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The Determinants of Capital Structure: Evidence from Turkish Panel Data

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Abstract
The aim of this study is to reveal the determinants of capital structure. In the study, the factors affecting capital structure are examined by testing 75 Turkish manufacturing firms traded on Borsa Istanbul, with 375 observations from 2010 to 2014. This study makes contribution to the empirical literature in the context of emerging economies.In this study, different levels of leverage are employed as proxies for capital structure. Using Short Term Debt, Long Term Debt and Total Debt as proxies for capital structure on panel data analysis, the significant relationship is found between independent variables used in models and capital structure. Profitability, size, growth, maturity, dividend yield, tangibility, and non debt tax shield are used as the firm's specific variables that affect a firm's capital structure decision. General evaluation suggests that the obtained results conform to trade off theory better than pecking-order theory.In addition, modified Altman's Z score is employed as proxy for bankruptcy risk. Using Altman's Z-score model as a foundation, this study explores whether financial distress affect on debt capacity or not. According to results of the study, bankruptcy risk is inversely related with capital structure. Consistent with much of the previous literature, it is found that riskier firms have lower leverage.
Keywords: Altman Z-Score, Pecking Order Theory, Trade off Theory.

1. Introduction

Rapid developments in technology and globalization push firms to operate in a heavily competitive environment and increase future risks for firms. Therefore the effective use of capital and risk management has become essential for long-term success (Akpinar and Fettahoğlu, 2015: p.1).

A firm's capital structure is the mix of financial securities used to finance its activities and asset investments. In addition to equity securities, many debt securities are used in financing a firm. Moreover, in theoretical approaches, the capital structure components are summarized as debt and equity.

Capital structure decisions are essential for a firm to maintain its operations effectively. The primary financial objective of a firm is to maximize the wealth of its shareholders. In other words, it can be stated the maximization of earnings per share or net income (Jensen & Meckling, 1976). To achieve this goal, the firm needs to create a low-cost, high-benefit financing compound.

The concept of capital structure was not a thoroughly investigated subject until Modigliani & Miller (MM) (1958) suggested their "*irrelevance theory*". Many studies have been conducted after MM and alternative theories were suggested. Still, the empirical findings from the studies are not convincing enough.

The aim of this study is to determine the factors affecting capital structure decisions. Thus, the aim is to find out the magnitude and direction of the effects of different firm-specific factors on different debt levels. Another aim is to contribute to the finance literature that contains conflicting findings.

In this study, the factors affecting capital structure is examined by testing 75 listed Turkish manufacturing firms traded on Borsa Istanbul in Turkey, with 375 observations from 2010 to 2014. Non-manufacturing firms were not included in the study since their incentives are different compared to manufacturing firms. In the models of the study, different levels of leverage were used as proxies of capital structure and independent variables were chosen on the basis of previous studies.

2. Literature Review

One of the oldest studies concerning capital structure was conducted by Durand (1952). The theory called "irrelevance theory" by MM (1958) attracted the attention of all researchers. Durand (1959) and some other researchers supported the theory. According to the perfect market assumptions of Modigliani and Miller (MM, 1958), due to procedures of investors who intend arbitrage and who have an equal right to get into the market, it is asserted that capital structure would have no effect on firm risk and value.

Theoretically, the "irrelevance theory" is based on many assumptions. However, these assumptions are not consistent with real life. In the study by MM (1963), when the initial assumptions were relaxed, they had to consider the tax-savings effect of interest expenses. In line with this adjustment, MM (1963) concluded that the leveraged firm value consisted of the non-leveraged firm value and the tax-savings effect of the leveraged firm.

In the 1970s and 1980s, new variables and various models that were thought to affect the capital structure were suggested by many researchers. Agency costs (Jensen and Meckling, 1976), income tax effect (Miller, 1977), financial distress and bankruptcy costs (Titman, 1984), information asymmetry (Myers, 1984)

can be mentioned among these. Generally speaking, "*pecking order theory*" and "*trade off theory*" are the most prevalent among the approaches investigated in the literature.

The pecking order theory was first discussed in the 1960s and was developed by Myers and Majluf (1984). This approach is based on sorting the financial resources of firms according to their importance. It suggests that the retained earnings should be evaluated first as they are the cheapest resource; and the next to be evaluated should be bond issuance since it is cheaper than equity issuance. Equity issuance, as an expensive financial resource, should be evaluated last. According to this theory, there is no optimal capital structure to maximize firm value. While using debts or equity, only the capital costs are considered. In Baskin's study (1989), it was found that the firms frequently choose internal financing instead of external financing.

In addition to interest expenses, depreciation on tangibles and intangibles are also tax deductable. DeAngelo and Masulis (1980) argue that tax deductions for depreciation and investment tax credits are substitutes for the tax benefits of debt financing. Besides, according to pecking order theory, there is a negative relationship between non-debt tax shields and leverage (Titman and Wessels, 1988).

The trade off theory claims that a firm's optimal debt ratio is determined by a trade-off between the losses and gains of borrowing, holding the firm's assets and investment plans constant. The firm substitutes debt for equity, or equity for debt until the value of the firm is maximized. The gain of debt is primarily the tax-shelter effect, which arises when paid interest on debt is deductible on the profit and loss account. (Frydenberg, 2004, p.8). According to this approach, due to the trade-offs that occur in various ways, an optimal capital structure that will maximize the firm value is possible. One of these trade-off methods is balancing the tax benefits of the debt and its financial distress effects. Additionally, Jensen and Meckling (1976) suggested that a trade-off between the benefits of the debt and the agency costs may achieve the optimal capital structure.

While some of the studies in the literature concerning capital structure emphasize the effects of capital structure on the firm performance, others, as in this study, examines the determination of the factors affecting capital structure decisions. The studies in the literature present conflicting findings.

Titman and Wessels (1988) reached conclusions supporting the "pecking order theory". Since high-profitable firms are able to find internal resource financing, they can maintain their operations through relatively lower debt ratios. Their study used short-term debts, long-term debts and total debts as independent variables. It was concluded that all the independent variables had a negative and significant effect on the return on assets.

Frank and Goyal (2003) examined the factors affecting on capital structure decisions using a sample of US firms. They concluded that the pecking order theory couldn't explain the dataset well, and that the trade off theory was better suited when generally evaluated. The most significant variables were median industry leverage (+ effect on leverage), bankruptcy risk as measured by Altman's Z-Score (-), firm size (+), dividend- paying (-), intangibles (+), market-to-book ratio (-).

Chen and Strange (2005) examined the factors determining capital structure in a sample of Chinese firms. The significant variables in their study were profitability (- effect on leverage), size (+), risk (+), age (+), ownership (-). They concluded that tax is not an effective factor on debts.

Berger and Patti (2006), in their study on US banking industry, tested the assumption that debt affects agency costs, and thus firm performance. They obtained significant correlations between the capital structure and profitability efficiency.

Margaritis and Psillaki (2010) examined the relationship between capital structures, ownership structures and firm performance in terms of the French industrial companies. In their study, they performed data enveloping analysis and have tested whether the profitable companies have lower debt ratios. They used both profitability and capital structure as dependent variables in their models.

Muzir (2011) examined firm size, capital structure and firm performance in his study. He concluded that any asset expansion financed with debt has proved to increase risk exposure especially during economic downturns, which favors the static trade off theory over the others.

Skopljak (2012) used return on equity as a dependent variable in his study. According to his findings, he concluded that the effect of capital structure on performance was not linear and caused a second-degree curved effect. Additionally, their finding indicated that at relatively low levels of leverage an increase in debt leads to increased profit efficiency, at relatively high levels of leverage increased debt leads to decreased profit efficiency.

Kakilli Acaravci (2015) has performed panel data analysis on the sample of manufacturing firms in Borsa Istanbul. That study examined the factors that were the determinants of capital structure. The factors applied in the basic model of the study were growth opportunity, size, profitability, tangibility, non-debt tax shield. Growth opportunity has effect on capital structure that this result supports the trade off theory. Size, profitability and tangibility have effects and support the pecking order theory.

3. Methodology

The aim of this study is to reveal the determinants of capital structure. In the study, the factors affecting capital

structure is examined by testing 75 listed Turkish manufacturing firms traded on Borsa Istanbul, with 375 observations from 2010 to 2014. Non-manufacturing firms were not included in the study since their incentives are different compared to manufacturing firms.

The situation often arises in financial modeling where the data comprising both time series and cross-sectional elements, and such a data set is known as "panel data" or "longitudinal data". A panel of data will embody information across both time and space. Importantly a panel keeps the same individuals or objects and measures some quantity about them over time. (Brooks, 2008: p.487).

This study included all the possible alternatives of the variables (leverage, profitability, size, growth, maturity, dividend yield, tangibility, non-debt tax shield and bankruptcy risk) and considered the most explanatory ones. The explanations for all the variables are presented in Table 1.

Table 1. Variables - Proxies

VARNAME	VARIABLES	PROXIES
(LEV1)	Leverage1	Short Term Debt / Total Assets
(LEV2)	Leverage2	Long Term Debt / Total Assets
(LEV3)	Leverage3	Total Debt / Total Assets
(ROE)	Profitability	Net Profit / Total Equity
(SIZE)	Size	Natural logarithm of Total Sales
(GROW)	Growth	(Total Assets $_t$ / Total Assets $_{t-1}$) -1
(AGE)	Maturity	Firm Age
(DIV)	Dividend Yield	Dividend per Share / Price per Share
(TANG)	Tangibility	Fixed Assets/ Total Assets
(NDTS)	Non Dept Tax Shields	Depreciation / Total Assets
(Z)	Bankruptcy Risk	Modified Altman Z-Score

The data for the variables in the models were obtained using the financial tables and audit reports of the firms taken into consideration for the study. The financial tables of the firms were accessed through the official web site of the "Public Disclosure Platform" (www.kap.gov.tr).

The different levels of leverage were used as dependent variables representing capital structure for the models composed for the study. The following models were created concordantly.

Models:

$$LEV(\text{1-2-3})_i = \alpha + \beta_1 ROE_{1it} + \beta_2 SIZE_{2it} + \beta_3 GROW_{3it} + \beta_4 AGE_{4it} + \beta_5 DIV_{5it} + \beta_6 TANG_{6it} + \beta_7 NDTS_{7it} + \beta_8 Z_{8it} + \varepsilon_i \quad (1)$$

The models tested different levels of leverage (dependent variables) as the proxies of capital structure for independent variables.

The expected signs of the independent variables in the models according to theoretical literature are presented in Table 2. The expected signs of the variables are generally organized according to the study by Frank and Goyal (2003).

Table 2. The Determinants of Capital Structure and Expected Signs

Variables	Pecking Order Theory	Trade off Theory
Profitability	-	+
Size	-	+
Growth	+/-	+
Maturity	-	+
Dividend Yield	+	-
Tangibility	-	+
Non Dept Tax Shields	-	-
Bankruptcy Risk	+/-	-

Altman's Z-Score was employed as proxy of bankruptcy risk in this study. The Altman Z-Score was developed by Edward I. Altman in 1968. Z-Score model is still a common component of many credit rating systems (Miller, W., 2009, p.4). The Z-Score is constructed from six basic accounting values and one market-based value. These seven values are combined into five ratios which are the pillars that comprise the Z-Score. The five pillars are combined using following equation to result in a firm's Z-Score.

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 1.0X_5 \quad (2)$$

Where: X_1=Working Capital/Total Assets, X_2=Retained Earnings/Total Assets, X_3= Earnings before Interest and Taxes (EBIT)/Total Assets, X_4=Market Value of Equity/Book Value of Total Liabilities, X_5= Sales/Total Assets, Z=Overall index.

Initially Altman's Z-score model was developed to predict bankruptcy risks of publicly traded listed manufacturing firms. Z-score was modified by its author in 1983 to be used for other industrial sectors such as

private manufacturing companies. The equation of the modified Z-Score with a new X_4 variable is:

$$Z' = 0.717X_1 + 0.847X_2 + 3.107X_3 + 0.420X_4' + 0.998X_5 \qquad (3)$$

I used modified Z-score in the study models, substituting the book values of equity for the market value in X_4.

4. Results

Two different estimators for the parameters of a panel data regression model as treated by Hausmann. Specifically, it is well known that both the "random effects" and the "fixed effects" panel estimators are consistent under the assumption that the model is correctly specified and that the regressors are independent of the "individual-specific effects".

It is often said that the random effects model is more appropriate when the entities in the sample can be thought of as having been randomly selected from the population, but a fixed effect model is more plausible when the entities in the sample effectively constitute the entire population (for instance, when the sample comprises all of the stocks traded on particular Exchange). However the random effects approach has a major drawback which arises from the fact that it is valid only when the composite error term is uncorrelated with all of the explanatory variables. If they are uncorrelated, a random effects approach can be used; otherwise the fixed model preferable (Brooks, 2008: p.500).

The Hausmann test was performed on the study models to determine appropriate model. The test results are presented in Table 3.

Table 3. The Results of Hausmann Test

Models	Chi-Sq. Statistic
Model 1	99.232050 (0.0000)***
Model 2	30.710332 (0.0002)***
Model 3	105.514050 (0.0000)***

***,** and * are statistical significant at %1 level, %5 level and %10 level.

The p-value for the tests are less than 1%, indicating that the random effects model is not appropriate and that the fixed effects specification is to be preferred. For all models, the panel data analysis was performed according to the fixed effect model.

Table 4. The Results of ADF Tests

Test	LEV1	LEV2	LEV3	ROE	SIZE	GRO	MAT	DIV	TANG	NDTS	Z
ADF	196.714	187.382	239.765	253.220	178.838	264.447	1381.55	200.530	186.686	274.411	216.015
	0.0114**	0.0369**	0.000***	0.000***	0.0903*	0.000***	0.000*	0.000***	0.0374**	0.000***	0.0007***

***,** and * are statistical significant at %1 level, %5 level and %10 level.

A common assumption in many time series models is that the data are stationary. A stationary process has the property that the mean, variance and autocorrelation structure do not change over time. Stationarity tests allow verifying whether a series is stationary or not. According to Augmented Dickey-Fuller test (ADF), the null hypothesis is that the series possesses a unit root and hence is not stationary. In the study, ADF unit root test was performed on the final series and it was concluded that the series were stationary. The test results are presented in Table 4.

According to Augmented Dickey-Fuller test (ADF) results, it was concluded that all of the series were stationary. The descriptive statistics of all series are shown in Table 5.

Table 5. Descriptive Statistics

Variable	LEV1	LEV2	LEV3	ROE	SIZE	GRO	MAT	DIV	TANG	NDTS	Z
Mean	0.292505	0.185470	0.421952	0.110095	20.31339	0.132238	46.06667	0.029486	0.496912	0.025096	2.581087
Median	0.267709	0.100489	0.400806	0.113968	20.14076	0.102769	45.00000	0.016430	0.506941	0.024592	2.306479
Max.	0.727472	21.08974	0.999401	0.748017	23.39685	1.180429	103.0000	0.205258	0.878585	0.087154	17.51473
Min.	0.000525	0.000343	0.024664	-0.97064	17.7928	-0.99894	13.00000	-0.07710	0.113265	2.54E-07	-0.62566
Std. Dev.	0.157179	1.087952	0.200621	0.173517	1.186247	0.198887	12.98532	0.037114	0.167918	0.020240	1.575739
Obs.	375	375	375	375	375	375	375	375	375	375	375
Cross sec	75	75	75	75	75	75	75	75	75	75	75

Panel data analysis was performed using three Models. The results obtained at the end of the analyses are presented in Table 6.

The coefficient of determinant also called R-squared shows the percentage of the effects on the dependent variables explained by the independent variables. The adjusted R-squared is considered a more effective result in terms of statistics. The adjusted R-squared values of Model 1, Model 2 and Model 3 were determined to be 72%, 83% and 93%, respectively.

Table 6. The Results of Analysis

	Dependent Variables		
	Model 1	**Model 2**	**Model 3**
Independent Var.	**Leverage1**	**Leverage2**	**Leverage3**
Constant (α)	**-6.895563***** (-3.165578)	**-14.3579***** (-5.999977)	**-5.968906***** (-7.053504)
Profitability	**-0.080281** (-0.458453)	**0.200729** (1.043442)	**0.149885**** (2.203268)
Size	**-0.150388*** (-1.940351)	**0.032542** (0.382192)	**-0.058476*** (-1.942099)
Growth	**0.473619***** (4.248402)	**0.122384** (0.999303)	**0.048438** (1.118426)
Maturity	**2.445376***** (3.7872)	**2.86077***** (4.033024)	**1.704136***** (6.793658)
Dividend Yield	**1.203902** (1.604409)	**-0.463915** (-0.56278)	**-0.398443** (-1.366839)
Tangibility	**-0.841299*** (-1.950202)	**1.533107***** (3.235023)	**0.090507** (0.540055)
Non-debt Tax Shield	**0.078974***** ;(3.823467)	**-0.044574*** (-1.9644)	**-0.011461** (-1.428307)
Bankruptcy Risk	**-0.016535** (-0.724305)	**-0.209994***** (-8.373529)	**-0.157168***** (-17.72222)
Observation	**375**	**375**	**375**
R^2	**0.785304**	**0.868583**	**0.951016**
Adjusted R^2	**0.725013**	**0.831679**	**0.937261**
F -statistics	**13.02517**	**23.53588**	**69.13640**
P-value	**0.000000**	**0.000000**	**0.000000**
Durbin Watson -statistics	**2.208296**	**1.517745**	**1.585204**

***,** and * are statistical significant at %1 level, %5 level and %10 level.

The Durbin Watson test examines the auto-correlation probability among the series. According to Table 6, neither of the models have an auto-correlation issue. Additionally, the F statistic shows the overall significance of the model. All of the models are statistically significant at the level of 1%.

According to the results obtained by applying Model 1, there are significant relationship at the level of 1% between growth, maturity, and non-debt tax shield, and leverage 1. The relationships for size and tangibility variables are significant at the level of 10%, and there is no significant relationship for profitability, dividend yield and bankruptcy risk.

According to the results of Model 2, there are significant relationships at the level of 1% between maturity, tangibility and bankruptcy risk, and leverage 2. While non-debt tax shield is significant at the level of 10%, profitability, size, growth and dividend yield are not significant.

According to the results of Model 3, there are significant relationship at the level of 1% between maturity and bankruptcy risk, and leverage 3. Profitability has positive effect at the level of %5. The relationship with size is significant at the level of 10%. And there is no significant relationship for profitability, growth, dividend yield tangibility and non-debt tax shield.

The variables providing consistent results in the models are size (- effect on leverage), growth (+), maturity (+) and bankruptcy risk (-). The results of tangibility and non-debt tax shield are not clear. Additionally dividend yield variable has no significant effect on capital structure.

Size has negative and weakly significant effect on capital structure that this result supports the pecking order theory. However; profitability, growth, maturity and bankruptcy risk have significant effects on capital structure and support trade off theory. General evaluation suggests that the obtained results conform to trade off theory better than pecking-order theory.

5. Conclusion

This study attempts to explore the determinants of capital structure of a sample of 75 listed Turkish manufacturing firms traded on Borsa Istanbul, with 375 observations from 2010 to 2014. In the models, different levels of leverage were used as proxies of capital structure. The study attempts to test the effects of as many factors as possible to the capital structure. These factors are profitability, size, growth, maturity, dividend yield, tangibility, non-debt tax shield and bankruptcy risk.

This study examines the pecking order theory and the trade off theory assumptions in a sample of

Turkish manufacturing firms. The pecking order theory emphasizes the ordering of financial resources according to their importance levels. According to this theory, there is no optimal capital structure to maximize firm value. It is thought that firms prefer to use internal financing instead of external financing. On the other hand, the trade off theory postulates the existing of an optimal capital structure, which indicates optimal choice of capital structure by firms is a balance of corporate tax shield against the bankruptcy cost and/or agency cost. This approach suggests a capital structure that will maximize the firm value.

The following conclusions were reached based on the results that were consistent in the models:
Bankruptcy risk is inversely related with capital structure. Consistent with much of the previous literature, it is found that riskier firms have lower leverage.

Under the trade off theory, mature firms should have more debt. The results of maturity have significant and positive effects upon capital structure.

As regards the coefficients of profitability are positive, it can be stated that firms with more profitable projects are inclined to use debt rather than internally generated funds. Additionally leverage is positively related to growth as measured by the change in total assets.

The sizes of Turkish firms are negatively correlated with capital structure. The results of size weakly support the pecking order theory. But, general evaluation suggests that the obtained results conform to trade off theory better than pecking order theory.

This study can be extended to cover longer time periods and larger sample sizes. In addition, future researchers can investigate the other factors affecting capital structure by different econometric models.

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