Capital Structure in Financial Distress: A Comprehensive Study across Industries and Borders

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Abstract

This paper examines the effects of financial distress on the relationships between capital structure and its determinants – continuing on the famous research by Rajan and Zingales from 1995. The sample contains balance sheet information for 3743 non-financial firms over a period of 14 years, classified into NAICS sectors and distributed across the G7 countries. Results reveal that financial stress (i) puts downwards pressure on the positive relationship between capital structure and tangible assets, (ii) causes a substantial shift in the negative link between capital structure and profitability, so much so that it becomes strongly positive, (iii) has an ambiguous effect on the relationship between capital structure and investment opportunities, putting upwards pressure when measured at book leverage and downwards pressure when measured at market leverage, (iv) has weak impact on the relationship between capital structure and tangible assets in countries and sectors with high tangibility, (v) has strong impact on the relationship between capital structure and company size in countries and sectors with large firms, and (vi) has weak impact on the relationship between capital structure and profitability in countries and sectors with high profit margin.

Keywords: Capital Structure, Leverage, Financial Recession, Financial Distress, Tangible Assets, Market-to-Book, Sales, Profitability, International Comparisons, Industrial Comparisons

JEL Classification: G01, G30, G32

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1 Introduction

1.1 Background

The research field of capital structure has gained considerable traction since 1958, the year when Modigliani and Miller published their famous theorem – *Capital Structure Irrelevance Principle*. Here Modigliani and Miller, in contrast to the theorem's name, conclude just how relevant capital structure actually is; by arguing that a firm's value is independent of how it is financed in an (i) efficient market and in the absence of (ii) taxes, (iii) bankruptcy costs, (iv) agency costs and (v) asymmetric information. This paints a picture only deemed possible in theory, thus highlighting the relevance of capital structure in a realistic scenario. Several theories have since attempted to explain its dynamics; signaling theory, pecking-order theory and agency cost theory just to mention a few. However, Myers (2001) debates that there is no universally accepted rational for the behavior of capital structure; even less so when looking at the effects during financial distress.

Although capital structure is a well-researched area, a large portion of its theoretical groundwork is still based on studies from the twentieth century; a quite different setting compared to today's financial markets. This is especially true in the case of credit markets, where an ever increasing debt quantum has made credit widely available in large parts of the world. In 2007, this widespread lending culminated in a global financial crisis – finally stagnating further development of debt. While corporations were not directly part of the immense credit apparatus causing the crisis, they still suffered the consequences, not only as the aggregated demand fell, but also as the corporate credit market dried up. This raises the question of what influences a company's position in the credit markets, especially in times of financial distress.

Our research paper is focused on answering this very question; combining some of the best regarded theoretical works in the field of capital structure, with some of the most relevant and up-to-date empirical evidence. Furthermore, additional dimensions are added to cross-validate the research question – and subsequent findings – both internationally and across different industries. We believe that our findings will meaningfully add to the current academic literature, as well as broaden the private sector's understanding of capital structure dynamics under extreme circumstances.

1.2 Earlier Literature

1.2.1 Determinants of Capital Structure

Earlier research by Harris and Raviv (1991) suggests that leverage increases with fixed assets, investment opportunities, non-debt tax shields and firm size, and decreases with volatility, advertising expenditures, uniqueness of product, probability of bankruptcy and profitability. Rajan and Zingales (1995) further elaborate on these relationships in their own study – *What Do We Know about Capital Structure?* However, due to issues with constructing good proxies, the authors choose to limit their research to the four most historically consistent determinants; fixed assets, investment opportunities, firm size and profitability. The reasoning and findings of Rajan and Zingales (1995) are as follows:

i Tangibility ratio (fixed assets) — measures the fraction of tangible assets on the firms balance sheet. Rajan and Zingales (1995) argue that these types of assets can be used as collateral; therefore, making highly tangible firms more attractive to creditors. It is also argued that fixed assets retain more value in case of a liquidation. As expected, the correlation between leverage and tangibility is shown to be positive.

ii Market-to-book ratio (investment opportunities) — Myers (1977) suggests that highly leveraged firms are more likely to pass up profitable investment opportunities, as compared to their less leveraged counterparts. The underlying rational being that high market-to-book ratio indicates strong future growth, making the firm more attracted to equity financing rather than debt. As expected, the correlation between leverage and growth opportunities is shown to be negative.

iii Log of net sales (firm size) — has shown ambiguous results in earlier studies. On one hand, larger firms are more diversified and have a lower probability of default; making them more attractive to creditors. On the other hand, larger firms also have more widely available information – as compared to smaller ones – subsequently increasing outside investors' demand for their equity. Rajan and Zingales (1995) find that the correlation between leverage and firm size is mostly positive.

iv Profitability ratio (profitability) — has also shown ambiguous results in earlier studies. Myers and Majluf (1984) argue that highly profitable firms will prioritize internal financing over debt, according to the classical pecking order theory. However, Jensen

(1986) points out that an effective market for corporate control will force firms to pay out cash when leveraging up. Also, firms with large cash flows will be more attractive to creditors, increasing the supply side of debt. Rajan and Zingales (1995) find that the correlation between leverage and profitability is mostly negative.

1.2.2 Capital Structure during Financial Distress

Duggal and Budden (2011) examine the capital structure of companies in the S&P 500, following the financial collapse of 2008. They show evidence that US firms have participated in both the equity- and debt markets in order to rebalance their capital structure. On the one hand, contraction in aggregate demand forced the firms to decrease their costs, thereby increasing their equity. On the other hand, their incentive to borrow increased due to an expansive monetary policy, the latter of which was implemented to stimulate the economy. Comparing the two cases, the authors found that companies surprisingly managed to uphold an overall unchanged degree of leverage.

Contradictory to Duggal and Budden (2011), Thach and Oanh (2018) provide evidence that capital structure indeed does change during economic recession and recovery, at least in the Vietnamese market. More specifically, their findings show that Vietnamese businesses used less debt in the recovery period – instead focusing on equity. Additionally, Iqbal and Kume (2014) also show evidence that there was a change in capital structure as a result of the crisis, this time in Germany, France and the UK. Their findings suggest that leverage increased both during- and post the crisis. This is further emphasized by Fosberg (2012), who saw debt levels rise starting in 2008, and then gradually decrease again in 2010.

A North American research by Harrison and Widjaja (2014) found that the relationships between capital structure and its determinants were significantly altered by the events of the 2007 - 2008 financial crisis. Similarly to the empirical evidence by Rajan and Zingales (1995), the authors find that leverage increases with fixed assets and firm size, and decreases with investment opportunities and profitability. Moreover, they also discover that the influence of tangibility and market-to-book became stronger during the crisis, while the influence of profitability became weaker. The effect of log of net sales completely switched signs, now affecting leverage negatively rather than positively. When analyzing different capital structure dynamics, the authors found that the pecking order theory had the highest explanatory power during the crisis.

1.3 Hypothesis Statement

- **H1a: The effects of fixed assets will become weaker in times of financial distress, especially in countries and sectors with low tangibility**. Although this hypothesis contradicts the findings of Harrison and Widjaja (2014), there is reason to suspect that fixed assets will become difficult to divest in times of financial distress. This is mainly due to the fact that tangible assets are especially prone to liquidity issues (He, Lin and Liu, 2018). Additionally, countries and sectors with low tangibility, i.e. low demand for tangible assets, should be even more exposed.

- **H1b: The effects of investment opportunities will become more negative in times of financial distress, especially in countries and sectors with high market-to-book**. This hypothesis is based on the empirical discoveries by Harrison and Widjaja (2014). However, the rational is rooted in Myers (1977), seeing as highly leveraged firms are likely to pass up on even more investment opportunities in riskier times. Consequently, countries and sectors with high market-to-book ratios are likely to express this behavior even more dramatically.

- **H1c: The effects of firm size will become more negative in times of financial distress, especially in countries and sectors with large firms**. This hypothesis follows the findings of Harrison and Widjaja (2014), as well as Kudlyak and Sanchez (2017), the latter of which has shown that larger firms are more affected than smaller ones in the event of a financial crisis. This also dictates that countries and sectors with large firms are even more affected.

- **H1d: The effects of profitability will become more positive in times of financial distress, especially in countries and sectors with low profitability**. This hypothesis is once again derived from the findings of Harrison and Widjaja (2014). Moreover, we reason that creditors will see cash flows as a solution to the liquidity risks associated with tangibility during times of financial distress. Additionally, countries and sectors with low profitability should not be able to sustain themselves on internal financing, as per the pecking-order theory (Myers and Majluf, 1984); therefore, leaving them more exposed to the influences of financial distress.

2 Methodology

2.1 Data Collection

All data is sourced from Thomson Reuters Eikon, an international database with extensive coverage of real-time financial information, company fundamentals and analyst recommendations. The sample is comprised of non-financial companies from the Thomson Reuters G7 Price Return Index, a market weighted equity index based on the G7 countries[1]. The observation period spans a total of 14 years[2] and includes any companies that may have entered or left the index; the latter of which is implemented to avoid survivorship bias. Each company in the sample is identified through its RIC code[3], country of exchange and economic sector[4]. Balance sheet information is gathered on an annual basis and converted to USD for meaningful international comparisons. Key variables consist of total debt, total equity, total assets, net fixed assets[5], net sales[6], cash and short term investments, EBITDA and market capitalization. Financial stress is measured using the St.Louis Fed Financial Stress Index (see Figure 1), which is constructed from a combination of interest rate series, yield spreads and other indicators (St. Louis Fed, 2019).

[1] Canada, France, Germany, Italy, Japan, the United Kingdom and the United States.

[2] Between 1999-12-31 and 2013-12-31.

[3] Reuters instrument code.

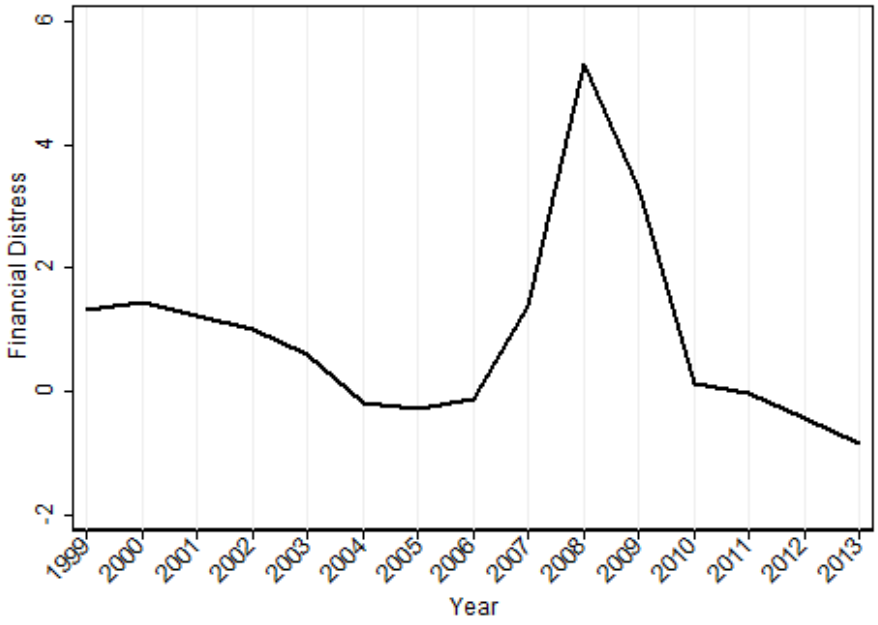
[4] Determined on the 2-digit NAICS level (Census Bureau, 2017).

[5] Calculated as property, plant and equipment (gross) reduced by accumulated depreciation.

[6] Calculated as sales receipts for products and services, less cash discounts, trade discounts, excise tax, and sales returns and allowances.

Figure 1: St.Louis Fed Financial Stress Index

Calculated as the annual maximum of weekly index data. The underlying index is designed to equal zero at its starting point in late 1993. Positive values indicate above-average financial stress, while negative values indicate below-average financial stress (St. Louis Fed, 2019).



Source: Authors' calculations based on the St.Louis Fed Financial Stress Index (St. Louis Fed, 2019).

Two sources of erroneous observations are found in the sample: *missing values* and *outliers*. One case of missing values consists of firms that have not yet been funded, or filed for bankruptcy, sometime within the observation period. Another case of missing values occurs seemingly random in what otherwise appears to be complete data, this is likely due to reporting issues by the companies or detection issues by Thomson Reuters Eikon. The second source of erroneous observations, *outliers*, occurs when adjusting the sample for international accounting differences[7]. Further data description is cleared of these outliers[8], which would otherwise make below tables and numbers highly unrepresentative of the final sample.

[7]See Adjustments and Definitions for further discussion on international accounting differences.
[8]See Adjustments and Definitions for further discussion on the removal of outliers.

Table I: Size Distribution of Firms by Country

All firms are ranked by their average market capitalization between 1999-12-31 and 2013-12-31, placed into deciles and distributed across the G7 countries. Distributions may not sum to 1.00 because of rounding errors.

	Decile										
Country	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Number of firms**
Canada	0.16	0.17	0.07	0.14	0.07	0.11	0.07	0.08	0.06	0.06	267
France	0.00	0.02	0.03	0.10	0.12	0.08	0.14	0.12	0.23	0.17	133
Germany	0.07	0.07	0.09	0.12	0.11	0.09	0.11	0.11	0.10	0.14	257
Italy	0.05	0.01	0.15	0.09	0.10	0.12	0.13	0.13	0.09	0.13	92
Japan	0.20	0.18	0.15	0.10	0.09	0.07	0.06	0.06	0.06	0.04	1393
United Kingdom	0.00	0.02	0.07	0.09	0.09	0.13	0.17	0.14	0.12	0.16	245
United States	0.02	0.03	0.06	0.10	0.12	0.13	0.13	0.14	0.13	0.13	1425

Source: Thomson Reuters Eikon Database.

Table II: Size Distribution of Firms by Sector

All firms are ranked by their average market capitalization between 1999-12-31 and 2013-12-31, placed into deciles and distributed across the 2-digit NAICS sectors. Distributions may not sum to 1.00 because of rounding errors.

	Decile										
Sector	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Number of firms**
Accommodation	0.14	0.11	0.11	0.13	0.17	0.04	0.06	0.06	0.12	0.06	83
Administrative	0.09	0.05	0.07	0.18	0.09	0.08	0.11	0.15	0.12	0.05	74
Agriculture	0.06	0.25	0.00	0.19	0.31	0.13	0.06	0.00	0.00	0.00	16
Arts	0.00	0.08	0.15	0.08	0.19	0.23	0.12	0.08	0.08	0.00	26
Construction	0.25	0.12	0.13	0.14	0.12	0.06	0.04	0.10	0.03	0.01	147
Educational	0.00	0.11	0.00	0.11	0.11	0.00	0.33	0.11	0.22	0.00	9
Health Care	0.06	0.07	0.09	0.15	0.09	0.20	0.13	0.04	0.11	0.06	54
Information	0.05	0.04	0.08	0.07	0.08	0.07	0.15	0.13	0.13	0.18	260
Manufacturing	0.11	0.11	0.10	0.09	0.10	0.09	0.10	0.10	0.10	0.09	1780
Mining, Quarrying	0.11	0.10	0.08	0.11	0.08	0.12	0.10	0.08	0.10	0.13	177
Other Services	0.12	0.12	0.12	0.24	0.06	0.18	0.06	0.06	0.06	0.00	17
Professional	0.11	0.09	0.10	0.11	0.13	0.12	0.08	0.11	0.10	0.07	257
Public Administration	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1
Real Estate	0.04	0.07	0.09	0.13	0.14	0.17	0.13	0.11	0.07	0.04	225
Retail Trade	0.06	0.08	0.10	0.15	0.10	0.12	0.08	0.12	0.08	0.11	248
Transportation	0.09	0.08	0.07	0.05	0.10	0.13	0.14	0.05	0.16	0.12	149
Utilities	0.04	0.03	0.05	0.09	0.04	0.07	0.11	0.19	0.16	0.21	124
Wholesale Trade	0.12	0.16	0.13	0.10	0.10	0.10	0.08	0.07	0.09	0.05	165

Source: Thomson Reuters Eikon Database.

As can be seen in Table I and Table II, there is a healthy amount of companies in each country, and most sectors, to perform meaningful cross-sectional analysis. Japan and Canada appear to be more skewed towards smaller businesses compared to the other countries. Likewise, sectors such as Agriculture, Construction, Manufacturing, Wholesale trade, Accommodation services, Professional services and Other services express a similar skew for sectors. Size distribution appears to be fairly homogeneous across the mid deciles, for both countries and sectors.

Overall, the sample contains a total of 3812 firms, covering approximately 35% of the world market capitalization and 28% of all listed companies in the G7 countries for 2013[9]. There are two potential sources of selection bias in the sample. First, index construction methods used by Thomson Reuters implement a set of data validation techniques and liquidity filters that skew the sample towards substantially large companies[10]. Second, only publicly traded companies are included in the sample, excluding a significant part of the total economy[11]. While it is difficult to evaluate how representative the sample is of the whole population, it does capture a significant portion of listed firms.

2.2 Adjustments and Definitions

Before discussing different estimation methods it is important to understand the underlying adjustments and definitions used in this study. First, all financial institutions are excluded due to the way their capital structure is influenced by explicit and implicit insurance schemes[12]. Second, a key metric of this study is *leverage*, but leverage can be measured in many different ways and capture substantially different aspects of a business. Rajan and Zingales (1995) primarily use debt to capital as a measure of leverage, arguing that it successfully captures the effects of past financing decisions[13]. To strengthen cross-sectional robustness they make sure to adjust the leverage measure for international accounting

[9]The 2013 world market capitalization was $60.24 trillion according to The World Bank (2019). The total number of listed companies in each of the G7 countries is sourced from The Global Economy (2019).

[10]Companies in the developed world have to have a trading frequency of at least 90% during the past 60 days, as well as a minimum market capitalization of $150 million (Thomson Reuters, 2015).

[11]There were a total of 5.8 million enterprises in the US alone in 2013 (Census Bureau, 2013).

[12]One example of such a scheme is deposit insurance.

[13]Compared to other leverage ratios such as total liabilities to total assets, debt to total assets and debt to net assets.

differences[14]. Their calculations also differentiate between capitalization measured at book- and market value of equity[15]. We find the framework by Rajan and Zingales (1995) very compelling and continue to follow it closely throughout our study.

Tangibility is defined as net fixed assets to total assets, representing the ratio of tangible assets on the firms balance sheet. *Market-to-book* ratio consists of total assets less total equity plus market capitalization, all divided by total assets, and stands as a proxy for investment opportunities. *Log of net sales* is a measure of company size and is calculated as the logarithm of net sales. *Profitability* ratio is defined as EBITDA to total assets. A major difference between this study and the one by Rajan and Zingales (1995) lies in the way market capitalization is captured; calculated as the annual average of daily values at close rather than the last known value of a given year. This is done to smooth out short-term disturbances and give a better representation of the firms market performance during the whole year.

In some instances, these calculations and adjustments produce highly unrealistic values, *outliers*, which make it next to impossible to logically interpret estimation results. Such values are removed by constraining each of the affected variables to a logical value range (see Table A1 in Appendix A). 938 firms (approx. 19.7% of the sample) are dropped after the removal of outliers, decreasing the total number of firms from 4750 to 3812. Furthermore, as briefly implied in Section 2.1 (Data Collection), some sectors contain too few firms to reliably represent the underlying population, this mainly concerns sectors of Agriculture, Arts and Entertainment, Public administration, Educational services and Other services. All sectors with less than 30 firms are censored, bringing the final sample size down to 3743 firms (approx. 78% of the original sample).

2.3 Model Specification

Three models are used to examine the effects of financial stress on the relationships between capital structure and its determinants; a *general* model, a *country-specific* model and a *sector-specific* model. All models are estimated twice, first when leverage is measured at

[14]By adjusting debt and equity, where adjusted debt is total debt less cash and short-term investments and adjusted equity is total equity plus provisions and deferred taxes less intangibles.

[15]Where book capital is the sum of adjusted debt and adjusted equity, while market capital is the sum of adjusted debt and market capitalization.

book value of equity – *book leverage* – and second when it is measured at market value of equity – *market leverage*. The effects of financial stress are captured with interaction terms, which are constructed by multiplying each capital structure determinant[16] with the St.Louis Fed Financial Stress Index (see Figure 1). These interaction terms produce positive coefficients when the relationships are affected positively by financial stress, and negative coefficients when they are affected negatively. It is important to stress that the St.Louis Fed Financial Stress Index also contains periods where the index is negative – indicating below-average financial stress – therefore, the expression "effects of financial stress" refers to an increase in the index and not its absolute value. On a final note, our primary focus lies with the coefficients of aforementioned determinants and interaction terms, any other regressors are included strictly for control.

The general model (see Equation 1) aims to capture the true causal effects of financial stress on the relationships between capital structure and its determinants, regardless of country or economic sector. The last two mentioned factors, and time trends, are controlled for with dummy variables[17], disentangling their effects from the other coefficients.

$$\begin{aligned}\text{Leverage}_{it} = \alpha_{it} \; &+ \; \beta_1 \text{Tangibility}_{it} \; + \; \beta_2 \text{Market-to-book}_{it} \; + \; \beta_3 \text{Log of Net Sales}_{it} \\ &+ \; \beta_4 \text{Profitability}_{it} \; + \; \beta_5 \text{Financial Stress}_t \; + \; \beta_6 \text{T.Inter}_{it} \\ &+ \; \beta_7 \text{M.Inter}_{it} \; + \; \beta_8 \text{S.Inter}_{it} \; + \; \beta_9 \text{P.Inter}_{it} \\ &+ \; i.\beta_{10 \to 23} \text{Year} \; + \; i.\beta_{24 \to 29} \text{Country} \\ &+ \; i.\beta_{30 \to 41} \text{Sector} \; + \; \varepsilon_{it}\end{aligned} \tag{1}$$

where:

$$\begin{aligned}\text{T.Inter}_{it} \; &= \; \text{Tangibility}_{it} \; * \; \text{Financial Stress}_t \\ \text{M.Inter}_{it} \; &= \; \text{Market-to-book}_{it} \; * \; \text{Financial Stress}_t \\ \text{S.Inter}_{it} \; &= \; \text{Log of Net Sales}_{it} \; * \; \text{Financial Stress}_t \\ \text{P.Inter}_{it} \; &= \; \text{Profitability}_{it} \; * \; \text{Financial Stress}_t\end{aligned}$$

The country-specific model (see Equation 2) is very similar to the general mode described

[16]Tangibility ratio, market-to-book ratio, log of net sales and profitability ratio.

[17]Dummy variables for the country of Canada, sector of Accommodation Services and year of 1999 are excluded to avoid creating a dummy variable trap.

above, the main difference being that it is conducted on each country separately rather than the whole sample at once. Consequently, the goal of this model is to capture international differences in the effects of financial stress on the relationships between capital structure and its determinants. One could argue that leverage ratios in one country might affect leverage ratios in another, for example if both compete in the same markets and force each other to take on more debt in order to keep up; however, controlling for such behaviour is not easy and is beyond the scope of this study. As such, control dummy variables for each country are excluded.

$$\begin{aligned}\text{Leverage}_{it} = \alpha_{it} &+ \beta_1\text{Tangibility}_{it} + \beta_2\text{Market-to-book}_{it} + \beta_3\text{Log of Net Sales}_{it} \\ &+ \beta_4\text{Profitability}_{it} + \beta_5\text{Financial Stress}_t + \beta_6\text{T.Inter}_{it} \\ &+ \beta_7\text{M.Inter}_{it} + \beta_8\text{S.Inter}_{it} + \beta_9\text{P.Inter}_{it} \\ &+ i.\beta_{10\to23}\text{Year} + i.\beta_{24\to35}\text{Sector} + \varepsilon_{it}\end{aligned} \tag{2}$$

The sector-specific model (see Equation 3) is a modified version of the country-specific model, studying differences at an industry-level rather than internationally. Much in the same way as with the previous model, one could argue that leverage ratios in one sector might affect leverage ratios in another; and similarly that controlling for such behaviour is beyond the complexity of this study. As such, control dummy variables for each sector are excluded.

$$\begin{aligned}\text{Leverage}_{it} = \alpha_{it} &+ \beta_1\text{Tangibility}_{it} + \beta_2\text{Market-to-book}_{it} + \beta_3\text{Log of Net Sales}_{it} \\ &+ \beta_4\text{Profitability}_{it} + \beta_5\text{Financial Stress}_t + \beta_6\text{T.Inter}_{it} \\ &+ \beta_7\text{M.Inter}_{it} + \beta_8\text{S.Inter}_{it} + \beta_9\text{P.Inter}_{it} \\ &+ i.\beta_{10\to23}\text{Year} + i.\beta_{24\to29}\text{Country} + \varepsilon_{it}\end{aligned} \tag{3}$$

The next step is to choose an appropriate estimation method for our three models. There are three potential candidates; *pooled* estimation, *fixed-effects* estimation and *random-effects* estimation. Since the sample is comprised of panel data[18], i.e. time-series with both within-group- and between-group variation, it is highly likely that some kind of panel model is necessary to estimate consistent results. The *Breusch and Pagan Lagrangian Multiplier*

[18]The panel is not balanced as a results of missing values and data adjustments.

Test is used to decide between the pooled- and random effects estimation[19]. The test proves to be significant, meaning that there is between-group variation in the sample, and that random-effects estimation is more appropriate than pooled estimation. Next, the *Hausman Test* is used to determine whether to use random-effects- or fixed-effects estimation[20]. Once again, the test proves to be significant, meaning that the residuals are correlated with the regressors, and that fixed-effects estimation is more appropriate. Both tests are conducted on the general model (see Equation 1). Lastly, Section 2.2 (Adjustments and Definitions) mentions that some adjustments produce unrealistic values, this includes negative leverage; a phenomena also encountered by Rajan and Zingales in their study from 1995. Following their approach we decide to use the *random-effects tobit model*[21] with censoring of the dependent variable at zero.

2.4 Robustness Checks

Before drawing any strong conclusions about the estimated relationships, one has to evaluate the validity of the results. One way to do this is to diagnose the residuals for normality and heteroskedasticity, where the former tries to assess whether or not the error term is normally distributed, and the latter whether or not that error term has constant variance. As seen in Figure 2 and Figure 3, the general model produces reasonably normally distributed residuals, especially in the case of book leverage. This strengthens the inference-aspect of the estimation. However, Figure 4 and Figure 5 indicate that there are problems with heteroskedasticity of the residuals, especially so when the model is estimated on market leverage. This poses potential problems for estimation of standard errors and confidence intervals, something the reader will have to bear in mind while interpreting the results. Figure B1 through Figure B8 (Appendix B) show that residuals from the country-specific- and sector-specific model follow a very similar theme; being largely normally distributed but heteroskedastic.

[19]The null hypothesis of the test being that there exist no significant differences across groups.
[20]The null hypothesis of the test being that the residuals are uncorrelated with the regressors.
[21]The panel data tobit model has no options for fixed-effects estimation.

Figure 2: Normality for the General Model at Book Leverage

Distribution of the standardized residuals (gray) compared against a normal plot (black). Standardized values are designed to have a mean on 0 and standard deviation of 1. Values are generated by the general model (see Equation 1) and estimated with the random effects tobit model.

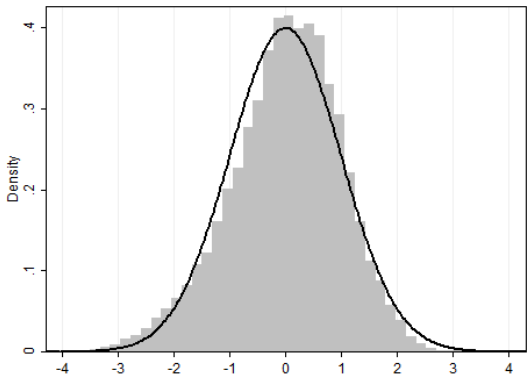


Figure 3: Normality for the General Model at Market Leverage

Distribution of the standardized residuals (gray) compared against a normal plot (black). Standardized values are designed to have a mean on 0 and standard deviation of 1. Values are generated by the general model (see Equation 1) and estimated with the random effects tobit model.

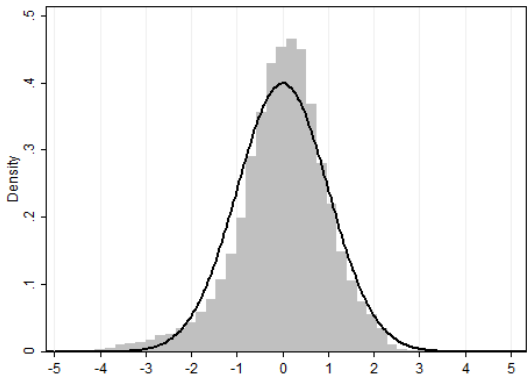


Figure 4: Heteroskedasticity for the General Model at Book Leverage

Standardized residuals (y-axis) plotted against standardized predicted values (x-axis). Standardized values are designed to have a mean on 0 and standard deviation of 1. Values are generated by the general model (see Equation 1) and estimated with the random effects tobit model.

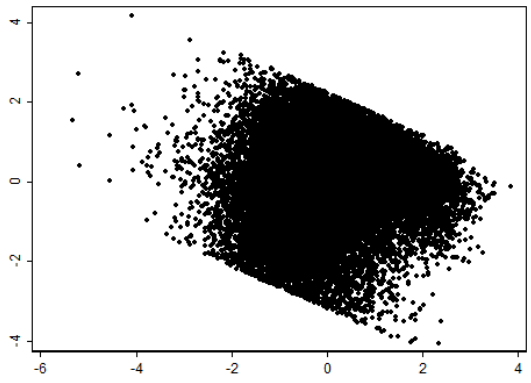
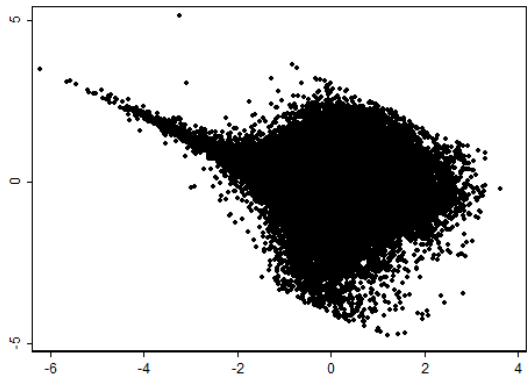


Figure 5: Heteroskedasticity for the General Model at Market Leverage

Standardized residuals (y-axis) plotted against standardized predicted values (x-axis). Standardized values are designed to have a mean on 0 and standard deviation of 1. Values are generated by the general model (see Equation 1) and estimated with the random effects tobit model.



3 Results and Analysis

3.1 Time-Series Patterns

In order to get a firm understanding of our findings and their implications, one has to study them from a broader spectrum than just by linear regression. For a start, graphical analysis gives one insight into how capital structure and its determinants evolve throughout the studied time frame – and whether or not some of the theorized relationships occur instantly or with delays. When comparing leverage in Figure 6 to the financial stress index in Figure 1 (see Section 2.1), both seem to develop somewhat similar; however, changes in financial stress appear to precede changes in leverage by about one to three years, indicating a positive but delayed relationship. One explanation for these delays may lie in the fact that leverage is reported annually while financial stress is reported weekly; hence, changes in the former should be realized only after they have occurred in the latter.

Figure 6: Capital Structure between 1999-12-31 and 2013-12-31

Calculated as the average annual capital structure between 1999-12-31 and 2013-12-31. Book leverage is defined as adjusted debt divided by the sum of adjusted debt and adjusted equity. Market leverage is defined as adjusted debt divided by the sum of adjusted debt and the average annual market capitalization.

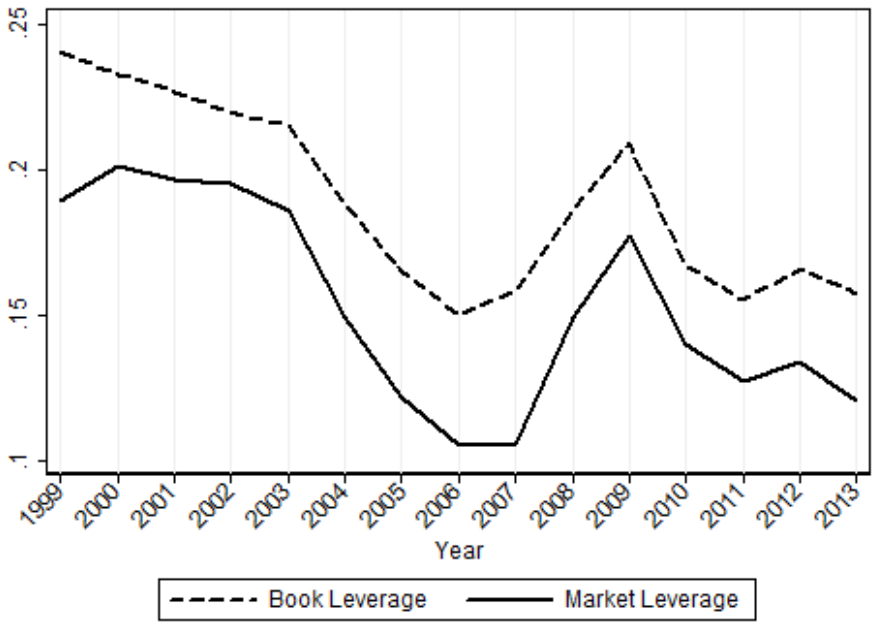


Figure 7: Tangibility Ratio between 1999-12-31 and 2013-12-31

Calculated as the average annual tangible assets ratio between 1999-12-31 and 2013-12-31. Tangible asset ratio is defined as net fixed assets divided by total assets.

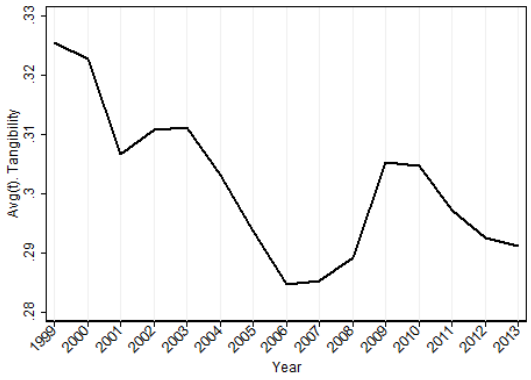


Figure 8: Market-to-book Ratio between 1999-12-31 and 2013-12-31

Calculated as the average annual market-to-book ratio between 1999-12-31 and 2013-12-31. Defined as total assets less total equity plus market capitalization, divided by total assets.

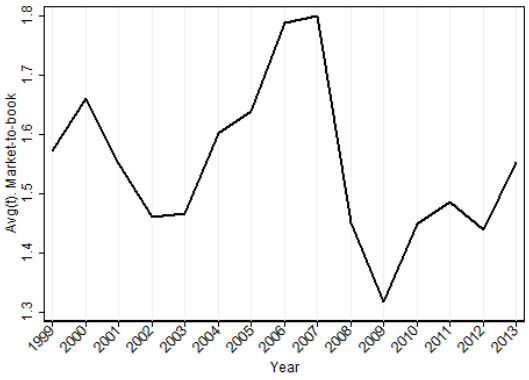


Figure 9: Log of Net Sales between 1999-12-31 and 2013-12-31

Calculated as the average annual log of net sales between 1999-12-31 and 2013-12-31. Log of net sales is defined as the logarithm of net sales.

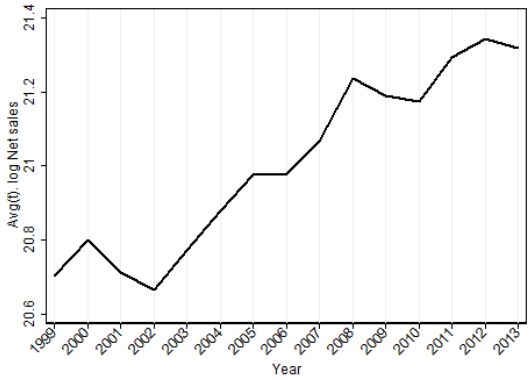
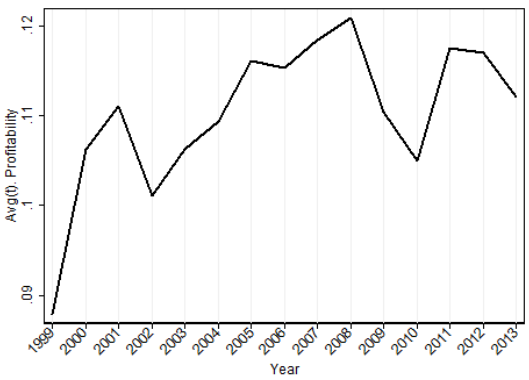


Figure 10: Profitability Ratio between 1999-12-31 and 2013-12-31

Calculated as the average annual profitability ratio between 1999-12-31 and 2013-12-31. Defined as EBITDA divided by total assets.



Both tangibility- and market-to-book ratio (see Figure 7 and Figure 8, respectively) appear to move in accordance with leverage in time, but in opposite directions with regards to correlation; where the former has a positive relationship with leverage while the latter has a

negative. This behaviour is in line with the findings of Rajan and Zingales (1995). However, the connection between capital structure and the last two determinants, log of net sales (see Figure 9) and profitability ratio (see Figure 10), is much harder to discern graphically due to inconsistent co-movements. Similarly, it is not at all obvious how the relationships are affected by financial stress – at least not without a comprehensive regression analysis.

3.2 International and Industrial Differences

This section aims to identify broad international- and industrial differences in capital structure and its determinants, as well as provide a rational for their existence. Table III and Table IV contain the average levels of each variable distributed across countries and sectors, respectively, as well as their total averages for the whole sample.

Table III: Capital Structure and its Determinants across the G7 Countries

All values are 14-year averages between 1999-12-31 and 2013-12-31. Book leverage is adjusted debt divided by the sum of adjusted debt and adjusted equity. Market leverage is adjusted debt divided by the sum of adjusted debt and the average annual market capitalization. Tangibility ratio is net fixed assets divided by total assets. Market-to-book ratio is total assets less total equity plus market capitalization, all divided by total assets. Log of net sales is the logarithm of net sales. Profitability ratio is EBITDA divided by total assets.

Country	Book Leverage	Market Leverage	Tangibility	Market-to-book	Log of Net Sales	Profitability
Canada	0.27	0.19	0.40	1.69	20.31	0.11
France	0.31	0.23	0.25	1.54	21.76	0.11
Germany	0.22	0.18	0.25	1.54	21.42	0.12
Italy	0.38	0.31	0.27	1.43	21.36	0.11
Japan	0.13	0.13	0.33	1.20	20.86	0.09
United Kingdom	0.23	0.13	0.30	1.92	21.43	0.14
United States	0.19	0.14	0.26	1.94	21.21	0.13
All Countries	**0.18**	**0.15**	**0.30**	**1.54**	**21.07**	**0.11**

Italy is by far the most leveraged country in the sample, both at book- and market leverage. Socio and Russo (2016) attribute this to cheap Italian debt in the wake of the 2007 - 2008 financial crisis. On the opposite side of the spectrum is Japan, the overall least leveraged country in the sample. Nishioka and Baba (2004) argue that Japan's low indebtedness stems from a lack of investment opportunities and heavy restructuring efforts post the 1990s asset price bubble.

Canada has the highest tangibility of all countries, this is partly due to its dominance in industries such as oil and mining, i.e. sectors that require substantial equipment and ma-

chinery. France and Germany, on the other hand, measure the lowest levels of tangibility; this is somewhat unexpected in the case of the latter, considering its heavy involvement in the automotive industry. However, it is important to stress that German companies report both funded and unfunded pension liabilities on their balance sheets; reducing their relative fraction of fixed assets.

Last, market-to-book and profitability seem to be somewhat positively correlated, especially considering the United States and Japan; where the former has some of the highest values in both cases and the latter has some of the lowest. In the case of the US, it is difficult to draw conclusions regarding which causes which, since high profitability can grant one access to additional investment opportunities – and likewise, readily available investment opportunities may lead to higher overall profitability. With regards to Japan, its low market-to-book and profitability is likely linked to the previously mentioned restructuring efforts and lack of investment opportunities. As for company size (log of net sales), the results are harder to discern without running a regression analysis.

Table IV: Capital Structure and its Determinants across NAICS Sectors

All values are 14-year averages between 1999-12-31 and 2013-12-31. Book leverage is adjusted debt divided by the sum of adjusted debt and adjusted equity. Market leverage is adjusted debt divided by the sum of adjusted debt and the average annual market capitalization. Tangibility ratio is net fixed assets divided by total assets. Market-to-book ratio is total assets less total equity plus market capitalization, all divided by total assets. Log of net sales is the logarithm of net sales. Profitability ratio is EBITDA divided by total assets.

Sector	Book Leverage	Market Leverage	Tangibility	Market-to-book	Log of Net Sales	Profitability
Accommodation	0.27	0.17	0.52	1.78	20.50	0.14
Administrative	0.14	0.11	0.21	1.97	21.10	0.14
Construction	0.15	0.13	0.19	1.11	21.16	0.06
Health Care	0.33	0.21	0.28	1.63	21.08	0.14
Information	0.20	0.12	0.22	1.89	21.29	0.13
Manufacturing	0.13	0.11	0.27	1.52	21.08	0.11
Mining, Quarrying	0.17	0.12	0.52	1.84	20.64	0.14
Professional	-0.02	0.01	0.14	1.95	20.65	0.11
Real Estate	0.50	0.43	0.54	1.28	19.79	0.08
Retail Trade	0.18	0.15	0.34	1.55	21.80	0.12
Transportation	0.40	0.33	0.57	1.28	21.46	0.10
Utilities	0.47	0.39	0.29	1.23	20.91	0.09
Wholesale Trade	0.21	0.17	0.20	1.35	21.70	0.10
All Sectors	**0.18**	**0.15**	**0.30**	**1.54**	**21.07**	**0.11**

Industrial differences are generally aligned with what one would expect. For instance, Real Estate is the most leveraged sector at both book- and market leverage. This is reasonable

since real estate firms have substantial fixed assets that can be used as collateral. In contrast, Professional Services is the least indebted sector, as well as the one with the lowest tangibility; meaning that only a small fraction of its total assets can be used as collateral. Transportation Services is the only sector with higher tangibility than Real Estate, this is likely linked to its significant dependence on warehouses and vehicles.

The positive correlation between market-to-book and profitability is seen across sectors as well, especially considering Administrative- and Construction Services; where the former has some of the highest values in both cases and the latter has some of the lowest. In the case of Administrative Services, it is difficult to find the rational behind this behaviour since it contains two rather different sub-sectors – *Administrative and Support Services* as well as *Waste Management and Remediation services* (Census Bureau, 2017). Construction Services, on the other hand, suffer from bad margins due to intense competition (Chan and Martek, 2017); which in turn likely limits its growth opportunities as well.

Finally, Retail Trade and Real Estate report the highest and lowest levels of sales, respectively. In the former this likely occurs because buyers and sellers are widely available, ready to engaging in rather small but frequent transactions. However, in the latter – a particularly illiquid market – both participants must exert substantial effort in order to find a suitable counterparty (He, Lin and Liu, 2018).

3.3 Regression Analysis

The general model (see Table V) estimates that all capital structure determinants are statistically significant, even at one percent level of significance, for both book- and market leverage. One standard deviation increase in tangibility, market-to-book, log of net sales and profitability[22] affect book leverage by 5.54, −2.34, 0.13 and −7.21 percentage points, respectively. For market leverage these coefficients change to 5.57, −5.70, 0.10 and −6.67 pp, respectively. As one can see, the coefficients remain quite similar regardless of the measure of leverage; the exception to this being the market-to-book ratio, whose magnitude more than doubles when switching from book- to market leverage. This is explained by the fact that an increase in market equity increases the market-to-book ratio and decreases market leverage – whereas book leverage remains mostly unaffected, i.e. less correlated.

[22]See Table A2 (Appendix A) for summary statistics on capital structure and its determinants.

Table V: Determinants of Capital Structure: An Evaluation across the G7 Countries between 1999-12-31 and 2013-12-31

Book leverage is adjusted debt divided by the sum of adjusted debt and adjusted equity. Market leverage is adjusted debt divided by the sum of adjusted debt and the average annual market capitalization. Tangibility is net fixed assets divided by total assets. Market-to-book is total assets less total equity plus market capitalization, all divided by total assets. Log of net sales is the logarithm of net sales. Profitability is EBITDA divided by total assets. T.Inter, M.Inter, S.Inter and P.Inter are interaction terms for tangibility, market-to-book, log of net sales and profitability, respectively; constructed by multiplying each of the latter variables with the St.Louis Fed Financial Stress Index (see Figure 1). Results from the general model (see Equation 1) and the country-specific model (see Equation 2) are estimated using the random effects tobit model.

Country	Tangibility	Market-to-book	Log of Net Sales	Profitability	T.Inter	M.Inter	S.Inter	P.Inter
Book Leverage								
Canada	0.1135**	-0.0239***	0.0447***	-0.6780***	-0.0001	0.0009	-0.0001	0.0421
	(0.04)	(0.01)	(0.01)	(0.09)	(0.01)	(0.00)	(0.00)	(0.03)
France	0.0792**	-0.0253**	0.0634***	-0.6496***	-0.0210	0.0014	0.0034**	0.0336
	(0.04)	(0.01)	(0.01)	(0.14)	(0.01)	(0.01)	(0.00)	(0.06)
Germany	0.0481	-0.0732***	0.0324***	-0.5717***	-0.0480***	-0.0019	0.0040***	0.0652*
	(0.05)	(0.01)	(0.01)	(0.08)	(0.02)	(0.00)	(0.00)	(0.04)
Italy	0.0694	-0.0290*	0.0665***	-0.2761	0.0032	0.0124	-0.0022	0.0197
	(0.07)	(0.02)	(0.01)	(0.20)	(0.02)	(0.01)	(0.00)	(0.09)
Japan	0.4415***	0.0230***	0.1091***	-1.5950***	-0.0106**	-0.0033	-0.0010*	0.0749***
	(0.02)	(0.00)	(0.00)	(0.05)	(0.00)	(0.00)	(0.00)	(0.02)
United Kingdom	0.1946***	-0.0196**	0.0571***	-0.3016***	-0.0211*	-0.0053	-0.0011	0.0572
	(0.07)	(0.01)	(0.01)	(0.12)	(0.01)	(0.00)	(0.00)	(0.05)
United States	0.3491***	-0.0453***	0.0655***	-0.6885***	-0.0015	0.0019	-0.0014*	0.0532***
	(0.03)	(0.00)	(0.00)	(0.04)	(0.01)	(0.00)	(0.00)	(0.02)
General Model	**0.2640*** **	**-0.0244*** **	**0.0794*** **	**-0.9013*** **	**-0.0087*** **	**0.0019** **	**-0.0003**	**0.0491*** **
	(0.01)	**(0.00)**	**(0.00)**	**(0.03)**	**(0.00)**	**(0.00)**	**(0.00)**	**(0.01)**
Market Leverage								
Canada	0.1849***	-0.0553***	0.0352***	-0.6238***	0.0093	-0.0035	0.0010	0.0226
	(0.03)	(0.01)	(0.00)	(0.07)	(0.01)	(0.00)	(0.00)	(0.02)
France	0.1047***	-0.0423***	0.0587***	-0.6469***	-0.0324***	-0.0025	0.0011	0.0355
	(0.03)	(0.01)	(0.01)	(0.10)	(0.01)	(0.00)	(0.00)	(0.04)
Germany	0.0194	-0.1222***	0.0251***	-0.6510***	-0.0245*	-0.0057	0.0022**	0.0702**
	(0.04)	(0.01)	(0.01)	(0.07)	(0.01)	(0.00)	(0.00)	(0.03)
Italy	0.1649***	-0.0390***	0.0779***	-0.7707***	-0.0026	0.0069	-0.0038*	0.0736
	(0.06)	(0.01)	(0.01)	(0.17)	(0.02)	(0.01)	(0.00)	(0.07)
Japan	0.4663***	-0.0309***	0.1027***	-1.6524***	-0.0184***	-0.0077***	-0.0018***	0.0670***
	(0.02)	(0.00)	(0.00)	(0.04)	(0.00)	(0.00)	(0.00)	(0.01)
United Kingdom	0.1719***	-0.0443***	0.0290***	-0.2880***	-0.0154***	-0.0082***	0.0002	0.0431*
	(0.04)	(0.01)	(0.00)	(0.06)	(0.01)	(0.00)	(0.00)	(0.02)
United States	0.3070***	-0.0689***	0.0400***	-0.4476***	0.0123***	-0.0037***	0.0002	0.0175*
	(0.02)	(0.00)	(0.00)	(0.03)	(0.00)	(0.00)	(0.00)	(0.01)
General Model	**0.2653*** **	**-0.0594*** **	**0.0647*** **	**-0.8334*** **	**-0.0027**	**-0.0027*** **	**-0.0003**	**0.0337*** **
	(0.01)	**(0.00)**	**(0.00)**	**(0.02)**	**(0.00)**	**(0.00)**	**(0.00)**	**(0.01)**

*, **, and *** reflect significance at 10%, 5% and 1%, respectively.

The effects of tangibility and market-to-book are in line with the previous findings of Rajan and Zingales (1995) – where leverage increases with fixed assets and decreases with investment opportunities. This also supports the relationships found in the graphical

analysis (see Section 3.1). However, as mentioned in the beginning of this study, there is no clear theoretical consensus regarding the last two determinants – company size and profitability. In case of the former, our general model predicts a positive relationship with capital structure; a possible rational being that larger firms are more diversified and can withstand higher amounts of debt. In case of the latter, the relationship is predicted to be negative, hinting to the fact that profitable firms can use their own equity to fund development, as well as pay off any existing debt faster.

Next, we examine the effects of financial distress on the relationships between capital structure and its determinants, primarily focusing on the financial crisis of 2007 - 2008. It becomes quickly apparent that the results are not as consistent as those described earlier. As an example, the interaction term for log of net sales is not significant in either of the two general models, while the interaction for tangibility is only significant at book leverage. Another ambiguity can be seen with the interaction term for market-to-book, which switches signs depending on the measure of leverage. At the peak of the financial crisis, one standard deviation increase in tangibility and market-to-book affected book leverage by 0.93 and -1.33 pp rather than 5.54 and -2.34 pp, respectively. With regards to market leverage, the effect of market-to-book changed from -5.70 pp to -7.13 pp. The most profound impact was found in the effect of profitability, now actually increasing book- and market leverage by 18.79 and 11.18 pp, respectively, rather than decreasing them.

These findings are generally consistent with our hypotheses (see Section 1.3). As mentioned in Section 3.1, leverage and financial stress have a positive but delayed relationship, meaning that the incentive to take on debt grows with market risk. However, creditors may now fear liquidity issues and be more reserved about fixed assets serving as collateral, especially in the case of real estate. Instead, they may now emphasize on the firm's cash flows and profitability. Furthermore, the heightened market risk may cause highly leveraged companies to pass up on even more investment opportunities, putting downwards pressure on the relationship between leverage and the market-to-book ratio. One possible explanation for the unexpected behaviour between market-to-book and book leverage may lie in the fact that some firms are desperately trying to increase their profits – in order to attain higher leverage – regardless if it means taking on risky investments during a crisis.

Table VI: Determinants of Capital Structure: An Evaluation across NAICS Sectors between 1999-12-31 and 2013-12-31

Book leverage is adjusted debt divided by the sum of adjusted debt and adjusted equity. Market leverage is adjusted debt divided by the sum of adjusted debt and the average annual market capitalization. Tangibility is net fixed assets divided by total assets. Market-to-book is total assets less total equity plus market capitalization, all divided by total assets. Log of net sales is the logarithm of net sales. Profitability is EBITDA divided by total assets. T.Inter, M.Inter, S.Inter and P.Inter are interaction terms for tangibility, market-to-book, log of net sales and profitability, respectively; constructed by multiplying each of the latter variables with the St.Louis Fed Financial Stress Index (see Figure 1). Results from the general model (see Equation 1) and the sector-specific model (see Equation 3) are estimated using the random effects tobit model.

Sector	Tangibility	Market-to-book	Log of Net Sales	Profitability	T.Inter	M.Inter	S.Inter	P.Inter
Book Leverage								
Accommodation	0.4376***	0.0298***	0.0471***	-1.3813***	0.0132	0.0004	0.0044	0.0405
	(0.09)	(0.01)	(0.02)	(0.20)	(0.02)	(0.01)	(0.00)	(0.08)
Administrative	0.3453**	-0.0547***	0.0121	-0.3302	-0.0089	0.0234**	0.0014	-0.0415
	(0.17)	(0.02)	(0.02)	(0.28)	(0.03)	(0.01)	(0.00)	(0.11)
Construction	0.7258***	0.0197	0.1126***	-1.0872***	-0.0145	-0.0084	-0.0015	0.0932*
	(0.10)	(0.02)	(0.02)	(0.13)	(0.02)	(0.01)	(0.00)	(0.05)
Health Care	0.4119***	-0.0741***	-0.0152	-1.4110***	0.0213	0.0106	0.0049	0.0476
	(0.11)	(0.02)	(0.02)	(0.23)	(0.03)	(0.01)	(0.00)	(0.10)
Information	0.3409***	-0.0413***	0.1000***	-0.3372***	-0.0095	-0.0034	-0.0033	0.0131
	(0.08)	(0.01)	(0.01)	(0.11)	(0.02)	(0.01)	(0.00)	(0.05)
Manufacturing	0.4589***	-0.0264***	0.0898***	-1.0960***	-0.0246***	-0.0008	-0.0008	0.0630***
	(0.03)	(0.00)	(0.00)	(0.04)	(0.01)	(0.00)	(0.00)	(0.01)
Mining, Quarrying	0.1370***	0.0011	0.0379***	-0.5018***	-0.0138	0.0075*	0.0019	0.0354
	(0.05)	(0.01)	(0.01)	(0.10)	(0.02)	(0.00)	(0.00)	(0.04)
Professional	0.7315***	-0.0258***	0.0518***	-0.4769***	-0.0559**	0.0035	-0.0008	-0.0049
	(0.11)	(0.01)	(0.01)	(0.13)	(0.02)	(0.00)	(0.00)	(0.04)
Real Estate	0.0338*	-0.0313***	0.0556***	-0.3746***	0.0050	0.0008	0.0019	0.0194
	(0.02)	(0.01)	(0.01)	(0.10)	(0.00)	(0.00)	(0.00)	(0.03)
Retail Trade	0.2775***	-0.0186*	0.0850***	-1.6880***	-0.0142	0.0082*	-0.0026*	0.1492***
	(0.07)	(0.01)	(0.01)	(0.13)	(0.01)	(0.00)	(0.00)	(0.04)
Transportation	0.4286***	0.0374**	0.0701***	-1.3444***	0.0153	0.0044	-0.0020	0.0183
	(0.05)	(0.02)	(0.01)	(0.13)	(0.01)	(0.01)	(0.00)	(0.05)
Utilities	0.2404***	0.0061	0.0408**	0.6184*	-0.0206	-0.0077	0.0039	-0.0160
	(0.09)	(0.04)	(0.02)	(0.37)	(0.03)	(0.01)	(0.00)	(0.15)
Wholesale Trade	0.2603***	0.0174	0.0621***	-1.6718***	-0.0354**	-0.0005	-0.0020	0.1442***
	(0.08)	(0.01)	(0.01)	(0.17)	(0.01)	(0.01)	(0.00)	(0.05)
General Model	**0.2640*** **	**-0.0244*** **	**0.0794*** **	**-0.9013*** **	**-0.0087*** **	**0.0019** **	**-0.0003**	**0.0491*** **
	(0.01)	**(0.00)**	**(0.00)**	**(0.03)**	**(0.00)**	**(0.00)**	**(0.00)**	**(0.01)**
Market Leverage								
Accommodation	0.2936***	-0.0144*	0.0501***	-1.3515***	0.0071	0.0002	0.0023	0.0381
	(0.06)	(0.01)	(0.01)	(0.13)	(0.01)	(0.00)	(0.00)	(0.05)
Administrative	0.3672***	-0.0856***	0.0156	0.0742	0.0043	0.0062	-0.0007	-0.0813
	(0.10)	(0.01)	(0.01)	(0.17)	(0.02)	(0.01)	(0.00)	(0.07)
Construction	0.8148***	-0.0596***	0.1336***	-1.1996***	-0.0409*	-0.0132	-0.0046*	0.0739
	(0.09)	(0.02)	(0.02)	(0.13)	(0.02)	(0.01)	(0.00)	(0.05)
Health Care	0.2670***	-0.1619***	0.0057	-0.8388***	0.0238	0.0116*	0.0022	-0.0192
	(0.08)	(0.02)	(0.01)	(0.17)	(0.02)	(0.01)	(0.00)	(0.07)
Information	0.2124***	-0.0596***	0.0444***	-0.1785***	-0.0020	0.0011	0.0017	-0.0543*
	(0.05)	(0.01)	(0.01)	(0.06)	(0.01)	(0.00)	(0.00)	(0.03)
Manufacturing	0.5087***	-0.0599***	0.0690***	-1.0048***	-0.0059	-0.0037***	-0.0005	0.0480***
	(0.02)	(0.00)	(0.00)	(0.03)	(0.00)	(0.00)	(0.00)	(0.01)
Mining, Quarrying	0.1648***	-0.0286***	0.0276***	-0.3374***	0.0092	0.0024	0.0016	0.0187
	(0.03)	(0.01)	(0.01)	(0.06)	(0.01)	(0.00)	(0.00)	(0.02)

Table VI continued from previous page

Sector	Tangibility	Market-to-book	Log of Net Sales	Profitability	T.Inter	M.Inter	S.Inter	P.Inter
				Market Leverage				
Professional	0.4650***	-0.0340***	0.0303***	-0.4040***	-0.0336***	-0.0027	0.0013	0.0228
	(0.06)	(0.01)	(0.01)	(0.07)	(0.01)	(0.00)	(0.00)	(0.02)
Real Estate	0.0218	-0.1807***	0.0538***	-0.3414***	0.0076*	-0.0081**	0.0014	-0.0004
	(0.02)	(0.01)	(0.01)	(0.09)	(0.00)	(0.00)	(0.00)	(0.03)
Retail Trade	0.2610***	-0.0317***	0.0722***	-1.5037***	-0.0222***	-0.0096***	-0.0019*	0.1461***
	(0.05)	(0.01)	(0.01)	(0.10)	(0.01)	(0.00)	(0.00)	(0.03)
Transportation	0.4951***	-0.1344***	0.0534***	-1.3745***	0.0052	0.0036	-0.0032***	0.0095
	(0.04)	(0.01)	(0.01)	(0.11)	(0.01)	(0.01)	(0.00)	(0.04)
Utilities	0.3264***	-0.1847***	0.0316**	0.1074	-0.0322	0.0118	0.0038	-0.1665
	(0.07)	(0.03)	(0.01)	(0.29)	(0.02)	(0.01)	(0.00)	(0.13)
Wholesale Trade	0.4431***	-0.0434***	0.0622***	-1.5989***	-0.0328***	-0.0098*	-0.0020	0.1119***
	(0.07)	(0.01)	(0.01)	(0.15)	(0.01)	(0.01)	(0.00)	(0.04)
General Model	**0.2653*** **	**-0.0594*** **	**0.0647*** **	**-0.8334*** **	**-0.0027**	**-0.0027*** **	**-0.0003**	**0.0337*** **
	(0.01)	**(0.00)**	**(0.00)**	**(0.02)**	**(0.00)**	**(0.00)**	**(0.00)**	**(0.01)**

*, **, and *** reflect significance at 10%, 5% and 1%, respectively.

Next, we explore how country-specific- and sector-specific differences in interaction effects (see Table V and Table VI, respectively) relate to broad international- and industrial differences in capital structure and its determinants (see Table III and Table IV, respectively). There are no clear patterns for the interaction effects of investment opportunities (market-to-book ratio) – disregarding them from further evaluation.

Out of all countries, Canada has the highest ratio of fixed assets and one of the least significant interaction effects for tangibility. The former is likely related to its dominance in the fields of oil and mining. Interestingly, the Mining and Quarrying sector follows a very similar pattern, both with regards to interaction effects and overall tangibility. France and Germany, on the other hand, have some of the lowest ratios of tangible assets- and the largest corresponding interaction effects. The same can be said about their most dominant industries – Professional Services and Manufacturing. This suggests that the relationship between capital structure and tangible assets is *less affected* by financial stress in countries and sectors with high tangibility. One possible explanation is that groups with high tangibility experience less liquidity issues – due to internal demand – than those with low; therefore making it easier to attain credit in the former case as compared to the latter.

The interaction effect for log of net sales (company size) is most prominent in France and Germany, two countries with some of the largest businesses in the sample. However, these effects likely stem from country-related reasons, seeing as no statistically significant sectors have the same signs in their coefficients. On the opposite side of the spectrum is Canada,

a country with some of the smallest firms and the least significant interaction effects. This is to some degree also reflected in its dominant sector – Mining and Quarrying. Hence, the relationship between capital structure and company size is *more affected* by financial stress in countries and sectors with large firms. Seeing as the interaction effects for France and Germany are positive, one could argue that larger businesses are more diversified and better shielded against financial distress. However, this directly contradicts Kudlyak and Sanchez (2017), who found that sales of large firms contracted more relative to small ones during the 2007 - 2008 financial crisis.

Last, the country of Japan has both the lowest profit margin and the strongest interaction effect for profitability. This is also seen in the country's largest sector – Wholesale Trade. The US and the UK, on the other hand, have some of the greatest profits- and weakest interaction effects in the sample. The same can be said about their most prominent industries – Mining and Quarrying, Health Care, Accommodation Services and Administrative Services. This implies that the relationship between capital structure and profit margin is *less affected* by financial stress in countries and sectors with high profitability. Tying this back to the pecking order theory (Myers and Majluf, 1984) – highly profitable firms continue to rely on internal financing, regardless of what takes place in the credit markets. Consequently, this decreases their sensitivity to the disturbances of financial stress.

4 Conclusion

This paper examines the effects of financial distress on the relationships between capital structure and its determinants; continuing on the famous research by Rajan and Zingales from 1995 – *What Do We Know about Capital Structure?* Although capital structure is a well-researched area, a large portion of its theoretical groundwork is still based on studies from the twentieth century; a quite different setting compared to today's financial markets. This raises the question of what influences a company's position in the modern day's credit markets, especially in times of financial distress.

The sample contains balance sheet information for 3743 non-financial firms over a period of 14 years, between 1999-12-31 and 2013-12-31, classified into NAICS sectors and distributed across the G7 countries. Overall, the sample covers approximately 35% of the world market capitalization and 28% of all listed companies in the G7 for 2013. Three models are

formulated to address the research question; a *general* model, a *country-specific* model and a *sector-specific* model. The general model is aimed at capturing the true causal effects of financial stress on the relationships between capital structure and its determinants, regardless of country or economic sector. The country-specific model is used to study these effects at an international level, while the sector-specific model is used to study them across sectors. Following the approach of Rajan and Zingales (1995), we decide to estimate said models using the *random-effects tobit* method.

Overall, results from the general model reveal that the determinants of capital structure are statistically significant and in line with earlier literature. It is also learned that financial stress (i) puts downwards pressure on the positive relationship between capital structure and tangible assets, (ii) causes a substantial shift in the negative link between capital structure and profitability, so much so that it becomes strongly positive, (iii) has an ambiguous effect on the relationship between capital structure and investment opportunities, putting upwards pressure when measured at book leverage and downwards pressure when measured at market leverage, (iv) has weak impact on the relationship between capital structure and tangible assets in countries and sectors with high tangibility, (v) has strong impact on the relationship between capital structure and company size in countries and sectors with large firms, and (vi) has weak impact on the relationship between capital structure and profitability in countries and sectors with high profit margin.

4.1 Future Research

We strongly encourage further research and development of this topic, both for the purposes of reevaluation and expansion. For a start, one could gather more data on countries such as Italy and France, seeing as they currently lag behind in terms of observations. Moreover, it is possible to better represent the underlying population by using databases that are less skewed towards larger companies. Also, it would be interesting to see similar studies for private firms, given their significant role in the total economy. With regards to model specification and robustness, there is room to tackle the previously mentioned issue of heteroskedasticity. Last but not least, one could further expand upon the briefly discussed delays between leverage and financial stress – as well as their implications for earlier studies.

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A Tables

Table A1: Truncation Criterion for Outliers

Book leverage is adjusted debt divided by the sum of adjusted debt and adjusted equity. Market leverage is adjusted debt divided by the sum of adjusted debt and the average annual market capitalization. Tangibility is net fixed assets divided by total assets. Market-to-book is total assets less total equity plus market capitalization, all divided by total assets. Log of net sales is the logarithm of net sales. Profitability is EBITDA divided by total assets. Market capitalization is recorded in USD. Market leverage, book leverage, tangibility, market-to-book and profitability are ratios, where 1 equals 100%.

Variable	Truncation at min	Truncation at max
Book Leverage	-1	1
Market Leverage	-1	1
Tangibility	-	-
Market-to-book	-	10
Log of Net Sales	-	-
Profitability	-1	1
Market Capitalization	>0	-

Table A2: Summary Statistics for Capital Structure and its Determinants

Book leverage is adjusted debt divided by the sum of adjusted debt and adjusted equity. Market leverage is adjusted debt divided by the sum of adjusted debt and the average annual market capitalization. Tangibility is net fixed assets divided by total assets. Market-to-book is total assets less total equity plus market capitalization, all divided by total assets. Log of net sales is the logarithm of net sales. Profitability is EBITDA divided by total assets. Market capitalization is recorded in USD. Market leverage, book leverage, tangibility, market-to-book and profitability are ratios, where 1 equals 100%.

Variable	Observations	Mean	Standard Deviation	Min	Max
Book Leverage	37972	0.18	0.42	-1.00	1.00
Market Leverage	37972	0.15	0.31	-1.00	1.00
Tangibility	37883	0.30	0.21	-1.33	2.87
Market-to-book	37972	1.54	0.96	0.30	10.00
Log of Net Sales	36789	21.06	1.60	7.27	26.88
Profitability	37972	0.11	0.08	-0.93	0.96
Market Capitalization	37972	5.23e+09	1.70e+10	298394	5.39e+11

B Figures

Figure B1: Normality for the Country-Specific Model at Book Leverage

Distribution of the standardized residuals (gray) compared against a normal plot (black), across countries of exchange (the G7-members). Standardized values are designed to have a mean on 0 and standard deviation of 1. The residuals are generated by the country-specific model (see Equation 2) and estimated with the random effects tobit model.

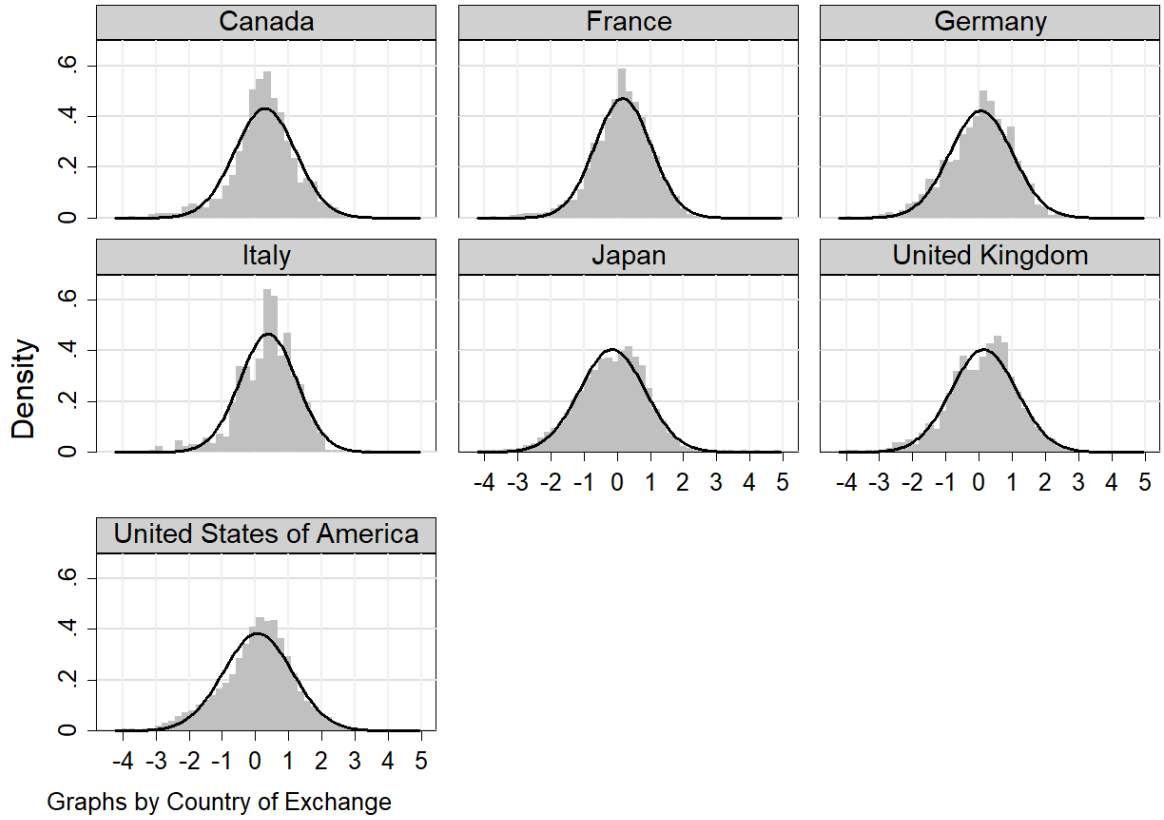

Figure B2: Normality for the Country-Specific Model at Market Leverage

Distribution of the standardized residuals (gray) compared against a normal plot (black), across countries of exchange (the G7-members). Standardized values are designed to have a mean on 0 and standard deviation of 1. The residuals are generated by the country-specific model (see Equation 2) and estimated with the random effects tobit model.

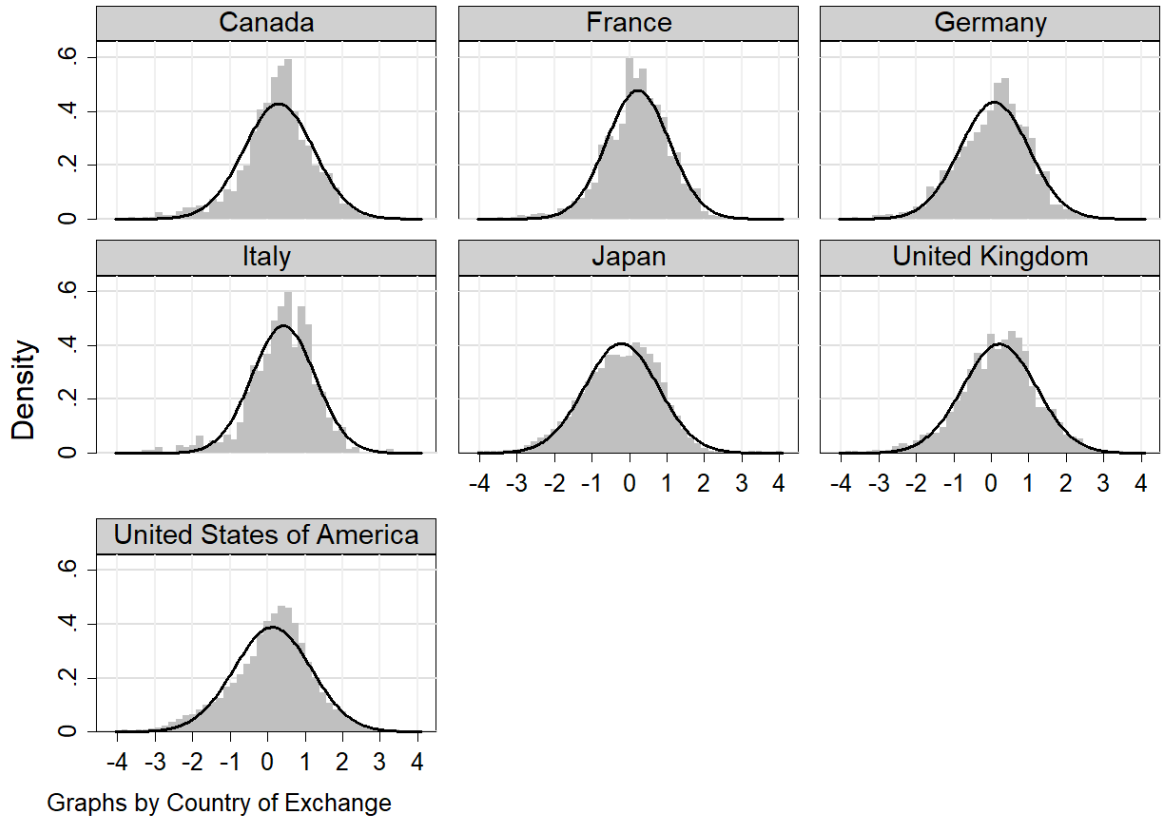

Figure B3: Normality for the Sector-Specific Model at Book Leverage

Distribution of the standardized residuals (gray) compared against a normal plot (black), across NAICS sectors. Standardized values are designed to have a mean on 0 and standard deviation of 1. The residuals are generated by the sector-specific model (see Equation 3) and estimated with the random effects tobit model.

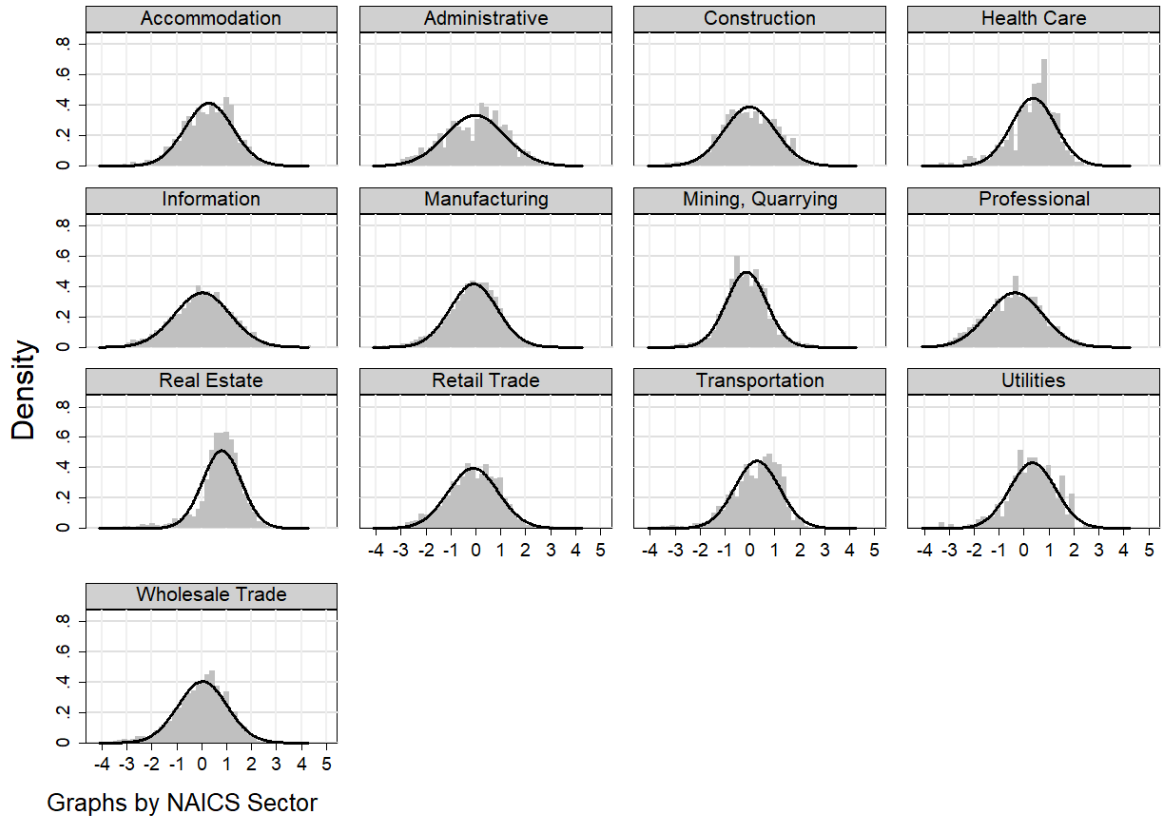

Figure B4: Normality for the Sector-Specific Model at Market Leverage

Distribution of the standardized residuals (gray) compared against a normal plot (black), across NAICS sectors. Standardized values are designed to have a mean on 0 and standard deviation of 1. The residuals are generated by the sector-specific model (see Equation 3) and estimated with the random effects tobit model.

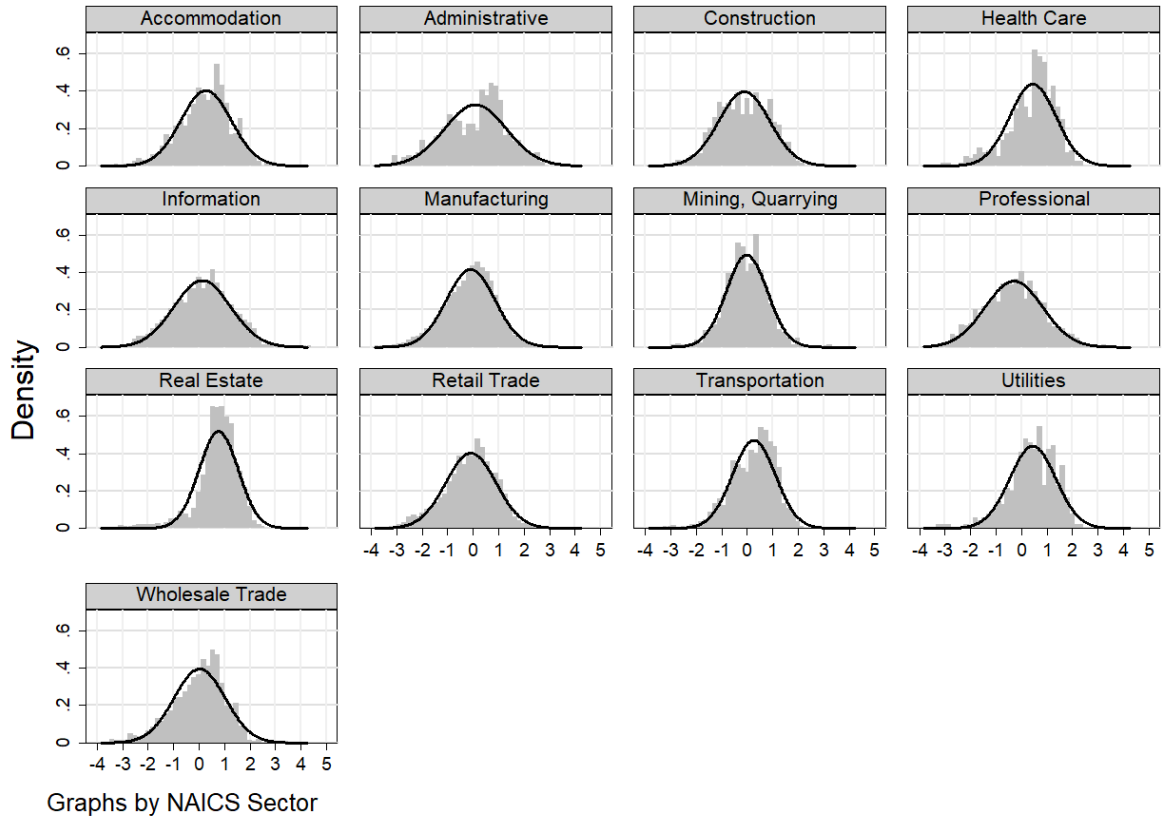

Figure B5: Heteroskedasticity for the Country-Specific Model at Book Leverage

Standardized residuals (y-axis) plotted against standardized predicted values (x-axis), across countries of exchange (the G7-members). Standardized values are designed to have a mean on 0 and standard deviation of 1. All values are generated by the country-specific model (see Equation 2) and estimated with the random effects tobit model.

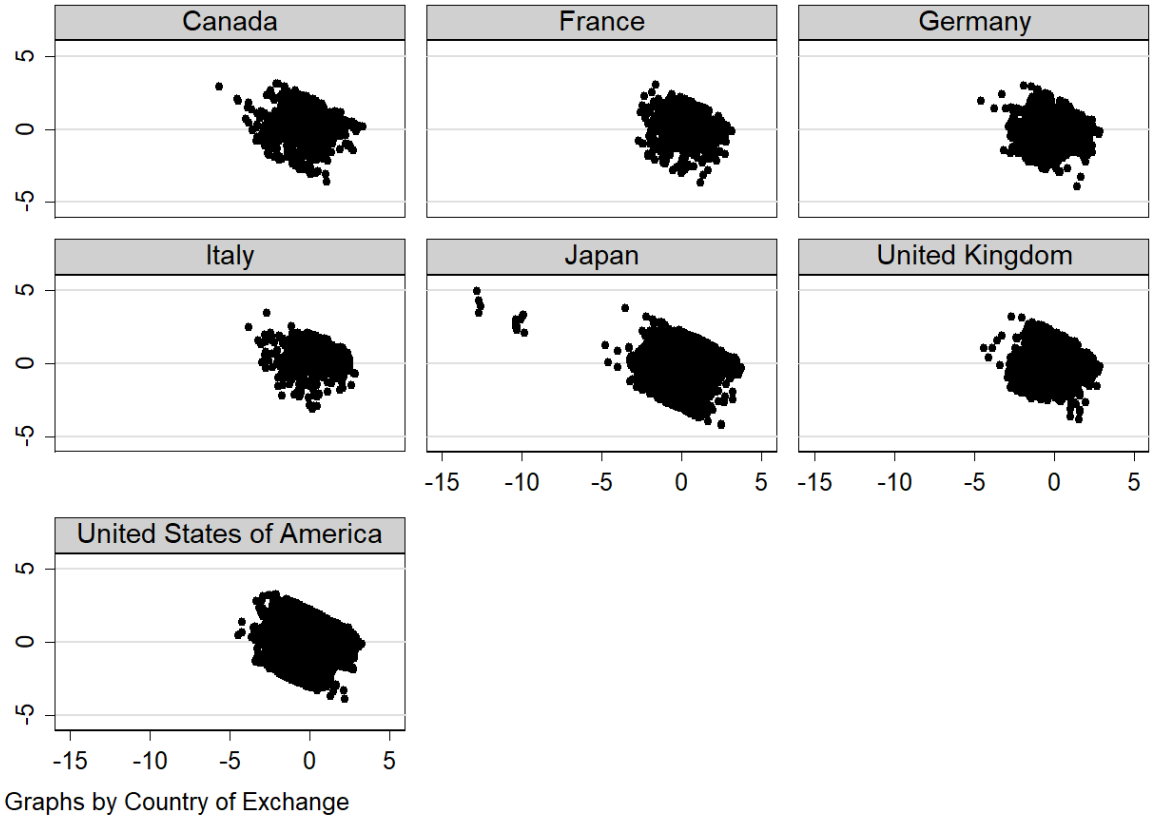

Figure B6: Heteroskedasticity for the Country-Specific Model at Market Leverage

Standardized residuals (y-axis) plotted against standardized predicted values (x-axis), across countries of exchange (the G7-members). Standardized values are designed to have a mean on 0 and standard deviation of 1. All values are generated by the country-specific model (see Equation 2) and estimated with the random effects tobit model.

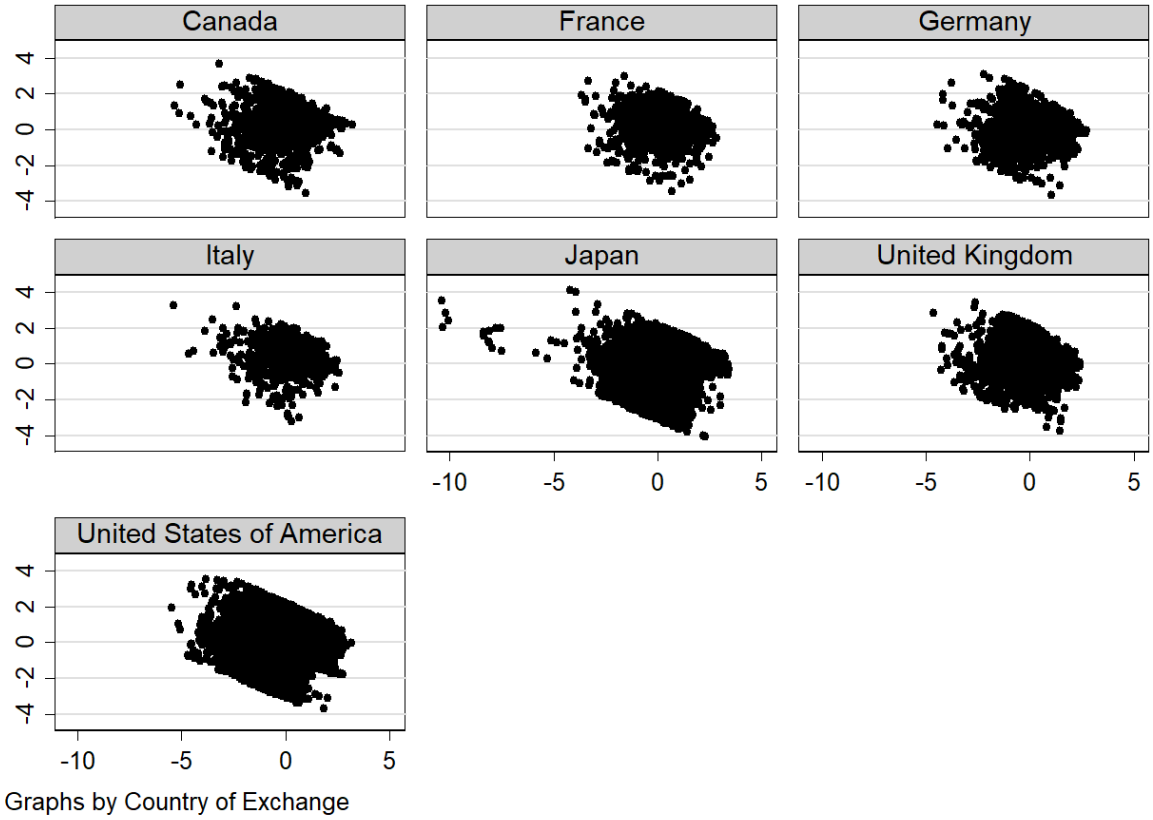

Figure B7: Heteroskedasticity for the Sector-Specific Model at Book Leverage

Standardized residuals (y-axis) plotted against standardized predicted values (x-axis), across NAICS sectors. Standardized values are designed to have a mean on 0 and standard deviation of 1. All values are generated by the sector-specific model (see Equation 3) and estimated with the random effects tobit model.

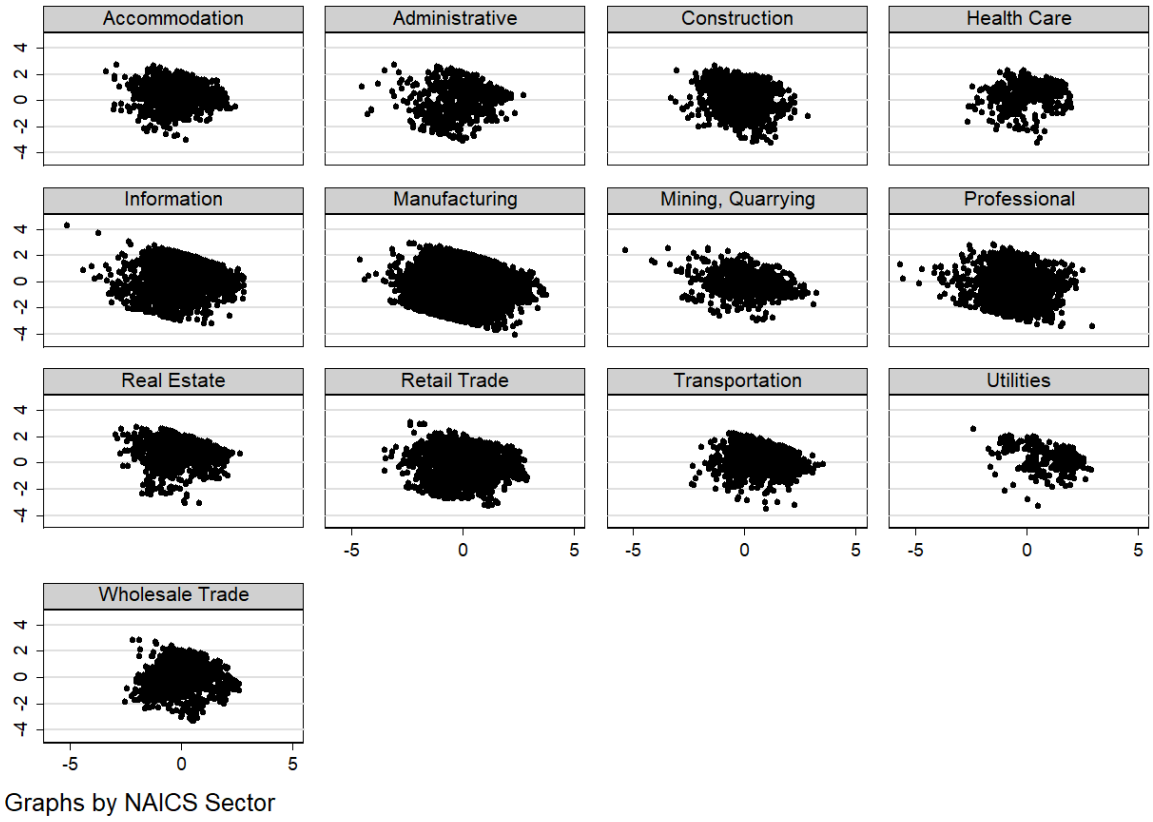

Figure B8: Heteroskedasticity for the Sector-Specific Model at Market Leverage

Standardized residuals (y-axis) plotted against standardized predicted values (x-axis), across NAICS sectors. Standardized values are designed to have a mean on 0 and standard deviation of 1. All values are generated by the sector-specific model (see Equation 3) and estimated with the random effects tobit model.