Impacts of the Subprime Crisis on the Leverage of Construction and Construction-Related Firms

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Abstract

The purpose of this paper is to investigate how negative economic conditions brought upon by the subprime crisis affected the leverage of publicly held construction and construction-related companies. Using the Case-Shiller Home Price Composite-20 Index as the main measure of the state of the economy, I find that the changes in home prices that resulted from the subprime crisis do have a statistically and economically significant impact on leverage. However, these changes in leverage are not caused as much by a firm changing its debt levels drastically as they are by a firm failing to adjust its debt levels to changing assets. Because each firm is unique, there may be firm-specific characters that cause different firms’ leverage ratios to change differently. When controlling for firm-specific characters, I find that changing home prices have similar effects on leverage. When analyzing the differences between different types of construction firms, I find that the construction-related firms are the ones that are most affected by the subprime crisis and changing home prices.
1. Introduction and Subprime Crisis Background

How firms choose their capital structure plays a big role in how successful they are. However, it has not been easy for economists to determine the optimal capital structure for a firm. In a perfect Modigliani Miller world with no frictions, such as taxes and costs of financial distress, the capital structure of a firm does not affect the value of the firm. There are no advantages or disadvantages to using either debt or equity. However, in the real world, frictions do exist, so the leverage ratio that a firm chooses matters and, if not chosen correctly, can lead to a loss of value. Economists have developed many theories about how firms choose their leverage ratios and identified many factors that help explain how firms arrive at their optimal capital structure. One such factor is the state of the economy. In theory, when there is a negative economic shock to an industry, firms in that industry should choose to reduce their leverage. However, if a firm fails to adequately change its debt levels, leverage may actually increase due a drop in assets caused by the poor state of the economy. This study of the subprime crisis tests to see the type of impact that a shock to the economy has on leverage.

One of the biggest negative economic shocks in the recent years has been the subprime crisis. It resulted from the rapidly growing house prices, low interest rates, and relaxed government standards in the past few years that led to an increase in the amount of subprime mortgages, which are loans that do not meet the government sponsored housing enterprises’ “conforming” criteria. In fact, almost half the loans made in 2006 were subprime loans. Unlike the conforming loans that contain severe requirements for borrowers, these subprime loans were made to people with poor credit or unstable income
and could not show proof that they were able to pay off the loan (Kiff and Mills pp 6). However, due to rising home prices, lenders thought that people who may have trouble paying off their monthly mortgage could always sell their houses or refinance them in order to pay back their whole loan since the houses would be worth more than the original mortgage after a few months. Thus, lenders were more willing to lend to anyone who wanted to buy a house. Recent housing data showed that the increase in the supply of loans led to $83 billion of additional home purchase loans in 2005 (Mian and Sufi 32). Banks who made these loans then securitized them by selling them off to investors as mortgage backed securities (MBSs). MBSs are bonds “whose payments are based on the payments of a collection of individual mortgages” (Rosen 1). These bonds would be sliced into different tranches with different levels of risk and sold to a variety of investors. The securitization process actually added to the problem of an increase in subprime loans. Because banks earned money through charging a securitization fee, the desire to earn more money motivated them to increase the quantity of loans made. At the same time, a strong demand by investors for high yield bonds also attributed to the growth in subprime loans (Kiff and Mills 7). As more subprime loans were made, the proportion of MBSs backed by subprime loans increased. Meanwhile, rating agencies rated these bonds like any other. Since the majority of the bonds, around 80 percent, were in the top tranches, they received AAA ratings. Many high-grade bond investors, such as pension funds, bought these bonds just as they would with any other AAA rated bonds (Kiff and Mills 5). These investors also thought that as long as housing prices kept rising, default risk was not a problem. Further adding to the problem was that some investors resecuritized these MBSs by packing them together and selling them off to
other investors as collateralized debt obligations (CDOs) and structured investment vehicles (SIVs) since these financial instructions spread the risky subprime mortgages to more investors (Rosen 3-4).

However, starting in 2005, home prices stopped rising and interest rates started climbing back up. Many people were then unable to pay their mortgages, even if they sold their homes, because home prices had stopped rising and actually started falling. Default rates began to rise, increasing by over 50% from the fourth quarter of 2005 to the second quarter of 2007. As a result, many of the MBSs began defaulting as well, which in turn led to CDOs and SIVs defaulting. The market value of these securities fell greatly, with some of the tranches losing up to 70 to 80% of their values (Mian and Sufi 1). Investors then realized that the bonds they bought were rated incorrectly. The AAA rated MBSs were nowhere nearly as safe as other AAA rated bonds because even the highest-rated, least risky tranches experienced default, and yields on these AAA rated MBSs had been much higher than yields on other AAA rated bonds. Eventually, rating agencies began downgrading the MBSs, causing the prices of these securities to decline, which in turn led to turmoil in the financial sector (DiMartino and Duca 3, 5-6). In addition to affecting the financial sector, the decline in housing prices also influenced other parts of the economy, especially the construction industry, just as much. The instability caused in financial markets led to an increase in interest rates on mortgages. Higher interest rates combined with falling home prices reduced the demand for houses. This housing slowdown then, in turn, caused the residential construction industry to falter because with the excess supply of homes for sale at lower prices and expected lower future demand, no one wanted to build new ones. In the third quarter of 2006, the decline
in residential construction alone caused the growth of real GDP to experience a 1.3 percentage point drop. Single-family permits fell by 52 percent from their peak in September 2005 (DiMartino and Duca 6-7).

Although the subprime crisis had a huge impact on residential construction, it should not affect all construction companies similarly. There are vast differences across the construction industry. The types of firms in the construction industry include a variety of different builders and contractors as well as companies that produce construction supplies and equipment. Because the subprime crisis originated in the residential real estate market before spreading to the rest of the economy, its effects should be felt the strongest by the residential construction firms. In the past, different types of construction firms reacted differently to a bad economy. Based on data from the 1990-1991 recession, although unemployment rose across the entire industry due to the recession, different types of construction firms dealt with unemployment differently. The firms characterized as special trade contractors suffered losses in employment just like everyone else, but were able to recover the fastest following the recession due to increased spending on homes throughout the country and on renovations of existing homes following the recession. The employment rates of these companies grew at rates faster than the national job market. Meanwhile, general contractors lost more jobs during the recession and recovered at a slower rate than the specialized trade contractors since they were only involved with new construction and not renovation. General contractor job rates grew at only half the rate of the total nonfarm economy. A third group, the heavy construction firms, had not fully recovered from the 1980-1982 recession, so it suffered additional unemployment from the 1990-1991 recession. These firms were
unable to recover on their own, but required the government to undertake heavy-construction jobs in order to boost growth and did not finally recover until 1999 since they primarily dealt with infrastructure construction such as roads and waterways, which are sometimes subsidized by the government since they are public goods. From these past data, it can be seen that different types of construction firms dealt with and reacted to the 1990-1991 recession differently, which may indicate that different types of construction firms might react differently to the subprime crisis (Hatch and Clinton 7). Also, every firm has its own firm-specific factors that affect performance. Thus, even when the entire industry is impacted by a negative economic shock, not all firms within that industry will be affected in the same manner.

2. Literature Review

Other than causing unemployment, a recession can and should also cause a firm to change the way it is financed. Because of the poor economic conditions that have resulted from the subprime crisis, construction firms may need to find a new optimal capital structure. However, finding the optimal capital structure is not simple. Many different factors play a role in how firms choose their capital structure. While in a perfect Modigliani Miller world, the capital structure of a firm does not matter, in the real world, the leverage ratio that a firm chooses does matter and plays a role in how well the firm operates. There are two hypotheses that help explain how much debt a firm chooses to carry and why.

- The Static Tradeoff Hypothesis says that a firm’s optimal leverage ratio is determined by a tradeoff between the costs and benefits of issuing debt. On the up side, increasing the amount of debt increases the interest tax shield benefit,
which increases the value of a firm. On the down side, more debt means a greater risk of financial distress, which decreases the value of a firm. Thus, the firm’s value is maximized at the optimal point along this tradeoff (Myers 577).

- The Pecking Order Theory states that firms prefer to finance all their projects internally above all other methods. When required to depend on external financing, firms will first issue the safest type of securities, starting with bonds and then resorting to equity as a last resort. Thus, the firm’s leverage ratio depends on how much external financing it requires (Myers 581).

These two theories alone do not fully explain why firms have the leverage ratios that they do. They provide a basic understanding of how firms arrive at their current level of debt, but many other factors also play a role. These factors include: transaction costs, recent stock movements, intangible assets (liquidity), risk, and the state of the economy.

- Transaction costs help explain why firms may have more debt than expected. When issuing new equity, firms are required to pay transaction costs. Thus, when a highly levered firm is faced with higher transaction costs compared to costs of financial distress, it will not issue new equity right away to help buy back some of the debt (Myers 585). New equity will only be issued when the cost of financial distress is greater than the transaction cost of issuing new equity.

- Recent stock movements affect whether a firm is more likely to issue debt or equity because firms will be more reluctant to issue equity when stock prices have been falling and more willing to issue equity when stock prices have been rising.
However, firms would prefer to sell more shares of their company when stock prices have risen only if the value of the firm did not rise by more than the stock price. This factor violates both hypotheses presented because if the stock price of a firm rises, the firm’s leverage ratio falls. Thus, to achieve its optimal leverage ratio, the firm should issue debt but will instead issue equity. Also, pecking order is violated because when stock prices rise, firms will prefer to issue equity over debt (Myers 586).

- Firms holding more valuable intangible assets and growth opportunities will tend to borrow less because these firms are more illiquid so their expected cost of financial distress increases. Firms that spend more in advertising and R&D will borrow less, and firms that have higher capital expenditures will borrow more (Myers 586).

- Risky firms will borrow less with all other things being equal. Risky firms have higher probabilities of financial distress so they also have a higher expected cost of financial distress. A simple way to lower this expected cost is to reduce the cost of financial distress by issuing less debt (Myer 588).

- The state of the economy plays a role because during good economic times, firms will lever up. Likewise, during recessions, firms would like to try and get rid of debt because they know that there are higher costs of financial distress, but may not always be able to. The condition of the economy is a factor that can affect many different firms across various industries. The other factors mentioned are all specific to how an individual firm chooses its capital structure, but economic shocks can lead to either widespread levering up or levering down (Chen 4-5).
While all of these factors can play a role in how firms determine their capital structure, I wish to mainly focus on the effects of economic shocks. In fact, economic shocks can actually trigger some of the other factors by changing stock prices or changing the riskiness of a firm.

Given all these different factors, a firm will manipulate its leverage ratio in hopes of avoiding financial distress while maximizing the benefits of an interest tax shield. However, some firms may set their leverage ratio too high and thus may have to face the consequences of financial distress. Firms with more debt have higher interest payments to make. In a study of 31 highly leveraged transactions that became financially distressed, Andrade and Kaplan found that having too much leverage was the main reason for distress for 26 of these transactions. For firms that entered into Chapter 11 bankruptcy, the direct cost of distress was up to three percent of the firm’s total asset value. The overall cost of financial distress ranged from 10 percent to 20 percent assuming that: a change in margin is permanent, the beginning of financial distress was properly identified, and that there were no costs of economic distress. Doing away with the assumption that there were no costs of economic distress showed that adverse economic conditions do have an effect on how costly financial distress can be. The 19 firms in the sample that did not face an adverse economic shock had much lower costs of financial distress. Thus, it can be seen that firms are susceptible to higher costs of financial distress if they have high leverage and suffer from negative economic shocks (Andrade and Kaplan 1462-1471). Economic shocks can be seen as one of the biggest factors in determining how much debt a firm should carry. It would be expected that
firms, especially those with a lot of debt to begin with, would lever down when faced with poor economic conditions if they can see it coming, ceteris paribus.

Previous studies on the construction industry do indeed seem to agree with the notion that firms with less leverage and more liquidity will not be hurt as badly when the economy does poorly. In a study done by Abidali and Harris, it was shown that a construction firm’s chance of failure depended on seven main variables. Four of these dealt with a firm’s debt and asset values: current assets to net assets ratio, ratio of turnovers to net assets, ratio of short-term loans to earnings before tax and interest, and short-term loan trends. The ratio of turnovers to assets signals how well a firm reacts to the current market situation while the other three all measure a firm’s liquidity and ability to meet short-term loans. The study showed that companies that failed tended to rely too much on short-term loans, did not have enough liquidity to pay off these loans, and were unable to respond properly to market conditions (Abidali and Harris 191). Given this study, it is expected that in response to a negative market shock occurring, construction firms need to react properly to this shock by depending less on debt and financing more through equity as early as possible in order to ensure they are liquid enough to survive the shock. Firms that fail to restructure properly would be at risk of deep financial distress or bankruptcy.

Based on the evidence provided above, it would seem crucial that firms lever down when faced with negative economic shocks. However, they may not always be able to or the cost of doing it exceeds the cost of financial distress. The dynamic capital structure policy is a continuous-time frame model unlike the static tradeoff model, so a firm’s action in one period will depend on information from another. This dynamic
tradeoff model says that a firm’s capital structure depends on underlying asset variability, the riskless interest rate, and the size of the costs of recapitalizing, all of which vary over time, in addition to the benefits of tax shields versus the costs of financial distress (Fischer, Heinkel and Zechiner 20). These additional factors explain why firms are not always at their optimal leverage ratios as suggested by the static tradeoff model, but instead have a range of leverage ratios with a critical upper and lower bound that needs to be crossed before warranting a recapitalization. Thus, even if a firm’s leverage ratio changes as a result of an economic shock changing a firm’s value, it may still fall inside this range, and so the firm will not restructure. Transaction costs then determine whether firms make small changes to the leverage ratio until it is back in the range or make one big change to take the ratio back to where it was (Fischer, Heinkel and Zechiner 23-24).

Changes in stock price also play a big role in how firms pick their leverage ratio. In the analysis of stock price changes, it was shown that recent stock moves can influence a firm’s decision to issue debt or equity. Lower stock prices encourage issuing more debt and vice versa. However, it is more important to look at change in stock price relative to change in the value of the firm. If both fell by the same amount, then firms should have no reason not to issue equity in an attempt to rebalance. If stock prices fell more relative to the fall in value, then there may exist a mispricing. The market has undervalued the stock so management will not want to issue new equity. When going through a recession, the profitability and growth possibilities of firms in the industries affected by the recession tend to fall, which will lower their stock price. Psychologically, a fall in prices may signal to managers to avoid issuing new equity, but it is only rational to not issue new equity if the stock is underpriced as a result of falling. Management may also
refuse to issue new equity after a fall in stock prices and equity because they may place too much emphasis on accounting ratios such as earnings per share, which does not have anything to do with the firm’s optimal capital structure. By using these accounting ratios, it may be possible for management to see their stocks as underpriced, causing them to refuse to issue new equity (Hovakimian, Opler and Titman 22-23). When analyzing the construction industry in response to the subprime crisis, it is important to take into account these two restrictions if the data shows that firms did not lever down at all or as much as they would be expected to.

3. **Data**

3.1 *Description of the Industry*

The construction industry consists of firms with standardized industrial codes (SICs) between 1520 and 1721. Table 1 contains a list of all the SICs used in this study along with a brief description of each one. Within the construction industry, there are a variety of firms. Residential contractors and operative builders (SIC 1520 and 1531) are the ones who build the residential homes. Non-residential contractors (SIC 1540) build a variety of non-residential buildings in the commercial, industrial, and retail sectors such as office buildings. Heavy construction (SIC 1600) consists of firms that primarily focus on civil construction in the area of infrastructure. These are the companies that build highways, bridges, dams, canals, and other transportation related facilities. A few of these firms also construct oil and gas production and processing facilities. Some firms only specialize in one or more of the following areas: water, sewerage, pipelines, communication, and power lines (SIC 1623). Special trade contractors (SIC 1700) do many various miscellaneous work including building maintenance and repairs, steel
The last group of firms in the construction industry specializes solely in electrical work (SIC 1731).

The rest of the companies used in this study are related to construction but are not a part of the construction industry as indicated by their SICs. Some of them produce the machinery and equipment that are used by construction firms (SIC 3530 and 3531). A well-known example of such a firm is Caterpillar, which produces many of the machines such as bulldozers that a lot of construction companies use. Another group of construction-related firms sell material and equipment to builders (SIC 5030-5211). Some sell wholesale while others sell retail. A few well-known examples of these firms include Home Depot and Lowe’s.
For this study, I will be grouping all the firms into three categories. Groups designated as Type 1 will only have the residential construction firms. Type 2 will consist of all of the other firms in the construction industry. Type 3 will contain the construction-related firms.

3.2 Description of the data

All of the financial data for the companies come from the Compustat North America database. “Compustat North America is a database of U.S. and Canadian fundamental and market information on more than 30,000 active and inactive publicly held companies. It provides thousands of Income Statement, Balance Sheet, Statement of Cash Flows, and supplemental data items.”¹ For the purpose of this study, quarterly data from January 2000 to December 2008 was collected for all the firms with the SICs listed in Table 1 that were in the Compustat database. The data was then cleaned up so that firms that had the SICs listed above were truly ones that are in the construction industry or are construction-related and were not mislabeled. As a result, I am using 63 different firms for this study. One thing to note is that all the firms used in this study are publicly held firms since Compustat only has data for publicly held firms. There are in fact many private construction firms, which most likely have been impacted by the subprime crisis as well. However, since financial data is much harder, if not impossible, to gather for private companies, these companies will be left out of this study. Thus, this study is indicative only of the effects of the subprime crisis on the leverage of publically held construction and construction-related firms.

¹ http://wrds.wharton.upenn.edu/ds/comp/index.shtml
The financial variables gathered from Compustat for each firm at the end of each fiscal quarter came from various parts of a company’s financial statement. Data on assets, liabilities, shareholder’s equity, earnings, and stock prices are all gathered. See table 1 in the Appendix for a full list of all the variables gathered. However, not all firms have data for each of these variables each quarter. When possible, missing data was collected from the companies’ previous 10-Q filings.

From the financial variables gathered from Compustat, other variables for each firm were calculated. The measure of a firm’s debt for this study will be the sum of the firm’s long-term debt and debt in current liabilities. A firm’s equity value will be the market value of equity as calculated as the product of a firm’s shares outstanding and share price. Thus, the firm’s asset value will then be the sum of its debt and equity. Other variables calculated from the Compustat data that will be used include current assets and current liabilities. The calculation of all the variables can be found in table 2 in the Appendix.

Because the firms range in size, I cannot simply analyze the dollar amount of debt each firm has. A million dollars of debt is different for a firm that has two million dollars of total assets as it is for a firm that has two hundred million dollars of total assets. Thus, I will need to use ratios so the leverage value can be compared across firms. The leverage ratio that I will be using is the debt-to-asset ratio (D/A). Other ratios that will be used in this study include a profitability ratio, a liquidity ratio, and an interest coverage ratio. Earnings before interest, taxes, depreciation and amortization divided by assets (EBITDA/assets) will serve as the profitability ratio. This ratio shows how much a

\footnote{Current assets and current liabilities can be gathered from Compustat, but there was too much missing data so I will be manually calculating these two variables.}
company is earning relative to its size. Since bigger firms earn more, EBITDA itself cannot be used as a measure so a ratio is used. The current ratio, current assets divided by current liabilities, will serve as the liquidity ratio. This ratio shows how much of the firms assets can be liquidated immediately in order to pay off short-term liabilities. Thus, firms that are more liquid can afford to safely borrow more as they will not have to resort to a fire sale and sell off illiquid assets at a discount. EBITDA/interest expense will serve as the interest coverage ratio. This ratio shows how capable a firm is at paying the interest on its debt with its current earnings.

In addition to financial data, data on home prices during the same period were collected from the Case-Shiller Home Price Indices. The Case-Shiller Indices include individual home price indices that track 20 different regions in America, as well as 2 composite indices tracking the aggregate home price in these regions, a Composite-10 and a Composite-20. These indices are indexed to January 2000 with a benchmark value of 100. Thus, if a future value is 170, it means that home prices in that period are 170% of what they were in January 2000. For the purposes of this study, only the Case-Shiller Home Price Composite-20 index will be used and will be known simply as the Case-Shiller Index for the rest of the study. The Case-Shiller Index from 2000 to 2008 is shown in Figure 1 as the blue line that starts increasing before decreasing towards the end. For the purposes of this study, it will serve as the basis used to measure the effects of the housing market, even though it only captures changes in residential home prices. Thus, GDP data will also be gathered during the same period to serve as another measure of the state of the economy.

3.3 Summary of the Data
From the data gathered, I can not only plot the changes in the Case-Shiller Index from 2000 to 2008 but also the mean leverage ratios of the firms used in this study over the same period to see the correlation between the two. Figure 1 shows mean leverage values for the sample in addition to the value of the Case-Shiller Index over the periods used in the study. From this figure, it can be seen that there appears to be a negative correlation between the two. When home prices, as measured by the Case-Shiller Index, increased, leverage fell, and when home prices decreased, leverage rose. Figure 2 further breaks down this relationship by showing how leverage at the 25th, 50th, and 75th
percentile changed when home prices changed. All of them exhibit the same negative correlation, but the 75th percentile experienced the biggest changes, which indicates that changes in home prices have greater effects on firms that are more highly leveraged. In fact, the firms in the 25th percentile barely experienced any changes in leverage.

From the data, I can also look at how summary statistics for certain firm characteristics, which can determine how a company decides on its leverage ratio, differ across the different types of firms as described above. From Table 2, I can see that Type 1 firms (residential construction) select a much higher leverage ratio than the other two types because historically, the residential real estate sector has been less risky. Less risky
firms are able to have more leverage. From the results in Figure 2, it would appear that these firms are the ones in the 75th percentile leverage-wise and therefore, were the ones that reacted the most to the changes in home prices.

The mean and median values for the factors affecting leverage sometimes produce very different results. One thing to note is that when using ratios, there are often outliers if the denominator is a very small number. Thus, the 1st and 99th percentile of the data for all the ratios, except the debt-to-asset ratio, are truncated in order to provide more accurate results. Even after the truncation, the mean and median values still differ

Table 2
Firm Characteristic Summary Statistics

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<th>Type 1</th>
<th>Type 2</th>
<th>Type 3</th>
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<tr>
<td>Leverage (mean)</td>
<td>0.4311</td>
<td>0.2458</td>
<td>0.2685</td>
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<tr>
<td>Leverage (median)</td>
<td>0.4160</td>
<td>0.1738</td>
<td>0.2280</td>
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Factors Affecting Leverage 

Mean

<table>
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<th></th>
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</thead>
<tbody>
<tr>
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<tr>
<td>Profitability</td>
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<td>0.0297</td>
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<tr>
<td>Coverage</td>
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<td>3.983</td>
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<tr>
<td>Liquidity</td>
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<td>6.133</td>
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Median

<table>
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</thead>
<tbody>
<tr>
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<tr>
<td>Profitability</td>
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<tr>
<td>Coverage</td>
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</tr>
<tr>
<td>Liquidity</td>
<td>1.851</td>
<td>1.600</td>
</tr>
</tbody>
</table>

This table shows the average firm characteristics of the three different types of firms. All of the factors, except size, that are expressed as a ratio that affect leverage are truncated at the 1st and 99th percentile. Also, each factor has a statistically significant impact on leverage. The mean and median values are both included. All non-missing values of the entire sample are used to calculate each summary statistic. All financial data comes from Compustat between 2000 quarter 1 and 2008 quarter 4.
immensely for some variables. However, regardless of the differences between mean and median values, Type 1 firms have a lower interest coverage ratio and a higher liquidity ratio compared with the other type of firms. Another key similarity between mean and median values is the fact that type 2 firms are much smaller than the other two types. The differences between the mean and median value seems to hint that type 1 and type 2 firms just are not as profitable as type 3 firms.

3.4 Models

The purpose of this study is to measure the impact of the subprime crisis on the leverage of construction and construction related firms. The most basic model uses the following multivariable-variable ordinary least squared regression with the following variables:

\[
\frac{\text{debt}}{\text{asset}} = \beta_0 + \beta_1 \ln(CS) + \beta_2 \ln(\text{size}) + \beta_3 \text{profitability} + \beta_4 \text{liquidity} \\
+ \beta_5 \text{stock1} + \beta_6 \text{stock2} + \beta_7 \text{stock3} + \beta_8 \text{stock4} 
\]

(1)

- The dependent variable is the leverage as measured by the debt-to-asset ratio.

- This regression will be using the log of the Case-Shiller Index in order to capture the impact of a percentage change in the index rather than a unit change. It makes more sense to use percentage changes in the Index instead of the actual numbers themselves because a 3\% change in the Index is not the same as a change from 200 to 203. The percentage change is a lot more intuitive and is easier to interpret.

- Size is the mean size of each firm as measured by the market value of its assets. Because assets are part of the measure of leverage, I did not want to hold size
constant so I will be using a firm’s mean size across the entire time period of this study.

- Profitability is the profitability of a firm as measured by its EBITDA divided by its assets.

- Liquidity is the liquidity of a firm as measured by its current ratio.

- Dstock\textsubscript{1} through Dstock\textsubscript{4} are percentage changes in a firm’s stock price over the past periods with dstock\textsubscript{1} being the change from last period to the current period and dstock\textsubscript{4} being the change from four periods ago to three periods ago.

This regression allows me to test to see the impact of a change in the Case-Shiller Index on leverage while controlling for many of the other variables that affect leverage. For the remainder of this study, this regression will be referred to as the basic OLS regression. Based on the results in Figures 1 and 2, I would expect to see that an increase in home prices would lead to a decrease in leverage.

In addition to testing the impact of changes in residential home prices as measured by the Case-Shiller Index, I will also be testing the impacts of changes in GDP on leverage. The same regression as above will be run except instead of ln(CS), the first independent variable will be ln(GDP).\textsuperscript{3} Because changes in GDP are more reflective of the economy as a whole, I would expect this regression to have different effects on leverage because GDP is a better measure of the overall status of the economy as opposed to just a specific sector. While residential construction firms are more likely to

\[
\frac{\text{debt}}{\text{asset}} = \beta_0 + \beta_1 \ln(GDP) + \beta_2 \ln(\text{size}) + \beta_3 \text{profitability} + \beta_4 \text{liquidity} + \beta_5 \text{dstock}_1 + \beta_6 \text{dstock}_2 + \beta_7 \text{dstock}_3 + \beta_8 \text{dstock}_4
\]  
\text{(2)}
respond to changes in home prices, construction-related firms are not as likely to respond
to changes in home prices as they are to changes in GDP. Since this sample contains so
many nonresidential construction firms, changes in GDP should have a stronger impact
on leverage.

The debt-to-asset ratio is the primary measure of leverage, but sometimes, a
firm’s interest coverage ratio is used as a measure of leverage. I will be running the basic
model with interest coverage as the dependent variable instead of the debt-to-asset ratio
to test if this measure of leverage will respond differently to changes in home prices.
Instead of using the interest coverage ratio itself, I will be using the log of one plus the
interest coverage ratio divided by 100 for the dependent variable, which was the
dependent variable used in the model derived by Faulkender and Petersen\(^4\). Taking the
natural log makes the distribution more symmetric. Also, since negative ratios are hard
to interpret, all negative values will be converted to zero. In this model, home prices
should have a positive correlation with interest coverage because higher interest coverage
means less leverage. Thus, while I would expect the debt-to-asset ratio to increase with
decreasing home prices, I would expect the interest coverage ratio to decrease with
decreasing home prices.

Because the data set has panel structure, there may be unobserved characteristics
unique to each firm, or firm fixed effects, which may be affecting its leverage over time.
Having these firm fixed effects can cause the standard errors produced by standard OLS

\[
\ln\left(1 + \frac{IC\ Ratio}{100}\right) = \beta_0 + \beta_1 \ln(CS) + \beta_2 \ln(size) + \beta_3 profit\ ability + \beta_4 liquidity
+ \beta_5 ds\ stock1 + \beta_6 ds\ stock2 + \beta_7 ds\ stock3 + \beta_8 ds\ stock4
\]  

(3)
regression to understate the true standard errors. In order to obtain correct standard errors, I will run the OLS regressions with standard errors clustered by firm. Clustering will allow me to control for firm fixed effects in the standard error but will not change the coefficients. Therefore, I will also be using regressions involving both a within estimator and a between estimator in order to account for the impact of firm fixed effects. These regressions will give different coefficients as well. The within estimator controls for the differences between a firm’s leverage during a certain period and the firm’s mean leverage. The between estimator controls for the differences between different firms’ mean leverages. Using the within estimator runs the basic OLS regression with dummies for each firm in the sample. Firm dummies will allow me to control for factors affecting leverage that are unique to a specific firm. In addition, using the within estimator also clusters the standard errors by firms.

Finally, because I am dealing with different types of firms as indicated above, it would be necessary to see how each type of firm was affected by the subprime crisis. Just like how the 1990-1991 recession impacted different types of firms in different ways, the subprime crisis should impact different types of construction firms in different ways. To account for the differences amongst the industries, I will first run the basic OLS model with industry type dummies to control for industry specific effects. However, using dummy variables will only give different intercept values for the three different types of firms. In other words, it will only show that different types of firms have different leverage amounts. To get different slope values, or the different effects that the Case-Shiller Index has on the leverage of different types of firms, I will run the following regression:
\[
\frac{\text{debt}}{\text{asset}} = \beta_0 + \beta_1 \ln(\text{CS}) + \beta_2 \ln(\text{size}) + \beta_3 \text{profitability} + \beta_4 \text{liquidity} + \beta_5 \text{ds}1 + \beta_6 \text{ds}2 \\
+ \beta_7 \text{ds}3 + \beta_8 \text{ds}4 + \beta_9 \text{type}2 + \beta_{10} \text{type}3 + \beta_{11} \text{type}2 \cdot \ln(\text{CS}) + \beta_{12} \text{type}3 \cdot \ln(\text{CS}) \quad (4)
\]

\(\beta_i\) is the slope for Type 1 firms, \(\beta_i + \beta_{1i}\) is the slope for Type 2 firms, and \(\beta_i + \beta_{i2}\) is the slope for Type 3 firms.

4. Result

4.1 Basic OLS Model

The most basic model used is equation 1, which regresses a firm’s leverage on the change in home prices as captured by the Case-Shiller Index, a set of firm characteristics, and recent changes in stock prices. From the results shown in Table 3 column I, it can be seen that every independent variable in the regression is statistically significant. When analyzing the sign of the coefficients on some of the characteristics that determine leverage, I noticed that the direction of the impact on some of these variables appears to go against intuition. First, the relationship between liquidity and leverage does make sense. Firms that are more liquid are more able to pay off their debts and thus, have lower costs of financial distress. The more liquid a firm is, the more debt it can have. However the relationships between size and leverage and profitability and leverage obtained from the regression seem contrary to what would be expected. Bigger firms and more profitable firms all tend to be more financially stable and safe. Therefore, I would expect the bigger firms and the more profitable firms to have more leverage. However, my results show exactly the opposite. An explanation for the inverse relationship between size and leverage is that size is measured as total assets, and total assets is the denominator in the equation for leverage. Thus, when size increases, the denominator for
leverage increases, which decreases leverage. Lastly, it can be seen that changes in stock price from the most recent periods have the largest impact on leverage.

When analyzing the effects of changes in the Case-Shiller Index, I will need to check to see if it is economically significant in addition to it being statistically significant. A coefficient of -0.2002 means that a one standard deviation increase in ln(CS) (0.2297) causes leverage to decrease by 0.046. Since the mean leverage is 0.3118, a decrease in leverage of 0.046 is a 14.75% decrease, which is economically significant. From Figure 1 above, it can be seen that the mean leverage value steadily fell as the Case-Shiller Index increased during the first half of 2000. Then as home prices started falling, the average leverage value started increasing. However, based on the previous literature about leverage presented, this relationship is surprising because I expected firms to increase

### Table 3

**Basic OLS Regression**

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ln(Case-Shiller Index)</td>
<td>-0.2002 (0.0231)*</td>
<td>-0.3273 (0.0391)*</td>
<td>0.1411 (0.0246)*</td>
</tr>
<tr>
<td>Ln(GDP)</td>
<td>-0.0000 (0.0000)*</td>
<td>-0.0000 (0.0000)*</td>
<td>0.0000 (0.0000)*</td>
</tr>
<tr>
<td>Ln(Mean Size)</td>
<td>-0.8471 (0.1021)*</td>
<td>-0.8901 (0.1029)*</td>
<td>1.1575 (0.1180)*</td>
</tr>
<tr>
<td>Profitability</td>
<td>0.0071 (0.0009)*</td>
<td>0.0072 (0.0009)*</td>
<td>-0.0040 (0.0009)*</td>
</tr>
<tr>
<td>Liquidity</td>
<td>-0.1106 (0.0146)*</td>
<td>-0.1195 (0.0147)*</td>
<td>0.0123 (0.0161)</td>
</tr>
<tr>
<td>Dstock1</td>
<td>-0.1054 (0.0148)*</td>
<td>-0.1108 (0.0149)*</td>
<td>0.0180 (0.0164)</td>
</tr>
<tr>
<td>Dstock2</td>
<td>-0.0884 (0.0150)*</td>
<td>-0.0948 (0.0150)*</td>
<td>0.0367 (0.0168)*</td>
</tr>
<tr>
<td>Dstock3</td>
<td>-0.0699 (0.0151)*</td>
<td>-0.0766 (0.0152)*</td>
<td>0.0382 (0.0167)*</td>
</tr>
<tr>
<td>Dstock4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R²               | 0.1759       | 0.1741       | 0.1211       |

Number of Observations | 2222         | 2222         | 2014         |

This table shows the results of the basic OLS regression of leverage on the factors affecting leverage and changes in recent stock prices. Columns I and II show the results of the regressions of equation 1 and 2, where the debt to asset ratio is used to measure leverage. Column III shows the results of the regression on equation 3, where interest coverage is used to measure leverage. The data used in the regressions only include the firm quarters that had a debt value. * indicates statistically significance at the 5% level.
their leverage when the economy is doing well, as indicated by increasing home prices, and to decrease their leverage when the economy is not doing well, as indicated by decreasing home prices.

The reason for the inverse relationship between leverage and home prices can be largely attributed to the fact that firms are slow or unable to adjust their debt levels. When the state of the economy changes, a firm’s stock price will also change, which in turn changes the value of assets since equity is a part of assets. In order to maintain a constant leverage ratio, a firm needs to adjust its debt level in order to match the change in assets. If the firm is too slow to change debt, then the leverage ratio will change. Figure 3 shows how the mean asset value and mean debt value across all firms changed over time. During the period when home prices were rising, both debt and assets were increasing. Increasing home prices meant the economy was growing so firms wanted to take on more debt. The booming economy also tremendously boosted stock prices, which led to an increase in assets that was greater than the increase in debt. Thus, leverage fell during this period because assets outgrew debt. Once home prices stopped increasing, firms’ performances suffered and stock prices fell, which caused assets to fall. Debt actually remained fairly constant during this period. Firms realized that taking on more debt was not optimal in a poor economy, but they did not reduce their debt levels perhaps because they were unable to. With debt remaining constant and assets falling, leverage grew.

Also, from Figure 2 above, it can be seen that firms with different amounts of leverage adjusted their debt levels at different rates. The big changes in leverage experienced by the 75th percentile firms indicate that these were the firms that most likely
failed to adjust the most. The big changes experienced by the more highly leveraged firms may be explained by the fact that since these firms were already highly leveraged, when their asset values rose during the periods of growth in the housing market, they were much slower to issue additional debt so their assets rose a lot more relative to their debt. Meanwhile, the other firms that were less leveraged to begin with were faster to increase their debt so their leverage ratios did not fall as much. Then when home prices...
began falling, asset values also fell so the highly leveraged firms had to buy back a lot more debt than the less leveraged firms in order to maintain a constant leverage ratio. They were unable to do so and thus, their leverage increased by more.

Because home prices only show the effects of the economy on one sector, it may be useful to look at changes in GDP, which is a good measure of the state of the whole economy. The regression of equation 2, where ln(GDP) replaces ln(CS), is shown in column II of Table 3. Once again, all of the independent variables are statistically significant. The coefficients on the firm characteristics are nearly identical in magnitude. The coefficient on ln(GDP) is over 50% the size of the coefficient on ln(CS) (-0.3272 for ln(GDP) compared to -0.2002 for ln(CS)). A standard deviation change in ln(GDP) (0.1293) causes leverage to change by 0.0423, which is a 13.57% change. This percentage change is fairly close to the percentage change in leverage caused by a standard deviation change in the Case-Shiller Index (13.57% for ln(GDP) compared to 14.75% for ln(CS)). Therefore, it seems that using GDP as another measurement for the economy does not yield much different results, even though I had expected GDP to have a different impact on leverage. The similar results can be explained by the fact that the subprime crisis is at the root of the current economic slump. The fall in home prices played a main role in the economic downturn.

4.2 Interest Coverage as Measure of Leverage

While the debt-to-asset ratio serves as a good measure of leverage, some researchers have found that the interest coverage ratio can serve as a good alternative measure of leverage. The results of the model using interest coverage ratio as the dependent variable, regression 4, are shown in column III of Table 3. As expected, the
coefficient on ln(CS) is now positive. With a coefficient of 0.1411, a one standard
deviation change in ln(CS) causes ln(1+(IC Ratio)/100) to change by 0.0324, which
means that the interest coverage ratio itself changed by 3.293. With a mean of 17.407,
the interest coverage ratio changed by 18.92% as a result of a one standard deviation
change in ln(CS). Thus, using the interest coverage ratio as a measure of leverage
produces slightly different results from using the debt-to-asset ratio. The difference can
be explained by examining a mature firm with high future cash flow growth. This firm
will have low leverage as measured by the debt-to-asset ratio because the high future cash
flows mean that the asset value is very high relative to debt. However, the same firm will
be considered highly leveraged as measured by the interest coverage ratio because this
firm has low current cash flows relative to high interest payments (Faulkender and
Petersen 66). Based on the different results I get from using the two different measures
of leverage, it would appear that construction and construction-related firms tend to be
ones with high expected growth.

It is worth noting that the $R^2$ in these three regressions is quite low, around 0.17
when debt-to-asset is used and around 0.12 when the interest coverage ratio is used as the
measure of leverage. This low $R^2$ means that there are many additional factors that
determine leverage which are not captured in the OLS regressions. Section 4.3 below
will investigate to see if there are unobserved firm-specific characteristics not captured by
the OLS regressions that are affecting leverage.

4.3 Controlling for Firm Fixed Effects
Having firm fixed effects will cause the standard errors to be correlated with some of the dependent variables. Using a basic OLS regression will miscalculate standard errors in the presence of firm fixed effects. Clustering the data by firms is necessary in order to correctly calculate the standard errors. In Table 4, column I shows the results of running the basic OLS regressions with standard errors clustered by firm. The coefficients are unchanged, but the standard errors are much higher on some variables, which means that the standard errors are correlated with some of the dependent variables. In fact clustering the standard errors by firm causes ln(mean size) and liquidity to no longer be significant at the 95% level.

**Table 4**

Firm Fixed Effects Regressions

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ln(Case-Shiller Index)</td>
<td>-0.2002 (0.0525)*</td>
<td>-0.1863 (0.0150)*</td>
<td>-0.5802 (0.2777)*</td>
</tr>
<tr>
<td>Ln(Mean Size)</td>
<td>-0.0000 (0.0000)</td>
<td>dropped</td>
<td>-0.0000 (0.0000)</td>
</tr>
<tr>
<td>Profitability</td>
<td>-0.8471 (0.2322)*</td>
<td>-0.7398 (0.0779)*</td>
<td>-1.4797 (0.8107)**</td>
</tr>
<tr>
<td>Liquidity</td>
<td>0.0071 (0.0038)**</td>
<td>-0.0026 (0.0011)*</td>
<td>0.0091 (0.0041)*</td>
</tr>
<tr>
<td>Dstock1</td>
<td>-0.1106 (0.0170)*</td>
<td>-0.0984 (0.0093)*</td>
<td>-0.4772 (0.6062)</td>
</tr>
<tr>
<td>Dstock2</td>
<td>-0.1054 (0.0154)*</td>
<td>-0.0953 (0.0095)*</td>
<td>-1.6456 (0.8174)*</td>
</tr>
<tr>
<td>Dstock3</td>
<td>-0.0884 (0.0128)*</td>
<td>-0.0947 (0.0095)*</td>
<td>0.6461 (0.8391)</td>
</tr>
<tr>
<td>Dstock4</td>
<td>-0.0699 (0.0128)*</td>
<td>-0.0813 (0.0096)*</td>
<td>0.6884 (0.6284)</td>
</tr>
<tr>
<td>R^2</td>
<td>0.1759</td>
<td>0.2365</td>
<td>0.3165</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>2222</td>
<td>2222</td>
<td>2222</td>
</tr>
</tbody>
</table>

This table shows the different ways of accounting for firm fixed effects. Column I shows the result of an OLS regression on equation 1 with standard errors clustered by firm, which accounts for the correlation between the independent variable and the standard error. Column II shows the results of a regression on equation 1 using within estimates, which estimate the coefficients based on the differences between a firm's leverage during a given quarter and the firm's mean leverage. The R^2 listed does not include the dummy variables. If dummy variables are included, the R^2 rises to 0.6856. Column III shows the results of a regression on equation 1 using between estimates, which estimate the coefficients based on the differences between firms' mean leverages. The data used in the regressions only include the firm quarters that had a debt value. * indicates statistically significant at the 5% level. ** indicates statistically significant at the 10% level.
Column II shows the effects of the regression that uses within estimators. Within estimators estimate the coefficients using the differences between a firm’s leverage during a given quarter and the firm’s mean leverage. In essence, running a regression using within estimators is equivalent to running an OLS regression with dummy variables for each company. The use of firm dummies controls for factors affecting leverage that are constant and unique to a specific firm. The results of this regression are somewhat similar from the results of the OLS regression. The coefficient on ln(CS) has barely changed (-0.2002 in the basic OLS regression to -0.1863 in the then regression using within estimators). The coefficients on the other firm characteristic variables have changed more. Most significantly, the relationship between liquidity and leverage has flipped; increasing a firm’s liquidity now decreases the amount of leverage that firm has. Also, ln(mean size) has been dropped from the results because for each firm, the value of ln(mean size) is the firm’s mean asset value, so there is no variation from the mean across time for each firm. The R² of this regression is 0.2365 if the explanatory power of the firm dummies is not included. If it is included, then R² goes up to 0.6856, which means that firm dummies have a lot of explanatory power. Therefore, there exists strong firm fixed effects that affect leverage, but these effects are uncorrelated with home prices which is why the coefficient on ln(CS) has not changed much. Ln(CS) is not a good proxy for the unobserved firm fixed effects.

The results of the regression using between estimators is shown in column III of Table 4. This time, the coefficient on ln(CS) has changed drastically (-0.2002 in the basic OLS regression to -0.5802 in the regression using between estimators). A possible reason for the much larger coefficient is because the regression that uses between
estimators includes the unobserved firm fixed effects. Also, since ln(CS) is the same value for each firm during a given period, I should not even be able to estimate the coefficient on ln(CS). The only reason I can even estimate a value for this coefficient is because my data is an unbalanced panel. Many of the other independent variables are now not statistically significant at the 95% level. The other variables may not be statistically significant because when using between estimators, the regression is run on the firm means. Since I only have 63 firms in my data, there are only 63 different values for firm means. Having such a low number of unique observations can easily lead to high standard errors and statistically insignificant results. Thus, this estimation is a very poor and inaccurate one. Due to the poor estimation of the coefficient on ln(CS) and the statistical insignificance of many of the variables, the results of this regression cannot be relied on to produce accurate results.

4.4 Variation Amongst Different Type of Firms

As the results from the 1990-1991 recession show, each different type of construction company reacted differently to the economic slump. Thus, it would be expected that the different types of firms in the construction industry react differently to the subprime crisis. Because the firms are split into only three different types in this study, I can easily run an OLS regression using dummy variables. Column I in Table 5 shows the results of an OLS regression with dummies for the different industries. Once again, the coefficient on ln(CS) has not changed much, which seems to indicate there are no industry fixed effects that are correlated with home prices. The dummy variables both have negative coefficients, which mean that Type 1 firms have higher leverage. This result matches the results from Table 2 showing that Type 1 firms have higher leverage.
Coefficients on the some of the other variables have changed. The size of the coefficient on liquidity is a lot smaller now.

The use of firm dummies assumes that ln(CS) has the same effects on the different types of firms. The results of the regression on equation 4, which allows each type of firm to have different coefficients on ln(CS), is shown in column II of Table 5. The coefficient on ln(CS) is -0.0834 for Type 1 firms, -0.2044 for Type 2 firms, and -0.3826 for Type 3 firms. Figure 4 depicts these results graphically by showing how leverage changed for each of the three types of firms when the Case-Shiller Index changed. However, the results from Table 5 and Figure 4, which show that Type 3 firms were the most affected by the changes in residential home prices, seems counterintuitive.
because these are the construction-related firms. These are the firms that should be impacted the least by the subprime crisis and changing home prices since they do not directly deal with the construction of residential homes. These results also seem to go against the results from Figure 2 that shows the most leveraged firms (Type 1 firms) as having the biggest changes in leverage over time. The reason that the coefficient is so much bigger for Type 3 firms is due to the fact that Type 3 firms had much lower leverage during the periods when home prices were at their highest points. Figure 5 shows that while different types of firms had high leverage ratios in the periods affected by the subprime crisis, 2007 and 2008, Type 3 firms had significantly lower leverage during the period before the subprime crisis, 2006. All but one of the Type 3 firms had a
leverage ratio under 0.5 when the Case-Shiller Index was over 200 while the other types of firms had many firms with leverage ratios over 0.5 during the same period. The results
in Figure 4 show that Type 2 firms had the lowest leverage when the Case-Shiller Index was over 200, but these results are generated using the mean values of the sample for the other independent variables instead of looking at the leverage of each individual firm, which Figure 5 does. Thus, it can be said that the subprime crisis did affect all types of firms, but it appears to have affected Type 3 firms the most because these were the firms that had less leverage in the periods before.

A possible reason that Type 3 firms had such low leverage ratios in 2006 is that assets increased by a lot more for these companies than they did for the other type of firms. From Table 3, it can be seen that Type 3 companies were the most profitable so it is not surprising that assets increased the most for them. At the same time, all companies were slow or unable to adjust their debt levels to match the rise in assets. The large increase in assets and slow increase in debt led to Type 3 firms having the lowest leverage ratios during this period. Once the subprime crisis occurred and the economy started to decline, assets across the industry fell. Assets for Type 3 firms fell the most. Since they were at much higher levels prior to the subprime crisis, they experienced the largest decreases, which lead to the largest leverage increases after the onset of the subprime crisis. The result was that some of the Type 3 firms' leverage ratios went back up to the same level as the leverage ratios of the other types of firms. Thus, based on the behavior of the Type 3 firms, it can be said that they were the ones most affected by the subprime crisis and the changes in home prices that resulted since they were the firms that experienced the greatest changes in assets and in turn, the greatest changes in leverage as a result of the subprime crisis.

5. Conclusion
The subprime crisis did have an effect on the leverage of construction and construction-related firms, but not in the manner predicted. Prior literature would indicate that a firm’s leverage increases when the economy is doing well and decreases when it is not. However, the results from this study show the opposite effect. This study found that when home prices increased during the booming economy, leverage for construction companies actually fell while leverage increased when home prices fell. The rationale behind this inverse effect can be attributed to the fact that firms were too slow or unable to adjust their debt levels to changes in their assets brought on by changes in home prices.

When analyzing the effects on the different sectors of this industry, this study found that the construction-related companies were actually the ones most affected by the subprime crisis and changing home prices. These firms experienced the largest increases in assets right before the subprime crisis but the largest decrease in assets after the subprime crisis hit, which accounts for the bigger changes in leverage.

The main finding of this paper is that for the construction industry, leverage changes are brought on by changes in assets. Compared to the changes in assets, debt did not change much at all. It would be interesting to analyze how leverage changed in an industry where debt changed significantly. Also, this paper only focused on the amount of debt that firms wanted to have – the demand side of debt. In the real world, there are also factors that determine how much debt a firm can be supplied – the supply side of debt. A good follow up study would be to analyze if there were restrictions on the supply of debt to construction companies and whether the constant levels of debt can be attributed to the supply side.
Appendix

1. Description of Quarterly Financial Variables Gathered from Compustat

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acoq</td>
<td>Current Assets – Other – Total</td>
</tr>
<tr>
<td>apq</td>
<td>Accounts Payable/Creditors – Trade</td>
</tr>
<tr>
<td>cheq</td>
<td>Cash and Short-Term Investments</td>
</tr>
<tr>
<td>cshoq</td>
<td>Common Shares Outstanding</td>
</tr>
<tr>
<td>dlcq</td>
<td>Debt in Current Liabilities</td>
</tr>
<tr>
<td>dlttq</td>
<td>Long-Term Debt – Total</td>
</tr>
<tr>
<td>invtq</td>
<td>Inventories – Total</td>
</tr>
<tr>
<td>lcoq</td>
<td>Current Liabilities – Other – Total</td>
</tr>
<tr>
<td>oibdpq</td>
<td>Operating Income Before Depreciation – Quarter (the same as EBITDA)</td>
</tr>
<tr>
<td>prccq</td>
<td>Price Close - Quarter</td>
</tr>
<tr>
<td>rectq</td>
<td>Receivables - Total</td>
</tr>
<tr>
<td>txpq</td>
<td>Income Taxes Payable</td>
</tr>
<tr>
<td>xintq</td>
<td>Interest and Related Expenses – Total</td>
</tr>
</tbody>
</table>
2. Calculations of Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>asset</td>
<td>asset = debt + equity</td>
</tr>
<tr>
<td>ca (current assets)</td>
<td>ca = acoq + cheq + invtq + rectq</td>
</tr>
<tr>
<td>cl (current liabilities)</td>
<td>cl = apq + dlcq + lcoq + txpq</td>
</tr>
<tr>
<td>interest coverage</td>
<td>coverage = ( \frac{EBITDA}{xintq} )</td>
</tr>
<tr>
<td>debt</td>
<td>debt = dlcq + dlttq</td>
</tr>
<tr>
<td>dstockn</td>
<td>( dstockn = \frac{prccq_n - prccq_{n-1}}{prccq_{n-1}} )</td>
</tr>
<tr>
<td>equity</td>
<td>equity = cshoq * prccq</td>
</tr>
<tr>
<td>leverage</td>
<td>leverage = ( \frac{debt}{asset} )</td>
</tr>
<tr>
<td>liquidity</td>
<td>liquidity = ( \frac{ca}{cl} ) (also known as the current ratio)</td>
</tr>
<tr>
<td>profitability</td>
<td>profitability = ( \frac{EBITDA}{asset} )</td>
</tr>
</tbody>
</table>
Sources


