# Firm Leverage and the Financial Crisis

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**Abstract.** The firm growth dynamics is an important topic since the growth performance of firms is the main source of the economic growth in countries. Generally, crises produce a sharp decline in firms' growth and this leads to a decline in both the level of employment and the income of households. This paper focuses on the role of firm leverage on the growth performance of the firm during the global financial crisis. We investigate whether the firms that experienced a large leverage increase before the global financial crisis has worse growth performance of 2007 to 2009 than the firms that didn't experience this rise. The findings suggest that the poorer sales growth performance of the firm was related to the firm leverage increase before the global financial crisis. The evidence shows that the correlation between leverage growth and the poorer sales growth performance is robust to firm-level control variables, such as size, age, fixed assets, liquid assets, inventories, profitability, export share and industry-specific factor.

**JEL Classification**: G30, G32

**Keywords**: Leverage, Growth, Global Financial Crisis, Financial Stability

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# 1. Introduction

The firm growth dynamics is an important issue since the growth performance of firms is the main source and key determinant of the economic growth. Generally, crises produce a sharp decline in firms' growth and this leads to a decline in both the level of employment and the income of households. Furthermore, as well as the structure of leverage, the level of firm leverage and change in its level may play a crucial role on the growth of the firms. More specifically, highly leveraged firms may have difficulty of new borrowing to finance their working capital or some other regular expenditure. Similarly, a sharp increase in the leverage may also dampen their performance in terms of accessing new finance or lacking good governance. Moreover, during a financial crisis, a sharp increase in the leverage may have severer impacts on the growth of firms. Most of the studies focus on the aggregate debt of the counties using aggregate data and majority of the studies are cross-country analysis. To our knowledge, there is no study exploring the impact of fast growing leverage on the growth of firm during the recent crisis. Therefore, this paper seeks to void this gap.

This paper focuses on the role of firm leverage on the growth performance of the firm during the global financial crisis. We investigate whether firms that experienced a large increase in leverage before the global financial crisis has a worse growth performance during the 2008 crisis than firms that didn't experience the increase in leverage. We show that negative impacts of the global financial crisis differ between firms with small and large increases in leverage since these different types of firms have different growth recovery rates during the period of 2007-2009.

There is a growing literature, especially after the global financial crisis, on the relation between economic crisis and high growth of leverage. King (1994) show that the countries with higher household debt ratios before 1990 to 1991 recession had more severe economic crisis by using cross-country analysis. Similarly, Glick and Lansing (2010) find evidence that the countries with lower leverage ratios had better economic performance after the global financial crises of 2008. Leamer (2007) argue that most of the U.S recessions after World War II have been related with the increase in leverage. Mendoza and Terrones (2008) claim that excessive leverage growth has increased the fragility of banking sector especially in emerging markets and this situation has been associated with economic and financial crisis. Schularick and Taylor (2012) claim that financial crisis are preceded by rapid credit growth periods. In a micro-level cross-sectional analysis, Mian and Sufi (2010) examines the relation between household leverage and economic downturns across U.S counties and they show that a sharp increase in household leverage before the global financial crisis is closely linked to the economic recession of 2007 in U.S.

Borrowing the approach by Mian and Sufi (2010), we explore how the high growth of leverage before the crisis affects the growth of firms during the crisis by using Turkish public firms' balance sheet and income statement data. We successfully apply their approach which they used to analyze the household leverage of U.S. We separate the increase in leverage years from the years of performing sales growth to overcome high potential of endogeneity problem. More specifically, we study whether the firms that experienced a large increase in their debt-to-asset ratio from 2004 to 2007 has worse sales growth performance of 2007 to 2009 than the firms that didn't experience this rise. The findings suggest that the poorer sales growth performance of the firm was related to the fast increase in firm leverage before the global financial crisis. The evidence shows that the correlation between leverage growth and the poorer sales growth

performance is robust to firm-level control variables, such as size, age, fixed assets, liquid assets, inventories, profitability, export share and industry-specific factor. Moreover, the results are robust for the manufacturing firms, non-distressed firms and less leveraged firms.

Our main contribution to the literature is that this paper is first study that explores the fast growth of firm leverage and its impact on the firm growth during the recent financial crisis. We successfully use micro-level data to explain the increase in firm leverage. On the other hand, except Mian and Sufi (2010) who uses micro-level data on household leverage, most of the studies use macro-level data.

The remainder of the paper is organized as follows. The next section presents the brief review of firm growth literature. Section 3 gives details about the dataset and the empirical methodology used. Section 4 shows the empirical results of this study and the robustness results are shown in Section 5. Section 6 concludes the paper.

## 2. Firm Growth Literature Review

Since the publication of the Gibrat's (1931) "law of proportionate effect" which argues that there is no relation between the current growth of firm and its size or past growth performance, there have been an increasing number of empirical studies about firm growth with mixed results. Hart and Prais (1956) show that firm growth is independent from its size by using British companies' data. On the other hand, Mansfield (1962) argues that there are severe departures from Gibrat's Law for small firms. Moreover, Evans (1987b), Hall (1987) and Dunne and Hughes (1994) find a negative relationship between firm's size and growth. Nelson and Winter (1982) develop a theoretical model that investigate under which circumstances firm

growth decreases with firms size. Jovanovic (1982) argue theoretically that there is an inverse relation between firm's age and growth when size is held constant. Empirically, Evans (1987a,b) and Dunne et al.(1989) show that there is a negative correlation between firm's age and growth. In a more recent study by Huynh and Petrunia (2010), it is shown that youngest firms are the fastest growers by using Canadian firms' data.

On the relation between firm's growth and financial structure and access to external financing side, Chittenden et al. (1996) find that financial structure is related to the growth of a firm when there is a lack of access to external capital market by using a sample of listed and unlisted small firms. Cooley and Quadrini (2001) study the effects of financial variables in firm growth dynamics and they argue that financial variables in the firm growth regression reduce the economic significant of age in firm's growth. Demirgüc-Kunt and Maksimovic (1998) find that an active stock market and a high score legal system are important determinants of firm growth dynamics. Levine and Zervos (1998) show that financial market development affect firm's growth indirectly through fostering economic growth.

On the correlation between leverage and firm's growth, Lang et al. (1996) find that current leverage and future growth is negatively correlated and the economic significance of this negative relation is higher that the economic significance of relation of cash flow and future growth. McConnell and Servaes (1995) find that there is a negative relation between corporate value and leverage for high-growth firms and a positive relation for low-growth firms. Aivazan et al. (2005) show that there is a negative relation between leverage and investment and this negative effect is stronger for low-growth firms by using a panel of Canadian publicly traded firms. On the other hand, Huynh and Petrunia (2010) argue that there is a positive and nonlinear

relationship between leverage and firm's growth by using listed and unlisted Canadian manufacturing firms.

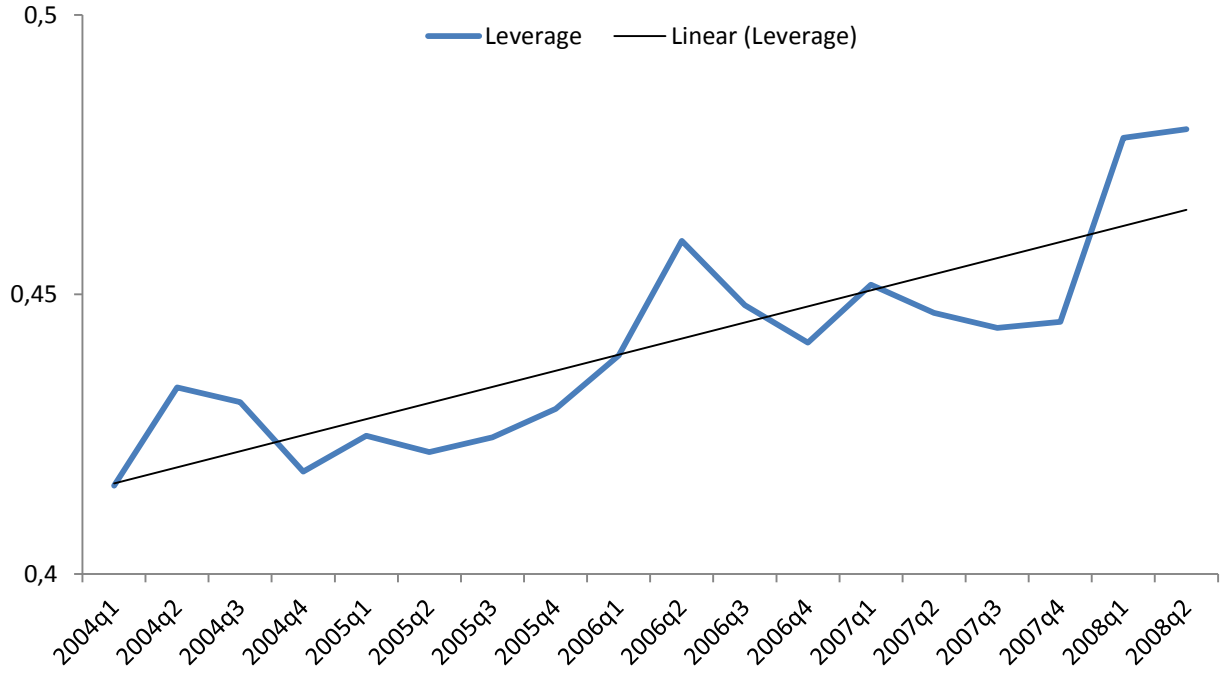
## 3. Data and Empirical Model

### 3.1 Sample Design

Our sample consists of panel data for public Turkish nonfinancial firms for the period 2003q4–2009q4 and constructed by using consolidated statements obtained from Borsa Istanbul. There are about 250 Turkish firms in our dataset. By at the end of 2012, the book value of total assets of the firms in our data set is worth of 286 billion Turkish liras(TL) and the value of total sales is 300 billion TL.

There is drastic increase in the leverage of the firms between the period of 2004 and 2007 as seen in Figure 1. Thus, we select this period to determine the high and low-leverage growth firms in order to examine their growth performance during the global financial crisis. On the other hand, investigation of growth performance period is 2007-2009 when we observe the sharp declines in the sales of the firms. We convert our panel dataset to a cross-section dataset to overcome the very possible endogeneity problem due to the huge correlation and reverse causality problem between sales growth and leverage of the firms. We follow a very similar approach of Mian and Sufi (2010) to deal with this endogeneity problem. We do not have 24 quarters of data for all firms because of entry and exit of the firms into the sample. Thus, we use all the firms that are active during that period of time. As a result, we have data of 202 of firms for our final analysis.

**Figure 1**




### 3.2 Descriptive Statistics

Table 1 presents the descriptive statistics for all of our variables. On average, sales growth has declined by 13.8 % from 2007q4 to 2009q4. There is large variation among the firms in terms of change in sales growth where the largest decrease is 67.2% and the largest increase is 47.2%. On the other hand, the average change in leverage of the firms is 2% between the period of 2004q4 and 2007q4. The sharpest increase in the leverage is 30% while the lowest change is -25% with the standard deviation of 14%. At the beginning of the period, an average firm has a leverage of 43% whereas the most leveraged one has 97% and the least leveraged one has 13% leverage. Similarly, the mean sales growth of a firm is 10.6% while the largest growth is 99.0% and the smallest growth is -28.8%. The average firm has book value of asset of 675 million TL, the largest firm has book value of asset of 12.8 billion TL and the smallest firm has 3 million TL worth of assets with the price of 2007. Similarly, an average firm is 29 years old while the oldest firm is 99 years old in 2007.

**Table 1**
**Descriptive Statistics**
This table presents the descriptive statistics for the dependent and independent variables. All numbers are reported in three decimal places.

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| **Change in sales growth, 2007q4-2009q4** | **206** | **-0.138** | **0.295** | **-0.672** | **0.472** |
| **Change in leverage, 2004q4-2007q4** | **210** | **0.021** | **0.146** | **-0.259** | **0.301** |
| Leverage, 2003q4 | 193 | 0.439 | 0.233 | 0.127 | 0.967 |
| Ln(Assets) | 234 | 14.018 | 1.556 | 9.919 | 18.297 |
| Ln(Age) | 234 | 3.394 | 0.538 | 1.179 | 4.593 |
| Fixed assets/ Assets, 2007q4 | 234 | 0.352 | 0.208 | 0.007 | 0.750 |
| Fixed assets/ Assets, 2004q4 | 210 | 0.408 | 0.205 | 0.049 | 0.729 |
| Inventories/ Assets, 2007q4 | 234 | 0.148 | 0.116 | 0.000 | 0.409 |
| Inventories/ Assets, 2004q4 | 210 | 0.149 | 0.108 | 0.002 | 0.372 |
| Liquid assets/ Assets, 2007q4 | 234 | 0.075 | 0.080 | 0.001 | 0.271 |
| Liquid assets/ Assets, 2004q4 | 210 | 0.064 | 0.074 | 0.000 | 0.249 |
| Return on assets, 2007q4 | 215 | 0.057 | 0.095 | -0.102 | 0.263 |
| Return on assets, 2004q4 | 195 | 0.031 | 0.090 | -0.167 | 0.207 |
| Gross margin, 2007q4 | 215 | 0.220 | 0.146 | 0.007 | 0.550 |
| Gross margin, 2004q4 | 194 | 0.223 | 0.131 | 0.025 | 0.512 |
| Sales/ Assets, 2007q4 | 215 | 1.031 | 0.607 | 0.164 | 2.595 |
| Sales/ Assets, 2004q4 | 195 | 1.020 | 0.562 | 0.183 | 2.393 |
| Sales/ Assets, 2004q4 | 187 | 0.106 | 0.323 | -0.288 | 0.990 |
| Exports/ Sales, 2007q4 | 214 | 0.219 | 0.237 | 0.000 | 0.759 |
| Exports/ Sales, 2004q4 | 195 | 0.176 | 0.229 | 0.000 | 0.740 |

### 3.3 Model

We model firms' sales growth as the leverage increase before the crisis and a function of numerous firm-specific variables in 2004 and 2007 by using a cross-section data framework. Specifically, we estimate the following Ordinary Least Squares (OLS) model:

$$\Delta SG_i = \beta_0 + \beta_1 \Delta Leverage_i + \sum_k \beta_k X_i + \varepsilon_i \quad (1)$$

where $\Delta SG_i$ is the change in sales growth from 2007q4-2009q4 of firm $i$. Our focus variable is $\Delta Leverage_i$ which represents the change in leverage from 2004q4-2007q4 of firm $i$. The other

control variables are represented by the vector $X_i$ which includes log of assets, log of age, fixed assets to assets ratio, inventories to assets ratio, liquid assets to assets ratio, return on assets, gross margin, total sales to assets and exports share in total sales. We also include the level of leverage for 2003q4 to control the initial level of the leverage. Finally, $\varepsilon_i$ is the error term. Our results are robust to heteroskedasticity and serial correlation. We estimate the model by winsorizing all variables at the 5% level in both tails of the distribution to check whether outliers and most extremely misrecorded data affect the results.

## 4. Results

The distinct patterns for sales growth performance of low and high-leverage-increase firms are displayed in Figure 2. The firms that experienced a large increase in their debt-to-asset ratio from 2004 to 2007 have inferior sales growth performance. By the last quarter of 2009, sales declined for firms experiencing a sharp increase in leverage by 13% compared to 2007 q4. Quite the opposite, there is an increase of sales growth by 12% compared to 2007 q4 for low-leverage-increase firms at the last quarter of 2009. In the third quarter of 2009, although sales growth declines for both low and high-leverage-increase firms, the decline is less severe for low-leverage-increase firms. The scatter plots of sales growth from 2007 to 2009 and leverage increase from 2004 to 2007 is depicted in Figure 3. It is shown that there is a significant negative relation between change in sales growth and leverage increase.

**Figure 2**

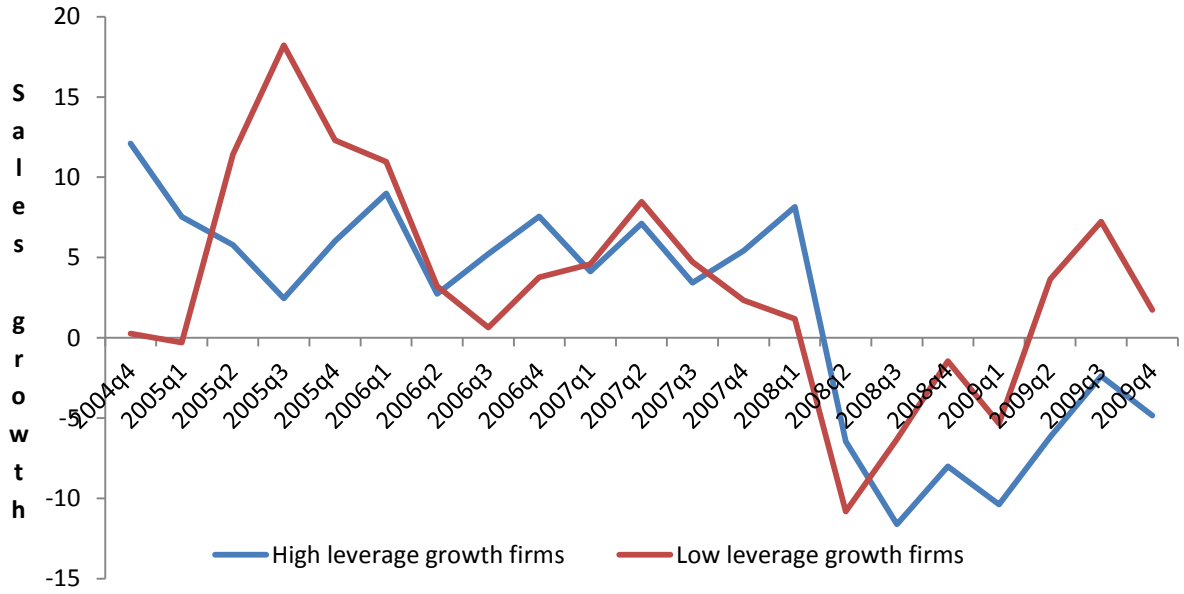
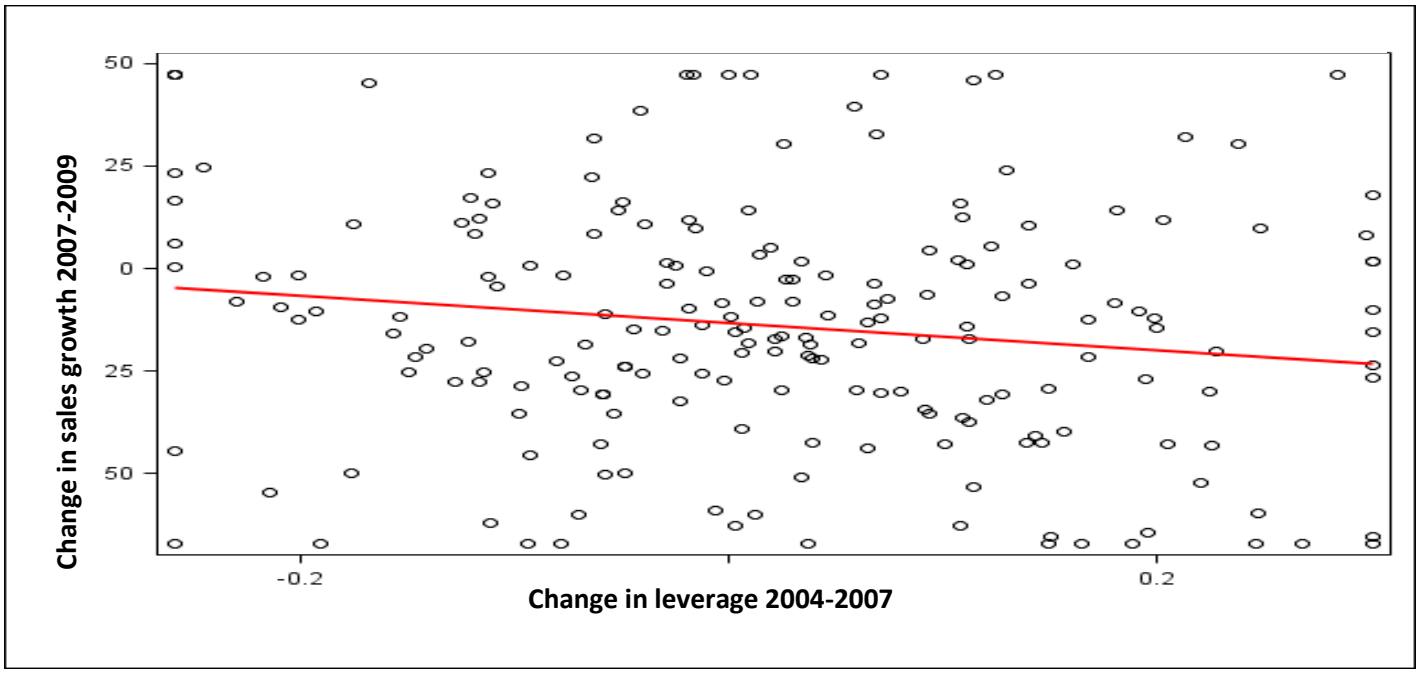



**Figure 3**




The regression results are presented in Table 2 and the negative correlation is robust to enclosure of firm-level control variables as well as industry dummies. First column present that the change of debt-to-asset ratio from 2004 to 2007 is significantly negatively correlated with the

sales growth performance of 2007 to 2009. To illustrate, a 10 percent increase in the leverage of an average firm between 2004 and 2007 will result in 15 percent decline in the sales growth between the period of 2007 and 2009. After showing that leverage growth from 2004 to 2007 has significant impact on the sales growth performance of firms in the period of 2007-2009, we test whether adding a variety of control variables improve the performance of the cross-section regression. The second through fourth column show these results. The coefficient of leverage increases with the addition of control variables. For example, when we include all the control variables and industry dummies, we find 24 percent decline in the sales growth for the same period for a 10 percent increase for an average firm.

**Table 2**

**Leverage Increase and Sales Growth Performance**

This table presents the results from the estimation of our cross-section regression equation (1): The variables are those defined in Table 1 and industry dummies; and all are reported in three decimal places. Heteroskedasticity and serial correlation robust standard errors are reported in parentheses. ***, ** and * denote significance levels at the 1%, 5%, and 10% levels, respectively.

| | Change in sales growth, 2007q4-2009q4 | | | |
|---|---|---|---|---|
| VARIABLES | (1) | (2) | (3) | (4) |
| **Change in leverage, 2004q4-2007q4** | **-33.204**** | **-41.585**** | **-52.609**** | **-54.706***** |
| | **(16.468)** | **(17.822)** | **(20.367)** | **(20.496)** |
| Leverage, 2003q4 | | | -8.349 | -10.009 |
| | | | (13.362) | (13.711) |
| Ln(Assets) | | | 1.624 | 0.321 |
| | | | (1.607) | (1.670) |
| Ln(Age) | | | 1.092 | 5.582 |
| | | | (5.975) | (6.282) |
| Fixed assets/ Assets, 2007q4 | | | -19.184 | -18.882 |
| | | | (24.915) | (24.444) |
| Fixed assets/ Assets, 2004q4 | | | -5.482 | -4.046 |
| | | | (23.345) | (23.433) |
| Inventories/ Assets, 2007q4 | | | -1.326 | 2.158 |
| | | | (43.930) | (42.095) |
| Inventories/ Assets, 2004q4 | | | -28.252 | -18.651 |
| | | | (45.383) | (44.699) |

| | | | | |
|---|---|---|---|---|
| Liquid assets/ Assets, 2007q4 | | | -57.120 | -58.660 |
| | | | (38.021) | (38.248) |
| Liquid assets/ Assets, 2004q4 | | | 39.169 | 35.783 |
| | | | (40.538) | (38.633) |
| Return on assets, 2007q4 | | | -6.475 | 14.614 |
| | | | (40.459) | (44.448) |
| Return on assets, 2004q4 | | | -91.727** | -102.343** |
| | | | (41.653) | (43.803) |
| Gross margin, 2007q4 | | | -28.545 | -40.435 |
| | | | (37.881) | (41.658) |
| Gross margin, 2004q4 | | | 17.194 | 26.428 |
| | | | (39.536) | (42.650) |
| Sales/ Assets, 2007q4 | | | -16.736** | -17.424** |
| | | | (7.027) | (6.968) |
| Sales/ Assets, 2004q4 | | | 5.976 | 4.769 |
| | | | (7.872) | (8.362) |
| Changes in sales growth, 2004q4 | | | -0.036 | 0.009 |
| | | | (0.087) | (0.090) |
| Exports/ Sales, 2007q4 | | | 1.432 | 11.082 |
| | | | (14.052) | (13.906) |
| Exports/ Sales, 2004q4 | | | 6.741 | 2.675 |
| | | | (14.170) | (13.549) |
| Industry dummies | no | yes | no | yes |
| Constant | -13.182*** | 12.904** | -5.307 | 17.163 |
| | (2.096) | (5.329) | (34.571) | (28.052) |
| Observations | 202 | 202 | 183 | 183 |
| R-squared | 0.025 | 0.073 | 0.169 | 0.219 |
| Adj. R-squared | 0.020 | 0.020 | 0.070 | 0.080 |

## 5. Robustness

We perform a number of checks to confirm that our results are robust. First, we restrict our analysis only for manufacturing firms to see whether our results hold. We want to test how increase in the leverage affects the real sector since real sector is the main determinant of the economic growth in Turkey. Table 3 presents the regression results for only manufacturing firms

and we find consistent results of the negative correlation between leverage increase and change in sales growth.

**Table 3**

**Robustness of Sample Results for only Manufacturing Firms**

This table presents the results from the estimation of only manufacturing firms. The variables are the same as those defined in Table and all are reported in three decimal places. Heteroskedasticity and serial correlation robust standard errors are reported in parentheses. ***, ** and * denote significance levels at the 1%, 5%, and 10% levels, respectively.

| | Change in sales growth, 2007q4-2009q4 | |
|---|---|---|
| VARIABLES | (1) | (2) |
| **Change in leverage, 2004q4-2007q4** | **-30.465*** | **-50.595***** |
| | **(17.862)** | **(18.702)** |
| Leverage, 2003q4 | | -24.012* |
| | | (12.638) |
| Ln(Assets) | | 1.071 |
| | | (1.483) |
| Ln(Age) | | -2.571 |
| | | (6.052) |
| Fixed assets/ Assets, 2007q4 | | 29.610 |
| | | (24.972) |
| Fixed assets/ Assets, 2004q4 | | -30.527 |
| | | (20.981) |
| Inventories/ Assets, 2007q4 | | 5.408 |
| | | (38.649) |
| Inventories/ Assets, 2004q4 | | -3.804 |
| | | (39.337) |
| Liquid assets/ Assets, 2007q4 | | -49.131 |
| | | (38.083) |
| Liquid assets/ Assets, 2004q4 | | 34.915 |
| | | (33.167) |
| Return on assets, 2007q4 | | -43.936 |
| | | (41.649) |
| Return on assets, 2004q4 | | -100.684** |
| | | (43.072) |
| Gross margin, 2007q4 | | 9.800 |
| | | (39.764) |
| Gross margin, 2004q4 | | 27.727 |
| | | (41.395) |
| Sales/ Assets, 2007q4 | | -23.988*** |
| | | (6.045) |

| | | |
|---|---|---|
| Sales/ Assets, 2004q4 | | 18.410** |
| | | (7.848) |
| Changes in sales growth, 2004q4 | | -0.032 |
| | | (0.084) |
| Exports/ Sales, 2007q4 | | 6.690 |
| | | (13.226) |
| Exports/ Sales, 2004q4 | | 5.137 |
| | | (10.914) |
| Constant | -14.824*** | -6.151 |
| | (2.131) | (32.112) |
| Observations | 164 | 153 |
| R-squared | 0.023 | 0.316 |
| Adj. R-squared | 0.020 | 0.220 |

Second, we perform the same analysis excluding the distressed firms which have negative profit and sales growth in 2007. We investigate this scenario since the distressed firms may drive our results due to their poor performance during the financial crisis. By doing so, we overcome some structural problems and the problems related with the poor management of those firms. However, we find that our result are robust that that there is a significant negative relation between change in sales growth and leverage increase. Lastly, we also exclude the most leveraged firms right before the crisis since their high level of leverage might cause their poor performance during the crisis. For this analysis, we exclude the most leveraged quintile of the firms, thus we perform the analysis for remaining 155 firms. We still obtain consistent robust results. This results show that there is a very strong negative correlation between leverage increase and change in sales growth. These results are provided in Table 4.

**Table 4**

**Robustness of Sample Results for Non-distressed Firms and Less Leveraged Firms**

This table presents the results from the estimation of only non-distressed firms and less leveraged firms. The results are reported in three decimal places. Heteroskedasticity and serial correlation robust standard errors are reported in parentheses. ***, ** and * denote significance levels at the 1%, 5%, and 10% levels, respectively.

| | Change in sales growth, 2007q4-2009q4 | | | |
|---|---|---|---|---|
| | Non-distressed | | Less Leveraged | |
| VARIABLES | (1) | (2) | (3) | (4) |
| **Change in leverage, 2004q4-2007q4** | **-40.967**** | **-48.889***** | **-39.460*** | **-48.649**** |
| | **(19.009)** | **(18.933)** | **(22.905)** | **(25.063)** |
| Industry dummies | no | yes | no | yes |
| Constant | -22.656*** | 7.518 | -14.111*** | 8.351 |
| | (2.530) | (7.298) | (2.440) | (7.266) |
| Observations | 96 | 96 | 155 | 155 |
| R-squared | 0.048 | 0.279 | 0.026 | 0.103 |
| Adj. R-squared | 0.040 | 0.190 | 0.020 | 0.040 |

## 6. Conclusion

Understanding the firm growth dynamics is crucial since economic fluctuations depend heavily on them. This paper focuses on the role of firm leverage on the growth performance of the firm during the global financial crisis. We investigate whether the firms that experienced a large leverage increase before the global financial crisis has worse growth performance during the 2008 crisis than the firms that didn't experience this rise. We show that the harmful effects of the global financial crisis differ between firms with small and large leverage increases since these different types of firms have different growth recovery rates in the period of 2007-2009. The evidence shows that the correlation between leverage growth and the poorer sales growth performance is robust to firm-level control variables as well as industry dummies.

It is worthwhile to understand the firm leverage and fast change in its level as well as the structure of the leverage. Fast growth of the firm leverage might deepen the crisis and increase the severity of the crisis. Moreover, fast growth of the firm leverage might give some clues about an upcoming crisis.

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