INVESTIGATING THE ROLES OF LEVERAGE AND SIZE ON FIRM'S VULNERABILITY: TURKEY EVIDENCE

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ABSTRACT

This paper aims to examine the roles of leverage and size on a firm's vulnerability. Some studies defend the larger firms are more financially fragile. Considering that there are opposite views in the literature, this study tested which one is valid for Turkish manufacturing firms.

We applied panel data analysis, including Altman's Emerging Market Z Score and Merton's Distance to Default Score. We examined 116 Borsa Istanbul (BIST) firms in the manufacturing sector using their last ten-year data. We found that leverage is positively, and size is negatively correlated to the firms' vulnerability. These findings have been reached using both accounting-based and market-based measures. Unlike the studies championing larger firms are more vulnerable, our results support the vice versa. The firms with less leverage and larger are more resilient and less vulnerable.

This study's originality is the first one that uses both accounting-based and market-based measures together in Turkey. Although both measures identify firm vulnerability, each one uses different kinds of information about a firm and thus reflects different perspectives. We don't investigate which model is running best. Instead, we search if the effects of size and leverage on firm vulnerability are similar for each measure.

Whether larger firms are more vulnerable or not is an essential question for managers and regulatory agencies. The findings of the study can be used for regulatory and managerial purposes.

INTRODUCTION

Detecting the determinants of firms' failures is one of the core issues investigated widely in finance. Following early warning systems enable the firms to take necessary actions before any failure. Firms may encounter financial distress during their lives for various reasons. If these situations cannot be eliminated, many stakeholders such as shareholders, managers, financing institutions, the firms within the supply chain, state agencies may face negative results. Sometimes such results could be vital for firms. As a result, it is important to closely monitor firms' financial conditions and take necessary steps to prevent possible failures.

Generally, as firms grow, the cash inflows increase and stabilize. Firms' leverage levels are getting rise and the capital structure change in favor of debt over equity. At the maturity stages, firms have debts at their highest level (Damodaran, 2014). Since the earnings are so small

or negative in the start-up or growth stages, the effects of the tax shield would be limited. However, as the debt levels get higher for mature firms, the tax shield effects start to rise, and expected bankruptcy costs begin to decrease. The benefits of borrowing are more than its costs up to an optimum point. Exceeding that certain point exposes the firms to more bankruptcy costs. So, there would be a trade-off between the benefits and costs of debt.

Leverage is one of the variables frequently handled in the studies investigating the reasons for firms' financial distress. According to some of those studies, most firms face financial trouble when they are at their all-time peak market leverage (DeAngelo et al., 2016); high leverage is the primary cause of financial distress (Andrade & Kaplan, 1997); leverage and past excess stock returns are short-term signals of financial distress rather than long-term (Hilscher & Szilagyi, 2005); equity ratio is evaluated as an effective predictor of bankruptcy for a very long period considering its relation to the retained earnings and long-term profitability which presents especially in SMEs using little financing other than debt (Altman, 2016); the probability of bankruptcy is a decreasing function of return on assets and an increasing function of financial leverage (Zmijewski, 1984); leverage is positively related to the probability of bankruptcy (Charalambakis & Garrett, 2019); a firm's debt structure affects the way financially distressed firms restructure (Asquith et al., 1994); the level of debt is a crucial variable that effects the costs of financial distress and the composition of debt is another important determinant of the outcome of financial destress (Asquith et al., 1994); as the debt level of firms increases, the financial distress level of those firms increases (Abdioğlu, 2019); there is a positive and significant relationship between debt and financial distress (Turaboğlu et al., 2017); the use of debt by nonfinancial firms increases their level of financial distress (Muigai & Mutiso, 2018); leverage has significant positive effect to financial distress (Giarto & Fachrurruzie, 2020).

There is a tendency for firms to get larger as they mature. The assets grow, the market share and earnings increase as benefiting from economies of scale, efficiencies, know-how experiences, established distribution channels, and professionalism. Then, is there any significant difference between the larger and smaller firms in terms of vulnerability? Are the larger firms more vulnerable or more resilient?

Size is one of the most investigated variables in the studies on firms' failures. A firm's size is evaluated as strongly related to bankruptcy probability with other factors such as past stock returns and the idiosyncratic standard deviation of stock returns. Firm size is a significant predicting variable since the market equity of firms that are close to bankruptcy is typically discounted by traders (Shumway, 2001). According to the other studies, default risk is related to the size and book to market characteristics of a firm (Vassalou & Xing, 2004); up to four years horizon, bankruptcy risk has a local minimum as a function of the size, which is taken into account as logarithmic total assets (Altman et al., 2016); larger firms which have more mature business lines, higher profitability and lower volatility of profit have significantly lower firm risk (Bartram et al., 2015). Firms with higher leverage, lower profitability, lower market capitalization, lower past stock returns, lower cash holdings, higher market-book ratios, and lower prices per share are more likely to financial failure; at longer horizons, the most persistent firm characteristics, market capitalization, the market-book ratio, and equity volatility become relatively more significant (Campbell et al., 2005).

Larger firms can access finance more cheaply and diversify financing sources easier. Also, they are more stable than smaller firms (Kurshev & Strebulaev, 2006). There is a positive relationship between firm size and profitability (Rahman & Yilun, 2021). Firms with low profitability, low liquidity, and small size will have a higher probability of financial distress (Thim et al., 2011); large firms can reduce financial distress risk by using more debt (Muigai & Mutiso, 2018). According to this literature, as the firm gets larger, it becomes more resilient. In other words, there is a negative relationship between size and firm fragility.

On the other hand, there are some mixed results regarding the size effect. For example, Alfaro et al. (2019) have evaluated the size effect on a firm's fragility as time-invariant and in a negative way. They have found the larger firms are more vulnerable in their studies. In addition to that, Vassalou and Xing (2004) have concluded that the size effect is a matter only within the quintile with the highest default risk. Akpinar and Akpinar (2017) have found that leverage, size, and dividend payment increase the risk of financial distress.

In a recent study investigating the relationships of size and leverage with the fragilities of the firms in emerging markets, it was found that there is a strong relationship between firm size and firm fragility independent of time (Alfaro et al., 2019). According to this study, larger firms are more vulnerable for a given level of leverage. Additionally, it was mentioned that there is a negative relationship between leverage and firm fragility; however, this power of association changes depending on time. The firms operating in Turkey were also in the scope of that study. The finding that the relationship between size and fragility is positive and larger firms are more financially fragile, is surprising.

In this framework, we wonder if this relationship is valid, and if so, what the direction of this relationship is, from a narrower perspective. Considering that mentioned studies either focus on the firms operating in developed economies or bulk (public and private) of firms in Turkey from a cross-country perspective, this study concentrates solely on BIST firms in the manufacturing sector in Turkey. To do this, we examine the roles of both leverage and size on firms' fragility for these firms using their ten-year data and considering both accounting-based and market-based measures.

METHODOLOGY AND DATA COLLECTION

We seek to find the relationships of leverage and size with the firm fragility. To determine a firm's vulnerability, we use two different measures. One is Altman's Emerging Market Z-Score (EM Z-Score) which is an accounting-based measure. The other is Merton's Distance to Default Score (DD Score), a market-based measure. The reason why we use two different kinds of measures to evaluate a firm's vulnerability is to determine if the questioned relationships are valid for each measurement. Since the EM Z-Score depends on several ratios from financial tables, the information they reflect is generally backward-looking about a firm (Xu & Zhang, 2009).

On the other hand, the DD Score evaluates the situation of a firm based on market values. So, it uses more daily information about a firm. Although both measures are related to firm vulnerability, each one uses different kinds of information about a firm and thus reflects different

perspectives for the firm situations. Here, we don't investigate which model is running best. We want to test if the relationships of size and leverage between a firm's vulnerability are the same or different based on each measure.

For the leverage variable, we use the ratio of total liabilities to total assets for each firm. For the size variable, we use two different measures. First is the log of total assets. The other is the log of the ratio of the market value of equity to the total BIST market capitalization. So, we get two alternative results regarding with size of each regression model. Thus, we can compare the results in terms of alternative measures, which enable us to reach more comprehensive conclusions.

In this paper, we focus on BIST firms in the manufacturing sector. We gather related data from Eikon. We collect ten-year data of firms between the years 2010-2019. There are 116 manufacturing firms of which we can reach ten-year data. Thus, we have used 1160 firm-year observations in the study.

Emerging Market Z-Score

The Altman Z-score, which was firstly developed for manufacturing firms in the USA, was modified several times to address more specifically non-manufacturing firms and private firms. Altman has proposed a new version of the original Z-score, Emerging Market Z-score (EM Z-score), to capture emerging market firms' characteristics (Altman, 2005).

EM Z-score consists of four different ratios and one constant value as below:
EM Z-Score = $6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4 + 3.25$
where;

X_1 = Working Capital / Total Assets
X_2 = Retained Earnings / Total Assets
X_3 = Operating Income / Total Assets
X_4 = Book Value of Equity / Total Assets

There are two threshold values to classify the firms as safe, vulnerable, and distressful.
The firms are evaluated as *safe* if the EM Z-score is over 5.85.
The firms are evaluated as *vulnerable* if the EM Z-score is between 3.75 and 5.85.
The firms are evaluated as *distressful* if the EM Z-score is below 3.75.

The formula mentioned above is initially only one part of the calculation of the EM Z-score. There are other additional steps to reach the final score, such as adjusting bond ratings for foreign currency devaluation vulnerability, adjusting for industry, adjusting for competitive position, taking into account the special debt issue features, and comparing the sovereign spread. The formula represents the basis of the calculation, and the others represent some adjustments. Altman mentioned that anyone not having information or time for the other steps could apply the

initial first step and infer useful information (Altman, 2005). So, we have adopted this approach when calculating EM Z-score.

Since being a component of the EM Z-score, using leverage as an independent variable is potentially a multicollinearity problem. So, Alfaro et al. have offered another EM Z-score named Modified EM Z-score (MEM Z-score) (Alfaro et al., 2019). We also adopt that approach. Thus, to calculate MEM Z-score, we drop the leverage term and keep the others. In addition to that, we also use the volatility of equity's market value as another independent variable in the models.

We use the following models regarding with MEM Z-score:

$$\text{Model 1: } MEMZ_{i,t} = \alpha_i + \beta 1(Leverage_{i,t}) + \beta 2(Size1_{i,t}) + \beta 3(Volatility_{i,t}) + \beta 4(CFO_{i,t}) + \beta 5(MB_{i,t}) + \varepsilon_{i,t} \quad (1)$$

$$\text{Model 2: } MEMZ_{i,t} = \alpha_i + \beta 1(Leverage_{i,t}) + \beta 2(Size2_{i,t}) + \beta 3(Volatility_{i,t}) + \beta 4(CFO_{i,t}) + \beta 5(MB_{i,t}) + \varepsilon_{i,t} \quad (2)$$

where $MEMZ_{i,t}$ is the modified emerging market Z-score for firm i, for year t; $Leverage_{i,t}$ is the ratio of total liabilities to total assets for firm i, for year t; $Size1_{i,t}$ is the log of the total assets for firm i, for year t; $Size2_{i,t}$ is the log of the ratio of the market value of equity to total BIST cap for firm i, for year t; $Volatility_{i,t}$ is annualized standard deviation of the daily market value of firm i, for year t. Net cash flow from operations is able to indicate the financial distress of a firm (Fitzpatrick & Ogden, 2011; Koh et al., 2015), so we control for a firm's cash flow. $CFO_{i,t}$ is the ratio of net cash flow from operations divided by total assets of firm i for year t. Market to book ratio contributes explanatory power and is essential to predict failures at long horizons. Also, it captures the relative value placed on the firm's equity by stockholders and accountants (Campbell et al., 2005). So, we also use market to book ratio as control variable in the model. $MB_{i,t}$ is the ratio of market value to book value of firm i, for year t. The standard errors are clustered at the firm and year level.

Distance to Default Score

Distance to default (DD) measure stands on a solid theoretical background. According to the DD, a firm's equity is evaluated as a call option on the firm's assets (Merton, 1974). The equity holders are residuals claimants on the firm's assets after all other obligations have been met. According to the Black Scholes (1973) formula below, V_E is the market value of equity, V_A is the firm's asset value, the strike price of the call option is the book value of the firm's liabilities.

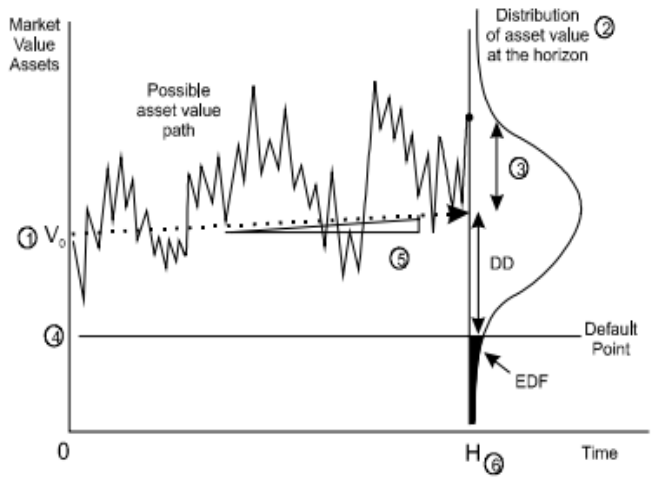
$$V_E = V_A N(d1) - Xe^{-rT} N(d2), \quad (3)$$

$$d1 = (\ln(V_A / X) + (r + 0.5\sigma^2_A)T) / (\sigma_A \sqrt{T}), \quad (4)$$

$$d2 = d1 - \sigma_A \sqrt{T}, \quad (5)$$

where r is the risk-free rate, N is the cumulative density function of the standard normal distribution.

Figure 1 Distance to Default



The numbers in Figure 1 (Crosbie & Bohn, 2003) corresponds to the meanings below:

1- The current asset value
2- The distribution of the asset value at time H
3- The volatility of the value of the future assets at time H
4- The level of the default point, the book value of the liabilities
5- The expected rate of growth in the asset value over the horizon
6- The length of the horizon, H (Crosbie & Bohn, 2003).

DD measures the distance between the current value of assets and the debt amount in terms of volatility which is the standard deviation of the growth rate of the assets. However, the market value of the assets and their volatility are not directly observed. So, an iterative procedure is applied to obtain them. We have used Löffler and Posch's (2007) approach to estimate those values.

First, we obtain the daily price of firms' stocks. Then we calculate the standard deviations of these. After that, we annualize daily standard deviations and thus reach volatility of equity. We also get the market value of equity by multiplying the number of outstanding shares with the price of shares per year. We take the time horizon as one year. We include all short-term liabilities and half of the long-term liabilities for the book value of liabilities per year. Servicing long-term debt and its interest payments consist of a part of the one-year-horizon debt. So, there is a convention of including half of the long-term debt in the literature (Crosbie & Bohn, 2003; Vassalou & Xing, 2004). We use the interest rates of bonds that mature up to one year and take the average of these rates for a specific year for the risk-free rates. We get these rates from the Central Bank of the Republic of Turkey (CBRT) website.

We calculate the asset value by summing up the market value of the equity and the book value of the liabilities as mentioned above. We calculate asset volatility by proportionate the volatility of equity volatility. Then we get another asset value and asset volatility by using the

Black-Scholes formula. In this way, we get equity value and equity volatility. Finally, we minimize the square roots of the errors by converging asset values and asset volatilities. At the end of this iteration process, the calculated d2 term in the formula above gives the distance to default for each firm.

We use the following models regarding with DD score:

$$\text{Model 3: } DD_{i,t} = \alpha_i + \beta 1(Leverage_{i,t}) + \beta 2(Size1_{i,t}) + \beta 3(Volatility_{i,t}) + \beta 4(CFO_{i,t}) + \beta 5(MB_{i,t}) + \varepsilon_{i,t} \quad (6)$$

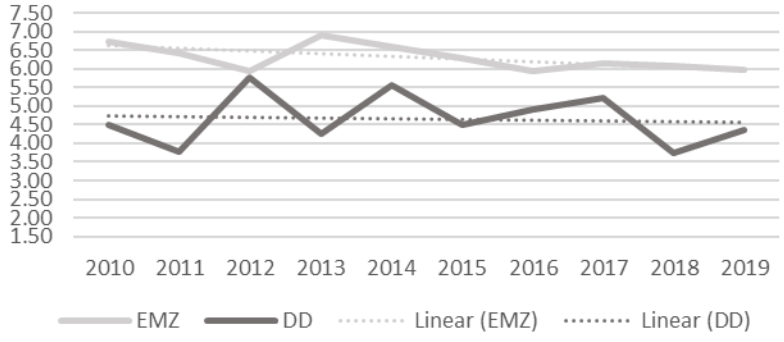
$$\text{Model 4: } DD_{i,t} = \alpha_i + \beta 1(Leverage_{i,t}) + \beta 2(Size2_{i,t}) + \beta 3(Volatility_{i,t}) + \beta 4(CFO_{i,t}) + \beta 5(MB_{i,t}) + \varepsilon_{i,t} \quad (7)$$

where, $DD_{i,t}$ is the distance to default score for firm i, for year t; $Leverage_{i,t}$ is the ratio of total liabilities to total assets for firm i, for year t; $Size1_{i,t}$ is the log of the total assets for firm i, for year t; $Size2_{i,t}$ is the log of the ratio of the market value of equity to total BIST cap for firm i, for year t; $Volatility_{i,t}$ is annualized standard deviation of daily market value for firm i, for year t. Net cash flow from operations and market to book ratio are also included as control variables in the models. The standard errors are clustered at the firm and year level.

Snapshot of the Sector

We calculate the Z-scores and DD-scores of the firms in the scope of the study. The figure below depicts the development of the average scores over the years. Both the average of EM Z-scores and the average of DD scores show a decreasing trend. We observe that firms' average fragility has slightly risen in the last decade.

Figure 2
Average EMZ Scores and DD Scores Over Time



The table below presents the change in the numbers of firms according to the zones they involve. While the number of firms in the safe zone is 70 in 2010, it decreases to 57 in 2019. For

the same period, the number of firms in the distress zone has increased from 19 to 27. We observe that more firms are having financial difficulties in 2019 compared to 2010.

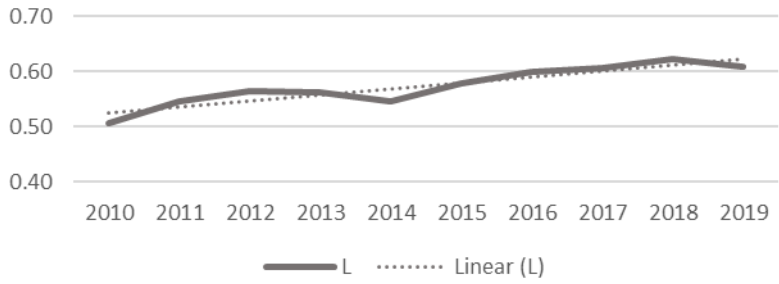
Table 1
The Numbers of Firms According to Their Vulnerability Scores (EMZ Score)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Safe Zone	70	67	67	63	61	59	53	59	64	57
Grey Zone	27	28	31	37	31	35	38	39	29	32
Distress Zone	19	21	18	16	24	22	25	18	23	27
Total Firms	116	116	116	116	116	116	116	116	116	116

Safe Zone: EMZ>5.85, Grey Zone: 3.75<EMZ<5.85, Distress Zone: EMZ<3.75

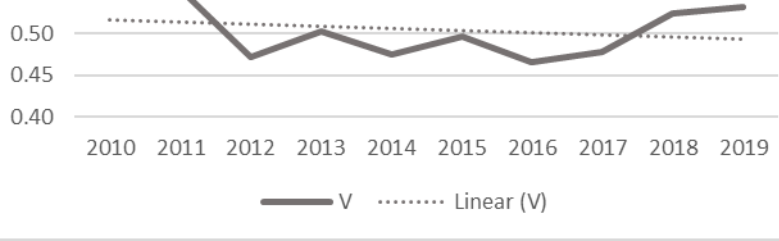
There is an upward trend of the averages of the firms' leverages. While it was about 50% in 2010, it passed slightly over 60% in 2019.

Figure 3
Average Total Liabilities to Total Assets



On the other hand, although there are some upside and downside movements in the volatility of these firms, average volatility keeps going around 50%.

Figure 4
Average Volatility Over Time



RESULTS

We calculate the Leverage, Size 1, Size 2, Volatility, CFO, MB, EM Z-scores, MEM Z-scores, DD scores for the firms in question. Table 2 puts the summary statistics.

Table 2
Summary Statistics

	Obs.	Min	Median	Mean	Max	St. Dev.
EM Z-Score	1160	-77.738	6.042	6.293	32.973	5.847
MEM Z-Score	1160	-76.809	5.128	4.710	23.251	4.721
DD Score	1160	0.113	4.080	4.653	20.075	2.431
Leverage	1160	0.036	0.549	0.574	8.665	0.478
Size 1	1160	15.837	19.676	19.878	24.740	1.613
Size 2	1160	-12.893	-7.711	-7.709	-3.223	1.731
Volatility	1160	0.113	0.384	0.505	7.050	0.669
CFO	1160	-0.970	0.050	0.063	7.516	0.247
MB	1160	0.049	0.643	0.955	10.981	1.137

Leverage: Total Liabilities / Total Assets
Size 1: Ln (Total Assets)
Size 2: Ln (Market Equity / Total BIST Market Cap)
Volatility: (St. Dev of Daily Values of Equity)*250^0.5
EM Z-Score (Emerging Market Z Score): 6.56*(Working Capital / Total Assets) + 3.26*(Retained Earnings / Total Assets) + 6.72*(Operating Income / Total Assets + 1.05*(Book Value of Equity / Total Liabilities) + 3.25
MEM Z-Score (Modified Emerging Market Z Score): The same formula of EMZ Score above, only eliminating the fourth component
CFO: Cash Flow from Operations / Total Assets
MB: Ratio of Market Value / Book Value

As mentioned in the methodology section, we use four models. The first two models are designed for the dependent variable of the MEM Z-scores, and the remaining models are designed for the dependent variable of the DD scores. Both these scores show the current positions of firms in terms of financial distress. The higher the scores, the better the situations of firms.

We seek the signs of coefficients regarding dependent variables and any heterogeneity across firms over a ten-year period. We investigate the fixed effect estimates of the relationship between size, leverage, and financial distress. Firm fixed effects and year dummies are specified in the regression. So, their estimates are constant at the firm level and year level. The control variables (volatility, cash flow from operations, market value to book value ratio) are measured at firm-year level. The regression coefficients on control variables remain constant in the sample.

We run balanced panel data regressions using fixed-effects model for each designated model. The results of the regressions are showed in Table 3. In the table, MEMZ denotes the modified emerging market Z-score; DD denotes the distance to default score. Leverage is the ratio of total liabilities to total assets. S1 is the log of total assets. S2 is the log of the ratio of the market value of equity to the total BIST market cap. V is the annualized volatility of equity's market value. CFO is cash flow from operations. MB is the ratio of market value to book value.

The coefficients of both S1 and S2 variables are positive and significant in model 1 and model 2. It suggests that the larger firms have a higher MEMZ score. According to this positive relationship between size and MEMZ score, the larger firms are more resilient. The coefficient of leverage is negative and significant for both model 1 and model 2. It shows that as the leverage of a firm gets higher, the firm becomes more financially vulnerable. Volatility is found negatively and significantly correlated with the MEMZ score for model 2. CFO has a positive and significant relationship with the MEMZ score for both models, as expected. All else equal, a higher CFO indicates that the firm is more financially resilient. While the coefficient of market value to book value ratio is significant for both models, the signs differ.

For model 3 and model 4, the relationships of S1 and S2 with DD scores are different. S2 has a positive and significant relation with financial vulnerability; the coefficient of S1 is not significant. While the sign of S2 is positive as predicted, we see that the relationship between size and financial vulnerability is sounder for MEMZ score than DD score. Leverage and volatility show a negative and significant relationship with the DD score. According to this, the firms with higher leverage and higher volatility are more financially vulnerable. The CFO and MB variables have a positive and significant relationship with the DD score, as expected. All else equal, the higher CFO and higher MB, the higher the DD score.

Table 3
Regression Results

	Model 1	Model 2	Model 3	Model 4
L	-10.722734***	-10.2550848***	-1.360100***	-1.379000***
S1	1.013433***		-0.112338	
S2		0.5495142***		0.188723.
V	0.035484	-0.0093132	-1.977827***	-1.983195***
CFO	6.953449***	6.9271261***	0.316805.	0.328405.
MB	0.140022.	-0.2107763*	0.250072**	0.189742*
F Statistic (p value)	876.641 (< 2.2e-16)	769.79 (p< 2.2e-16)	30.023 (p< 2.2e-16)	30.3652 (p< 2.2e-16)
Year Dummy	Yes	Yes	Yes	Yes
Firm Fixed Effect	Yes	Yes	Yes	Yes
Adj. R-squared	0.78625	0.76289	0.025326	0.026726
Observations	1160	1160	1160	1160
Number of Firms	116	116	116	116

DISCUSSION

Whether there is any relationship of leverage and size with fragility is an essential question for the firms. If so, the direction of the relationship is also significant for managers to follow the right way. Although there is a consensus on the presence of the relationship, different findings are on the table in terms of the direction of this relationship. To contribute to this issue, we examine 116 manufacturing firms in BIST. The originality of our study is using either accounting-based measure and market-based measure together.

Both accounting-based measure and market-based measure appoint a financial stability score to firms. However, each measure uses different kinds of information about firm. When calculating accounting-based measure, various firm characteristics such as liquidity, profitability, productivity, solvency, and sales-generating ability are included. All these data cover different aspects of a firm. So, the use of abundant information is an advantage of accounting-based measure. On the other hand, this measure tends to look backward. Contrary, market-based measure adopts a forward-looking approach. The disadvantage of this measure is oversimplified and restrictive assumptions about capital structure and the stochastic process of asset value (Xu & Zhang, 2009).

We find that leverage and volatility are negatively; size is positively related to the firm's financial resilience. We reach these results both using accounting-based measurement and market-based measurement. According to our findings, the larger firms are more resilient. Also, the firms with more debt are more vulnerable. Our results present a different picture from the studies advocating that the larger firms are more fragile.

On the other hand, the results of our study show some differences between these two measures. As size variable, total assets (S1) and the ratio of market equity to total BIST market cap (S2) are positively related with MEMZ (accounting-based measure). On the other hand, while the ratio of market equity to total BIST market cap is positively and significantly associated with DD (market-based measure), the variable of total assets is negatively related to DD, and this relation is not significant.

Although there are many similarities between firms, larger firms differ from smaller firms in some respects. As firms get larger, they can use economies of scale and minimize their costs. This maintains efficiency. Larger firms can also benefit from well-established supply chains and distribution channels. Additionally, larger firms have bigger market share, more opportunities to make a profit and abundant resources. This phenomenon is also regarded with the mature of these firms. As the firms get older, their know-how experiences and professionalism increase. So, it is expected that larger firms have more strengths to difficult conditions compared with smaller ones.

The signs of leverage variable are negative and significant for all models. On the other hand, the relation of leverage with MEMZ is sounder than DD. In terms of leverage, firms can be on one of two opposite sides, benefiting from a tax shield or exposing heavy debt costs. Firms have a tax shield when using debt. By borrowing, they can decrease the cost of capital. However, this phenomenon is valid until a certain point. The level of this threshold is different for each firm. On the other hand, it is open that firms expose severe costs if they pass beyond that level. Thus, it is not surprising that leverage has a negative effect on a firm's financial fragility.

The variable of CFO has apparent explanatory power on financial strength. This relation is positive and significant for both measures. It can be said that net cash flow from operations is able to indicate the financial distress of a firm. While the explaining power of volatility is more substantial in DD scores, there is no significant relationship between volatility and MEMZ. The signs of market value to book value are positive and significant in DD scores. However, there are mixed results in MEMZ scores.

The focus of the study is to find the relation of size and leverage with financial distress. According to the results, the larger firms are more resilient. Also, the firms with more debt are more vulnerable. These findings can be useful for managers and supervisory authorities. The vulnerability of a firm should be evaluated individually. Although the larger firms have several advantages and resources to overcome financial difficulties, they also expose to more risks because of their position in the whole economy. So, they should be supervised closely by supervisory authorities. The vulnerability stemming from leverage is another concern for the firms. The factors related with leverage such as debt ratio, maturity mismatches, interest rate risk should be closely monitored, and necessary actions should be taken proactively by the managers.

CONCLUSION

In this study, we investigate the roles of leverage and size on firms' fragility. To this purpose, we use two different measures for determining the firms' conditions. One is MEM Z-Score which is an accounting-based measure. The other is DD Score which is a market-based measure. For the right-hand side variables, we use leverage, size, and volatility. We use two alternatives for the size variable. According to our findings, the larger firms are more resilient. Leverage and volatility have a negative impact on firms' resilience.

For further studies, the scope of this study can be enlarged either by extending the time dimension and by including the other firms in different sectors or different countries.

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