Available online at www.sciencedirect.com

Borsa İstanbul Review

Borsa İstanbul Review 19-2 (2019) 171–185

http://www.elsevier.com/journals/borsa-istanbul-review/2214-8450

Full Length Article

Factors affecting leverage during a financial crisis: Evidence from Turkey☆

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Received 1 August 2017; revised 5 July 2018; accepted 5 July 2018
Available online 9 July 2018

Abstract

The purpose of this study is to investigate the determinants of capital structure over time and the level of leverage before, during and after a financial crisis. Using a sample of publicly traded Turkish firms for the period of 1989–2012, we hypothesize and find that firm size and industry median leverage are positively and significantly associated with leverage while profitability and growth opportunities are negatively and significantly associated with leverage. Furthermore, we hypothesize and find that leverage levels are different before, during and after a financial crisis. The results are consistent using both static and dynamic models of leverage. The results suggest that managers need to adjust their leverage during and after a financial crisis to meet their need for debt and equity financing.

JEL classification: G31; G35; L2

Keywords: Leverage; FInancial crisis; Turkey; Fundamental factors

1. Introduction

Turkey has increased its integration with the world's economy particularly with Europe in recent years. Despite its benefits such as improvement in exports, employment opportunities and foreign direct investment, the open economic system makes Turkey more prone to the changes in global economy. The recent example is the impact of the 2008 global financial crisis on Turkey's economy. For example, according to Turkish Statistics Institution, in 2009 (the period immediately following the 2008 financial crisis), Turkey experienced a significant decline in export, production and construction sectors. These three sectors declined by 32.8%, 10.8% and 13.4% respectively in terms of their volume values for 2009 as compared to those in 2008 (Turkey Statistics Institute (TUIK), 2012).

During the second semester of 2008, the economic recession caused by the mortgage loan crisis in the U.S. has affected the global financial markets. Major capital market index such as Dow Jones (USA), Financial Times (UK), Nikkei (Japan), Hang Seng (Hong Kong), Straits Times (Singapore) decreased by 25.54%, 30.28%, 22.5%, 33.06%, 33.90%, respectively. Similarly, Turkey's capital market index also decreased by 54% during this period as compared to the first semester of 2008 (WordPress, 2010).

One of the consequences of the financial crisis is that companies need to adjust their capital structure[1] due to the changes in equity and debt markets. For example, during financial crisis, banks tend to have difficulties with their liquidity and their ability to lend money to their existing and potential borrowers (Berg & Kirschenmann, 2010). Hence,

☆ This paper is a revised and improved version of Yigit (2017) and has benefitted from comments and suggestions from participants at the 2015 European Accounting Association Annual Congress and the Simon Fraser University Accounting Seminar.

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Peer review under responsibility of Borsa İstanbul Anonim Şirketi.

[1] In this paper, we use capital structure and leverage interchangeably since these two terminologies are commonly used in the finance and accounting literature to refer to companies' financing decisions.

https://doi.org/10.1016/j.bir.2018.07.002

banks' lending preference tend to be shifted toward larger companies and companies with more tangible assets to serve as collateral (Stiglitz & Weiss, 1981). Furthermore, the equity market is also declined significantly during financial crisis making it more difficult for companies to issue shares particularly due to a significant decrease in companies' profitability (Council of Economic Advisers, 2011).

The purpose of this study is to investigate the determinants of capital structure over time and the level of leverage before, during and after a financial crisis. We hypothesize that the traditional determinants of leverage such as profitability, firm size, growth opportunities, tangibility, and industry median leverage will be different for different sub-periods over time. Furthermore, we hypothesize that leverage levels are different before, during and after a financial crisis. Using a sample of publicly traded Turkish firms for the period of 1989–2012, we find that the traditional determinants of leverage are different for each sub-period and leverage levels are different before, during and after a financial crisis. The results are consistent using both static and dynamic models of leverage. The results suggest that managers need to adjust their leverage during and after a financial crisis to meet their need for debt and equity financing.

The remainder of this paper is organized as follows. Section two presents the related literature as the basis for developing the hypotheses tested in this study. Section three explains the research method used in this study. Section four describes the data analyses and the results of statistical tests. The final section discusses the major findings of this study, limitations and opportunities for future research in this area.

2. Literature review and hypothesis

The topic of capital structure has attracted a significant attention in accounting and finance literature. From a theoretical perspective, researchers have proposed several major theoretical arguments to explain managers' decision on how much to borrow. Kraus and Litzenberger (1973) propose the trade-off theory and argue that in making capital structure decisions, managers make a trade-off between the tax benefits of debt and the expected cost of bankruptcy. This theory predicts that leverage has positive association with firm size, tangible assets and profitability, but has negative association with growth.

Myers and Majluf (1984) propose the pecking order theory and argue that profitable companies tend to use internal source of funding to finance profitable projects while less profitable firms tend to use debt financing since they do not have much profits and retained earnings. Hence, managers tend to follow the "pecking-order" of internal funds, debt, and equity in making capital structure decisions. This theory predicts that leverage is negatively associated with profitability.

Jensen and Meckling (1976) propose the agency theory and argue that managers who own a fraction of the firm's equity prefer debt rather than equity in order to keep their fraction of equity high and therefore motivate them to work hard to maximize the interest of the shareholders. In a similar vein, Jensen (1986) argues that debt improves the ability of the firm to monitor and discipline its entrenched managers.

Empirical evidence tends to report mixed results with respects to the predictions of the theories mentioned above. Some studies (e.g., Lemmon, Roberts, & Zender, 2008; Shyam-Sunder & Myers, 1999) find support for the prediction of the pecking-order theory. Other studies (e.g., Chirinko & Singha, 2000; Leary & Roberts, 2010) do not find support for the pecking-order theory. Frank and Goyal (2003) find partial support for the pecking order theory showing that only large firms follow the pecking-order.

Regarding the fundamental variables such as firm size, tangibility, growth opportunity and profitability, Harris and Raviv (1991) report that empirical studies tend to agree with the positive association between leverage and firm size, tangible assets, and growth opportunity, but has negative association with profitability. Interestingly, Titman and Wessels (1988) report that previous studies tend to find no association between leverage and future growth, tangible assets and volatility. Frank and Goyal (2009) argue that despite the vast theoretical arguments and abundant empirical studies, the factors that drive capital structure decisions remain vague. To increase our understanding of the important factors that affect capital structure decisions, Frank and Goyal (2009) suggest that researchers need to examine determinants of capital structure over a long period of time since institutional settings tend to change over time. For example, firms tend to increase the level of leverage due to increased pressure from the market for corporate control from debt holders. Similarly, in recent years, small firms have more opportunities to issue shares to finance their projects.

In this study, we investigate the determinants of leverage over a long period of time from 1989 to 2012. Furthermore, it is likely that the determinants of leverage change during and after a financial crisis. During a financial crisis, lenders tend to have problems with their liquidity and prefer to lend money to large companies and companies with large collateral in terms of tangible assets. Furthermore, during a financial crisis, growths tend to be limited and profitability reduced. It is therefore important to investigate the determinants of leverage during and after a financial crisis. Finally, it has been argued for the need to use a dynamic model of leverage to capture the change in firms' behaviour toward leverage decisions due to the costs associated with adjusting the level of leverage (Miglo, 2011). Hence, we use both the static and dynamic models of leverage to take into account the dynamic nature of the leverage decisions.

2.1. Hypotheses

Previous studies (e.g., Frank & Goyal, 2003; Harris & Raviv, 1991; Rajan & Zingales, 1995) have identified five fundamental variables that affect leverage: profitability, firm size, growth, tangible asset, and industry median. These fundamental variables have been shown to account for a significant variation in leverage (Frank & Goyal, 2009).

2.1.1. Leverage and profitability

The pecking-order theory predicts that profitable companies tend to use less debt financing since they are able to accumulate large amount of retained earnings. By contrast, unprofitable companies have to use external funding since they are not able to accumulate enough retained earnings. Hence, we predict that there will be a negative association between leverage and profitability. During a financial crisis, companies usually experience a significant decline in their profitability, and in turn, their retained earnings. We expect that during a financial crisis, companies are less capable of using retained earnings to finance their activities. Specifically, the following hypothesis will be tested:

H1a. *Leverage will be negatively associated with profitability*

H1b. *The negative association between leverage and profitability will be weaker during a financial crisis as compared to the periods before and after a financial crisis.*

2.1.2. Leverage and firm size

Larger firms tend to be more diversified and have lower default risk as compared to smaller firms. In addition, larger firms usually have better reputation in debt markets and therefore have lower debt costs. Hence, they are more likely to use debt financing. During a financial crisis, lenders have limited resources to provide new loans and tend to prefer larger firms with known reputation and less risk. Therefore, we predict a positive association between leverage and firm size and the association will be stronger during a financial crisis. Specifically, the following hypothesis will be tested:

H2a. *Leverage will be positively associated with firm size.*

H2b. *The positive association between leverage and firm size will be stronger during a financial crisis as compared to the periods before and after a financial crisis.*

2.1.3. Leverage and growth

Companies with high growth rate usually suffer a significant reduction in their value when they face financial distress. In addition, high growth companies tend to invest their free cash flow internally resulting in less opportunity for managers to make discretionary spending and engage in opportunistic behaviour. Hence, we predict that there will be a negative association between leverage and growth. During a financial crisis, companies usually experience low growth and therefore the association between leverage and growth will be weaker. Specifically, the following hypothesis will be tested:

H3a. *Leverage will be negatively associated with growth.*

H3b. *The negative association between leverage and growth will be weaker during a financial crisis as compared to the periods before and after a financial crisis.*

2.1.4. Leverage and tangible asset

Tangible assets usually retain their value when companies go into financial distress. Companies with more intangible assets such as technology-based companies tend to face difficulties in borrowing money from banks due to lack of collateral. During a financial crisis, the need for tangible asset to serve as collateral is even higher due to lack of lenders' liquidity. Hence, we predict a positive association between leverage and tangibility and the association will be stronger during a financial crisis. The following hypothesis will be tested:

H4a. *Leverage will be positively associated with tangible assets.*

H4b. *The positive association between leverage and tangible asset will be stronger during a financial crisis as compared to the periods before and after a financial crisis.*

2.1.5. Leverage and industry median

Previous studies (e.g., Frank & Goyal, 2009; Lemmon et al., 2008) have shown that leverage ratios vary significantly across industries. Frank and Goyal (2009) argue that companies use the average of industry leverage to make their companies' leverage decisions. We predict that there will be a positive correlation between leverage and industry median leverage. During a financial crisis, companies tend to have difficulties using retained earnings to finance their activities due to the decrease in profitability. Consequently, companies need to rely more on raising money from external sources resulting in an increase in industry median leverage. Hence, we expect that the correlation between leverage and industry median leverage will be stronger during a financial crisis. The following hypothesis will be tested:

H5a. *Leverage will be positively associated with industry median leverage.*

H5b. *The positive association between leverage and industry median leverage will be stronger during a financial crisis as compared to the periods before and after a financial crisis.*

3. Methodology

3.1. Sample selection

The sample consists of publicly traded Turkish non-financial firms for the period 1989–2012, which overlaps with two breaks in Turkish accounting system. In 1994 the accounting system was changed to Uniform Accounting System, and in 2004 inflation accounting was made compulsory. Therefore, we created sub-periods which is ended in 2004 and is begun in 2004 to avoid the problems of the accounting system change. Otherwise it would not be possible to have continuous data series for the period 1989–2012.

The data are collected from the firms' audited annual reports provided by Borsa Istanbul (BIST). The market value data are also obtained from BIST. The main advantage of using the data from audited annual reports is that the data are reliable, accurate and consistent across periods. We develop our proprietary database by compiling the sampled firms' financial statements combined with other data from various sources such as Borsa Istanbul (BIST) and Turkish Statistical Institute (TURKSTAT). We exclude financial firms and omit firm-years with a market value less than one, a leverage ratio

greater than one, a market-to-book ratio greater than ten, or missing data for any leverage determinants. We deflate the net sales (a measure of firm size) by the 1989 liras with the PPI (Producer Price Index) obtained from Turkish Statistical Institute (TURKSTAT).

Table 1 summarizes the sample selection processes. Total 115 firms listed in financial sectors were eliminated. In addition, 705 firm-year observations were eliminated due to incomplete data needed for the statistical analyses. The final sample consists of 278 firms and 3799 firm-year observations.

3.2. Research design

Following the common practice found in previous studies, we use lagged variables for the independent variables because we don't expect that the determinants will affect the dependent variable immediately. Their effects are expected at least after one year. We use the following panel regression model to test the hypotheses:

$$\begin{aligned} LEVERAGE_{it} = {} & \alpha_i + \gamma_0 + \gamma_1 PRF_{i,t-1} + \gamma_2 SIZE_{i,t-1} \\ & + \gamma_3 MTB_{i,t-1} + \gamma_4 TANG_{i,t-1} \\ & + \gamma_5 MEDIAN_{i,t-1} + year_{it} + \varepsilon_{it} \end{aligned} \quad (1)$$

$$\begin{aligned} LEVERAGE_{it} = {} & \alpha_i + \gamma_0 + \gamma_1 PRF_{i,t-1} + \gamma_2 SIZE_{i,t-1} + \gamma_3 MTB_{i,t-1} + \gamma_4 TANG_{i,t-1} + \gamma_5 MEDIAN_{i,t-1} \\ & + \gamma_6 BFCR_{it} + \gamma_7 AFCR_{it} + \gamma_8 PRF_{i,t-1} * BFCR_{it} + \gamma_9 PRF_{i,t-1} * AFCR_{it} \\ & + \gamma_{10} SIZE_{i,t-1} * BFCR_{it} + \gamma_{11} SIZE_{i,t-1} * AFCR_{it} + \gamma_{12} MTB_{i,t-1} * BFCR_{it} \\ & + \gamma_{13} MTB_{i,t-1} * AFCR_{it} + \gamma_{14} TANG_{i,t-1} * BFCR_{it} + \gamma_{15} TANG_{i,t-1} * AFCR_{it} \\ & + \gamma_{16} MEDIAN_{i,t-1} * BFCR_{it} \gamma_{17} MEDIAN_{i,t-1} * AFCR_{it} + \varepsilon_{it} \end{aligned} \quad (2)$$

Eq. (1) shows the standard capital structure equation without crisis dummy but with year dummy. Eq. (1) (without the interaction terms) estimates the main effects of profitability (PRF), firm size (SIZE), market to book (MTB), tangibility (TANG), and median of book leverage (MEDIAN) on the dependent variable (LEVERAGE). Eq. (2) (with the interaction terms) allows us to estimate the effects of *PRF, SIZE, MTB, TANG, MEDIAN, BFCR, AFCR, PRF*BFCR, PRF*AFCR, SIZE*BFCR, SIZE*AFCR, MTB*BFCR, MTB*AFCR, TANG*BFCR, TANG*AFCR, MEDIAN*BFCR, MEDIAN*AFCR* on firms' leverage (see Table 2). We predict positive coefficients on *SIZE, TANG, MEDIAN,* but negative coefficients for *PRF, MTB, PRF*BFCR, PRF*AFCR, SIZE*BFCR, SIZE*AFCR, MTB*BFCR, MTB*AFCR, TANG*BFCR, TANG*AFCR, MEDIAN*BFCR,* and *MEDIAN*AFCR*. Table 2 shows the definition of the variables used in our study. We cluster the standard errors by firm in the estimations.

3.3. Variable measurement

3.3.1. Leverage

There is lack of consensus among researchers regarding the measure of leverage. On one hand, some researchers argue that book leverage is better because debt is better supported by assets than growth opportunities and market leverage is unreliable to determine corporate leverage due to equity market fluctuations (Frank & Goyal, 2003; Myers, 1977; Shyam-Sunder & Myers, 1999). Furthermore, Graham and Harvey (2001) suggests that a large number of managers do not rebalance their capital structure with the market movements due to a significant adjustment costs. On the other hand, some scholars suggest that market leverage is better. Welch (2004), for example argues that book value of equity is a "plug number" used to balance the statement of financial position rather than a managerial tool. He further asserts that book value can even be negative although the firms' assets have positive value.

Furthermore, the literature uses different definitions for debt. Various measures of debt that have been used by previous studies include total debt, long-term debt, long term debt plus accounts payable, and financial debt (e.g., Baker & Wurgler, 2002; Fama & French, 2002; Frank & Goyal, 2009; Kayhan & Titman, 2007; Rajan & Zingales, 1995).

Given that both market leverage and book leverage have compelling reasons to determine corporate leverage, we use both measures of leverage. Similarly, we use two measures of debt namely total debt and long term debt. Therefore, the book leverage is measured by the ratio of total debt to total assets and the ratio of long term debt to total assets. The market leverage is measured by the ratio of total debt to market value (total assets minus book value of equity plus market value of equity) and the ratio of long term debt to market value (total assets minus book value of equity plus market value of equity).

3.3.2. Fundamental factors

Previous studies (e.g., Harris & Raviv, 1991; Rajan & Zingales, 1995) have identified five fundamental factors that significantly affect leverage. These factors are profitability, firm size, growth opportunities, tangibility of assets, and industry median leverage. Profitability is measured by the ratio of earnings before interest and tax to total assets. Firm size is measured by the natural logarithm of net sales deflated by the

Table 1
Sample Selection Process.

	Firm	Observations
Total number of the initial sample	398	6,084
Less: Financial firms	115	1,580
Less: Market value less than one		5
Less: Leverage ratio greater than one	1	51
Less: Market-to-book ratio greater than ten	4	622
Less: Missing data for any leverage determinants		27
Number of the final sample	278	3,799

The sample consists of publicly traded Turkish firms for the period of 1989 to 2012. The data are collected from the firms' audited annual reports provided by Borsa Istanbul (BIST).

1989 Turkish Lira Producer Price Index. Growth opportunity is measured by the ratio of market to book values. Tangibility of assets is measured by the ration of fixed assets to total assets. We use four measures of industry medians: median of book leverage by industry by year, median of long term book leverage by industry by year, median of market leverage by industry and by year and median of long term market leverage by industry by year.

4. Statistical analyses and results

4.1. Descriptive statistics and correlations

We investigate the effects of profitability, firm size, growth opportunity, tangibility, and industry medians on leverage. In addition, we are also interested in the effects of these fundamental factors on leverage over time and the effects of a financial crisis on the relation between the fundamental factors and leverage. We use before and after crisis dummies to investigate the effects of financial crises on capital structure. We expect that a financial crisis would cause changes on the relations between the fundamental factors and the level of leverage. In order to examine the effects of a financial crisis on capital structure, we separate the study into three periods according to the three financial crisis occurred in Turkey during the study period from 1989 to 2012. We analyse the time periods of 1989–1997, 1998–2004 and 2005–2012 separately to determine the effects of 1994, 2001 and 2008 financial crisis in Turkey. Our rule to separate the period is to have at least three years before and after the crisis year. We create two dummy variables for each period: before crisis and after crisis and the crisis year serves as the base year. The descriptive statistics and correlations of the variables used in this study for the entire period are presented in Tables 3 and 4.[2] Table 3, Panel A shows the raw data in thousands of Turkish Lira[3] and Panel B shows the data in ratios except for the firm size which is the logarithmic function of the deflated total sales.

[2] Because of some missing information, the data we used in the statistical analyses are unbalanced.

[3] As of September 25, 2014, the exchange rate for Turkish Lira relative to Euro is TRY 1 = Euro 0.350.

Table 3 shows that the level of leverage varies significantly across firms ranging from zero to 99 percent with an average of 20 percent for book leverage and zero to 85 percent with an average of 16 percent for market leverage. Table 4 depicts that except for firm size, all the fundamental variables are highly correlated with both book leverage and market leverage. The means of the book leverage and market leverage (including the short term and long term leverage) over the study periods are depicted graphically in Figs. 1 and 2 respectively.

Both Figs. 1 and 2 indicate that the level of leverage reach its peak in 2001 and 2008, the two years when Turkey experienced a financial crisis. In 2001, Turkey experienced a local financial crisis while in 2008 was the year of the global financial crisis which also severely affected Turkey's financial sector. It is also interesting to note that the short term leverage is almost always higher than the long term leverage. One plausible explanation for this phenomenon is that in a developing country like Turkey, the opportunity to have long term debts are quite limited.

4.2. The static model

To test the hypotheses developed in the previous section, we use panel regression models. We first examine which regression models are more suitable for each data set. We compare the classical model (pooled OLS) with both the fixed effects estimator and the random effects estimator. We use F test for fixed effects estimator and Breusch-Pagan Lagrange Multiplier (LM) test for random effects estimator to examine which test are more suitable for our data.

The null hypothesis of F test for fixed effects estimator is that all the fixed effects are zero. If the null hypothesis of the F-test is rejected, fixed effects estimator is favoured over the classical model. The results shown in Table 5 indicate that the null hypothesis that all the fixed effects are zero are rejected for all models suggesting that the fixed effects estimator is more suitable than pooled OLS to analyse our data.

The Lagrange Multiplier (LM) test helps us to decide between random effects estimator and pooled OLS estimator. The null hypothesis of LM test is that variances across entities are zero. According to the results of the LM tests, we reject the null hypothesis suggesting that the classical model (pooled OLS) is inferior to the random effects estimator.

We then run the Hausman test to decide whether the fixed effects or the random effects estimators are more suitable for our models as both fixed and random effects estimator are significant. Hausman test examines if the individual effects are uncorrelated with other regressors in the model. Random effects is preferred under the null hypothesis, while fixed effects is preferred under the alternative hypothesis. On one hand, if we could not reject the null hypothesis, both of the estimators are consistent but only random effects estimator is efficient. On the other hand, if we reject the null hypothesis, then random effects estimator is not consistent. In our analyses, we reject the null hypothesis for each model and therefore decide that fixed effects estimator is more suitable for our models.

Table 2
Definition of Variables.

Variable	Notation	Definition
Book leverage	BKL	Total debt / Total assets
Long term book leverage	LTBL	Long term debt / Total assets
Market leverage	MTL	Total debt / (Total assets - Book value of equity + Market value of equity)
Long term market leverage	LTML	Long term debt / (Total assets - Book value of equity + Market value of equity)
Profitability	PRF	Earnings before interest and tax / Total assets
Firm size	SIZE	Natural logarithm of net sales
Market to book	MTB	Total assets - Book value of equity + Market value of equity / Assets
Tangibility	TANG	Fixed assets / Total assets
BKL industry median	INDB	Median of book leverage by industry and by year using two digits industry codes
LTBL industry median	INDLTB	Median of long term book leverage by industry and by year using two digits industry codes
MTL industry median	INDM	Median of market leverage by industry and by year using two digits industry codes
LTML industry median	INDLTM	Median of long term market leverage by industry and by year using two digits industry codes
Interaction term 1	PRF*BFCR	Interaction term of profitability and before crisis dummy
Interaction term 2	PRF*AFCR	Interaction term of profitability and after crisis dummy
Interaction term 3	SIZE*BFCR	Interaction term of firm size and before crisis dummy
Interaction term 4	SIZE*AFCR	Interaction term of firm size and after crisis dummy
Interaction term 5	MTB*BFCR	Interaction term of market to book and before crisis dummy
Interaction term 6	MTB*AFCR	Interaction term of market to book and after crisis dummy
Interaction term 7	TANG*BFCR	Interaction term of tangibility and before crisis dummy
Interaction term 8	TANG*AFCR	Interaction term of tangibility and after crisis dummy
Interaction term 9	INDLTB*BFCR	Interaction term of industry median and before crisis dummy
Interaction term 10	INDLTB*AFCR	Interaction term of industry median and after crisis dummy

The table presents the definitions of variables. Total debt is the sum of long term and short term debts. Market value of equity is closing price multiplied by shares outstanding. The data of net sales is deflated by Producer Price Index (PPI). MED represents INDB, INDLTB, INDM, and INDLTM, if the leverage of the model is BKL, LTBL, MTL, LTML respectively. BFCR represents BF94, BF01, and BF08 for 1989−1997, 1998−2004, and 2005−2012 sub-periods respectively. AFCR represents AF94, AF01, and AF08 for 1989−1997, 1998−2004, and 2005−2012 sub-periods respectively.

In Table 6, we re-construct our models using the fixed effects parameter estimates with cluster-robust standard errors to control for heteroskedasticity and autocorrelation. We cluster the standard errors by firm. This procedure causes changes on the standard errors, t-values, confidence interval and F-value of the models, but it does not affect the coefficients of estimates. We also use lagged values of the predictor variables to mitigate the potential of endogeneity problems associated with

Table 3
Descriptive Statistics.

Item	Mean	Standard deviation	Minimum	Maximum
Panel 1: Financial items				
Total debt	101,600	443,104	0	8,666,994
Long term debt	58,780	317,695	0	7,800,982
Total assets	449,041	1.517,355	16	18,780,902
Fixed assets	244,939	912,463	1	14,881,141
Book value of equity	210,757	730,294	−251,321	12,875,257
Market value of equity	404,303	1.655,248	6	28,160,000
Earnings before interest and tax	41,019	188,643	−454,899	3,366,402
Net sales	490,356	1,966,424	5	47,099,089
Deflated net sales	542	1,660	0.03	30,093
Variable	**Mean**	**Standard deviation**	**Minimum**	**Maximum**
Panel 2: Variables				
Book leverage (BKL)	0.20	0.18	0	0.99
Long term book leverage (LTBL)	0.07	0.11	0	0.88
Market leverage (MTL)	0.16	0.16	0	0.85
Long term market leverage (LTML)	0.06	0.09	0	0.82
Profitability (PRF)	0.12	0.17	−2.79	1.71
Firm size (SIZE)	11.73	1.67	3.56	17.21
Market to book (MTB)	1.56	1.00	0.30	9.79
Tangibility (TANG)	0.45	0.21	0.00	0.99
BKL industry median (INDB)	0.17	0.10	0	0.60
LTBL industry median (INDLTB)	0.03	0.04	0	0.40
MTL industry median (INDM)	0.13	0.09	0	0.60
LTML industry median (INDLTM)	0.02	0.03	0	0.46

Sample includes 3799 firm-year observation from 1989 to 2012. Panel 1 consists of figures and Panel 2 consists of ratios. All figures in “thousands Turkish liras”. Market value of equity is closing price multiplied by shares outstanding.

Table 4
Correlation Matrix.

	BKL	LTBL	MTL	LTML	PRF	SIZE	MTB	TANG	INDB	INDLTB	INDM	INDLTM
BKL	1.0000											
LTBL	0.6600 [a]	1.0000										
MTL	0.8935 [a]	0.5850 [a]	1.0000									
LTML	0.6037 [a]	0.9208 [a]	0.6708 [a]	1.0000								
PRF	0.1697 [a]	−0.1711 [a]	−0.2060 [a]	−0.1870 [a]	1.0000							
SIZE	0.0159	0.0679 [a]	−0.0028	0.0364 [b]	0.1886 [a]	1.0000						
MTB	−0.1428 [a]	−0.0857 [a]	−0.3390 [a]	−0.2076 [a]	0.2454 [a]	0.0142	1.0000					
TANG	0.0459 [a]	0.2556 [a]	0.1092 [a]	0.2994 [a]	−0.3546 [a]	−0.1435 [a]	−0.1381 [a]	1.0000				
INDB	0.4146 [a]	0.1957 [a]	0.3721 [a]	0.1814 [a]	−0.0801 [a]	−0.0201	−0.0465 [a]	−0.0264	1.0000			
INDLTB	0.2276 [a]	0.2835 [a]	0.2037 [a]	0.2649 [a]	−0.1489 [a]	0.0009	-0.0227	0.1639 [a]	0.5703 [a]	1.0000		
INDM	0.3856 [a]	0.1848 [a]	0.4509 [a]	0.2393 [a]	−0.1676 [a]	−0.0497 [a]	−0.2073	0.0554 [a]	0.8376 [a]	0.4817 [a]	1.0000	
INDLTM	0.2264 [a]	0.2849 [a]	0.2546 [a]	0.3150 [a]	−0.1883 [a]	−0.0204	−0.1023 [a]	0.2046 [a]	0.5149 [a]	0.8787 [a]	0.5784 [a]	1.0000

The table presents pairwise correlations of variables. a, b, and c indicate significance at the 0.01, 0.05, and 0.10 levels respectively.

the regressions. Table 6 shows the results of this procedure. Since our analyses indicate that the fixed effects estimator is the most suitable model, we present only the results based on fixed effects procedure in Table 6. The results are presented based on the overall sample with year dummies.

In this paper, we will focus our discussions based on Book Leverage (BKL) measured as the ratio of total debt to book value of assets to define leverage. The main reason for using book leverage is that managers tend to focus on book leverage because debt is better supported by assets in place than it is by growth opportunities (Myers, 1977). Frank and Goyal (2009) also argue that book leverage is preferred over market leverage because financial markets fluctuate a great deal and managers tend to perceive that market leverage is unreliable for determining corporate financial policy. Furthermore, Graham and Harvey (2001), report that a large number of managers indicate that they do not adjust their capital structure in response to equity market movements because of the adjustment costs. However, given that there are different views in accounting and finance literature on how to define leverage, we also report the results based on alternative definitions of leverage (i.e. market leverage (MKL), long term market leverage (LTML), and long term book leverage (LTBL).

To test hypotheses H1a, H2a, H3a, H4a, and H5a, we perform the fixed effects with cluster-robust standard errors procedure for the overall sample (1989–2012). Table 6 shows that profitability (PRF) and growth opportunities (MTB) are negatively and significantly associated with leverage ($r = -0.159$, $p < 0.01$ and $r = -0.010$, $p < 0.05$, for PRF and MTB respectively). In terms of economic significance, the results indicate that a one standard deviation increase in profitability and growth opportunities lead to a 0.159 and 0.010 standard deviation decrease in book leverage. These results are consistent with hypothesis H1a and H3a. Furthermore, the results show that both firm size (SIZE) and industry median (INDB) have a positive and significant association with leverage ($r = 0.033$, $p < 0.01$ and $r = 0.304$, $p < 0.01$, for SIZE and INDB respectively). In terms of economic significance, the results indicate that a one standard deviation increase in firm size and industry median lead to a 0.033 and

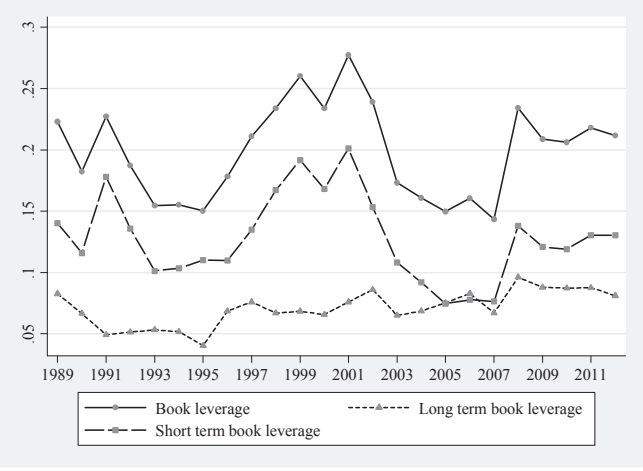

Figure 1. Book Leverage Ratios. Source: Borsa Istanbul (BIST). Book leverage is measured as the ratio of total debt to total assets. Short term book leverage is measured as the ratio of short term debt to total assets. Long term book leverage is measured as the ratio of long term debt to total assets.

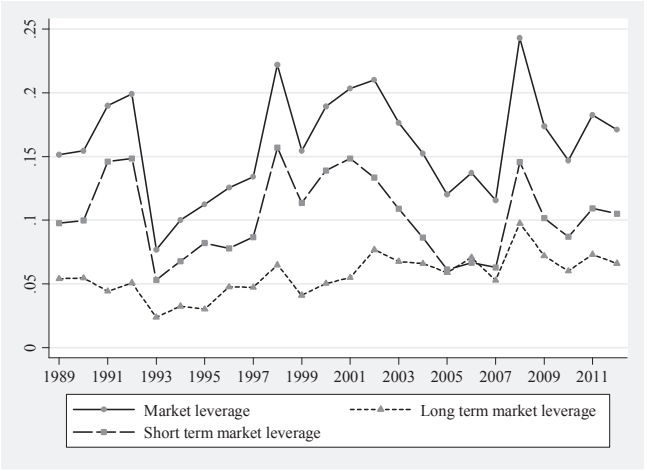

Figure 2. Market Leverage Ratios. Source: Borsa Istanbul (BIST). Market leverage is measured as the ratio of total debt to total market value (total assets minus book value of equity plus market value of equity). Short term book leverage is measured as the ratio of short term debt to total market value. Long term book leverage is measured as the ratio of long term debt to total market value.

Table 5
Estimator Selection.

	1989–2012			1989–1997			1998–2004			2005–2012		
	Pooled OLS	Fixed Effects	Random Effects	Pooled OLS	Fixed Effects	Random Effects	Pooled OLS	Fixed Effects	Random Effects	Pooled OLS	Fixed Effects	Random Effects
Panel 1: Book leverage (BKL)												
Model test	28.12 [a]	22.24 [a]	626.07 [a]	21.68 [a]	10.38 [a]	83.60 [a]	36.14 [a]	24.40 [a]	206.90 [a]	46.86 [a]	36.10 [a]	283.95 [a]
R^2	.179	.156	.153	.179	.114	.089	.181	.151	.150	.167	.154	.151
N	3498	3498	3498	705	705	705	1151	1151	1151	1642	1642	1642
Effect test		13.62 [a]	4808.81 [a]		6.89 [a]	348.08 [a]		11.58 [a]	1127.05 [a]		15.07 [a]	2070.52 [a]
Hausman test		43.65 [b]			38.91 [a]			16.62 [b]			27.49 [a]	
Panel 2: Long term book leverage (LTBL)												
Model test	16.31 [a]	6.29 [a]	227.86 [a]	10.30 [a]	11.09 [a]	80.32 [a]	9.45 [a]	3.52 [a]	24.05 [a]	35.55 [a]	6.06 [a]	80.21 [a]
R^2	.112	.050	.049	.094	.121	.118	.055	.025	.013	.132	.030	.028
N	3498	3498	3498	705	705	705	1151	1151	1151	1642	1642	1642
Effect test		9.36 [a]	2682.32 [a]		5.23 [a]	296.84 [a]		6.47 [a]	557.86 [a]		10.18 [a]	1527.93 [a]
Hausman test		23.81			12.56 [c]			45.15 [a]			26.07 [a]	
Panel 3: Market leverage (MTL)												
Model test	40.97 [a]	31.87 [a]	890.46 [a]	25.25 [a]	11.75 [a]	107.67 [a]	32.86 [a]	2.50 [b]	32.71 [a]	59.49 [a]	45.57 [a]	346.63 [a]
R^2	.241	.210	.206	.202	.127	.114	.168	.018	.010	.203	.186	.182
N	3498	3498	3498	705	705	705	1151	1151	1151	1642	1642	1642
Effect test		13.57 [a]	4607.28 [a]		4.75 [a]	186.75 [a]		12.39 [a]	989.45 [a]		13.16 [a]	1898.04 [a]
Hausman test		116.98 [a]			60.74 [a]			141.23 [a]			50.09 [a]	
Panel 4: Long term market leverage (LTML)												
Model test	21.27 [a]	11.21 [a]	356.76 [a]	20.92 [a]	18.84 [a]	150.04 [a]	13.94 [a]	4.61 [a]	42.07 [a]	38.23 [a]	8.59 [a]	95.92 [a]
R^2	.142	.085	.085	.174	.190	.186	.079	.033	.029	.141	.041	.038
N	3498	3498	3498	705	705	705	1151	1151	1151	1642	1642	1642
Effect test		10.87 [a]	3277.32 [a]		4.43 [a]	229.95 [a]		6.99 [a]	547.50 [a]		9.52 [a]	1527.91 [a]
Hausman test		−56.45			13.98 [c]			46.42 [a]			27.33 [a]	

The table presents test results of panel regression model which is given in Equation (1) for different dependent variables. Model test is result of F test for pooled OLS and fixed effects estimator, and results of Wald chi2 for random effects estimator. Reported R^2 numbers for models including fixed effects are "within" R^2 statistics. Effect test is result of F test for fixed effects estimator, and result of Breusch and Pagan LM test for random effects estimator. Year dummies which are included for 1989–2012 period and intercepts are not reported. a, b, and c indicate significance at the 0.01, 0.05, and 0.10 levels respectively.

Table 6
Results of Fixed Effects Estimator with Time Dummies.

	BKL		LTBL		MTL		LTML	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
PRF	−.159 [a]	.042	−.053 [b]	.022	−.097 [a]	.031	−.029 [c]	.017
SIZE	.033 [a]	.007	.009 [b]	.004	.032 [a]	.006	.009 [a]	.003
MTB	−.010 [b]	.005	−.005 [c]	.002	−.022 [a]	.004	−.007 [a]	.002
TANG	.024	.035	.074 [a]	.022	.041	.029	.070 [a]	.018
INDB	.304 [a]	.082						
INDLTB			.216 [a]	.106				
INDM					.340 [a]	.068		
INDLTM							.296 [a]	.086
1991	.035	.024	−.004	.011	.027	.022	−.000	.008
1992	−.004	.025	−.010	.013	.025	.023	.001	.010
1993	−.032	.026	−.014	.013	−.107 [a]	.023	−.031 [a]	.009
1994	−.022	.027	−.004	.015	−.025	.024	−.005	.011
1995	−.025	.028	−.017	.015	−.033	.024	−.012	.011
1996	−.022	.027	.004	.015	−.051 [b]	.024	−.003	.011
1997	.001	.027	.004	.014	−.048 [c]	.024	−.006	.010
1998	.002	.027	−.002	.014	.037	.026	.014	.011
1999	.002	.027	−.009	.014	−.088 [a]	.024	−.021 [b]	.010
2000	−.007	.027	−.008	.013	.011	.025	.001	.010
2001	.031	.027	−.001	.014	−.018	.024	−.005	.011
2002	−.008	.027	.014	.013	−.004	.025	.020 [c]	.011
2003	−.084 [a]	.025	−.022 [c]	.013	−.063 [b]	.025	−.002	.011
2004	−.093 [a]	.026	−.030 [b]	.014	−.090 [a]	.026	−.014	.011
2005	−.104 [a]	.026	−.030 [b]	.012	−.113 [a]	.025	−.025 [b]	.010
2006	−.085 [a]	.027	−.014	.014	−.079 [a]	.026	−.005	.011
2007	−.101 [a]	.027	−.028 [b]	.013	−.105 [a]	.025	−.024 [b]	.010
2008	−.015	.027	−.003	.014	.027	.027	.021 [c]	.012
2009	−.083 [a]	.026	−.018	.013	−.098 [a]	.025	−.015	.010
2010	−.060 [b]	.026	−.013	.013	−.085 [a]	.025	−.019 [c]	.010
2011	−.038	.026	−.006	.013	−.031	.026	.002	.011
2012	−.048 [c]	.026	−.011	.013	−.058 [b]	.025	−.005	.011
F test	13.07 [a]		3.65 [a]		16.16 [a]		5.98 [a]	
R^2	.156		.050		.210		.085	
N	3498		3498		3498		3498	

The table presents fixed effects parameter estimates and cluster-robust standard errors. The standard errors are clustered by firm. The factors are defined in Table 2 and are lagged by one year. Reported R^2 numbers are "within" R^2 statistics. Intercepts are not reported. a, b, and c indicate significance at the 0.01, 0.05, and 0.10 levels respectively.

0.304 standard deviation increase in book leverage. These results support hypotheses H2a and H5a. With respect to tangible assets, although the result indicates that the association is positive, it is not statistically significant. This result does not support hypothesis H4a. Table 6 also shows that the year dummies for the period of 2003−2012 (except 2008 and 2011), are significantly negative. The significant results indicate that the level of leverage decreases significantly as compared to the base year. It is interesting to note that tangible asset is positively and significantly associated with long term leverage types (LTBL and LTML). These results suggest that tangibility is important only for long term debts. The non-significant association between total leverage and tangible asset might be due to the fact that short term loans are dominant in Turkey as shown in Figs. 1 and 2. Another plausible interpretation of this non-significant result of tangible asset is that the share of trade credits in the total external finance is significantly higher in Turkey as compared to those of other countries because Turkey has a bank-based financial system that the share of bank loans in total liabilities seems to be higher as compare to that of other countries. Furthermore, trade credits constitute a large portion of their external finance, given that virtually no formal market finance (no corporate bond market) is available for the corporate sector in Turkey (Aydin et al., 2006; Yalcın, Culha, & Ozlu, 2005).

Another interesting finding is that the coefficient of growth opportunities for the market leverage (MTL) is two times bigger than its book leverage counterparts. This is consistent with the notion that both market leverage and growth opportunity are forward looking but book leverage is backward looking (Frank & Goyal, 2009). It is also interesting to note that the pattern of relationships between the fundamental variables and leverage are consistent across different measures of leverage.

To test hypotheses H1b, H2b, H3b, H4b, and H5b, we include the interaction terms into the fixed effect estimators. Table 7 shows the full results of the fixed effects with cluster-robust standard errors procedure with the interaction terms. Table 7 shows that the relation between PRF and leverage is not statistically significant before, during and after all the three crisis periods. These results do not support hypothesis H1b.

Table 7
Fixed Effects Estimations with Interaction Terms.

	1989–1997				1998–2004				2005–2012			
	BKL	LTBL	MTL	LTML	BKL	LTBL	MTL	LTML	BKL	LTBL	MTL	LTML
PRF	−.137 (.093)	.026 (.045)	−.112 (.086)	.016 (.035)	−.137 (.095)	−.142 [b] (.067)	−.064 (.061)	−.074 (.054)	−.033 (.022)	.009 (.016)	−.031 (.022)	.002 (.015)
SIZE	.078 [a] (.023)	.023 [c] (.013)	.035 [c] (.021)	.009 (.007)	.019 (.016)	−.001 (.010)	.017 [c] (.009)	−.006 (.009)	.019 [c] (.010)	.009 (.007)	.020 [b] (.008)	.011 [c] (.006)
MTB	−.008 (.011)	−.017 [a] (.006)	−.001 (.010)	−.009 [b] (.005)	.005 (.014)	.003 (.009)	−.013 (.008)	.003 (.006)	−.003 (.008)	−.004 (.004)	−.023 [a] (.006)	−.010 [b] (.005)
TANG	.215 [b] (.084)	.216 [a] (.063)	.117 (.073)	.128 [a] (.044)	.096 (.059)	.063 (.054)	.036 (.045)	.017 (.053)	.083 [c] (.046)	.049 (.030)	.094 [b] (.046)	.099 [a] (.032)
MED	−.055 (.163)	.532 (.543)	−.036 (.316)	.515 (.531)	.491 [a] (.139)	.080 (.260)	−.027 (.104)	.295 (.444)	.612 [a] (.145)	.489 [b] (.220)	.114 (.074)	.212 [c] (.125)
BFCR	.351 [a] (.125)	.121 [c] (.071)	.272 [b] (.134)	.083 (.061)	.041 (.111)	.071 (.059)	.008 (.084)	.047 (.048)	.060 (.067)	.046 (.057)	.051 (.073)	.111 [c] (.061)
AFCR	.174 (.106)	.129 [b] (.065)	.146 [c] (.079)	.094 [b] (.041)	.067 (.114)	.192 [a] (.069)	−.021 (.071)	.099 [c] (.057)	−.019 (.065)	−.043 (.053)	−.047 (.073)	.006 (.053)
PRF*BFCR	−.162 (.106)	−.061 (.064)	−.220 [b] (.104)	−.049 (.046)	−.064 (.098)	.070 (.061)	−.071 (.071)	.016 (.048)	−.020 (.076)	−.040 (.042)	−.010 (.057)	−.032 (.038)
PRF*AFCR	.010 (.093)	−.083 [c] (.043)	.019 (.084)	−.052 (.034)	.014 (.109)	.119 [c] (.061)	.064 (.063)	.074 (.046)	−.067 (.053)	−.064 (.042)	−.041 (.044)	−.046 (.032)
SIZE*BFCR	−.024 [b] (.010)	−.012 [b] (.006)	−.015 (.011)	−.009 [c] (.005)	.003 (.008)	−.008 [c] (.005)	.000 (.006)	−.006 (.004)	−.008 (.005)	−.005 (.004)	−.014 [a] (.006)	−.010 [b] (.005)
SIZE*AFCR	−.019 [a] (.007)	−.006 (.005)	−.014 [a] (.005)	−.005 [c] (.003)	−.007 (.008)	−.015 [a] (.005)	−.003 (.005)	−.008 [c] (.005)	.001 (.005)	.004 (.004)	−.003 (.006)	−.001 (.004)
MTB*BFCR	.003 (.012)	.020 [b] (.008)	−.005 (.011)	.011 [b] (.005)	−.016 (.014)	−.003 (.008)	.005 (.009)	.000 (.006)	−.004 (.012)	.005 (.005)	.024 [a] (.008)	.009 [c] (.005)
MTB*AFCR	.011 (.015)	−.001 (.008)	.001 (.011)	−.002 (.005)	.013 (.016)	−.006 (.010)	.025 [b] (.011)	−.006 (.007)	.003 (.007)	.006 (.004)	.019 [a] (.006)	.011 [b] (.004)
TANG*BFCR	−.118 (.085)	.000 (.050)	−.081 (.077)	.019 (.038)	.006 (.067)	.047 (.046)	.086 (.057)	.072 (.048)	−.027 (.042)	−.004 (.033)	−.049 (.045)	−.071 [c] (.035)
TANG*AFCR	−.016 (.065)	−.062 (.039)	.003 (.048)	−.030 (.025)	−.146 [b] (.063)	−.065 (.049)	−.044 (.041)	.015 (.057)	−.007 (.038)	−.021 (.025)	−.049 (.041)	−.082 [a] (.028)
MEDIAN*BFCR	.226 (.181)	−.209 (.502)	.335 (.330)	.035 (.499)	−.370 [a] (.127)	−.375 (.330)	−.332 [a] (.122)	−.629 (.505)	−.263 [b] (.124)	−.436 [c] (.239)	−.337 [c] (.178)	−.235 (.162)
MEDIAN*AFCR	.325 (.207)	−.387 (.519)	.201 (.312)	−.175 (.528)	−.180 [c] (.107)	−.253 (.227)	.040 (.082)	−.292 (.411)	−.317 [a] (.103)	−.211 (.190)	.060 (.104)	−.017 (.111)
F test	5.78 [a]	4.48 [a]	7.33 [a]	7.28 [a]	10.15 [a]	2.28 [a]	3.69 [a]	1.67 [c]	8.50 [a]	2.27 [a]	11.21 [a]	3.51 [a]
R^2	0.137	0.146	0.155	0.211	0.194	0.058	0.087	0.051	0.166	0.045	0.210	0.069
N	705	705	705	705	1151	1151	1151	1151	1642	1642	1642	1642

The table presents fixed effects parameter estimates with interaction terms and cluster-robust standard errors in parentheses. The standard errors are clustered by firm. The factors are defined in Table 2 and are lagged by one year. MEDIAN represents INDB, INDLTB, INDM, and INDLTM, if the leverage of the model is BKL, LTBL, MTL, LTML respectively. BFCR represents BF94, BF01, and BF08 for 1989–1997, 1998–2004, and 2005–2012 sub-periods respectively. AFCR represents AF94, AF01, and AF08 for 1989–1997, 1998–2004, and 2005–2012 sub-periods respectively. Reported R^2 numbers are "within" R^2 statistics. Intercepts are not reported. a, b, and c indicate significance at the 0.01, 0.05, and 0.10 levels respectively.

With respect to firm size, hypothesis H2b predicts that the positive relation between size and leverage will be stronger during the crisis. The results show that the relation between size and leverage is stronger during the crisis period. The results indicate that the coefficients are negative and significant both for before and after the 1994 crisis provide some supports for hypothesis H2b ($r = -0.024$, $p < 0.05$ and $r = -0.019$, $p < 0.01$, for the periods before and after the 1994 crisis). For the 2001 and 2008 crisis periods, the relations between size and leverage are not statistically significant. The negative coefficients of the interactions with the crisis dummy variables for the 1994 crisis indicate that the relation is weaker before and after the crisis as compared to the relation between size and leverage during the crisis period. These results provide some support to Hypothesis H2b.

Hypothesis H3b predicts that the negative relation between growth opportunity and leverage will be weaker during the crisis. The results shown in Table 7 indicate that none of the coefficients of interactions for growth opportunity are statistically significant. These results do not support H3b.

Hypothesis H4b expects that the positive relations between asset tangibility and leverage will be stronger during the crisis. The results shown in Table 7 indicate that none of the coefficients of interactions are statistically significant, except for the period after the crisis of 2001 in which the coefficient of interaction is negative and statistically significant for after the crisis period ($r = -0.146$, $p < 0.05$). This negative and significant coefficient of interaction indicates that the relation between asset tangibility and leverage is stronger during the 2001 financial crisis as compared to the period after the 2001 crisis. This result provides some support to Hypothesis H4b.

Hypothesis H5b expects that the positive relations between industry median and leverage will be stronger during the crisis periods. The results shown in Table 7 indicate that while the coefficient of interaction for the 1994 crisis are not significant, the coefficients of interactions during the 2001 and 2008 crisis periods are negative and significant ($r = -0.370$, $p < 0.01$ and $r = -0.180$, $p < 0.10$ for before and after the 2001 crisis; and $r = -0.263$, $p < 0.05$ and $r = -0.317$, $p < 0.01$ for before and after the 2008 crisis). These negative and significant coefficients of interactions support Hypothesis H5b.

4.3. Are Turkish firms moving towards a moving target?

The model we used to test the hypotheses in the previous section assumes that the target leverage is the observed leverage and target adjustment is made exactly. However, previous studies suggest that leverage could not be adjusted to the exact level. According to the target adjustment model, a vector of firm characteristics (X) determine the desired (target) level of leverage (Lev^*) and can be written as follows:

$$Lev^*_{i,t} = \beta X_{i,t-1} + \alpha_i + year_{it} \quad (3)$$

In the absence of adjustment costs, firms would maintain their target leverage. But in the real world, firms could only adjust their leverage partially due to the adjustment costs. A standard partial adjustment model can be stated formally as follows:

$$Lev_{i,t} - Lev_{i,t-1} = \lambda\left(Lev^*_{i,t} - Lev_{i,t-1}\right) + u_{i,t} \quad (4)$$

Usually a firm closes a portion of the gap (λ) between its observed and target leverage levels. Eq. (3) and Eq. (4) can be reorganized to show the model of target adjustment:

$$Lev_{i,t} = (\lambda\beta)X_{i,t-1} + (1 - \lambda)Lev_{i,t-1} + \alpha_i + year_{it} + u_{i,t} \quad (5)$$

We use this dynamic model to validate the results of our study presented in the previous section. This model, however, suffers a serious econometric bias. OLS estimator does not consider the unobserved heterogeneity. For this reason, the OLS procedure gives consistent estimations if all time-varying regressors are exogenous. Fixed effects estimator considers the unobserved heterogeneity and it allows the relation between explanatory variables and fixed effects portion (α_i) of the error term, but not with idiosyncratic portion $(\varepsilon_{i,t})$. Hence, fixed effects estimator provides consistent estimates of the coefficients of the time-varying regressors under a limited form of endogeneity of the regressors. However, including the lagged dependent variable in the dynamic model will cause a relationship between lagged dependent variable and $\varepsilon_{i,t}$ (Cameron & Trivedi, 2010).

We begin our analyses using the dynamic model with pooled OLS estimation. It is useful to decide the consistent estimator. Nickell (1981) reveals that the least squares dummy variable estimation of the dynamic model would be biased in "*large N, finite T*" because of the relationship between lagged dependent variable and error term. Previous studies which try to explain the determinants and outcomes of financial decisions have generally face the endogeneity problem. The endogeneity problem causes biased and inconsistent parameter estimates (Wintoki, Linck, & Netter, 2012). To mitigate the endogeneity problem, researchers use instrumental variables which are related with endogenous explanatory variables and aren't related with error term. Using instrumental variables produces larger standard errors than OLS estimation. Despite the larger standard errors and smaller explanatory power, estimations with instrumental variables produce more consistent parameter estimates (Wooldridge, 2006).

Pooled OLS estimation which doesn't consider unobserved heterogeneity would produce upward biased coefficient estimates because of the positive correlation between lagged dependent variable and the error term. And the fixed effects estimation which consider unobserved heterogeneity would produce downward biased estimates due to ignoring the relation between lagged dependent variable and the error term. A valid coefficient estimation of lagged dependent variable must be between these borders. Furthermore, convincing coefficient estimation should be less than one. Because the estimation of more than one means the dynamic relation is unstable. These boundaries are very useful to evaluate the results of complex estimation methods (Roodman, 2009b).

We use the generalized method of moments (GMM) procedure which is improved by Arellano and Bover (1995) and Blundell and Bond (1998). This procedure uses two different equations in levels and first differences. It is possible to classify the explanatory variables under three categories in this technique: strictly endogenous, predetermined but not exogenous and endogenous. Furthermore, one lagged values of predetermined variables and two-lagged values of endogenous variables could be used as instrumental variables.

Arellano and Bover (1995) propose the forward orthogonal deviation if there are gaps in the data. With this method, contrary to the first differencing deviation, only the last observation of each individual would be dropped. Thus the effects of missing information would be reduced. We carry out our dynamic regressions using the forward orthogonal deviations transformation, proposed by Arellano and Bover (1995). This increases efficiency because our data has some gaps.

There are two important diagnostic tests of GMM estimation: test of overidentifying restrictions and test of second order autocorrelation. The null hypothesis of overidentifying restrictions test is all instruments are valid while the null hypothesis of second order autocorrelation test is there is no second-order autocorrelation. For a valid model, we shouldn't reject both null hypothesis.

GMM techniques are widely used because of their ability to avoid the dynamic panel bias, fixed effects and endogeneity of variables. But instrument proliferation problem is very common and generally unnoticeable problem which makes the results biased. This problem would make specification tests unreliable. Tests would seem valid but they aren't really valid. Hansen J test which has a null hypothesis of all instrumental variables are jointly valid, would produce perfect p-values (Roodman, 2009a).

There are two techniques to solve the instrument proliferation problem. One of them is to restrict the lags and to use only certain lags instead of all available lags. The second solution is to combine instruments and to create smaller sets by collapsing (Roodman, 2009a).

We use the collapse option to avoid instrument proliferation. This option specifies that *xtabond2* should create one instrument for each variable and lag distance variable, rather than one for each time period. We have tried the lag restriction technique to overcome the instrument proliferation. However, in our data, using collapsed instrument set significantly increases the power of diagnostic tests. In line with many studies like Flannery and Hankins (2013), and Wintoki et al. (2012), we specify explanatory variables without time and crises dummies as predetermined, not exogenous.

Table 8 presents the results of the GMM estimations of the dynamic model. The results indicate that the signs and significances of firm specific explanatory variables are nearly the same in static model presented in the previous section. However, the magnitudes are smaller in the GMM model. The coefficients of lagged leverage is notably high in magnitude and statistically significant. The positive sign on lagged leverage suggests the presence of target leverage process. Adding the lagged leverage increases the performance of regression. For example, the regressions in the first columns, explanatory power of fixed effects estimation for dynamic model is 52.8%, while the same estimator' explanatory power for static model is only 8.5%. Past leverage appears to explain a significant portion of the variation of current leverage.

The coefficient on lagged BKL implies that firms close 36.6% (=1−0.634) of the gap between current and desired leverage within one year. At this rate, it takes approximately three years to close the gap. Adjustment speeds of LTBL, MTL and LTML are 49%, 46.3% and 53.8% respectively. In Table 8, we also report the results of the specification tests which are AR (2) second-order serial correlation tests and the Hansen J test of over-identifying restrictions. The AR (2) tests yield p-values of more than 10% which means that we cannot reject the null hypothesis of no second-order serial correlation. The results of Hansen tests also reveal J-statistics with p-values more than 10% which means that we cannot reject the null hypothesis of all instruments are valid. The results of the diagnostic tests suggest that there is no second-order correlation and all instruments are valid. Hence, the results can be interpreted accordingly. As indicated in Table 8, the results are qualitatively similar to those using the static model.

5. Conclusions, limitations, and implications for future research

This study examines the relations between fundamental variables and leverage and how a financial crisis affects the relations. Consistent with our prediction, we find that firm size and industry median are positively and significantly related to leverage. We also find that profitability and growth opportunity are negatively and significantly related to leverage. With respect to the effects of a financial crisis on the relation between the fundamental variables and leverage, we find that the positive relation between firm size and leverage are weaker for the period before and after the 1994 financial crisis. We also find that the positive relation between asset tangibility and leverage is stronger during the 2001 financial crisis as compared to the period after the 2001 financial crisis. Finally, we find that the positive relations between industry median and leverage is weaker during the periods of before and after the financial crisis of 2001 and 2008 as compared to the relations between industry median and leverage during the two crisis periods.

The results of our study regarding the direct relations between the fundamental variables and leverage are consistent with those of previous studies (e.g., Frank & Goyal, 2003; Harris & Raviv, 1991; Rajan & Zingales, 1995). Our study contributes to the literature on capital structure by investigating the relations between the fundamental variables and leverage before, during and after a financial crisis. Our study shows the relations are somewhat different during a financial crisis. These results suggest that managers need to make some adjustments to the levels of firms' leverage to meet their need for debt and equity financing.

Table 8
System GMM Estimation of Dynamic Models.

	1989−2012				1989−1997				1998−2004				2005−2012			
	BKL	LTBL	MTL	LTML	BKL	LTBL	MTL	LTML	BKL	LTBL	MTL	LTML	BKL	LTBL	MTL	LTML
BKL $_{t-1}$	.634 [a]				.573 [a]				.550 [a]				.551 [a]			
	(.030)				(.068)				(.052)				(.064)			
LTBL $_{t-1}$		.510 [a]				.577 [a]				.435 [a]				.441 [a]		
		(.042)				(.120)				(.070)				(.077)		
MTL $_{t-1}$			.537 [a]				.404 [a]				.523 [a]				.380 [a]	
			(.028)				(.051)				(.054)				(.047)	
LTML $_{t-1}$				.462 [a]				.446 [a]				.465 [a]				.350 [a]
				(.043)				(.097)				(.066)				(.063)
PRF	−.215 [a]	−.069 [a]	−.126 [a]	−.034 [a]	−.271 [a]	−.001	−.169 [a]	−.018	−.192 [a]	−.030	−.120 [a]	.002	−.253 [a]	−.092 [a]	−.136 [a]	−.044 [a]
	(.032)	(.014)	(.025)	(.013)	(.062)	(.034)	(.043)	(.025)	(.041)	(.030)	(.036)	(.025)	(.058)	(.022)	(.041)	(.017)
SIZE	.013 [a]	.006 [b]	.011 [a]	.004 [c]	.031	.011	.010	−.003	−.000	−.011	−.001	−.014 [b]	.026 [a]	.010 [b]	.021 [a]	.007 [c]
	(.003)	(.002)	(.003)	(.002)	(.020)	(.016)	(.017)	(.011)	(.007)	(.008)	(.008)	(.006)	(.006)	(.004)	(.005)	(.003)
MTB	−.001	.000	−.019 [a]	−.004 [b]	−.003	−.002	−.023 [a]	−.007 [c]	−.002	.001	−.032 [a]	−.008 [a]	−.001	.003	−.017 [a]	−.006 [a]
	(.004)	(.003)	(.004)	(.002)	(.007)	(.004)	(.007)	(.004)	(.005)	(.003)	(.007)	(.003)	(.006)	(.004)	(.006)	(.002)
TANG	.020	.058 [b]	.047 [c]	.065 [a]	.139	.252 [a]	.110 [c]	.151 [a]	.050	.053	.067	.053	−.013	.023	−.035	.038
	(.033)	(.023)	(.025)	(.021)	(.092)	(.068)	(.059)	(.045)	(.046)	(.044)	(.048)	(.039)	(.056)	(.032)	(.049)	(.030)
INDB	.433 [a]				.587 [a]				.535 [a]				.310 [a]			
	(.070)				(.122)				(.127)				(.086)			
INDLTB		.447 [a]				.537 [a]				.529 [a]				.470 [a]		
		(.114)				(.177)				(.173)				(.157)		
INDM			.394 [a]				.668 [a]				.602 [a]				.475 [a]	
			(.072)				(.090)				(.092)				(.123)	
INDLTM				.506 [a]				.622 [a]				.532 [a]				.518 [a]
				(.113)				(.130)				(.142)				(.151)
BF94					−.040 [a]	−.009	−.037 [a]	−.015 [b]								
					(.013)	(.007)	(.011)	(.006)								
AF94					−.009	.003	−.012	−.003								
					(.012)	(.008)	(.009)	(.006)								
BF01									−.016 [c]	−.004	.002	.001				
									(.009)	(.006)	(.007)	(.004)				
AF01									−.043 [a]	−.017 [b]	−.043 [a]	−.011 [c]				
									(.014)	(.008)	(.009)	(.006)				
BF08													−.029 [a]	−.009 [b]	−.048 [a]	−.016 [a]
													(.009)	(.004)	(.012)	(.004)
AF08													−.033 [a]	−.011 [b]	−.052 [a]	−.014 [b]
													(.008)	(.005)	(.009)	(.005)
Firm-years	3498	3498	3498	3498	705	705	705	705	1151	1151	1151	1151	1642	1642	1642	1642
Firms	244	244	244	244	135	135	135	135	186	186	186	186	242	242	242	242
Instrument	166	166	166	166	56	56	56	56	98	98	98	98	146	146	146	146
Half-life	1.52	1.03	1.11	.90	1.24	1.26	.76	.86	1.16	.83	1.07	.91	1.16	.85	.72	.66
AR (2)	.559	.684	2.24	.665	.910	.929	1.43	.953	−2.68	1.19	−.610	.640	1.77	−.564	.814	−.549
p-value	.58	.49	.03	.51	.36	.35	.15	.34	.01	.23	.54	.52	.08	.57	.42	.58
Hansen *J*	154	139	148	164	45.9	50.8	42.4	49.5	89.3	89.2	99	91.9	152	140	165	147
p-value	.15	.43	.24	.06	.52	.33	.66	.37	.47	.48	.22	.40	.18	.41	.05	.27

The table presents two-step system GMM parameter estimates and Windmeijer-corrected standard errors in parentheses. The standard errors are clustered by firm. The factors are defined in Table 1. Number of firms, the firm-year observations, the Hansen-*J* statistics, which is a test of the over-identifying restrictions, the Arellano-Bond test, AR (2), for second order autocorrelation in the first-differenced residuals, are provided. Leverage half-life is defined as the time (in years) that it takes a firm to adjust back to the target leverage after a one-unit shock to ε, ln(0.5) / ln(1−λ). Year dummies which are included for 1989−2012 period and intercepts are not reported. a, b, and c indicate significance at the 0.01, 0.05, and 0.10 levels respectively.

The results of this study, however, should be interpreted in light of three limitations. First, we conducted our study in Turkey, a developing country that has experienced three financial crisis in a relatively short period of time. Future studies might use data from other countries both from developing and developed countries to increase the generalizability of the results reported in our study.

Second, due to data availability at the time this study was conducted, we cannot perform several analyses that might provide useful insight in interpreting the results of our study. For example, with the enactment of the Law on Pledges of Movable Property in Commercial Transactions effective by January 1, 2017, the relation between tangibility and leverage during the period of our study might be different. Future studies might consider the relation between movable property and non-movable property separately when investigating the relation between tangible assets and leverage. Furthermore, future study might also partition their sample into permanent and non-permanent sample based on the continuity of data available for their assets similar to the method used by Lemmon et al. (2008) and Kalemli-Ozcan, Sorensen, and Yesiltas (2012).

Finally, although we use data from publicly traded companies in Turkey, previous researchers have indicated that managers in Turkey tend to avoid uncertainties and risk as compared to managers in America and Australia (House et al., 1999; Jermias & Yigit, 2013). Managers in Turkey might therefore choose the level of leverage that might be more conservative than managers in other countries. Future research might examine the robustness of our model by incorporating risk preference and other cultural dimensions in their model.

Conflict of interest

None declared.

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