent with Z score. By measuring the performances of stock portfolios that is formed by benefiting from the results, acquired with all models and belonging to the companies, it is tried to determine which model provides investor with the most correct data.

In the study, theoretical expressions are made primarily on Altman's Z score and Data Envelopment Analysis. Then the studies, conducted in Turkey and all around the world related with the topic, are included. Lastly, models, summarized above, are formed and the results gathered are tried to be interpreted.

2. Literature Review

In the study, three different models are used to measure the financial strength of the companies. These models ground on Altman Z score model and Data Envelopments Analysis. Both models have taken place in the scope of the financial literature for so long and have had the characteristics of being the models that empirical studies intensify.

Z score, which was suggested by Edward I Altman in 1968 and aims to measure financial failure of bankruptcy proximity degree of the companies, represents a value consisting of the weighted total of five financial ratios of the companies. By using multiple discriminant analysis in his model, Altman produced a distinctive measurement on financial failure which enables to evaluate the companies as a whole and decreases the number of variables to a large extent which analysts use to decide, and used the financial ratios for this.

Altman, Hartzell and Peck have renewed the Z score model for emerging markets and obtained a new equation with different coefficients. The model obtained in the study was used in rating Eurobonds traded in Mexico market. In the study revised by Altman in 2005, it is concluded that the model enables to make a new and corrected rating in the event of the use of the model together with the basic credit analysis.

In his study, Altman (2000) has developed ZETA model in order to evaluate bankruptcy risk of the companies. But the most important part in this model is Z score Model which is a model of current failure classification. Z score Model is suitable for more up to date and industrial firm data. Z model is conducted as the use of the most suitable united data and the model of current risk classification. As a result of the study, it is determined that 70 % of the companies are in the position of bankruptcy proximity before five-year reporting period. As a result of the evaluation, it is found that the reasons of the bankruptcy proximity of the companies are financial problems and items related with treatment of discriminant analysis.

Altman has been carrying on his studies to improve his Z score model and to examine it empirically. Altman, E.I., Rijken, H. (2011), Altman E.I., Saunders A. (1998) and Zhang, L., Altman, E.I. and Yen, J. (2010) can be given as examples to these studies.

A certain number of studies examining the use of Altman's Z score with different aims have been conducted in our country. The study of Yıldız (2014) is a recent example of these studies. In her study, she has emphasized that the issue of company rating draws much intention after global financial crisis and remarked that many studies based on financial data have been conducted but it is impossible to obtain demanded results without paying attention to the data that are not financial. Therefore by using corporate governance index besides Altman Z score model based on financial data, she has tried to determine the rating of 35 companies available in BIST 100 index according to the options of being investable and not investable by implementing dual logistic regression method. The result of the analysis shows that there is a meaningful relationship between investable positions of the companies and Altman Z score. A meaningful relationship between corporate governance index and investable positions couldn't be found and so the effect of index on investable positions couldn't be determined. These results show that financial data are effective on company ratings but corporate governance is not reflected enough to rating scores.

In his study Kulalı (2014) has emphasized that financial difficulties have been studied for more than fifty years and the concept of financial difficulty has been generally associated with bankruptcy prediction models but has differed from bankruptcy in particular points. Bankruptcy is the last step of financial difficulty when companies cannot carry out the responsibilities regarding debt agreement. That is to say, bankruptcy

is associated with company statement more. He has emphasized it is required that these two concepts, having close relationship, should become dissimilar and approaches different from prediction models should be adopted.

DEA technique that is used in our study is first suggested by Charnes, Coopers and Rhodes (1978). The method is a nonparametric method. They have implemented the efficiency of each decision making-unit in Decision Making Units (DMU) used in public programs. In the second part of the study, it is determined that it is also related with engineering and economic concepts. Additionally, by obtaining empirical data related with production function, useful models have been formed. Fundamental assumption of DEA is constant return assumption according to the scale. This DEA model is also known as CCR (Charnes, Coopers, Rhodes) Model.

The use of DEA technique in performance measurement is carried out with the study by Chandra, Cooper, Li and Rahman (1998). In this study, Data Envelopment Analysis CCR model is used and it is aimed to measure the performances of 29 Canadian Textile companies. The results obtained from the study, in which yearly sale total is used as output and total of average yearly investment and working staff numbers as input, has shown that very few companies work efficiently. On the basis of these results, it is concluded that decision making-units are required to regulate their structures, strategies and capacity plans in order to increase their efficiency level.

Another example for the use of DEA Model in performance measurement is the study of Paradi et al. (2014). In the study, slack-based-measure model is formed in order to compare Z score and DEA model. They have used the model in which they have used the ratios of the numerator and denominator, to measure Z score, as output and input respectively in DEA model in order to evaluate financial failure of the companies from non-production sector. The results they have obtained claim that they provide more helpful information compared to Z score.

In our country, by using DEA, empirical studies related to evaluation of company performances have been heavily conducted recently. For example, Bakırcı (2006) dealt with 13 companies ranking at top 500 in automobile industry in Turkey between 1999 and 2004. In the study, while net assets, equity capital and the number of manpower are used as input and pre-tax profit, export value and net sales are used as output. In the evaluation, input-oriented and output-oriented Data Envelopment Analysis is done according to CCR (Charnes, Cooper and Rhodes) and BCC (Banker, Charnes and Cooper) models. Although it is observed that the implemented method in the study gets the demanded result, it is concluded that complete and clearer results in terms of using the resources in automobile sector can be reached if the data that belong to all companies are obtained.

In Turkey, there are considerably plenty of studies with regard to the use of DEA model in effectivity measurement. Yıldız (2007), Yalama and Sayım (2008), Ata and Yakut (2009), Babacan, Kısakürek and Özcan (2009), Altın (2010) can be given as examples to these studies.

3. The Purpose and Scope of the Research

The aim of this study is to offer a measure which investors can easily compute on the stock selection contains more information and is more reliable than available measures. By obtaining three different measurement methods individually after examining their uses in investment decisions, the effect of the use of the methods together on investment decisions will be searched. Z score showing the bankruptcy proximity of the company at the simplest level and produced by Altman for emerging markets will be obtained. By using the balance items, in the numerator and denominator of the ratios used to measure that kind of Z scores, as output and input in a DEA model, an efficiency analysis will be carried out. The aim of setting up this model is to determine positive and negative contribution of the items forming Z score to the efficiency and to present an opinion on the policies that the companies are required to implement in order to enhance the contributions.

The research sample consists of 22 companies carrying on business in manufacturing industry sector producing mid-technology products and product groups in Istanbul Stock Exchange (BORSAISTANBUL). The first reason of choosing this sector is that it carries out 92% of Turkey's export. The second reason is that the items used to measure Z score on financial performance or failures are the most significant items for these companies. Because of the fact that it is manufacturing sector, sales, profit and capital goods are the primary elements of financial performance. But it is impossible for these data to be enough for that kind of sector without paying attention to cash flow.

4. Research Data and Methodology

In order to be able to calculate Z score and set the other two models, financial tables between the years of 2010-2014 of the companies taking part in the sample are used. So as to evaluate the performances of the companies decided to be invested upon, the incomes gathered by benefiting from the companies' stock prices are used. The companies taking part within the scope of the analysis is shown in Table 1.

Table 1: The Companies Taking Part within the Scope of the Analysis

	Company	**Code**		**Company**	**Code**
1	Ege Endüstri ve Ticaret A.Ş.	EGEEN	**12**	Silverline Endüstri ve Ticaret A.Ş.	SLVR
2	Ford Otomotiv Sanayi A.Ş.	FROTO	**13**	Emek Elektrik Endüstrisi A.Ş.	EMKEL
3	Otokar Savunma Sanayi A.Ş.	OTKAR	**14**	Bosch Fren Sistemleri Sanayi ve Ticaret A.Ş.	BFREN
4	Gersan Elektrik Ticaret ve Sanayi A.Ş.	GEREL	**15**	Vestel Beyaz Eşya Sanayi ve Ticaret A.Ş.	VESBE
5	Klimasan Klima Ticaret ve Sanayi A.Ş.	KLMSN	**16**	Ege Gübre Sanayii A.Ş.	EGGUB
6	Vestel Elektronik Sanayi ve Ticaret A.Ş.	VESTL	**17**	Aksa Akrilik Kimya Sanayii A.Ş.	AKSA

7	Anadolu Isuzu Otomotiv Sanayi ve Ticaret A.Ş.	ASUZU	**18**	Arçelik A.Ş.	ARCLK
8	Karsan Otomotiv Sanayii ve Ticaret A.Ş.	KARSN	**19**	Gübre Fabrikaları T.A.Ş.	GUBRF
9	Ditaş Doğan Yedek Parça İmalat ve Teknik A.Ş.	DİTAŞ	**20**	Bagfaş Bandırma Gübre Fabrikaları A.Ş.	BAGFS
10	Tofaş Türk Otomobil Fabrikası A.Ş.	TOASO	**21**	Soda Sanayii A.Ş.	SODA
11	Katmerciler Araç Üstü Ekipman Sanayi ve Ticaret A.Ş.	KATMR	**22**	Parsan Makina Parçaları Sanayii A.Ş.	PARSN

Five ratios necessary for being able to calculate Z values that belong to these companies are gathered from financial table data. Summarized information with regard to the data mentioned is given in Table 2 (Appendix 1). The first version of the multiple discriminant model produced in 1968, which is used in gathering Z scores by benefiting from five financial ratios given in the table, includes coefficients appropriate for the public companies operating in developed countries. Later on, as a result of his studies in 1983 and 1993, Altman expressed this model with three different equations according to the publicity of the companies and whether they are industrial enterprises or not. Moreover, he revised the equation that he set up for non-production sectors for emerging markets.

Z Score (Original Model – Publicly Held Companies)

$$Z = 1{,}2T_1 + 1{,}4T_2 + 3{,}3T_3 + 0{,}6T_4 + 0{,}999T_5 \quad (1)$$

Z Score (Non-public Companies)

$$Z = 0{,}717T_1 + 0{,}847T_2 + 3{,}107T_3 + 0{,}420T_4 + 0{,}998T_5 \quad (2)$$

Z Score (Non-production sector)

$$Z = 6{,}56T_1 + 3{,}26T_2 + 6{,}72T_3 + 1{,}05T_4 \quad (3)$$

Z Score (Emerging markets)

$$Z = 3{,}25 + 6{,}56T_1 + 3{,}26T_2 + 6{,}72T_3 + 1{,}05T_4 \quad (4)$$

In all models;

T_1 = Working Capital / Total Assets

T_2 = Available Surplus/ Total Assets

T_3 = Interest and Pre-tax Profit / Total Assets

T_4 = Market Value of the Business / Carrying Amount of Total Debt

T_5 = Sales / Total Assets

As can be understood from the equation, the proportion of Sales to Total Assets is not used in the last two models. The reason for this is to remove the sectoral impact deriving from asset transfer velocity. Hartzell, Altman and Heine (1995) added 3.25 fixed value in the model they set for emerging markets. This readjustment arises from credit scoring. In the study, this invariant, which is added so as to be able to standardize the stocks from the point of scoring, can be ignored in the calculations related to the company's financial success. The three zones formed for each of the models with regard to bankruptcy proximity are shown in the table below.

Table 3: Critical Values of Z Score

	Security Zone	Grey Zone	Danger Zone
Z Score (Original Model – Publicly Held)	Z > 2.99	1.8 < Z < 2.99	Z < 1.8
Z Score (Non-public)	Z > 2.90	1.23 < Z < 2.90	Z < 1.21
Z Score (Non-production sector)	Z > 2.60	1.1 < Z < 2.60	Z < 1.1
Z Score (Emerging countries)	Z > 5.85	4.35 < Z < 5.85	Z < 4.35

In this study, developing Z score equation is used. However, 3.25 constant taking place in the equation is ignored in our model as it is only used in stock scoring for appropriateness. When this change is taken into account from the point of critical values, values that belong to no-production sector can be used. That's why; the evaluation of the businesses is made by using the values that belong to non-production sector.

The establishment of a Data Envelopment Model in which the numerator and denominator values that belong to ratios forming Z score are thought as output and input, respectively, is forming the second model of the study. Finally, a Data Envelopment Model is set out in which Z scores and cash return period are, again, used as output and input, respectively.

Data Envelopment Analysis (DEA) is a non-parametric technique which has the flexibility that can measure the affectivity of the manufacturing areas where there is more than one input and output. The basis of the technique is based on linear programming. DEA models are divided into two groups according to their features as constant and flexible income. According to the scale constant income is (CRS); when inputs that are used without changing the compound ratio of the inputs are increased £ times, outputs are assumed to increase £ times – Constant Return to Scale.

According to the scale, flexible income (VRS) is; when inputs that are used without changing the compound ratio of the inputs are increased £ times, the models are defined under the assumption that the outputs increase in a different ratio from £ (Variable Return to Scale – VRS). Another concept that will be used in the classification of DEA models is orientation. According to this concept, DEA models can be classified as obtaining maximum output with certain amount of input (output oriented) or obtaining

certain amount of output with minimum input (input oriented), and as well as these, it can also be applied as non-oriented (Altın, 2010: 18).

The first study with regard to DEA which expresses Farrell's (1957) thought related to measuring the affectivity of the decision-making units as a linear programming model was done by Charnes, Cooper and Rhodes (1978). The mathematical expression of the model the main aim of which is to maximize Input/output ratio is as follows (Cooper et al., 2007: 23);

Objective Function;

$$Max h_k = \sum_{r=1}^{n} u_r y_{rjk} \tag{5}$$

Constraints;

$$\sum_{i=1}^{m} V_i X_{ijk} = 1 \tag{6}$$

$$\sum_{r=1}^{n} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \leqslant 0 \tag{7}$$

$$u_r, v_i \geq 0 \tag{8}$$

In the model;

h_k: affectivity value,

u_r: weight of r output,

v_i: weight of i input,

y_{rjk}: r output that belong to j decision units,

x_{ijk}: I input that belong to j decision units.

The numerators and denominators of the ratios used in the calculation of Z score for the first DEA are used as output and input. That's why, the basic assumption of the model is, in the event that it is input-oriented, to identify the affectivity of the businesses by using minimum Total Asset and Total Encumbrance, with regard to certain working capital, available surplus, interest and pre-tax profit, and market value. In the event that it is output-oriented, the assumption is to identify the affectivity of the businesses with regard to reaching maximum working capital, available surplus, interest and pre-tax profit, and market value via certain amount of asset and loan.

This model gives a different meaning to Z score form the point of the investor. For instance, in the event of forming an input-oriented model, by observing the variances in Total Assets and Total Loans of an ineffective company in time, it can be concluded

whether the policies of the business tend to change in a positive way or not. In an output-oriented model, the reason of being effective or ineffective may stem from one or several of available surplus, interest and pre-tax profit, working capital or market value of the business, and it can be concluded that in order to be effective, it is necessary to identify what these values should be.

In the second model developed by DEA, the variables are Z score and cash return period. The reason why we set up the model in which cash return period is input and Z score is output is to be able to use the relationship between cash flows and Z score as data in decision-making. Balance items used in the calculation of the ratios used in Z score are composed of accounting data. Together with these data, other the most significant factor in the achievement of the business is cash flow. That's why, it is aimed to make an affectivity measure with a test with regard to whether businesses with Z score have minimum cash flow or not. This affectivity measure, which the investor will use together with Z score, will ensure to provide a more cautious decision of investment. As a result, cash flow, which is the only variable that Z score does not take into account with regard to financial success (or failure) of the businesses, is involved in decision process together with this model. Inputs and outputs used in DEA models are shown in the table below.

Table 4: Input and Output Variances of DEA Models

1. DEA Model			
Inputs		**Outputs**	
Total Assets	I_1	Working Capital	O_1
Total Encumbrances	I_2	Available Surplus	O_2
		Interest and Pre-Tax Profit	O_3
		Total Market Value	O_4
2. DEA Model			
Cash Return Period	I_1	Z Score	O_1

5. Findings and Evaluation

In our study, application related to the years of 2010 – 2014 is conducted for the stocks registered to BORSAİSTANBUL, taking part in manufacturing industry sector which manufactures mid-technology product and product groups. Z score values obtained from Altman's formula related to emerging countries are given in Table 5.

Table 5: Z Scores between the Years of 2010 – 2014

Z Scores	**2010**	**2011**	**2012**	**2013**	**2014**	**Ort.**	**Z Scores**	**2010**	**2011**	**2012**	**2013**	**2014**	**Ort.**
EGEEN	6.58	7.29	5.95	6.70	7.95	6.89	**OTKAR**	4.75	4.97	4.90	4.41	4.12	4.63
KLMSN	5.12	4.81	5.22	5.85	5.84	5.37	**ASUZU**	5.00	5.41	5.38	7.88	6.60	6.05

DİTAŞ	4.43	4.85	4.36	5.53	5.93	5.02	**KATMR**	5.49	5.34	5.84	5.58	5.58	5.57
EMKEL	1.65	2.36	2.37	3.16	3.06	2.52	**VESBE**	6.34	5.47	5.50	5.78	8.03	6.22
AKSA	4.93	4.72	5.76	5.98	5.70	5.42	**GUBRF**	3.81	4.64	5.45	4.57	4.89	4.67
FROTO	5.97	6.09	4.68	3.44	3.26	4.69	**PARSN**	1.50	2.62	1.83	1.38	1.50	1.77
VESTL	5.00	5.18	4.32	4.23	4.87	4.72	**GEREL**	3.17	3.50	3.18	3.29	3.27	3.28
TOASO	5.10	4.96	5.83	6.10	5.71	5.54	**KARSN**	2.46	2.62	3.20	2.84	1.97	2.62
BFREN	3.63	5.37	8.32	6.93	6.92	6.23	**SLVR**	4.75	4.91	4.93	5.02	5.83	5.09
ARCLK	6.35	5.60	6.12	6.10	6.27	6.09	**EGGUB**	1.91	1.21	1.60	1.69	2.76	1.83
SODA	3.09	3.99	3.20	3.87	4.86	3.80	**BAGFS**	5.86	6.87	4.10	2.38	2.07	4.25

It is observed that Z scores did not show any significant fluctuations over the years mentioned above. Based upon the assumption that the investment level is only the security zone, a portfolio which is composed of equal shares is formed by excluding the businesses whose Z score is under critical value, out of 22 businesses. The income of the portfolio formed and the portfolio formed from the whole of the sector are compared.

In order to constitute DEA models, Efficiency Measurement System (EMS) Software is used. Two models are formed; one of them is input-oriented that will enable Total Assets and Total Encumbrance used as input in the first model to be at minimum level, and the other one is output-oriented that will enable available surplus, interest and pre-tax profit, market value and working capital to be at maximum level. The results related to input-oriented model are given in the first panel of Table 6. The results of the output-oriented model are eliminated as it could not produce conclusions appropriate to application constraints of DEA.

An input-oriented model is formed in the second DEA model that is set up between cash flows and Z score. The reason for this is to see the relationship between cash cycle of the business using cash flow period and Z score which is the summary of other performance indicators. It is assumed that businesses that are effective in this relationship will provide their investors the average return with minimum risk. The results of second DEA model are shown in the second panel of Table 6.

According to the results of the first DEA model given in Table 6 (Appendix 2), in 2010 BAGFS, in 2011 FROTO, and in 2012, 2013, and 2014 TOASO firms are found to be effective. As DEA for the other firms analyzed give us empty variances, it enables us to obtain recovery ratios. Because of the fact that these values show less manufacturing output and more input use, it bears the meaning of recovery that is necessary for ineffective businesses. In our application, these recoveries are thought to be the data that are used by the investors in the revision of decisions.

The recovery ratios with regard to the 1st DEA model, for example, expresses that the business can be effective on the condition of how much the business decreases its

assets and debts in the following terms. In other words, it can be thought as the minimum amount of investment and debt that it can preserve its present profit and other outputs. Nevertheless, in the event that this model is applied output-oriented, the recoveries that will be suggested for the business will express the maximization of these outputs and these suggestions will be meaningless as they are dependent to the variances that are out of the business's decision making zone. The fact that profit or variances related to profit are mostly determined via market dynamics is the basic reason of this meaninglessness.

According to the results of the 2nd DEA model, while in 2010 FROTO, in 2011 FROTO again, and in 2012, 2013, and 2014 TOASO firms are effective, the another firms are not. It is concluded that in 2010 and 2011, the firms except from FROTO need to decrease their input components as much as the distance to efficiency score, and also in 2012, 2013 and 2014 the firms except from TOASO need to decrease their input components as much as the distance to efficiency score.

So as to be able to test the hypothesis above, portfolios are formed for the companies that are defined to be effective by using the first and second DEA models. In the Table below, income and risk (standard deviation) results related to these portfolios are summarized.

Table 7: Portfolio Incomes and Risks

	2010		**2011**		**2012**		**2013**		**2014**	
	Income	**Risk**	**Income**	**Risk**	**Income**	**Risk**	**Income**	**Risk**	**Income**	**Risk**
All Portfolio	0,13	1,72	-0,12	1,94	0,06	1,11	-0,10	1,96	0,15	1,25
Z Score Portfolio	0,13	1,67	-0,10	1,92	0,08	0,98	-0,08	1,99	0,18	1,22
1st DEA Portfolio	0,19	1,72	-0,08	1,98	0,14	1,10	-0,02	2,19	0,32	1,60
2nd DEA Portfolio	0,21	3,04	0,06	2,24	0,25	2,23	0,03	3,45	0,03	2,42

Except from the years with negative income (2011 and 2013), the incomes of the portfolios formed with the stocks of the businesses whose Z scores are over the critical value are above the sector and their risks are below the sector. This conclusion is an indicator that Z score is efficiency used by the investors as a decision-making tool. In the 1st DEA model which is formed by using the components that constitute Z score, similarly, the portfolio which is formed off the years with negative income enables to obtain more income from the sector at the same risk levels. Moreover, the 1st DEA model has more income in all years when compared to the portfolio formed according to Z score. In the portfolios formed according to the 2nd DEA model, risk is higher because of the fact that one stock each is selected in all years, but also positive income could be provided in all these years. Especially in the years when the sector has especially negative income, the investor manages to stay with positive income by means of this strategy.

6. Conclusion

In stock selection, scientific proofs with regard to the fact that investors benefit from the financial data of the business are available for almost all the markets. A study made for Barron Company by Graham (2012), the writer of the book "The Intelligent Investor" who had his professor title in Warren Buffet, and who is at the same time an active market participant, is the most fundamental proof on this subject. According to the study, there are 10 fundamental data that investors take into account during stock selection. All these data belong to the business and there is information mostly related to profit distribution. As theoretical models (portfolio theory, arbitrage theory) with regard to stock selection give inconsistent results in empirical studies, their functionality could not be totally proved yet. That's why; the use of an inductive assumption has become widespread in the way of forming a theoretical structure (such as incident etude, anomalies that cause deviations from effective market hypothesis) that will verify the application.

At this point, the importance of presenting the factors that have impact on the investors' stock selection decisions in a more integrated and available manner arises from the theoretical and empirical improvements mentioned above. In this sense, Altman's Z score has been filling a huge gap for 40 years. This indicator whose fundamental function is to measure bankruptcy proximity is used as the measure of strength by the investors. It has become an indispensable measure of stock selection in long-term investments in especially developed markets. The most fundamental proof of it is that the income of the portfolio formed of stocks selected in accordance with Z score between 1999 and 2015 is 400% higher than the income of S&P index.

In the study, it is assumed that investors in developed markets use Z score to a large extent as stock and in addition to this information, they follow the cash flow. It is also assumed that this assumption, which is proved to be valid for developed markets, is also valid for BORSAİSTANBUL, 63% of which is formed of foreign investors. The fact that the portfolio formed of stocks chosen according to Z score beats the income of the market (the sector handled) in three years out of five years analyzed, verifies the first part of our assumption. That is to say, the investors take Z score into consideration. In the years of 2011 and 2013 when available surplus of the portfolio formed is negative, the income of the sector is negative, too. During the periods when things go wrong from the point of the sector as a whole, Z score does not give the expected conclusion.

At this point, we can assume that there are two paths investors can follow in decision-making process. The first one is to find out where the problem is by analyzing the financial status of the companies comprehensively and to try to forecast the impact of this problem on long term investments. However, with the first DEA model that we set up, affectivity analysis is conducted by dividing Z score into pieces. The income of the portfolio formed from the stocks chosen by using this method could not beat the market, just as Z score, only in 2011 and 2013 when there was negative income. This method makes us reach the same conclusion with Z score but in addition to this, provides us to

acknowledge the strengths and weaknesses of the businesses. However, it can be seen that it has no positive impact with respect to give more incisive decisions because potential investors use the same information, whereas present investors use this information as a data so as to maintain or change their position. It can easily be understood from this conclusion that changing positions for long term investors, at this point, is based on more knowledge.

Our assumption with regard to the second path that investors may follow is the fact that they use cash flows which does not take part in Z score and which is vitally important for the situation of the business as decision criterion. Investors feel the necessity of additional information related to stocks during the periods when the market is especially experiencing a decline and economic indicators are negative at the same time (Özdemir and Göçer, 2011). In such conditions, the success of the business is directly related with cash flows. That's why, the second DEA model we set up gave us, compared to the other two methods, rather cautious but better conclusions in the periods when the market had negative income. In this model at which cash return period is used as input and Z score is used as output, number of effective business decreased to one in all periods. The income of the businesses selected according to this method achieved to beat the market between the years of 2010-2013, but only in 2014 the income was below the market. This method has been the only method to beat the market in 2011 and 2013 when there was negative income. This conclusion is a significant proof to be able to understand the behaviors of the investors and it verifies our assumption. The reason of the conclusion obtained for 2014, thus, verifies all our assumptions. It is inferred that investors did not find the company mentioned effective in the first DEA model but found effective in the second DEA model. Within this context, for the ineffective businesses being effective from the point of cash flows, according to financial indicators in Z score, is not seen enough in the sense of the investors. For this reason, it is concluded that each of these three models is not enough alone for stock selection and the methods should be used as decision criterion as a whole especially in the periods when the income is negative.

In conclusion, it can be seen that the investors use these three methods together as decision criterion in stock selection. However, whether there are any changes in the use of decision criterions and whether other criterions are also effective or not should be investigated later on via a longer-termed analysis.

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Appendix 1:

Table 2: Summarized Data of the Companies within the Scope of the Analysis between 2010 – 2014

	2010				2011				2012			
DATA	Mean	Max	Min	St. Dev.	Mean	Max	Min	St. Dev.	Mean	Max	Min	St. Dev.
WORKING CAPITAL (000 TL)	228.530	2.229.357	664	487.069	331.496	3.089.000	768	718.211	297.644	2.438.262	692	568.561
TOTAL ASSET (000 TL)	418.308	3.335.080	968	792.912	545.721	4.421.459	1.226	1.085.456	553.514	4.647.117	1.315	1.062.507
AVAILABLE SURPLUS (000 TL)	21.371	340.819	35	70.348	24.293	390.964	37	82.560	26.122	432.432	38	91.365
INTEREST AND PRE-TAX PROFIT (000 TL)	50.603	618.994	0	137.703	75.487	800.072	0	186.496	66.411	641.582	0	164.321
TOTAL MARKET VALUE (000 TL)	949	5.270	19	1.504	845	5.368	19	1.424	1.299	7.906	20	2.340
TOTAL ENCUMBRANCE (000 TL)	219.751	1.580.036	456	414.018	304.446	2.523.241	717	626.595	305.985	2.651.352	586	613.455
TOTAL SALES (000 TL)	560.610	7.649.411	1.304	1.578.717	786.307	10.445.022	1.675	2.218.654	766.212	9.767.937	1.625	2.079.199
T1	0.55	0.74	0.21	0.17	0.60	0.82	0.18	0.18	0.58	0.80	0.17	0.18
T2	0.05	0.46	0.00	0.09	0.03	0.27	0.00	0.06	0.02	0.10	0.00	0.03
T3	0.06	0.23	0.00	0.07	0.07	0.26	0.00	0.08	0.08	0.46	0.00	0.11
T4	0.24	1.42	0.00	0.49	0.14	1.02	0.00	0.30	0.23	1.62	0.00	0.50
Z	4.40	6.58	1.50	1.51	4.67	7.29	1.21	1.46	4.64	8.32	1.60	1.59

	2013				2014			
DATA	Mean	Max	Min	St. Dev.	Mean	Max	Min	St. Dev.
WORKING CAPITAL (000 TL)	360.232	2.443.438	857	622.620	401.713	2.958.148	977	730.102
TOTAL ASSET (000 TL)	731.006	5.991.190	1.352	1.381.059	838.406	7.235.392	1.549	1.640.579
AVAILABLE SURPLUS (000 TL)	28.899	460.680	28	97.174	38.563	472.233	28	103.382
INTEREST AND PRE-TAX PROFIT (000 TL)	62.520	452.104	0	121.655	74.961	498.847	0	152.699
TOTAL MARKET VALUE (000 TL)	1.411	8.210	21	2.575	2.037	11.422	29	3.308
TOTAL ENCUMBRANCE (000 TL)	432.285	3.754.585	764	869.233	475.103	4.481.211	884	989.669
TOTAL SALES (000 TL)	896.805	11.404..912	1.756	2.420.357	933.604	11.924.836	2.104	2.547.293
T1	0.58	0.86	0.18	0.20	0.58	0.85	0.16	0.20
T2	0.03	0.13	0.00	0.03	0.04	0.23	0.00	0.05
T3	0.07	0.33	0.00	0.08	0.09	0.41	0.00	0.09
T4	0.25	1.94	0.00	0.57	0.33	2.31	0.00	0.68
Z	4.67	7.88	1.38	1.75	4.86	8.03	1.50	1.88

Appendix 2:

Table 6: The Results of the 1st and 2nd DEA Model

Panel 1 : The Results of the 1st DEA Model						Panel 2: The Results of the 2nd DEA Model					
DMU	**2010**	**2011**	**2012**	**2013**	**2014**	**DMU**	**2010**	**2011**	**2012**	**2013**	**2014**
EGEEN	24,13%	37,75%	43,10%	28,79%	52,50%	EGEEN	19,44%	24,82%	39,63%	25,20%	49,19%
FROTO	75,78%	100,00%	68,57%	41,34%	55,32%	FROTO	100,00%	100,00%	98,48%	63,97%	80,54%
OTKAR	27,14%	35,77%	27,58%	17,27%	26,13%	OTKAR	20,66%	23,66%	23,30%	15,20%	23,92%
GEREL	31,23%	36,88%	20,78%	14,95%	17,58%	GEREL	27,79%	27,04%	19,04%	13,48%	15,77%
KLMSN	37,87%	63,44%	41,42%	39,19%	44,57%	KLMSN	33,36%	43,79%	28,19%	26,12%	27,23%
VESTL	29,50%	36,30%	38,19%	18,21%	29,60%	VESTL	28,86%	25,79%	42,93%	16,06%	25,60%
ASUZU	19,97%	33,35%	26,92%	28,75%	30,94%	ASUZU	16,16%	23,50%	23,03%	22,07%	23,65%
KARSN	32,32%	52,39%	21,35%	21,87%	8,43%	KARSN	47,97%	67,77%	18,71%	20,93%	5,70%
DİTAŞ	25,50%	41,33%	34,86%	24,15%	38,89%	DİTAŞ	23,00%	34,64%	38,15%	20,56%	38,06%
TOASO	73,36%	79,71%	100,00%	100,00%	100,00%	TOASO	80,81%	62,56%	100,00%	100,00%	100,00%
KATMR	30,21%	18,18%	24,00%	8,94%	18,89%	KATMR	27,08%	9,37%	18,66%	5,08%	12,81%
SLVR	31,68%	48,45%	31,59%	27,67%	49,24%	SLVR	29,06%	37,16%	29,45%	27,31%	50,57%
EMKEL	11,72%	14,34%	11,68%	9,07%	14,12%	EMKEL	14,08%	10,07%	9,50%	6,73%	10,81%
BFREN	41,87%	35,06%	67,62%	62,31%	62,47%	BFREN	62,52%	18,26%	57,37%	49,58%	49,37%
VESBE	41,56%	43,80%	42,03%	28,68%	65,25%	VESBE	44,24%	35,47%	44,97%	28,32%	66,39%
EGGUB	24,05%	20,52%	29,47%	13,08%	20,92%	EGGUB	32,23%	27,74%	50,47%	17,22%	18,84%
AKSA	36,28%	44,22%	56,34%	39,19%	50,53%	AKSA	37,38%	35,95%	61,43%	39,33%	52,15%
ARCLK	33,62%	30,70%	36,03%	21,05%	33,30%	ARCLK	31,00%	20,43%	33,46%	18,03%	29,39%
GUBRF	19,17%	27,42%	45,16%	20,85%	31,98%	GUBRF	16,48%	17,35%	41,74%	15,94%	26,92%
BAGFS	100,00%	50,41%	32,52%	17,04%	17,32%	BAGFS	93,98%	31,45%	33,09%	15,75%	15,16%
SODA	29,34%	40,63%	32,33%	28,09%	51,52%	SODA	28,81%	29,02%	33,80%	25,38%	44,37%
PARSN	8,67%	18,87%	13,60%	6,11%	10,69%	PARSN	8,74%	15,01%	15,01%	6,28%	12,08%