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THE EFFECT OF THE COLLATERAL CHANNEL IN EUROPE: CROSS-COUNTRY EVIDENCE

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Abstract

This paper examines the collateral channel across 25 European countries during the period of 2006-2014. We use a large panel of firms to determine how the institutional environment affects the strength of the collateral channel. The evidence shows firms' financing decisions to be determined by collateral across countries, while the variation in the strength of the collateral channel is described by the level of market development, regulatory quality, informational asymmetry and nonperforming loans. Depending on the amount of collateral a firm owns, the relations will differ due to the institutional characteristics, as firms with less collateral often face borrowing constraints. Our findings are important for both firm managers as well as policy makers, as we discuss how firms can strive for better access of debt through the collateral channel, while the strength of the channel can be enhanced through higher financial development and informational efficiency.

1. Introduction

Previous literature finds the collateral channel to be one of the most significant determinants of capital structure (Rampini & Viswanathan, 2013). The collateral channel is the mechanism through which asset tangibility affects leverage. This relation means that asset structure and values affect firms' financing decisions. The reasoning behind this is that assets are pledged as collateral in acquiring external financing from banks, therefore greater asset tangibility gives companies better access to credit.

Increases in asset tangibility give firms more opportunity to take on debt, while also giving firms a better cost of debt (Van Binsbergen, Graham, & Yang, 2010; Benmelech, Germaise, & Moskowitz, 2005). Therefore, the value, quality and liquidity of collateral is of immense importance in determining the cost of borrowing. With a lower cost of borrowing, firms will be more inclined to raise debt levels.

There are both firm-specific and institutional factors, which affect how the collateral channel works across countries. Hall, Hutchinson, and Michaelas (2004) study the determinants of the capital structure of European small and medium enterprises and conclude that only firm-specific variables do not explain certain cross-country variations in leverage, indicating the need of including institutional variables in the empirical research design. In addition, they find collateral to be the most important determinant. Therefore, the collateral channel strength is likely to vary across countries due to institutional differences such as the strength of legal rights or level of market development. Given a certain institutional environment, we hypothesize a stronger or weaker collateral channel to be present.

In order to study the collateral channel, we formulate two research questions:

1. What is the relation between collateral and firms' capital structure across Europe?
2. How do institutional factors affect the collateral channel across countries?

Using a sample of public and private companies from 25 European countries over the period of 2006-2014, we study firm panel data to research the reasons behind the variation in the strength of the collateral channel. We use an industry fixed effects model to study the institutional environment. With a baseline regression, we determine the initial variation in the strength of the collateral channel by country, further adding interactions to determine the institutional influencers.

In line with the previous literature, such as findings by Rajan and Zingales (1995) and Antoniou, Guney, and Paudyal (2008), we find evidence that there is a positive relation

between collateral and leverage. We further find that the relation between the collateral channel and capital structure varies across countries due institutional differences. Our findings indicate that firms have different access to debt across countries. Firstly, we conclude that the level of market development has a positive relation with the collateral channel, meaning that in countries with higher market development, the collateral channel is stronger. Secondly, informational asymmetry is also an important determinant of the strength of the collateral channel, and shows that in countries with higher informational asymmetry, the relation is stronger. Thirdly, the same relation holds in countries with a higher regulatory quality. Fourthly, nonperforming loans also has a positive relation with the collateral channel. These four variables affect how the strength of the channel varies across countries and explain why certain environments allow for easier access to debt through the collateral channel. Our findings are relevant for both firm managers and policy makers. The implications of our findings determine which institutional environments allow for either more or less debt with the available collateral of firms, due to a stronger or weaker relation between asset tangibility and leverage.

Our contribution stems from researchers finding that institutional factors are very important in determining cross-country differences in capital structure. Researchers have studied topics such as the adjustment speed of capital structure (Öztekin & Flannery, 2012; Huang & Shen, 2015) and the determinants of variation in leverage (Jõeveer, 2013) and found that institutional factors do play a large role. Furthermore, Hall (2012) studies the strength of the collateral channel in countries with different land restrictions on collateral. By including institutional variables in the research design, these researchers explain the cross-country variations in empirical results. We contribute to the literature by taking a pan-European sample and analyzing the strength of the collateral channel, dependent on multiple institutional variables. In addition, our paper includes a wide span of countries and firms. To the best of our knowledge, a European-wide study has not been conducted previously on this topic.

The paper is organized as follows. In the next section (2) we form our hypotheses through relevant theory and empirical findings. In section 3 we present the data and descriptive statistics of our sample. Section 4 covers our research methods used to study our two research questions. In section 5 we present our findings and discuss the results. The paper ends with implications for further research and concluding remarks.

2. Literature Review

2.1. Overview of Capital Structure Literature

Formal models and theory of capital structure first begin in the 1950s, with Modigliani and Miller's (1958) seminal model of capital structure decisions in a frictionless world. Since then, subsequent capital structure theories incorporate various frictions to study their effects on capital structure. Two theories have been researched extensively; the trade-off theory and the pecking order theory.

Kraus and Litzenberger (1973) propose the trade-off theory of capital structure choice. They consider corporate tax and bankruptcy costs as the key to the trade-off theory. The theory states that as the interest payments on debt are tax deductible, higher levels of leverage allow firms to have lower tax payments and therefore higher after tax profits. However, as leverage increases, so do debt obligations, increasing the possibility of bankruptcy. Therefore, balancing the trade-off between the present value of the tax shield and the present value of bankruptcy costs allows the company to have the optimal capital structure. (Kraus & Litzenberger, 1973)

Myers and Majluf (1984) propose the pecking order theory. Asymmetric information being present in the market causes firms to have different funding preferences. Internal financing is preferred as the company insiders are considered to have better information regarding the firm's investments. Therefore, internal funds are first in the "pecking order". The next options are external financing, which is financing by either debt or equity. Debt is preferred over equity as firms consider it safer and the risks from asymmetric information tend to be lower. This leaves equity financing as the last preference in the pecking order. (Myers & Majluf, 1984)

Researchers have tried to link these theories to evidence, using the trade-off and pecking order theories to study the determinants of capital structure. A wide body of literature focuses on firm-specific determinants of capital structure in the US while some studies have used international samples as well. Researchers such as Bradley, Jarell and Kim (1984) provide evidence of the trade-off theory, confirming the theory of Kraus and Litzenberger (1973). They also present additional variables, such as the industry of the company, which is a strong determinant explaining 54% of the leverage differences within their analysis. Additionally, volatility of earnings (negative relation) and R&D expenditure (negative relation) are determinants of capital structure. The R&D expenditure relation is also observed by Titman and Wessels (1988). Interestingly Titman and Wessels (1988) also test the effects of volatility,

collateral value and expected future growth on leverage. For these variables they do not find an effect on leverage.

2.2. Asset Tangibility as a Determinant of Leverage

The studies prior to 1995 mostly focused on US companies. In 1995 however, Rajan and Zingales (1995) studied the determinants of capital structure in G-7 countries. To connect existing theory with practice, they focused on four basic determinants of leverage: tangibility of assets, market-to-book ratio, firm size and profitability. The results show that previous studies, which have included the US, conclude similar results as their cross-country analysis. Rajan and Zingales (1995) find a negative relation between profitability and leverage and between the market-to-book ratio and leverage. Size and asset tangibility are found to have a positive relation with leverage. However, they conclude that they cannot explain the positive relation of size and leverage, as the results from Germany are negative. Profitability and leverage in Germany have a positive relation, which is also opposite to the rest of the results. The main findings however still provide empirical evidence regarding the four key determinants of leverage, which they show to be important in large countries outside the US. Therefore, the findings of Rajan and Zingales (1995) confirm that according to international evidence, the four key determinants of capital structure are tangibility of assets, market-to-book ratio, firm size and profitability. Their findings are also in line with the trade-off theory of capital structure.

Other researchers follow the determinants presented by Rajan and Zingales (1995). Mackay and Phillips (2005), Faulkender and Petersen (2006), Almeida and Campello (2007), Rampini and Viswanathan (2010), Antoniou, Guney and Paudyal (2008), Frank and Goyal (2009) all analyze determinants of capital structure and find that among others, asset tangibility has a positive and strong effect on the leverage of a firm. Furthermore, a body of research has emerged, which finds that asset tangibility or collateral is the main determinant of capital structure. Rampini and Viswanathan (2013) who study the relation between the asset structure and leverage, find it be the most significant determinant. Firms use both tangible and intangible assets for operations and they find that the amount of tangible assets is the key determinant of capital structure.

Moreover, researchers also find a link between tangibility and increasing debt levels. Stiglitz and Weiss (1981) and Hart and Moore (1994) find that more collateral or tangible assets available to be pledged, increases a firm's debt capacity. In the case of bankruptcy, the creditors

can liquidate pledged assets, which both disciplines the borrowers but on the other hand reassures the creditors, as in the case of bankruptcy, they do not lose their loans.

The positive relation between tangible assets and leverage, therefore the collateral channel, is studied by Bernanke and Gertler (1989) and Kiyotaki and Moore (1997). Both papers study how shocks in business cycles can cause drops in asset values, causing constraints on borrowing, which in turn leads to less investment as firms have less access to credit. The collateral channel therefore affects the debt levels and investment opportunities of a given firm. The collateral channel also helps to explain why firms face different costs of debt.

Norden and Kampen (2013) study the collateral channel and try to look for new evidence regarding financing constraints and debt availability. They find that firms' property, plant and equipment (PPE) are the key determinants of the collateral channel, with more PPE resulting in higher leverage due to lower cost of debt. Receivables and inventories tend to have a smaller effect on the channel. Norden and Kampen (2013) also find that while more long-term assets, in their case PPE, are more related to long-term debt while short-term assets (receivables and inventory) are related to short-term debt. They also test the importance of the collateral channel in market- and bank-based economies and find that it is more important in bank-based economies.

Benmelech and Bergman (2011) take an interesting approach on the collateral channel and study how bankruptcy within an industry affects the other remaining nonbankrupt companies and their cost of debt. They analyze the airline industry and find that bankruptcies reduce the collateral values for all industry players. Such defaults result in an increase in the cost of debt for the whole industry, causing a slight industrywide downturn. The reason behind this is that as bankrupt companies sell off their assets, industrywide collateral values decrease due to an increase in supply.

Changes in collateral values can also be associated with asset price shocks. Goyal and Yamada (2004), who study Japanese companies during the asset bubble, which arose during the 1980s and 1990s, look at how the bubble affected firms' financing. They find that asset price shocks have a larger effect on bank-financing dependent firms than firms, which depend on equity market and public financing.

Following this line of research, Chirinko, Haan and Sterken (2008) study asset price shocks and investment using a cross-country sample of 11 countries from the European Union as well as the US and Japan. Even though they find that asset shocks differ in various countries, they conclude that real estate shocks have a larger effect on investment than equity shocks.

These findings highlight the importance of asset value changes when analyzing firm investment as well as capital structure.

Overall researchers present evidence of a positive relation between asset tangibility and leverage. We follow the line of research of Rampini and Viswanathan (2013) and others who state that asset tangibility is the main determinant of leverage. We form our first hypothesis:

Hypothesis 1: Asset tangibility has a positive effect on leverage through the collateral channel.

2.3. The Collateral Channel

In the past few years, a body of research has emerged, which looks at one specific type of asset, real estate, and how it affects leverage. Chaney, Sraer and Thesmar (2012) contribute to the literature by focusing on how strong the relation between real estate shocks and investment is. Their results indicate that when a given company's real estate holdings increase by 1$ in value, investment size increases by roughly 0.06$. The increase in investment is an approximation as smaller firms experience greater effects than large firms do.

Ding, Ni, Rahman and Saadi (2015) research a similar topic. They study how real estate price fluctuation affects the cost of equity financing. Stemming from the literature, that real estate prices have effects on investors risk preferences, they hypothesize that as real estate prices rise, cost of equity financing is affected and becomes cheaper. They find that a standard deviation increase in real estate prices causes a decrease from 5 to 8 basis points in the cost of equity capital. This relation is stronger for smaller firms.

Cvijanovic (2014) studies the relation between real estate prices, leverage and debt maturity, by analyzing a sample of US companies and using a similar approach as Chaney, Sraer, and Thesmar (2012). The results show that for a standard deviation increase in real estate holdings of the firm, leverage increases by 3 basis points. The increasing relation presents more attractive borrowing opportunities, which arise from higher collateral values. The cost of debt is therefore reduced through the collateral channel, which leads to an increase in leverage. Following the line of thought, Benmelech, Germaise and Moskowitz (2005) study the link between liquidation values of assets and debt contracts. They find that the higher the liquidation value of the asset, the lower the cost of borrowing will be. This is also found by Van Binsbergen, Graham and Yang (2010), who study the determinants of companies' cost of debt. By plotting a cost function, they find that the cost of debt decreases when collateral increases. Additionally, costs increase as the size of the loan increases.

These researchers find that collateral values influence how the collateral channel works. Increased asset liquidation values cause a decrease in the cost of debt and make investment

opportunities more appealing to companies and give incentives for firms to take on more debt. We form our second hypothesis:

Hypothesis 2: In countries with higher growth in asset values, the relation between collateral and leverage is stronger.

Öztekin and Flannery (2012) study how the strength of legal institutions, capital market effectiveness and better functioning financial systems affect the adjustment speed of capital structure. They find that countries with less efficient environments and lower strength of legal rights adjust slower, as obtaining debt is costlier and more complicated compared to countries with better institutional environments. Similarly, Chirinko, Haan and Sterken (2008) in their work on asset price shocks, find that the financial environment and its structure is the reason behind cross-country differences.

Focusing on leverage, Jõeveer (2013) studies both firm-specific and institutional determinants to analyze how they affect the capital structure of listed and unlisted companies. The findings indicate that even though industry variation is a key determinant, both asset tangibility and the institutional environment are important. Jõeveer (2013) studies both broad *(total liabilities/total assets)* and narrow *(total debt/ (debt +equity))* leverage, however concludes that in the case of narrow leverage, country specific variables explain most of the variation in leverage for unlisted companies. The important country-level variables, which Jõeveer (2013) finds, include market share of foreign banks, shareholder rights, corporate tax rates and corruption perception. Additionally, the institutional environment is more important for smaller firms as they are more dependent on local markets for borrowing.

These researchers find that certain institutional environments allow firms to obtain debt more easily and with less complication. With underdeveloped capital markets, companies are more reliant on bank financing and banks are more collateral hungry than capital markets. More developed and liquid stock markets could have a lowering effect on the corporate leverage, as companies are able to obtain equity financing (Booth, Aivazian, Demirguc-Kunt, & Maksimovic, 2001). Aside from the markets, financial development also reflects the quality of financial institutions. We form our third hypothesis:

Hypothesis 3: In countries with a higher market development level, there is a weaker relation between asset tangibility and leverage.

We further use nonperforming loans (NPL) as a percentage of banks' total gross loans within a country. In countries with a higher percentage of nonperforming loans, more collateral

is required to obtain debt as defaults are more likely and creditors demand larger amounts of collateral in return for a larger risk. In addition, the percentage of nonperforming loans shows the sustainability of credit given to firms and therefore might be an indicator of banks willingness to offer loans. We form our fourth hypothesis:

Hypothesis 4: In countries with a higher percentage of nonperforming loans, the relation between collateral and leverage is weaker.

Jõeveer (2013) uses corruption as an indicator of governance, showing that the regulatory quality affects companies' capital structure. In countries with lower regulatory standards, banks are more inclined to ask for more collateral due to issues of trust. In addition, banks might be unable to verify the financial statements of companies due to poor reporting standards and "dirty" books. Therefore, more collateral is needed for debt compared to countries with higher regulatory standards. We form our fifth hypothesis:

Hypothesis 5: In countries with higher regulatory standards, the relation between collateral and leverage is stronger.

Other researchers study how the strength of legal rights, among other variables, determines cross-country differences. Huang and Shen (2015) study the adjustment speed of capital structure, and analyze various institutional determinants. They find that adjustment speed is faster in countries with stronger legal rights, while using interactions with country credit rating downgrades or upgrades. They also study the financial development of countries, which also is an important variable to explain the variation in adjustment speed.

Hall and Jörgensen (2008) study the importance of legal rights in variations of leverage and debt maturity. They find that with higher levels of creditor protection, leverage levels increase. Following this thought, Hall (2012) furthermore studies how the strength of the relation between asset tangibility and leverage differs in Eastern European countries. The findings indicate that due to restrictions on collateral, countries in which land transferability is less regulated, there is a closer relation between leverage and asset tangibility. In addition, fewer restrictions result in more long-term debt taken by firms. Hall (2012) uses land transferability as a proxy for creditor rights because unrestricted purchases and sales of land is considered a property right. In addition, trading real estate and land allows for the transfer of wealth for both creditors and borrowers. With this reasoning, Hall (2012) uses land as a tangible asset and analyses how restricted or unrestricted land transferability affects the capital structure of companies.

Better creditor rights allow banks to offer companies more favorable loan conditions. We form our sixth hypothesis:

Hypothesis 6: In countries with stronger legal rights, the relation between collateral and leverage is stronger.

Our final hypothesis involves asymmetric information being present in the market of a given country. Higher levels of information asymmetry tend to lead to worse debt contracts (Bernanke & Gertler, 1989), discouraging companies from obtaining debt. Increased access to information should reduce informational efficiencies and lead to less collateral needed for borrowing. We form our seventh hypothesis:

Hypothesis 7: In countries with less informational asymmetry, the relation between collateral and leverage is stronger.

Overall, the collateral channel is an important factor in determining the leverage of companies. Whether this effect is studied using tangible assets, or focusing in more detail on specific assets, researchers present empirical evidence on the importance of the channel. The previously mentioned authors among others find the institutional environment to be very important in explaining cross-country differences, from adjustment speed to variations in leverage. As firms face different institutional and business environments, the above-mentioned findings could suggest that the collateral plays a different role for different firms in accessing debt.

3. Data and Descriptive Statistics

3.1. Firm-level Data

We study public and private companies of European countries during the period of 2006-2014. Our primary sample consists of 28 countries in the European Union. Accounting data is obtained from the Orbis database compiled by Bureau van Dijk. Orbis database offers the most extensive overview of financial and ownership information of both public and private firms across Europe.

We start forming our sample by selecting companies which have assets over 1 million EUR[1] and with year-end data for at least one year of the observed time period. The sample is further restricted to have data available for at least one of the observed years for the following

[1] We restrict our sample firms to have over 1 million EUR total assets, as smaller firms are irrelevant for analysis of studying leverage. They tend to source capital from non-bank sources or have specific and unique deal with banks for loans.

balance sheet and income statement items: tangible fixed assets, shareholder funds, long-term debt, total shareholder funds and liabilities, and net income. Moreover, we require firms to have unconsolidated accounts to differentiate between the parent company and subsidiaries, in order to avoid lower debt reported by subsidiaries due to loans from the parent company. In addition, we drop financial companies (SIC code 6000-6999) from our sample.

For the purposes of a cross-country comparison, a representative number of firm-year observations is needed at the country-level. We set a threshold of 10,000 firm-year observations for each country, leaving out Cyprus and Malta from our sample. Due to missing values for long-term debt, all Austrian firms are also excluded from the sample. We reach a sample of 1,109,694 companies from 25 countries (Table 1). Therefore, our main sample consists of 7,467,113 firm-year observations. On average, a firm in our sample has 6.7 firm-year observations[2].

Table 1: Number of firms in each country within our sample. Countries are divided regionally according to the UN geoscheme for Europe. The proportional percentage of the region is indicated in the last row.[3]

Northern Europe		Eastern Europe		Southern Europe		Western Europe	
UK	61,006	Poland	33,127	Italy	259,534	France	178,295
Sweden	41,037	Czech Republic	27,893	Spain	160,688	Germany	77,729
Finland	12,703	Romania	22,082	Portugal	37,731	Belgium	74,897
Denmark	7,260	Bulgaria	17,706	Greece	17,373	Luxembourg	5,046
Estonia	5,739	Slovak Republic	16,630	Croatia	11,086	Netherlands	5,038
Ireland	5,228	Hungary	16,537	Slovenia	7,293		
Latvia	5,184						
Lithuania	2,852						
	12.71%		*12.07%*		*44.49%*		*30.73%*

3.2. Variables Definitions

In capital structure literature, numerous definitions of leverage are used. These definitions revolve around firms having different types of liabilities and asset classes. We define leverage as the ratio of long-term debt divided by book value of total assets. Collateral is pledged in long-term debt contracts (Hall, Hutchinson, & Michaelas, 2004), making such a leverage measure most applicable for studying the collateral channel. Firms' holdings of such assets are measured by the tangibility ratio, which is defined as tangible fixed assets divided by total assets.

We check our sample for outliers in firm-level observations. We drop yearly observations for companies with negative long-term debt and total liabilities. We leave out

[2] Sample size decreased from 1,161,175 to 1,109,694 firms, due to data cleaning.
[3] All of the tables and figures included in this thesis are created by the authors.

observations with total asset values negative or equal to zero. Moreover, we exclude firms with negative tangible fixed assets and firms with a tangibility ratio larger than one. We drop observations if leverage is above 1. Firm-level controls used in the regressions include effective tax rate, which is defined as the tax paid over profit before tax. We express profitability of a firm as net income over total assets. We winsorize both effective tax rate and profitability at the 1st and 99th percentile by year, to account for outliers. Size is measured by the logarithm of total assets.

Country-level data is obtained from the World Bank, Eurostat and OECD. From these data sources, we are able to obtain time series data for all of the countries in the sample. As macroeconomic indicators, we obtain data on GDP growth, GDP per capita and inflation in each country (The World Bank, 2016c). These variables are used as country controls in our regressions. For the analysis of the collateral channel, we use various proxies to model the environment.

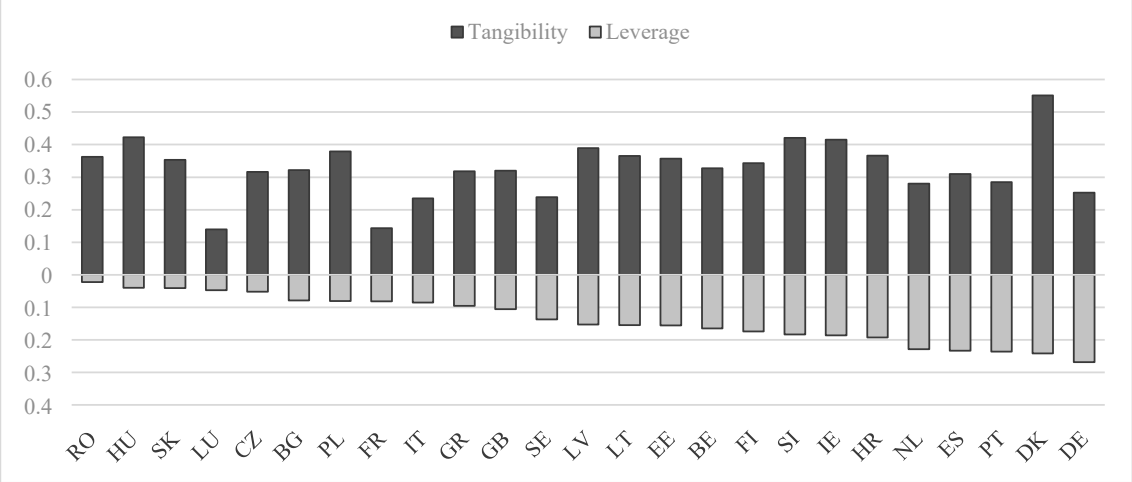
First, the strength of legal rights index is obtained from The World Bank (2016a) and serves as a proxy for creditor rights. The legal environment is evaluated from the perspective of collateral and bankruptcy laws, in terms of how regulated creditor and borrower rights are. The index ranges from 0 (weak laws) to 10 (strong laws), evaluating the legal design and framework for 8 collateral law and 2 bankruptcy law criteria. Presence of a given criteria adds one to the overall score of the country. Second, we use the depth of credit information index as a measure of informational asymmetry in a country. The index is constructed by The World Bank (2016a) to evaluate the quality and availability of credit information, with the index being in the range of 0 (no availability of credit information) and 6 (high availability of credit information). Third, the regulatory quality indicator, constructed by The World Bank (2016b), is used to measure the quality of governance and the government's ability to stimulate private sector development by developing favorable policies. Fourth, market capitalization of listed companies (% of GDP), obtained from The World Bank (2016c), is the proxy for measuring the market development level across countries. The indicator measures the total capitalization of all publicly listed companies. Rajan and Zingales (1998) discuss the validity problem of using market capitalization as a measure for financial development, arguing that the capitalization ratio includes market expectations about growth and payout ratios, while actual equity capital obtained by firms is hard to measure. They argue such a limitation from the U.S firms' perspective. Even though, European economies are more bank-based and firms have less access to equity markets, market capitalization still reflects the financial development level of the countries. Fifth, nonperforming loans, obtained from The World Bank (2016c), are

measured proportionally to banks' total gross loans. Sixth, house price index (HPI), obtained from Eurostat and OECD (Eurostat, 2016; OECD, 2016), measures the assets value changes in residential property markets across Europe. The index is set at the value of 100 for the base year of 2010. Due to missing data from Eurostat, values for Greece and Italy are obtained from OECD. However, both databases follow a similar methodology. We measure the change in HPI to capture the variation in the asset prices. All institutional data obtained from the World Bank, Eurostat, and OECD is time-series for the years 2006-2014. All variable definitions are further summarized in Appendix 1.

3.3. Summary of Data

Furthermore, we present descriptive statistics on firm-level and institutional data. Figure 1 shows the average values of leverage and tangibility across countries. Figure 2 orders countries by their wealth, measured as GDP per capita, and indicates the market development levels respectively. Figure 3 shows the average amount of nonperforming loans and the change in house price index by country. Figure 4 presents mean values of the depth of credit information, strength of legal rights, and regulatory quality. All means are constructed for the sample period of 2006-2014.

Figure 1: Average leverage and tangibility ratio of each country within our sample. Leverage is defined as book long-term debt divided by book total assets. Tangibility is defined as book tangible fixed assets divided by book total assets. The values presented are the average values of time series data during the period of 2006-2014. The bars on the top half of the graph indicate the average tangibility present in the country and the bottom bars indicate the average leverage present in the given country. Countries (country ISO codes) are indicated below the X-axis.



For the firms in our sample, leverage differs across countries. Such differences can be derived from variation in long-term debt levels, which could be explained by varying debt availability in the countries. Highest levered firms in the sample are present in Germany, with an average firm having a leverage of 0.26. Lowest level of leverage is present for Romanian

firms, with the leverage of 0.02. Mean leverage in our sample is 0.14 with a standard deviation of 0.21. In addition, looking at time series trends, leverage is relatively stable across the time period both on country-level and across the sample. The amount of tangible fixed assets divided by total assets also has little change over time, with countries such as Denmark, Hungary, and Slovenia showing the highest ratios on average. Firms in France and Luxembourg have the lowest tangibility on average. The mean tangibility ratio is 0.26 in our sample, with a standard deviation of 0.28.

Figure 2: Average GDP per capita and market capitalization of listed companies (% of GDP) of each country within our sample. The values presented are the average values of time series data during the period of 2006-2014. The bars indicate the average GDP per capita in the country and correspond to the left vertical axis and the dots indicate the average market capitalization as a percentage of GDP present in the given country, which correspond to the right vertical axis. Countries (country ISO codes) are indicated below the X axis.

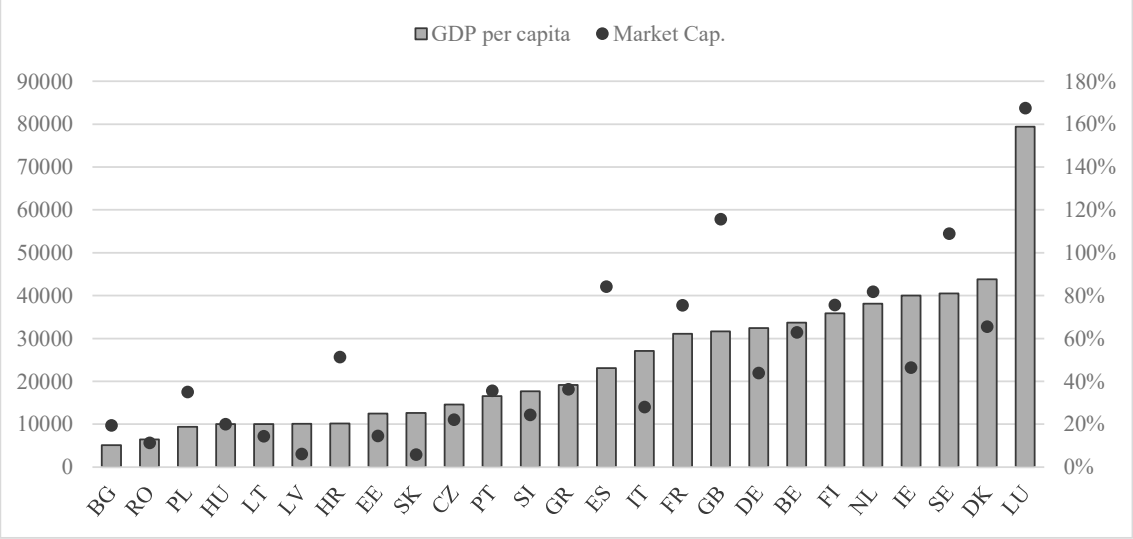


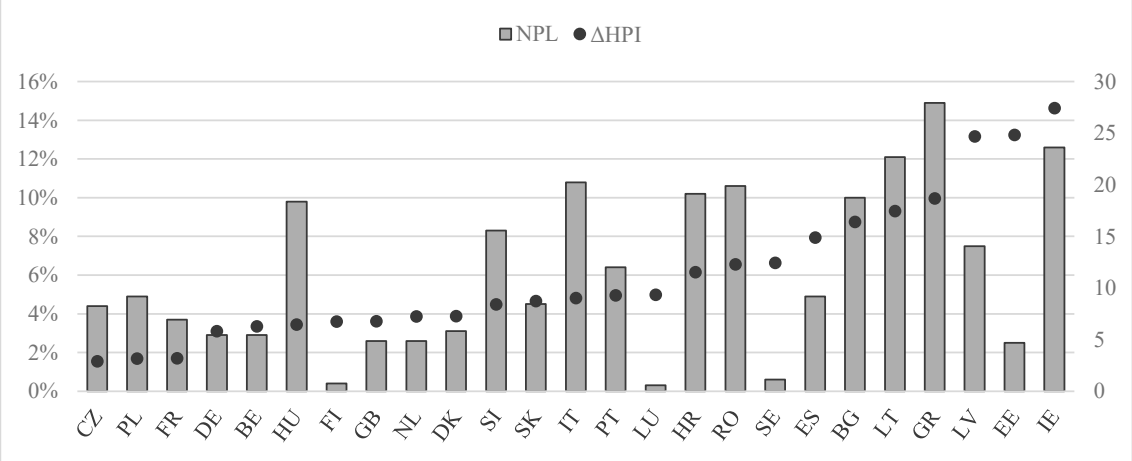
Figure 2 presents that the wealthiest countries in our sample are Luxembourg, Denmark and Sweden, while the lowest GDP per capita is for Romania and Bulgaria. Below the mean is Spain and above the mean is Italy. Highest growth in GDP was in Poland during the period of 2006-2014, while Slovak Republic, Bulgaria and the Baltic countries also showed strong growth on average[4]. Countries in Southern Europe have seen GDP decline on average during period.

The number of listed companies differs widely across Europe. Highest market capitalization ratio is present in Luxembourg, which is a small country with considerable emphasis on the financial sector. In addition, more developed capital markets are present in the UK and Sweden. Less developed markets are present in Eastern Europe. The market

[4] Institutional variables sample averages are presented in Appendix 3.

capitalization ratio is dependent on the economic cycle and shocks, therefore presents more time variation. The sample ranges from high fluctuations in Luxembourg, to the downfall of Greece, while large decreases in market capitalization also happen in Finland and UK during the period. This indicates that more developed markets are more sensitive to economic conditions, while less developed markets show more stable levels. The variation could be explained by liquidity and trading activity present in the respective markets.

Figure 3: Average nonperforming loans (% of banks' total gross loans) and change in the house price index of each country within our sample. The values presented are the average values of time series data during the period of 2006-2014. The bars indicate the average nonperforming loans in the country and correspond to the right vertical axis and the dots indicate the average change in the house price index in the given country, which correspond to the left vertical axis. Countries (country ISO codes) are indicated below the X axis



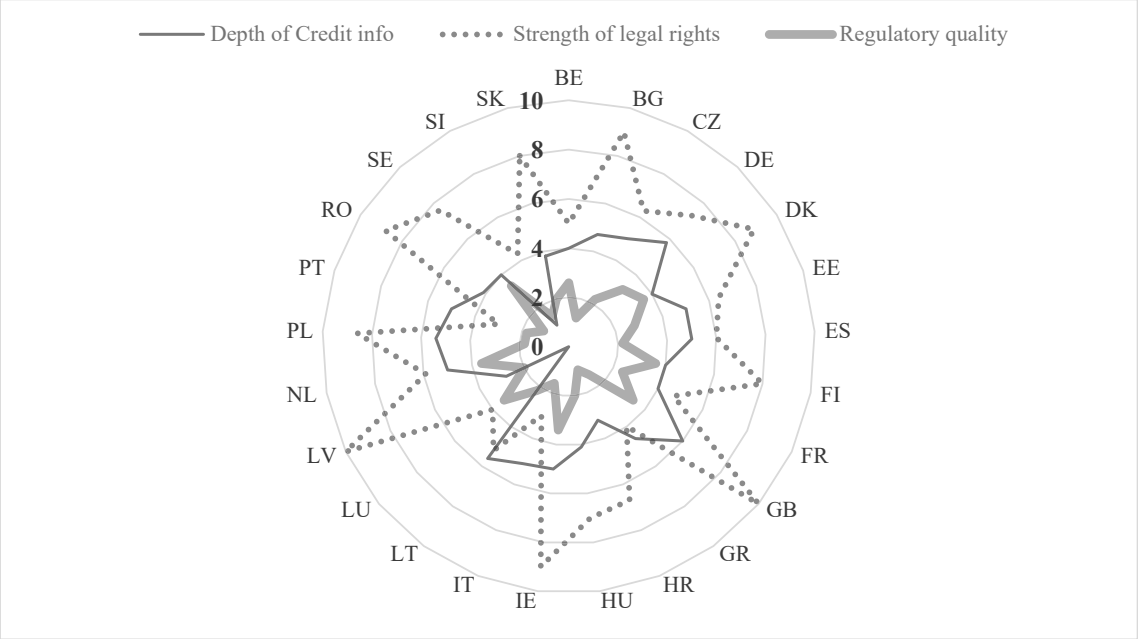
In addition, the asset price movements differently affect firms across countries. Real estate price movements, measured by the house price index, are influenced by economic trends and growth, but also domestic demand in property markets. We look at the change in the HPI, determining how asset price movements affect the collateral channel. The highest changes in HPI during the period are present in Ireland, Greece and the Baltic countries, while countries in Central Europe have more stable property markets.

The highest amount of nonperforming loans on average is present in Southern Europe, namely Greece and Italy. From the banks' perspective, Sweden, Finland and Luxembourg are the safest places to give out loans. On average the amount of bad loans has been increasing since 2006, indicating an interesting trend on the debt market.

The market indicators show more variation during the time period, while the legal environment, governmental efficiency and informational asymmetry measures have more stable values throughout the period. The strength of legal rights is the highest in countries such as UK, Latvia and Bulgaria, while most countries have the index unchanged during the period.

Germany, Slovak Republic, the Netherlands and Czech Republic have the index downgraded by 1, during the period. The lowest strength of legal rights is present in Poland and Italy.

Figure 4: Average depth of credit information, strength of legal rights and regulatory quality of each country within our sample. The values presented are the average values of time series data during the period of 2006-2014. The indicators are presented in a radar diagram, with the variable indicated at the top of the figure. Countries (country ISO codes) are indicated on the outside of the radar.



The highest regulatory environments are present in the Netherlands, Finland and Denmark. Lowest regulatory environments can be found in Croatia, Bulgaria and Romania. The largest time variation in the regulatory quality is present in Greece and Portugal.

Most efficient information is present in Poland, Lithuania and Denmark, while informational asymmetry is largest in Latvia, Slovenia and Luxembourg on average, however both Latvia and Slovenia have both increases during the end of the period.

Overall, we can find largely differing market conditions and variation during the period across countries. Moreover, institutional differences are present in between legal strengths and regulatory quality across Europe regionally. However, those measures are largely stable over time. The institutional variables show little correlation with one another, with some exceptions as well. Nonperforming loans has a correlation of -0.73 with the regulatory quality, while most other variable correlations are below 0.5. Additionally, the correlation between nonperforming loans and the market capitalization is -0.59. Regulatory quality shows a correlation of 0.52 with market capitalization and 0.54 with the strength of legal rights. Other correlations are smaller, indicating less dependence between variables. In Appendix 2, we present a correlation table of our institutional variables.

4. Methods

4.1. Baseline Model

To study our firm-year panel dataset, we use the following baseline model:

$$Lev_{i,t} = \alpha_k + \beta Tangibility_{i,t} + controls_t + \varepsilon_{i,t} \quad (1)$$

Here, $Lev_{i,t}$ is company *i*'s leverage ratio at time *t*, while $Tangibility_{i,t}$ measures the company *i*'s asset tangibility at time *t*. We include the following firm-level controls according to previous empirical findings of capital structure literature. First, we use profitability, which according to the trade-off theory has a positive relation with leverage, as firms that are more profitable have a competitive advantage to use the tax shield to increase leverage (Kraus & Litzenberger, 1973). However, under the pecking order theory the relation is negative, as firms prefer internal funding, as more profitable firms will use retained earnings to finance their investments instead of using leverage (Myers & Majluf, 1984). Empirical evidence shows that profitability has a negative relation with leverage (Rajan & Zingales, 1995; Titman & Wessels, 1988). Second, we use size, which has a positive relation with leverage under the trade-off theory, with the reasoning behind it being similar to profitability, that larger firms can take advantage of the tax shield. Profitability and size were studied by Rajan and Zingales (1995) and have been included as important determinants in empirical studies ever since. Empirical evidence shows size to have a positive relation with leverage (Rajan & Zingales, 1995; Wald, 1999; Frank & Goyal, 2009). Third, we use the effective tax rate, which under the trade-off theory has a positive relation with leverage, as with increasing tax payments, firms will have incentives to increase leverage to obtain a higher interest tax shield (Kraus & Litzenberger, 1973). Empirical findings present both negative and positive relations between effective tax rate and leverage, with institutional differences affecting the sign of the relation (Antoniou, Guney, & Paudyal, 2008).

We also include country-level controls in our regressions. Firstly, we include the GDP growth rate, as faster growing economies present more investment opportunities to firms, therefore giving more incentives to borrow. Secondly, we include GDP per capita as an indicator of overall economic development and wealth. With a higher economic wellbeing representing a less risky environment, it will give firms incentives to keep higher levels of leverage. Thirdly, we include inflation in our regressions, as higher inflation deflates companies' debt levels, thus increasing incentives to obtain debt.

The baseline model includes industry-level fixed effects (α_k). As we are studying leverage and the collateral channel over time, fixed effects allow to control for unobserved heterogeneity persistent over time. Given a standard OLS regression model, the assumption regarding residuals and independent variables is that they both have to be independent and not correlated. However, within our dataset, independent variables and residuals are possibly serially correlated within clusters of the same year, the same industry and the same firm. As we have a relatively small time period compared to the number of observations, we assume that our data possibly has a time-series dependence. This can also be called an unobserved firm effect. (Petersen, 2009)

Furthermore, an industry effect and a time effect may be present within our sample, which cause different residual dependences. Since we want to capture firm variations between countries, we account for the industry and time effects, so that the cross-country firm effect can be observed and studied. By using an industry fixed effects regression model we can account for the residual dependence caused by the industry effect. This regression approach fixes the average effects of each industry, which allows us to control for both observable and unobservable variables affecting across-industry variation.

Furthermore, we need to cluster our standard errors, to avoid over- or underestimating them. Following Cameron, Gelbach, and Miller (2006), Petersen (2009), and Thompson (2011), we use two-way clustering to obtain unbiased and heteroscedasticity-adjusted standard errors. We cluster standard errors by both industry and year.

We further add sample weights. Weights are used to account for the difference in the number of firms per country, by adjusting to countries being over- or underrepresented in the aggregate sample. This way we adjust for our model estimates possibly being driven by countries with a larger number of firms. Our country weight is the inverse number of observations for the given country, where $weight_j$ is the weight of country j and n_j is the number of observation within country j.

$$weight_j = \frac{1}{n_j} \tag{2}$$

4.2. Interaction Terms

For studying the variation in the institutional variables, we add to the baseline model, by including interaction terms of institutional variables with asset tangibility. The following model is estimated:

$$Lev_{i,t} = \alpha_k + \beta Tangibility_{i,t} + \theta X_{j,t} + \gamma Tangibility_{i,t} X_{j,t} + controls_t + \varepsilon_{i,t} \quad (3)$$

Accounting for institutional factors in the model, $X_{j,t}$ is a vector of country specific institutional variables. The variables are interacted with asset tangibility. The interaction of institutional variables and tangibility is between continuous variables. The $X_{j,t}$ is included with a simple effect, so that we can differentiate, whether the interaction between two variables is the main effect or whether it can also have an unaccounted simple effect influencing the coefficient.

However, interpreting the interaction results, the coefficients give little explanation due to the continuous nature of our variables. For the significant interactions terms, we have plotted predictive margins' graphs to study how the predicted leverage changes with given values of tangibility and a given institutional variable. We keep institutional variables constant at the minimum, 25th percentile, 75th percentile, and maximum values, to analyze their effect on the relation between asset tangibility and leverage.

5. Empirical findings

5.1. Baseline Model

In this section, we present our empirical findings on how the collateral channel varies across countries. First, we present results on determining the collateral channel in the pooled sample and then, in a country-by-country case, for the period of 2006-2014. We further explore the obtained results through subsamples, dividing on both firm and country-level. We also test the robustness of our findings through different model specifications and changing the control variables.

Our baseline regression results are presented in Table 2. The dependent variable leverage was regressed in a pooled industry fixed effects regression, with country sample weights and standard errors clustered by industry and year. We also include country and firm-level controls within the regressions. The results in Table 2 show that there is evidence of the collateral channel being present within our sample. There is a positive and significant relation between asset tangibility and leverage at the 1% significance level. For every unit increase in asset tangibility, there is a 0.241 unit increase in firms' leverage. Significant controls, profitability and GDP per capita, enter with predicted signs. Our finding confirms hypothesis 1. The magnitude of the baseline finding is quite large, as a standard deviation increase in tangibility results in a 6.7% increase in leverage. With more collateral available to be pledged, creditors will be reassured, thus firms are in a more favorable position to increase leverage.

The baseline finding is also consistent with previous literature such as Hall (2012), Frank and Goyal (2009) and Rajan and Zingales (1995), as well as Rampini and Viswanathan (2013), who find that asset tangibility is the most important determinant of capital structure. Furthermore looking at the significant controls, they are also consistent with previous empirical findings, such as a negative relationship between profitability and leverage (Frank & Goyal, 2009; Hall T. W., 2012; Rajan & Zingales, 1995; Titman & Wessels, 1988).

Table 2: This table reports our baseline regressions with each regression specification indicated in the column header. The dependent variable is leverage, defined as long-term debt divided by total book assets. Independent variables are indicated in the first column. Sample weights are used and standard errors are clustered by industry and year. ***, **, * indicate statistical significance at 1%, 5% and 10% levels respectively.

	Baseline	Simple OLS	Without Country Controls	Alternating Controls
Asset tangibility	0.241***	0.238***	0.227***	0.238***
	(15.70)	(14.74)	(9.41)	(11.11)
Profitability (ROA)	-0.164***	-0.166***	-0.189***	
	(-6.87)	(-6.63)	(-5.80)	
Effective tax rate	-0.002	-0.002	0.001	
	(-1.19)	(-1.36)	(0.25)	
Log of total assets	0.003	0.002	0.006	0.002
	(1.56)	(0.98)	(1.67)	(0.70)
Inflation	0.000	-0.000		-0.380
	(0.00)	(-0.00)		(-1.08)
Growth of GDP	-0.079	-0.079		-0.276
	(-1.22)	(-1.29)		(-1.27)
Log of per capita GDP	0.034***	0.036***		0.034*
	(7.72)	(8.29)		(2.07)
Profitability (ROE)				-0.013**
				(-3.05)
Total tax (% of profits)				-0.088
				(-1.23)
R-sqr	0.145	0.151	0.137	0.144
Observations	6631804	6631804	6631804	7095950
Fixed effects	Industry	No	Industry	Industry

We perform different regressions to check the robustness of our results. In the second column of Table 2, we present results of our baseline as a simple OLS regression, without fixed effects. The simple OLS regression shows that the coefficients of our variables do not change in magnitude, however they slightly decrease the significance of firm-level variables. In addition, removing industry fixed effects slightly improves the explanatory power of the variables and the fit of the model. However, capturing industry dynamics is important in studying firms' leverage. In the third column of Table 2, we leave out country controls. The

same firm-level variables are significant, however the coefficients decrease. The change indicates that there is country-level information, which helps to predict firms' financing choices. We further check the robustness by changing the measure of profitability, redefining it as net income over total equity. In addition, we remove the effective tax rate as a variable at the firm level and replace it with a country-level control variable of total tax rate[5]. Such a model specification increases the number of observations; however, the results do not differ in magnitude. Tangibility is still positive and significant, while the new profitability measure enters negatively and significantly. The total tax rate has more explanatory power than the effective tax rate, but is still insignificant.

Table 3 presents the results of our baseline regression and the strength of the collateral channel in each country respectively. We leave out GDP per capita as a control variable in the country-level regressions. All of the country regressions yield a positive and significant relation between collateral and leverage. The findings indicate that the collateral channel is strongest in Sweden, Ireland, Denmark and Belgium. Asset tangibility has the least effect on leverage in Hungary and Romania. Therefore, there are large differences across countries, with the coefficient of tangibility ranging from 0.430 in Sweden to 0.039 in Romania. The large deviation between the findings indicates differences in the country characteristics, which we analyze further.

In Table 4 we further look into our findings, by dividing our sample in 4 regions. The findings indicate that the collateral channel is more important in Northern and Western Europe. We find asset tangibility to be the most important predictor of companies' leverage in all countries, except for Portugal, Spain, Italy and Hungary. The unreported results of country regressions show that in these countries, profitability enters as the most important determinant of capital structure. These findings are in line with the results in Table 4, which show that for Southern Europe, asset tangibility and profitability are almost equal predictors of leverage. Compared to other regions, Eastern Europe presents a weaker collateral channel. Moreover, for all regions except Northern Europe, size enters positively with a significant coefficient, indicating that larger firms have better access to debt in those regions, through the collateral channel. In addition, we divide countries into high and low income, by the mean GDP per capita.

[5] Retrieved from World Bank ((2016c). Shows the total tax burden on average for firms across countries as a percentage of commercial profits.

Table 3: This table reports our baseline regression by country. The dependent variable is leverage, defined as long-term debt divided by total book assets. Each country within our sample is presented with the asset tangibility coefficient of the baseline regression. We report the coefficient for asset tangibility and leave the other coefficients unreported. Industry fixed effects are used, standard errors are clustered by industry and year. ***, **, * indicate statistical significance at 1%, 5% and 10% levels respectively.

Country	Asset tangibility	Country	Asset tangibility
Sweden	0.430***	Latvia	0.223***
	(47.28)		(10.31)
Denmark	0.390***	Croatia	0.214***
	(21.68)		(7.97)
Ireland	0.385***	United Kingdom	0.213***
	(10.66)		(20.46)
Belgium	0.376***	Portugal	0.208***
	(28.71)		(5.60)
Germany	0.323***	Poland	0.171***
	(26.75)		(12.29)
Netherlands	0.281***	Greece	0.164***
	(8.22)		(10.83)
Slovenia	0.265***	Italy	0.142***
	(47.01)		(3.91)
Luxembourg	0.263***	Bulgaria	0.135***
	(15.13)		(7.59)
Finland	0.259***	Slovak Republic	0.128***
	(19.45)		(20.22)
France	0.246***	Czech Republic	0.127***
	(8.28)		(6.59)
Lithuania	0.238***	Hungary	0.052***
	(12.52)		(7.36)
Spain	0.236***	Romania	0.039**
	(4.30)		(2.82)
Estonia	0.231***		
	(16.42)		

The results in the last two columns of Table 5 show that the collateral channel has a stronger presence in wealthier countries. Wealthier countries show stronger collateral channels as they can be considered to have more stable and less risky environments, thus allowing for firms to have higher leverage for a unit of collateral. The variation of the results by both country and region, show that more developed countries yield higher coefficients for asset tangibility. We argue that countries above the 75th percentile could be seen as more developed economically and more efficient institutionally than the 25th percentile and below.

Table 4: This table reports our baseline regression, with the sample countries divided by the UN geoscheme for Europe. The dependent variable is leverage, defined as long-term debt divided by total book assets. The subdivision is indicated in the column header with the independent variables indicated in the first column. Industry fixed effects are used, sample weights are included and standard errors are clustered by industry and year ***, **, * indicate statistical significance at 1%, 5% and 10% levels respectively.

	Northern Europe	Eastern Europe	Southern Europe	Western Europe
Asset tangibility	0.316***	0.110***	0.196***	0.330***
	(32.06)	(16.89)	(6.73)	(32.86)
Profitability	-0.199***	-0.063***	-0.304***	-0.163***
	(-15.01)	(-6.18)	(-6.84)	(-9.27)
Effective tax rate	-0.004*	-0.000	-0.004	-0.004
	(-2.12)	(-0.14)	(-1.47)	(-1.80)
Log of total assets	0.001	0.005***	0.011*	0.007***
	(0.22)	(3.97)	(2.51)	(5.61)
Inflation	-0.019	0.067	0.034	0.616*
	(-0.34)	(0.42)	(0.12)	(2.10)
Growth of GDP	0.046	0.011	0.252	-0.108
	(1.26)	(0.20)	(1.92)	(-0.99)
Per capita GDP	0.018***	-0.023**	-0.068***	-0.079***
	(4.04)	(-3.22)	(-8.62)	(-11.18)
R-sqr	0.232	0.076	0.113	0.208
Observations	679382	653577	3193912	2104933

Table 5: This table reports our baseline regressions with the sample divided by firm size and age, and countries divided by income. The dependent variable is leverage, defined as long-term debt divided by total book assets. The subdivision is indicated in the column header with the independent variables indicated in the first column. Industry fixed effects are used, sample weights are included and standard errors are clustered by industry and year. ***, **, * indicate statistical significance at 1%, 5% and 10% levels respectively.

	Large firms	Small firms	Mature firms	Young firms	High income	Low income
Asset tangibility	0.266***	0.235***	0.233***	0.272***	0.321***	0.167***
	(6.52)	(19.54)	(16.73)	(11.57)	(22.59)	(14.48)
Profitability	-0.220***	-0.156***	-0.174***	-0.121***	-0.183***	-0.157***
	(-6.11)	(-6.83)	(-7.77)	(-4.55)	(-7.49)	(-7.37)
Effective tax rate	0.000	-0.003	-0.002	0.001	-0.010***	-0.002
	(0.06)	(-1.95)	(-1.45)	(0.17)	(-5.31)	(-0.53)
Log of total assets	0.006	0.004*	0.002	0.007***	0.005	0.006*
	(1.75)	(2.29)	(1.16)	(3.60)	(1.71)	(2.24)
Inflation	-0.123	0.019	0.036	-0.088	-0.089	0.094
	(-0.61)	(0.14)	(0.26)	(-0.28)	(-0.59)	(0.77)
Growth of GDP	-0.258**	-0.048	-0.061	-0.207	0.160***	-0.085
	(-2.67)	(-0.73)	(-0.96)	(-1.58)	(4.31)	(-1.23)
Per capita GDP	0.025***	0.036***	0.032***	0.041***	-0.049***	0.025***
	(4.56)	(7.81)	(8.18)	(5.11)	(-3.73)	(4.23)
R-sqr	0.148	0.144	0.140	0.167	0.215	0.090
Observations	867850	5763954	5717909	913895	5490865	1140939

The importance of the collateral channel also varies given different firm characteristics. In Table 5, we divide our sample on the firm level by age and size. Firms are divided at the threshold of 10 years since incorporation, dividing firms into mature and young ones. Furthermore, firms are divided by a threshold of 10 million EUR for total assets, separating the large and small firms. The subsample results indicate that large firms face stronger collateral channels as they have a larger asset base and are considered more stable. Thus, we argue, large firms tend to have more favorable borrowing opportunities, increasing incentives to lever up. However, the findings also indicate that asset tangibility is a more significant determinant for smaller firms. Comparing young and mature firms, young firms face a stronger collateral channel, while for mature firms asset tangibility is a more significant determinant of leverage. Younger firms tend to have more growth opportunities, which are more value adding. Wald (1999) finds that in a sample including European countries, high growth firms hold more long-term debt. Therefore, collateral plays an important role in obtaining long-term debt for young firms.

The presented results show that the collateral channel exists in European countries. Our first research question focused on finding what the relation is across Europe, thus, we can conclude, that the relation across Europe is positive and significant, yet it varies across countries. Overall, the positive relation between tangibility and leverage within our sample is stronger in Western and Northern European countries, as these countries can be considered to have more stable and less risky environments. This is also supported by the findings that firms in high income countries show a stronger collateral channel. In addition, the collateral channel is more important for larger firms, yet also younger firms.

5.2. Interaction Terms

To empirically test the differences of countries, we include institutional variables in our regressions. In Table 6, we present the regression outcomes with the dependent variable leverage and included interaction terms. Disregarding the simple effects, the interaction term indicates how tangibility and institutional variable are interacted in the effect of change in leverage. We present only the coefficients of the interaction terms, with the whole output indicated in Appendix 5. In the first column of Table 6, we first add a block of three market measures (market development level, NPLs, HPI). The results indicate that the market development level is significant, while NPLs and HPI do not affect the collateral channel significantly. In the next column, we then add a block of three institutional environment measures (regulatory quality, strength of legal rights and depth of credit information).

Table 6: This table reports our interaction regressions with blocks added on to the baseline regression. The dependent variable is leverage, defined as long-term debt divided by total book assets. The regression blocks are indicated in the column header. Industry fixed effects are used, sample weights are included and standard errors are clustered by industry and year. ***, **, * indicate statistical significance at 1%, 5% and 10% levels respectively. Full output reported in Appendix 5.

	Market measures	Legal measures	All Measures
Nonperforming loans * Asset tangibility	-0.011		0.427**
	(-0.13)		(3.01)
Strength of legal rights * Asset tangibility		-0.006	-0.003
		(-1.43)	(-0.83)
Depth of credit information * Asset tangibility		-0.022***	-0.024***
		(-3.55)	(-3.40)
Regulatory quality * Asset tangibility		0.154***	0.143***
		(9.68)	(4.42)
Market capitalization * Asset tangibility	0.204***		0.107***
	(7.16)		(4.43)
Change in HPI * Asset tangibility	-0.011		-0.005
	(-0.20)		(-0.10)
R-sqr	0.155	0.159	0.163
Observations	5810304	6630954	5810304

Table 7: This table reports our robustness tests for the interaction regressions. The dependent variable is leverage, defined as long-term debt divided by total book assets. The robustness test is indicated in the column header with the interaction terms indicated in the first column. ***, **, * indicate statistical significance at 1%, 5% and 10% levels respectively. Full output reported in Appendix 5.

	Simple OLS	Stocks traded	Control of Corruption
Nonperforming loans * Asset tangibility	0.453**	0.608***	0.347**
	(3.18)	(5.26)	(2.78)
Strength of legal rights * Asset tangibility	-0.003	-0.005	0.001
	(-0.71)	(-1.16)	(0.21)
Depth of credit information * Asset tangibility	-0.024**	-0.032***	-0.020**
	(-3.19)	(-5.93)	(-2.88)
Regulatory quality * Asset tangibility	0.145***	0.170***	
	(4.44)	(5.32)	
Market capitalization * Asset tangibility	0.109***		0.059**
	(4.64)		(2.83)
Change in HPI * Asset tangibility	-0.004	0.091**	0.023
	(-0.08)	(3.09)	(0.43)
Stocks traded * Asset tangibility		0.042**	
		(2.59)	
Control of corruption * Asset tangibility			0.084***
			(5.49)
R-sqr	0.168	0.160	0.174
Observations	5810304	4942534	5810304
Fixed effects	None	Industry	Industry

The regulatory environment and credit information have a significant effect. In the third column, we run a regression with all six institutional variables. The outcome of the regression model indicates that the market capitalization as a percentage of GDP, regulatory quality of the country and the depth of credit information are significant at the 1% level. Interestingly, nonperforming loans interacted with tangibility becomes significant at the 5% level. This indicates a presence of information in the three legal indicators for the effect of nonperforming loans on the collateral channel. Strength of legal rights and change in the house price index are insignificant in our pooled regression.

We run different robustness tests on our regression with interactions. Table 7 reports the findings. First, we change the model specification by removing industry fixed effects and running a simple OLS regression. The results show that all the significant interactions remain that way. In addition, we use different measures and make substitutions in our variables. In column 2, we replace market capitalization with value of stocks traded[6] (% of GDP). The results indicate that our measure of market development level is robust to specification. Moreover, we replace the regulatory quality with an index, measuring control of corruption[7]. A higher index value indicates better governance in handling corruption. The measure enters again significantly and with the predicted effect, showing our measure for the quality of governance to be robust.

The plotted margins for predicted leverage are presented in Figures 5-8. We use country-averaged values for respective institutional variables and take the 25th and 75th percentiles for studying the interactions. Predicted margins' graphs illustrate the predicted leverage for each value of tangibility, keeping institutional variables constant at specified levels[8]. The marginal effects are essentially the slopes of the lines presented in the margins' graphs.

[6] Value of stocks traded as a percentage of GDP obtained from The World Bank (2016d), shows the total value of stocks traded during the year.
[7] The control of corruption indicates the use of public power for private gain. Obtained from The World Bank (2016b)
[8] Marginal values reported in Appendix 4.

Figure 5: Predicted margins of leverage for the interaction of the depth of credit information with asset tangibility.

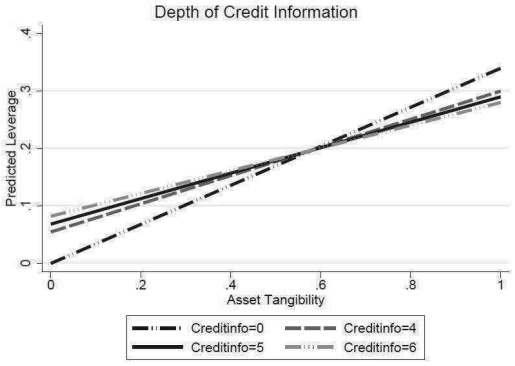


Figure 6: Predicted margins of leverage for the interaction of nonperforming loans with asset tangibility.

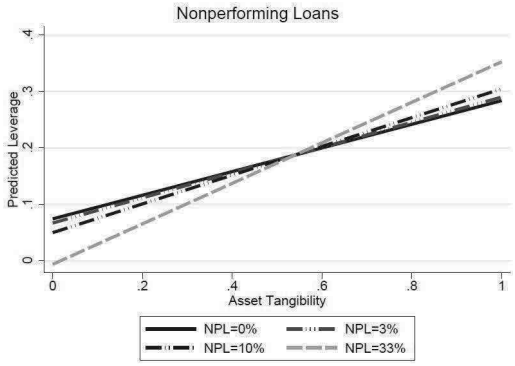


Figure 7: Predicted margins of leverage for the interaction of market capitalization with asset tangibility.

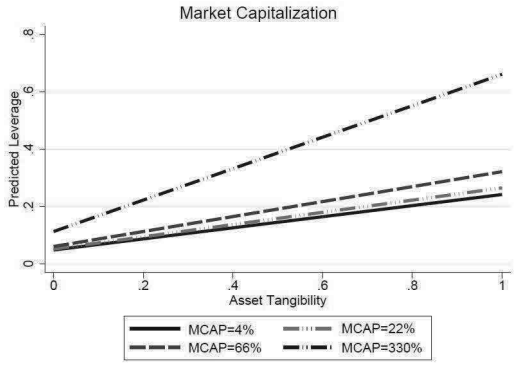


Figure 8: Predicted margins of leverage for the interaction of the regulatory quality with asset tangibility.

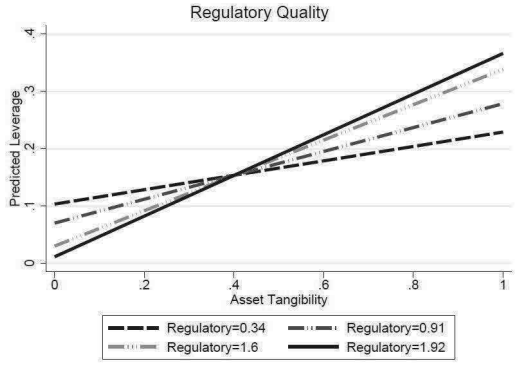


Table 8: This table reports the marginal effects of the institutional variables interactions with asset tangibility, with institutional variables kept constant at values indicated in the table. The institutional variable is indicated in the column header, with the value, which is kept constant indicated in the first column and the marginal effect indicated in the second column for each institutional variable.

Market Capitalization		Depth of credit info.		Regulatory quality		Nonperforming loans	
Value.	Marginal effect	Value	Marginal effect	Value	Marginal effect	Value	Marginal effect
4%	0.193	0	0.340	0.34	0.126	0	0.210
22%	0.213	4	0.246	0.91	0.208	3%	0.223
66%	0.261	5	0.222	1.6	0.308	10%	0.255
330%	0.548	6	0.198	1.92	0.355	33%	0.359

Table 9: This table reports our interaction regressions with subsamples. The dependent variable is leverage, defined as long-term debt divided by total book assets. The subdivision is indicated in the column header with the interaction terms indicated in the first column. Industry fixed effects are used, sample weights are included and standard errors are clustered by industry and year. ***, **, * indicate statistical significance at 1%, 5% and 10% levels respectively. Full output reported in Appendix 6.

	Large firms	Small firms	Mature firms	Young firms
Nonperforming loans * Asset tangibility	0.882***	0.162	0.341*	0.505**
	(15.56)	(0.91)	(2.25)	(2.80)
Strength of legal rights * Asset tangibility	-0.007	-0.003	-0.003	-0.010**
	(-1.03)	(-0.82)	(-0.78)	(-2.69)
Depth of credit information * Asset tangibility	-0.022*	-0.027***	-0.029***	0.000
	(-2.28)	(-4.68)	(-4.31)	(0.00)
Regulatory quality * Asset tangibility	0.226***	0.108**	0.135***	0.151***
	(5.60)	(3.18)	(4.05)	(5.06)
Market capitalization * Asset tangibility	-0.008	0.138***	0.109***	0.119***
	(-0.26)	(4.67)	(4.13)	(5.77)
Change in HPI * Asset tangibility	-0.092	-0.016	-0.010	-0.059
	(-0.82)	(-0.29)	(-0.16)	(-0.75)
R-sqr	0.191	0.161	0.159	0.196
Observations	755581	5054723	5058359	751945

5.3. Market Development

Table 8 displays the marginal effects of the institutional variables. Keeping market capitalization rates constant at different levels, the marginal effect indicates the effect on leverage for a unit change in tangibility. The country at the 25th percentile for market development (low development) is the Czech Republic. The country at the 75th percentile (high development) is Denmark. A unit change in tangibility corresponds to 0.213 unit change in leverage at the lower development level and 0.261 unit change at the higher development level.

The difference between high and low development is 0.048 units, indicating a larger change in leverage under a more developed market. This finding is not in line with our proposed hypothesis (H3), in which we hypothesize lower market development levels to indicate a stronger relation between leverage and asset tangibility. However, we find that the strength of the collateral channel increases when the market development level increases. Deriving from the findings of Rajan and Zingales (1995), that there are capital structure differences in market and bank based economies, we can argue that the market development level decreases the influence of banks. Hence, a higher market development level can result in a stronger collateral channel, through a lower cost of debt. Rajan and Zingales (1998) discuss that the financial development shows the efficiency of the relation between creditors and borrowers. They further add that financial development indicates how well the lending mechanism is in place for banks, in addition to how the external environment is influenced by the legal and regulatory factors. It must be noted that the specific indicator of market capitalization might not be able to fully capture all aspects of financial development (Rajan & Zingales, 1998). However, we can argue that the market development level results in a more efficient environment, where the strength of the collateral channel is enhanced by both the efficiency and a lower cost of debt. More debt for a unit of collateral is especially important for smaller firms (Table 9) as they tend to have less collateral. Overall, with a lower cost of capital, debt becomes more available for smaller firms. Larger firms on the other hand, possibly move towards equity financing as the market development level increases.

5.4. Nonperforming Loans

Analyzing the results for nonperforming loans and its effect on the collateral channel, the country at the 25th percentile is Denmark (low NPLs) and at the 75th percentile is Bulgaria (high NPLs). Table 8 shows that a unit change in tangibility results in a 0.223 unit change in leverage under low levels of NPLs, while at a higher level the change is 0.255 units. The difference in the effect on leverage is a 0.032 unit change. Therefore, a higher amount of nonperforming loans presents a stronger collateral channel. We reject our hypothesis (H4). However, if there are no defaults, firms with less collateral have a higher predicted leverage (Figure 6). This illustrates the importance of collateral under a higher percentage of nonperforming loans. As asset tangibility increases, it helps to mitigate the frictions between creditors and borrowers. Large firms face a stronger collateral channel under higher nonperforming loans (Table 9). A larger asset base and more collateral are considered less risky, even in a high-risk environment with nonperforming loans.

5.5. *Regulatory Quality*

In the case of regulatory quality, and its effect on the collateral channel, at the 25th percentile (low quality) are Portugal and Poland, while at the 75th percentile (high quality) is Spain. Table 8 shows that a unit change in tangibility results in a 0.208 unit change in leverage under low regulatory quality. When the regulatory quality is high, the corresponding change in leverage is 0.308 units, meaning the difference between a high and low regulatory environment quality is 0.100 unit change in leverage. This finding confirms our hypothesis (H5), which states that the collateral channel is stronger under a higher regulatory quality. Such a finding means that in countries with a better regulatory quality, firms are able to borrow more for a given amount of collateral. This finding is in line with the findings of Jõeveer (2013) who uses corruption to indicate the regulatory quality of a country. However, from Figure 8 we see that firms with little or no collateral have a lower predicted leverage under higher regulatory quality than firms in lower regulatory environments. Under high regulatory conditions, firms overall cannot borrow without collateral, which is illustrated by the strength of the collateral channel. Large firms drive the positive relation of the strength of the collateral channel (Table 9), as they tend to have more tangible assets for which they can obtain more long-term debt.

5.6. *Depth of Credit Information*

Analyzing the depth of credit information, at the 25th percentile is Belgium and at the 75th percentile, Estonia. Table 8 shows that a unit change in tangibility results in a 0.222 unit change in leverage at the 75th percentile level of the depth of credit information and in a 0.246 unit change at the 25th percentile. At the 25th percentile, a unit change in tangibility results in a 0.024 higher unit change in leverage, than at the 75th percentile. However, the difference between 25th and 75th percentile is only one unit for the credit information index value. For a more distinctive interpretation, we look at the difference between the minimum and maximum. Countries corresponding to these are Luxembourg and UK respectively, where a unit change in tangibility results in 0.340 and 0.198 unit changes in leverage respectively. The difference between an environment with high and low information availability is that with low information availability, the change in leverage is 0.142 units higher. We reject our hypothesis (H7). From Figure 5 we can see that if firms have no collateral, higher informational efficiency results in higher predicted leverage. However, as the asset tangibility increases, the strength of the collateral channel increases in an environment with higher informational asymmetry. Thus, collateral becomes more important when obtaining debt, as it helps to solve frictions between creditors and borrowers. Mature firms drive this relation (Table 9) under informational

asymmetry. Mature firms tend to be more sustainable and under informational asymmetry, banks consider them more trustworthy, thus they face a stronger collateral channel.

Furthermore, the subsample tests show that the strength of legal rights becomes significant at the 10% level in the case of young firms, with a negative coefficient. A possible reason behind this finding is that with higher legal rights, smaller firms are more reluctant to borrow with collateral, as firm managers do not want to lose control of their company. Furthermore, the collateral pledged by small firms might be the personal property of the owner, thus making smaller firms more reluctant to borrow, as they face a weak collateral channel.

Answering our second research question, we present evidence of what the reasons are behind the variations in the strength of the collateral channel between European countries. We are able to confirm our Hypothesis 5, as a higher regulatory quality allows for a stronger collateral channel. The other hypotheses are rejected, as our findings indicate that the market development level (Hypothesis 3), higher nonperforming loans (Hypothesis 4) and higher informational asymmetry (Hypothesis 7) enhance the strength of the collateral channel. With our findings, we also reject Hypothesis 2 and 6, as the results for the strength of legal rights and change in HPI are insignificant.

6. Limitations and implications for further research

6.1. Implications of Findings

Our findings have implications for both firm managers and policy makers. From the trade-off theory, we know that capital structure affects both the value of the company, while also affecting the riskiness. In essence, capital structure is part of a firm's financial policy. However, there are different risks companies face. These risks can include country risks, industry dynamics, or economic conditions and they can vary across institutional differences. From capital structure literature, we know that firms can have an optimal leverage ratio (DeAngelo & Masulis, 1980), while in practice it can be a targeted range. Risk factors affect the need for adjusting the leverage ratio. However, these adjustments are subject to the determinants of capital structure. We find that the asset base of the company has immense importance in determining the capital structure of a company, as more holdings of collateral allow companies to obtain more debt. We can argue that this mechanism also influences the speed and cost of the adjustment to the optimal leverage ratio. In different institutional environments, the strength of the collateral channel varies. For firm managers, this implies how much leverage a unit of collateral gives.

Under different levels of market development, we argue that collateral plays an important role in lowering the cost of debt. With informational asymmetry, the collateral channel helps to eliminate frictions between the banks and firms. The same frictions are also reduced by the collateral channel under different levels of NPLs. Under high regulatory quality, collateral plays an important role in obtaining debt overall. Firms, who have more collateral to pledge have better access to long-term debt. For a firm manager, this brings considerations for taking on investment opportunities and costs of adjustment to the target leverage.

For policy makers, their role is designing policies for growth and efficiency in the private sector. Our findings indicate, that under higher risks involved, the collateral channel plays a more important role, while with higher regulatory quality, firms face a stronger collateral channel. These findings imply that the collateral channel does play an important role in obtaining external financing. The median asset tangibility in our sample is 0.15. We can argue that for companies with lower tangibility, the access to credit markets is limited, while such a limitation in access to capital can lead to limited investments and less value-adding activities. Policy makers should strive to facilitate investment and support economic growth. We can argue, that from the evidence of companies with less access to external financing due to lower amounts of collateral, policy makers should promote financial market development and informational efficiency. Our evidence shows that in such cases, firms are able obtain a higher leverage with less collateral. Therefore, the policy makers should try to enhance the effect of the collateral channel.

6.2. Limitations

In order to fully perceive the findings presented, it is important to also discuss the possible limitations of our research. These limitations help to better understand the implications of our results, while also raising possible concerns to be addressed in future research.

Firstly, we want to address problems concerning our data. We acknowledge the limitations of using the Orbis database as there are three potential drawbacks. First, Orbis deletes all the firms, which are inactive or taken out of the business registry, after five years. This means our sample might be exposed to survivorship bias. However, we find that such bias possibly does not have a significant effect on our results, as our sample has a high number of firms present. Secondly, a concern of representativeness still remains. There is no clear indication of how many firms are missing from our sample, respective to the general population of firms in Europe. In addition, we have an unbalanced panel of firms, meaning many firms do not have available data for all the years. However, keeping an unbalanced panel gives us a

more representative sample of more firms to draw conclusions on. Thirdly, the low number of listed companies in our sample is another reason for representativeness concerns.

In the literature of capital structure, it is widely discussed that the implications of results must be subject to robustness checks on the leverage measure. Leverage can be defined in different ways, while we choose to define it the most applicable way for the collateral channel – long-term debt divided by total assets. Leverage can be subject to different definitions amid different asset classes and types of debt. We could change the definition into a more conventional book debt to total assets, which includes both short- and long-term debt. However, Hall et al (2004) find that long-term debt is more related to fixed assets, while short-term debt is affected by short-term assets in the case of SMEs. In addition, including short-term debt would cut down our sample, as many companies have it missing. Using broad leverage, defined as total liabilities to total assets, the R-squared of our baseline regression drops by more than half, indicating such a measure of leverage is not applicable to study the collateral channel, while yielding insignificant results for asset tangibility. Therefore, we believe our measure of leverage is the most applicable, however we find that a robustness check of the measure for leverage would validate the findings more.

In addition, we must note that there could be an endogeneity problem in conducting such a cross-country study. We believe that this problem is not from an omitted variable problem for country information, however the institutional variables included as independent variables for modelling the institutional environment, could be subject to endogeneity.

6.3. Further Research

Deriving from the limitations, findings presented and implications discussed, there are suggestions we would address for further research. Firstly, the strength of the collateral channel has a positive effect on company's leverage, while we have identified the institutional environment affecting that strength. However, as the literature discusses, there is an optimal capital structure firm manager's target. From the perspective of the collateral channel, further research could investigate the adjustment speed of capital structure and how it differs across institutional differences. We hypothesize that dependent on the institutional environment, the costs of adjusting to the optimal level can vary vastly. Finding out how the collateral channel and its strength link to the adjustment speed, would provide information on how firm managers should set targets for the optimal leverage ratio.

Moreover, as Cvijanovic (2014) studies the effect of real estate price shocks on capital structure in the US, a more detailed look into the collateral channel could be done in studying

how the asset price fluctuations affect capital structure in Europe. We have included the change in the house price index as a country-level indicator, whereas we do not find a significant effect. However, retrieving firm-level data on firms' real estate holdings would allow to study the asset price movements at the firm-level, possibly using an event study as an empirical strategy to capture the effect on capital structure.

In addition, the cost of debt and debt maturity have an integral role in the collateral channel. We discuss that the strength of the collateral channel increases with NPLs and informational asymmetry, while such relation could be argued to be present for the higher cost of debt. However, such discussion needs empirical support to validate such arguments. More tangible assets could have a lowering effect on the cost of debt. Still, the variation in the strength of the collateral channel indicates that the same trend could be present for cost of debt across countries. Explaining the variation by the institutional factors and other country risks, determining the relation between the cost of debt and asset tangibility is important in understanding how the collateral mechanism works.

While we find strength of legal rights not significant, further research could look more into different variable construction. As the more traditional proxies indicate the presence of certain laws important in determining creditor and debtor relationship, further research could look into evaluating the legal framework from the perspective of effectiveness.

7. Conclusion

We use a panel data sample of firms from 25 countries to conduct a cross-country study in determining the effect of the collateral channel on capital structure in Europe. The variation in the strength of the collateral channel is evident as we determine the relation between asset tangibility and leverage across countries. We further show that the institutional variables affect the strength of the collateral channel. The market development level, regulatory quality, informational asymmetry and amount of nonperforming loans determine the strength of the collateral channel in our sample. We reason that a higher market development level increases the efficiency and decreases the cost of debt, allowing for firms to obtain more debt for a unit of collateral. We find such a relation to be more important for smaller firms. In addition, we argue that under higher regulatory quality, collateral is required to access long-term debt, with larger firms behind the relation. With high informational asymmetry and nonperforming loans, we argue that collateral helps to mitigate possible frictions present in markets. Through the collateral channel, large firms obtain better access to debt with more nonperforming loans,

while small firms have better access to debt under high informational efficiency. We also divide firms by age, however such differentiation yields less variation.

Interestingly, opposed to previous literature (Hall & Jörgensen, 2008), we find the strength of legal rights to have no effect on the collateral channel. While the finding could be subject to the variable definition, other significant variables could be picking up the legal effect in our model. In addition, we find the change in asset prices to have no significant effect. Further analysis could however look at the real estate price changes at the firm-level opposed country-level, to capture how liquidation value changes affect the capital structure.

From the perspective of financial policy and optimal leverage to promoting financial development and informational efficiency, such findings matter for both firm managers and policy makers. However, these are implications for further research. As firms tend to have an optimal debt ratio, the adjustment speed of capital structure corresponding to the collateral channel could be studied for a further understanding of cross-country differences. We hypothesize that the strength of the collateral channel influences the cost of adjustment under a varying institutional environment. In addition, the analysis of the collateral channel can be extended to include studying the cost of debt and debt maturity, as cross-country differences can be expected.

As firms in Europe remain more dependent of bank financing, collateral remains to have a significant role in determining leverage, possibly explaining the cross-country variation in leverage. Therefore, understanding how the strength of the collateral channel varies by institutional factors is important in studying capital structure.

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Appendices

Appendix 1: Variables description

Variable	Description	Source
Asset tangibility	Ratio of tangible fixed assets divided by book total assets.	Orbis Database
Leverage	Long-term debt divided by book total assets	Orbis Database
Profitability	Return on assets ratio, which is net income divided by book total assets.	Orbis Database
Profitability	Return on equity ratio, which is net income divided by book equity.	Orbis Database
Firm size	Logarithm of book total assets.	Orbis Database
Effective tax rate	Ratio of tax divided by profit before tax.	Orbis Database
GDP growth	The GDP growth rate for each country within our sample. Data is for 2006-2014.	The World Bank, World Development Indicators (The World Bank, 2016c)
Per capita GDP	The per capita GDP for each country within our sample. Data is for 2006-2014.	The World Bank, World Development Indicators (The World Bank, 2016c)
Inflation	The inflation rate for each country within our sample. Data is for 2006-2014.	The World Bank, World Development Indicators (The World Bank, 2016c)
Total tax rate	The total tax rate as a percentage of commercial profits. Data is for 2006-2014.	The World Bank, World Development Indicators (The World Bank, 2016c)
Strength of legal rights	Strength of legal rights estimates how protected the creditors are in a given country. The index takes into account collateral and bankruptcy laws, which are in place to protect the creditors. Higher protection should make lending activities more attractive for creditors. The index range is 0-10. A higher score shows higher creditor protection.	The World Bank, Doing Business (The World Bank, 2016a)

Depth of credit information	The depth of credit information index shows the scope, accessibility and quality of credit information, which is available in the country through both private and public credit registries. The index range is 0-6 with higher scores showing a higher quality and availability of credit data. A higher index value will mean greater access to information, therefore having a positive effect on lending decisions.	The World Bank, Doing Business indicators (The World Bank, 2016a)
Regulatory quality	The regulatory quality indicates the government's ability to create and implement policies to promote private sector development.	The World Bank Worldwide Governance Indicators (The World Bank, 2016b)
Control of Corruption	This indicates the perception of the ability of public power to be used for private gain. Both small and large forms of corruption are included. We use this an alternative measure of regulatory quality.	The World Bank Worldwide Governance Indicators (The World Bank, 2016b)
Market capitalization of listed companies	The market capitalization of companies as a percentage GDP indicates the development of the country's financial market. The share price times the shares outstanding for companies listed on the national stock exchange. Investment companies, mutual funds and other investment related entities are excluded.	The World Bank, Global Financial Development (The World Bank, 2016d)
Nonperforming loans	Nonperforming loans indicates the total bank nonperforming loans to total gross loans.	The World Bank, World Development Indicators (The World Bank, 2016c)
House price index	The house price index (HPI) is retrieved from Eurostat and OECD databases and covers the countries of the European union. The base year is 2006 with 2010=100 for both databases. The index shows the movement of private house prices across the European Union. Country data is mostly obtained from Eurostat, with Greece and Italy obtained from OECD, due to lack of data for those countries. Both databases follow similar methodologies.	Eurostat and OECD databases. (Eurostat, 2016; OECD, 2016)
Stocks traded	Stocks traded is measured by the total value of stocks traded as a percentage of GDP. We use this as an alternative measure of financial market development.	The World Bank, Global Financial Development (The World Bank, 2016d)

Appendix 2: Correlation table of our institutional variables.

	Strength of legal rights	Depth of credit info.	Regulatory quality	Market cap.	NPL	HPI
Strength of legal rights	1					
Depth of credit info.	0,16	1				
Regulatory quality	0,54	0,05	1			
Market cap.	0,27	-0,19	0,52	1		
NPL	-0,32	0,14	-0,73	-0,59	1	
HPI	0,16	-0,15	0,36	0,28	-0,42	1

Appendix 3: Mean values for variables included in our analysis. The mean values are calculated for the period of 2006-2014. The country is indicated in the left with the variable indicated in the column header.

Country	Leverage	Tangibility	Profitability	Effective tax rate	ln(Size)	Inflation	GDP growth	GDP per capita	Depth of credit info.	Str. Of legal rights	Regulatory quality	NPL	HPI	Market Capitalization
Belgium	0.17	0.33	0.05	0.23	7.64	0.02	0.01	33805.04	4.00	5.00	1.29	0.03	0.03	0.63
Bulgaria	0.08	0.32	0.08	0.09	7.40	0.04	0.02	5279.64	4.67	9.00	0.59	0.11	0.02	0.18
Croatia	0.19	0.37	0.04	0.16	7.58	0.03	0.00	10187.90	3.22	6.68	0.48	0.10	0.00	0.51
Czech Republic	0.05	0.32	0.06	0.16	7.72	0.02	0.01	14649.41	5.00	6.30	1.15	0.04	-0.01	0.29
Denmark	0.24	0.55	0.03	0.20	8.02	0.02	0.00	45489.69	4.00	9.00	1.81	0.05	0.01	0.62
Estonia	0.16	0.36	0.08	0.05	7.46	0.04	0.02	12435.14	5.00	6.40	1.42	0.02	0.06	0.17
Finland	0.17	0.34	0.06	0.20	7.57	0.02	0.00	36019.13	4.00	8.00	1.78	0.00	0.03	0.74
France	0.08	0.14	0.06	0.19	7.67	0.01	0.01	31125.66	4.00	4.70	1.20	0.04	0.01	0.75
Germany	0.27	0.25	0.05	0.22	8.31	0.02	0.01	32090.27	5.79	7.33	1.56	0.03	0.02	0.43
Greece	0.10	0.32	0.02	0.16	7.96	0.02	-0.03	19151.80	4.57	4.00	0.67	0.15	-0.05	0.35
Hungary	0.04	0.42	0.05	0.11	7.76	0.04	0.01	10042.24	4.17	7.00	1.03	0.10	-0.01	0.20
Ireland	0.19	0.42	0.04	0.13	8.89	0.01	0.01	40009.41	5.00	9.00	1.71	0.12	-0.03	0.46
Italy	0.09	0.23	0.01	0.40	7.71	0.02	-0.01	27140.34	5.08	3.00	0.83	0.11	-0.03	0.28
Latvia	0.15	0.39	0.07	0.12	7.47	0.03	0.03	10287.94	3.58	10.00	1.02	0.08	0.01	0.06
Lithuania	0.15	0.37	0.06	0.17	8.31	0.04	0.03	10089.98	5.56	5.21	1.05	0.12	0.01	0.16
Luxembourg	0.05	0.14	0.04	0.12	9.23	0.02	0.02	80089.95	0.00	4.00	1.73	0.00	0.04	1.60
Netherlands	0.23	0.28	0.05	0.19	9.27	0.02	0.00	38659.99	5.00	5.87	1.76	0.03	-0.03	0.77
Poland	0.08	0.38	0.06	0.20	8.23	0.03	0.04	9513.31	5.53	8.61	0.92	0.05	-0.02	0.35
Portugal	0.24	0.28	0.02	0.24	7.83	0.02	0.00	16593.84	5.00	3.00	0.87	0.07	-0.03	0.35
Romania	0.02	0.36	0.07	0.16	7.80	0.04	0.04	6246.24	3.41	8.68	0.55	0.12	-0.03	0.14
Slovak Republic	0.04	0.35	0.05	0.17	7.45	0.02	0.03	12829.64	3.85	8.00	1.01	0.05	0.02	0.06
Slovenia	0.18	0.42	0.03	0.19	7.89	0.02	0.01	17721.15	1.13	4.25	0.72	0.09	-0.03	0.22
Spain	0.23	0.31	0.02	0.24	7.85	0.02	0.00	23048.80	5.00	6.00	1.07	0.05	-0.04	0.84
Sweden	0.14	0.24	0.07	0.17	7.36	0.01	0.02	40875.94	4.00	7.59	1.73	0.01	0.05	1.00
United Kingdom	0.11	0.32	0.07	0.21	8.57	0.03	0.01	31672.03	6.00	10.00	1.74	0.03	0.04	1.09

Appendix 4: Predicted margins of leverage, with a given value for tangibility while keeping an institutional variable constant at the minimum, 25th percentile, 75th percentile, and maximum values.

Depth of Credit Information			Market Capitalization			Regulatory Quality			Nonperforming Loans		
Tangibility	Credit info	Margin	Tangibility	MCAP	Margin	Tangibility	Regulatory	Margin	Tangibility	NPL	Margin
0	0	-0.001	0	4%	0.049	0	0.34	0.103	0	0%	0.074
0	4	0.054	0	22%	0.052	0	0.91	0.070	0	3%	0.066
0	5	0.068	0	66%	0.061	0	1.6	0.030	0	10%	0.049
0	6	0.082	0	330%	0.113	0	1.92	0.011	0	33%	-0.007
0.2	0	0.067	0.2	4%	0.087	0.2	0.34	0.128	0.2	0%	0.116
0.2	4	0.103	0.2	22%	0.095	0.2	0.91	0.112	0.2	3%	0.111
0.2	5	0.112	0.2	66%	0.113	0.2	1.6	0.092	0.2	10%	0.100
0.2	6	0.121	0.2	330%	0.223	0.2	1.92	0.082	0.2	33%	0.065
0.4	0	0.135	0.4	4%	0.126	0.4	0.34	0.154	0.4	0%	0.158
0.4	4	0.152	0.4	22%	0.138	0.4	0.91	0.153	0.4	3%	0.156
0.4	5	0.157	0.4	66%	0.165	0.4	1.6	0.153	0.4	10%	0.151
0.4	6	0.161	0.4	330%	0.332	0.4	1.92	0.153	0.4	33%	0.137
0.6	0	0.203	0.6	4%	0.165	0.6	0.34	0.179	0.6	0%	0.200
0.6	4	0.202	0.6	22%	0.180	0.6	0.91	0.195	0.6	3%	0.200
0.6	5	0.201	0.6	66%	0.218	0.6	1.6	0.215	0.6	10%	0.202
0.6	6	0.201	0.6	330%	0.442	0.6	1.92	0.224	0.6	33%	0.209
0.8	0	0.272	0.8	4%	0.204	0.8	0.34	0.204	0.8	0%	0.242
0.8	4	0.251	0.8	22%	0.223	0.8	0.91	0.237	0.8	3%	0.245
0.8	5	0.245	0.8	66%	0.270	0.8	1.6	0.277	0.8	10%	0.253
0.8	6	0.240	0.8	330%	0.552	0.8	1.92	0.295	0.8	33%	0.281
1	0	0.340	1	4%	0.242	1	0.34	0.229	1	0%	0.283
1	4	0.300	1	22%	0.265	1	0.91	0.278	1	3%	0.290
1	5	0.290	1	66%	0.322	1	1.6	0.338	1	10%	0.304
1	6	0.280	1	330%	0.661	1	1.92	0.366	1	33%	0.352

Appendix 5: Full output of interaction regressions.

	All Measures	Legal Measures	Market Measures	Simple OLS	Stock Traded	Control of Corruptio
Asset tangibility	0.125*	0.194***	0.150***	0.114*	0.158**	0.192***
	(2.31)	(5.21)	(8.27)	(2.13)	(2.90)	(4.90)
Profitability	-	-	-	-	-	-0.190***
	(-7.56)	(-8.53)	(-6.31)	(-7.32)	(-7.59)	(-7.74)
Effective tax rate	-0.004*	-0.004*	-0.002	-0.004**	-	-0.002
	(-2.36)	(-2.75)	(-1.08)	(-2.68)	(-3.33)	(-1.38)
Log of total assets	0.006*	0.004	0.005*	0.005	0.007*	0.005*
	(2.34)	(1.84)	(2.32)	(1.84)	(2.40)	(2.13)
Inflation	0.164	-0.044	-0.083	0.161	-0.203	0.294
	(0.87)	(-0.33)	(-0.45)	(0.87)	(-1.41)	(1.73)
Growth of GDP	-0.133	-0.043	-0.144	-0.133	-0.021	-0.090
	(-1.44)	(-0.66)	(-1.28)	(-1.58)	(-0.24)	(-1.20)
Per capita GDP	0.019	0.036***	0.017**	0.022*	0.018	-0.034***
	(1.78)	(5.19)	(2.72)	(2.04)	(1.81)	(-5.40)
Strength of legal rights	-0.000	0.002		-0.000	0.001	-0.007***
	(-0.13)	(0.96)		(-0.07)	(0.94)	(-3.35)
Depth of credit information * Asset	0.014***	0.010***		0.014**	0.010**	0.011**
	(3.72)	(3.66)		(3.42)	(3.74)	(3.19)
Regulatory quality	-0.055*	-		-0.058*	-0.067**	
	(-2.42)	(-3.93)		(-2.41)	(-3.02)	
Market capitalization	0.019		-0.021	0.020		0.017
	(1.44)		(-1.50)	(1.57)		(1.30)
Change in HPI	0.010		0.007	0.010	-0.017	-0.019
	(0.24)		(0.16)	(0.23)	(-0.36)	(-0.49)
Nonperforming loans	-0.233*		-0.058	-0.244*	-0.324**	-0.033
	(-2.31)		(-1.10)	(-2.34)	(-2.84)	(-0.47)
Nonperforming loans * Asset tangibility	0.427**		-0.013	0.453**	0.608**	0.347**
	(3.01)		(-0.13)	(3.18)	(5.26)	(2.78)
Market capitalization * Asset tangibility	0.107***		0.204***	0.109**		0.059**
	(4.43)		(7.16)	(4.64)		(2.83)
Change in HPI * Asset tangibility	-0.005		-0.011	-0.004	0.091**	0.023
	(-0.10)		(-0.20)	(-0.08)	(3.09)	(0.43)
Strength of legal rights * Asset tangibility	-0.003	-0.006		-0.003	-0.005	0.001
	(-0.83)	(-1.43)		(-0.71)	(-1.16)	(0.21)
Depth of credit information * Asset	-	-		-0.024**	-	-0.020**
	(-3.40)	(-3.55)		(-3.19)	(-5.93)	(-2.88)
Regulatory quality * Asset tangibility	0.143***	0.154***		0.145**	0.170**	
	(4.42)	(9.68)		(4.44)	(5.32)	
Stocks Traded					0.015*	
					(2.15)	
Stocks Traded * Asset tangibility					0.042**	
					(2.59)	
Control of Corruption						0.026***
						(3.49)
Control of Corruption * Asset tangibility						0.084***
						(5.49)
R-sqr	0.163	0.159	0.155	0.168	0.160	0.174
Observations	5810304	6630954	5810304	5810304	4942534	5810304

Appendix 6: Interaction output for subsample regressions.

	Large firms	Small firms	Mature firms	Young firms
Asset tangibility	0.050	0.184***	0.156***	0.064
	(0.95)	(3.67)	(3.34)	(0.95)
Profitability	-0.247***	-0.162***	-0.182***	-0.128***
	(-7.85)	(-7.16)	(-8.36)	(-5.85)
Effective tax rate	-0.004	-0.004*	-0.004**	-0.004
	(-1.43)	(-2.46)	(-2.59)	(-0.90)
Log of total assets	0.010**	0.007**	0.005*	0.010***
	(2.75)	(3.25)	(1.97)	(4.15)
Inflation	0.284	0.122	0.139	0.313
	(1.36)	(0.69)	(0.79)	(0.84)
Growth of GDP	-0.018	-0.161	-0.104	-0.333
	(-0.21)	(-1.69)	(-1.19)	(-1.90)
Per capita GDP	0.023	0.018	0.013	0.046*
	(1.80)	(1.67)	(1.34)	(2.43)
Strength of legal rights	-0.004	0.000	-0.001	0.005
	(-1.69)	(0.13)	(-0.45)	(1.29)
Depth of credit information * Asset tangibility	0.021***	0.014***	0.014***	0.023***
	(5.95)	(3.53)	(3.48)	(4.98)
Regulatory quality	-0.053*	-0.051*	-0.049*	-0.084*
	(-2.11)	(-2.17)	(-2.44)	(-2.02)
Market capitalization	0.016	0.018	0.016	0.047
	(1.13)	(1.44)	(1.36)	(1.74)
Change in HPI	-0.033	0.020	-0.001	0.098**
	(-0.85)	(0.46)	(-0.02)	(3.00)
Nonperforming loans	-0.178*	-0.212	-0.228*	-0.266*
	(-2.10)	(-1.94)	(-2.16)	(-2.16)
Nonperforming loans * Asset tangibility	0.882***	0.162	0.341*	0.505**
	(15.56)	(0.91)	(2.25)	(2.80)
Strength of legal rights * Asset tangibility	-0.007	-0.003	-0.003	-0.010**
	(-1.03)	(-0.82)	(-0.78)	(-2.69)
Depth of credit information * Asset tangibility	-0.022*	-0.027***	-0.029***	0.000
	(-2.28)	(-4.68)	(-4.31)	(0.00)
Regulatory quality * Asset tangibility	0.226***	0.108**	0.135***	0.151***
	(5.60)	(3.18)	(4.05)	(5.06)
Market capitalization * Asset tangibility	-0.008	0.138***	0.109***	0.119***
	(-0.26)	(4.67)	(4.13)	(5.77)
Change in HPI * Asset tangibility	-0.092	-0.016	-0.010	-0.059
	(-0.82)	(-0.29)	(-0.16)	(-0.75)
R-sqr	0.191	0.161	0.159	0.196
Observations	755581	5054723	5058359	751945