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The Cross-Sectional and Time-Series Dynamics of Corporate Finance:

Empirical Evidence from Financially Constrained Firms

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Empirical evidence from financially constrained firms

De cross-sectionale en tijdreeksdynamiek in bedrijfsfinanciering:

Empirisch bewijs van bedrijven met beperkte financiële mogelijkheden

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Acknowledgements

"L'intellectuel est quelqu'un dont le cerveau s'absente lui-même" – Albert Camus

At the moment I am bound to complete the mission that I started almost five years ago; receiving my PhD in Finance. Looking back at the trajectory, I realize how much I have grown in the past five years. I have not only grown intellectually, but I also have become more self-conscious, being more aware of my own strengths and weaknesses than before my PhD. This has made me a better and wiser person. For this reason, I refer back to the statement of Albert Camus at the top of this page.

During the PhD trajectory I have had several successes and struggles. These successes however I have not reached all by myself. In addition, there were many people available who helped me to get through the struggling. For this reason there are several people who I need to thank.

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Stefan van Kampen

Declaration of Contribution

In this section I state my contribution to each of the three studies (chapters 2 to 4) in this dissertation.

Chapter 2 is joint work with Lars Norden. I have collected all the data. The execution of the analyses has been done for 60% by me and for 40% by Lars Norden, while the writing has been done for 40% by me and 60% by Lars Norden.

Chapter 3 is joint work with Lars Norden and Manuel Illueca Muñoz. I have collected all the data, except for the bank-firm matched data for Spain. I conducted all the analyses. Lars Norden and I both did a major part of the writing (approximately 47.5% by the both of us, Manuel Illueca Muñoz did the remaining 5%).

Chapter 4 is single-authored where all the work has been done by me.

Abstract

This dissertation discusses the access to finance of mostly financially constrained firms on several dimensions. The first study[1] investigates the relationship between corporate leverage and the asset structure. It appears that non-current assets are more important sources of collateral than current assets. The collateral channel is more pronounced for bank-dependent firms, but it weakened the most for these firms during the crisis. The second study[2] investigates whether SMEs receive more trade credit after they experienced a negative shock to bank credit. This ability to substitute depends in a positive way on the credit quality of the firms and the stage of the economy. Moderately financially constrained firms are most likely to substitute. The third study investigates how several variables related to banking sector development, stock market development and legal development affect the access to SME finance. The main finding is that SME's have better access to finance if they are located in countries with a competitive banking sector, with a strong preference for long debt maturity, with high quality credit registries, with liquid and low-volatile stock markets and with strong creditor protection rights.

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[1] The description of the first study is based on the written abstract used in Norden, L., Van Kampen, S. (2013). Corporate Leverage and the Collateral Channel. Journal of Banking and Finance, 37(12), 5062-5072

[2] The description of the second study is based on the written abstract used in Norden, L., Van Kampen, S., Illueca, M. (2017). Substitution effects in private debt: evidence from SMEs. Working Paper Series.

Chapter 1

Introduction

The foundation for corporate finance research was laid in 1958 with the irrelevance theorem of Modigliani and Miller. Several important theories on how firms fund themselves have emerged since then. Most importantly, there is the trade-off theory (Modigliani and Miller, 1963; Kraus and Litzenberger, 1973), the pecking-order theory (Donaldson, 1961; Myers and Majluf, 1984) and the market-timing theory (Baker and Wurgler, 2002).

In reality, these theories do not apply to all firms in the same way. There is a lot of empirical research that provides evidence that there are determinants of corporate leverage unaccounted for in each of these theories. Some important examples are financial constraints (e.g. Fazzari, Hubbard and Petersen, 1988; Kaplan and Zingales, 1997), the access to the public debt market (Faulkender and Petersen, 2006; Kisgen, 2006, 2009), the size of the firm, (Beck, Demirgüç-Kunt and Maksimovic, 2008), the sensitivity towards information asymmetry (Stiglitz and Weiss, 1981), industry variation (Bradley, Jarrell and Kim, 1984; Kahle and Walkling, 1996), the place in the economic cycle (Gertler and Gilchrist, 1994), the stability of the banking sector (Ivashina and Scharfstein, 2010) and the differences in the institutional contexts across countries (La Porta, Lopez-de-Silanes, Shleifer and Vishny, 1997; Haselmann, Pistor and Vig, 2010).

In addition, we assume in these theories that debt is relatively homogeneous, while it is in fact very heterogeneous. Several examples of

the different forms of debt would be; short-term bank loans, long-term bank loans, lines-of-credit, government subsidies, trade credit, subordinated bank debt, informal loans, corporate bonds, government bonds and crowdfunding. All these types of debt have different levels of status, security and maturity and therefore the dependency on each of them differs a lot across firms and industries. For example, the importance of (a particular source of) bank debt is highly dependent on the used lending technologies (Berger and Black, 2011). Moreover, for SMEs or other financially constrained firms relationship lending is the most important lending technology. Banks that maintain close and long-lasting relationships with their clients are better able to assess the creditworthiness of their clientele, resulting in more beneficial borrowing terms for their clients (Petersen and Rajan, 1994). On the contrary, large and transparent firms rely more on transaction-based lending (e.g. Bharath, Dahiya, Saunders and Srinivasan, 2011). The importance of alternative forms of debt also differs across firms. Trade credit for instance, seems to be more relevant for financially constrained firms (Garcia-Appendini and Montoriol-Garriga, 2013).

Investigating the heterogeneity of debt is especially important for SMEs and large private firms because large public firms can almost always fall back on public securities in order to fund themselves. For this reason, SMEs and large private firms are more dependent on private debt than large publicly listed firms. In spite of this, private firms (especially SMEs) have more difficulties in attracting debt than public firms because they are less transparent and therefore considered as more risky by several lending institutions (Beck and Demirgüç-Kunt, 2006).

In this dissertation, I address both several determinants of corporate finance and the heterogeneity of debt. In other words, the goal of this dissertation is to elaborate on several drivers of the acquisitions among different forms of external finance. As addressed above, investigating the heterogeneity of debt is most important for SMEs. For this reason, two out of three chapters are based on empirical findings for SMEs.

The first study in this dissertation can be found in chapter 2. This chapter investigates how the asset structure of a firm affects corporate leverage. In former literature, it is found that strong asset tangibility and/or asset redeployability has a positive effect on leverage. This is because tangible and/or redeployable assets can be pledged as collateral in case the firm defaults and therefore mitigates problems related to information asymmetry (e.g. Chan and Thakor, 1987; Boot, Thakor and Udell, 1991; Leary, 2009; Campello and Giambona, 2013). Firms can use several assets with varying levels of tangibility and redeployability as collateral in a loan application. In the literature, it is not yet widely investigated how these individual forms of tangible/redeployable assets affect corporate leverage. Therefore the first main contribution of this chapter is that it investigates the effect of several types of assets (i.e. PPE, inventories and accounts receivables) on the leverage ratio. The second contribution is that it also considers how the effect of the collateral channel could differ across firms and over time by measuring the differences for bank-dependent vis-à-vis bank-independent firms and crisis vis-à-vis non-crisis periods respectively.

The first main finding of this chapter is that PPE is the most important source of collateral in explaining long-term leverage, while accounts receivables is the most important contributor in explaining short-term

leverage. This finding confirms the asset-liability match of Chung (1993). The second main finding is that all three types of assets are weaker sources of collateral during the 2007-09 financial crisis. In other words, tangible assets are less useful as collateral during times when collateral is actually needed the most (because there is more uncertainty during a crisis and therefore banks generally ask for more collateral). However, the usefulness of asset tangibility in receiving debt finance during the crisis only decreases for bank-dependent firms (which are the firms who need the collateral the most). The value of the collateral for bank-independent firms (i.e. firms who have access to public debt markets) seems to be unaffected by the financial crisis.

The second study of this dissertation can be found in chapter 3. This chapter investigates the nature of the relationship between two important sources of credit; bank credit and trade credit and the main drivers of this relationship. As addressed earlier, alternative sources of credit are more important for SMEs. Therefore, this study is based on SMEs only. In former literature, it is assumed that bank credit and trade credit are substitutes of one another (Petersen and Rajan, 1997; Biais and Gollier, 1997). This implies that firms who are unable to attract bank credit due to their high levels of financial constraints attract trade credit from their suppliers instead. Relatedly, Garcia-Appendini and Montoriol-Garriga (2013) report that firms that are unconstrained are able to collect credit from the bank and that they redistribute parts of the credit they have received from banks to their bank-constrained customers in the form of trade credit. However, there are reasons to suspect that this substitution relationship might not always hold. Most important, trade credit does not

create any cash inflow and therefore is by definition less flexible than bank credit. Put differently, trade credit cannot always be used for the same purposes as bank credit (Breza and Liberman, 2017). In addition, the providers of trade credit (i.e. suppliers) are on aggregate getting more constrained themselves during a financial crisis. Therefore, they might be more reluctant to step in as alternative finance providers during times of crisis (Yang, 2011). This would imply that firms that are excluded from bank credit also are excluded from trade credit, and hence that bank credit and trade credit are complementary. This study investigates whether bank credit and trade credit have a substitution or a complementary relationship. Moreover, it tries to find an answer what actually causes the nature of this relationship. The answer is that substitution and complementary relationships are - on average - almost equally likely to occur. However, the nature of the relationship is quite volatile over time. During economic booms, firms who do not have access to bank credit can indeed fall back on their suppliers most of the times. However, the opposite is true during economic recessions. Also, the paper reports that the Altman's Z-score (Altman, 1968) of the firm has a positive effect on the likelihood of substitution. This indicates that only firms who reach a certain level of credit quality are able to fall back on their suppliers when banks cut their lending, implying that substituting bank credit for trade credit is not that easy as initially assumed in the literature.

The third study of this dissertation can be found in chapter 4. Also this study is fully based on finance for SMEs. While the previous chapters have been focusing on firm-level determinants of finance, this chapter focuses on country-level determinants. The goal of this study is to investigate how

several country characteristics related to banking sector development, stock market development and legal development affect the access to finance for SMEs in general and the choices between several forms of external finance (e.g. bank finance, trade credit, informal finance, subordinated debt and equity) in particular. Next to this, it sheds light on which country characteristics help SMEs to attract external finance during times of crisis. This is a very relevant topic, since SMEs are more sensitive to cyclicality than large publicly listed firms (Behr, Foos and Norden, 2017).

The most important findings from the banking sector development variables are that SMEs have easier access to finance when more mature debt is issued, when banking sectors are competitive and if the quality of the credit registries is high. These results hold both for bank finance and non-bank finance (and for bank finance during crisis periods). SMEs who cannot access bank finance during a crisis in a developed banking sector seem to have troubles in attracting other forms of external finance though.

From the stock market development variables it appears that liquidity and inverse risk are important positive contributors to the access to almost all forms of finance. This probably is because stock market stability signals optimism about opportunities in the near future, making finance providers more willing to extend credit. Stock market stability does not seem to help in acquiring external finance during times of crisis though.

From the legal development variables, it is found that creditor protection rights are highly important to improve the access to finance for SMEs. This is because lenders are more willing to provide a loan when their rights are better protected in case of default. SMEs located in countries with strong creditor protection rights have easier access to both bank

finance and non-bank finance. However, these protection rights do not work optimally during a crisis.

In a separate section, this chapter investigates how these same country characteristics affect the likelihood of substituting bank credit for alternative sources of finance. In chapter 3 of this dissertation, the likelihood to substitute bank credit for trade credit appeared to be quite different across countries. For this reason, it is interesting to investigate which country characteristics actually explain these differences in the likelihood of substitution. The variables addressed above all have a positive effect on the likelihood that trade creditors are willing to step in as alternative finance providers when banks cut their lending to SMEs. To a smaller extent, this also holds for informal lenders and private equity providers. These findings indicate that a well-developed institutional context is a positive contributor for several non-bank parties to extend finance to SMEs, even in the scenario when SMEs are rationed from banks.

Chapter 2

Corporate Leverage and the Collateral Channel[3]

2.1 Introduction

Debt is an important and very flexible source of external corporate finance. Firms can raise debt in various forms, such as public vs. private debt (bonds and commercial papers vs. bank loans and trade credit), long-term vs. short-term, senior vs. junior debt, secured vs. unsecured, or any combination of these dimensions. Frictions at the firm-level and the entire economy, especially asymmetric information between firms and lenders, are the key factors that influence the availability of debt finance to firms and its form (e.g., Gertler and Gilchrist, 1994; Bernanke and Gertler, 1995; Kashyap, Lamont and Stein, 1995). Furthermore, lending technologies and country characteristics such as the financial system, the banking system and the legal environment, affect the scale and scope of debt finance (e.g., Berger and Udell, 2006; Djankov,McLiesh and Shleifer 2007; Haselmann, Pistor and Vig, 2010).

In this paper, we investigate the relation between corporate asset structure and leverage to provide new evidence on the collateral channel. Earlier theoretical and empirical research has shown that particular forms of debt finance, for example, lending against collateral, help mitigating ex ante and ex post informational problems, such as adverse selection and moral

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[3] This chapter is based on Norden, L., Van Kampen, S. (2013). Corporate Leverage and the Collateral Channel. Journal of Banking and Finance, 37(12), 5062-5072.

hazard (see, for example, Chan and Thakor, 1987; Boot, Thakor and Udell, 1991; Rajan and Winton, 1995; Faulkender and Petersen, 2006; Leary, 2009; Berger, Frame and Ioannidou, 2011). The main motivation for our study is, in addition to the general link between assets and debt as a source of finance for these assets, that certain assets are better suited to serve as collateral for debt finance than others. Originally, the corporate finance literature has focused on asset tangibility as major driver of the collateral channel, while recent research emphasizes that asset redeployability - which partly overlaps with tangibility - matters (e.g., Campello and Giambona, 2013; Hall, 2012; Campello and Hackbarth, 2012; Chaney, Sraer and Thesmar, 2012). The collateral channel is one mechanism that helps explaining the cross-sectional variation in the access to debt finance and financing terms at the firm and industry level (e.g., Benmelech and Bergman, 2009). Indeed, the literature on corporate financial constraints has pointed out that limited access to credit and prohibitively high costs of credit are major determinants of financial constraints that prevent firms from funding all desired investments (e.g., Fazzari, Hubbard and Petersen, 1988; Kaplan and Zingales, 1997; Almeida, Campello and Weisbach., 2004; Denis and Sibilkov, 2010; Hadlock and Pierce, 2010). In other words, asset redeployability strengthens the collateral channel, which in turn, reduces corporate financial constraints.

Next to the ex ante and ex post incentive effects, there is evidence that the use of redeployable collateral reduces the lender's expected and realized loss-given-default (e.g., Davydenko and Franks, 2008; Grunert and Weber, 2009; Calabrese and Zenga, 2010; Khieu, Mullineaux and Yi, 2012), and bank regulators and supervisors have recognized the risk-mitigation effect

of collateral in the Basel II and III capital adequacy frameworks (Basel Committee on Banking Supervision, 2006; Basel Committee on Banking Supervision, 2011).

Moreover, the maturity structure of firms' assets might affect the maturity structure of corporate debt. Next to the trivial financing link between assets and liabilities, it is reasonable to expect that short-term assets are likely to serve as collateral for short-term debt (e.g., trade credit or lines of credit from banks), while long-term (fixed) assets are likely to serve as collateral for long-term debt (e.g., long-term investment loans, commercial real estate mortgages).

While the benefits of the collateral channel theoretically apply to all firms, they should be particularly relevant to firms that are subject to stronger frictions. Large, transparent and financially unconstrained firms typically have access to public and private debt, while small, informationally opaque and financially constrained firms typically have to rely on private debt as source of external finance (i.e., bank loans and/or trade credit). Given that private debt is more likely to be secured than public debt, we expect the collateral channel to be more relevant for firms that have to rely on private debt financing.

Another question that has not been extensively studied yet is whether and how the strength of the collateral channel varies over time. Ivashina and Scharfstein (2010) document a sharp decline in US bank lending during the global financial crisis, but there is little evidence on potential changes in the strength of the collateral channel, especially during the different stages of the crisis. The survey conducted by Campello, Graham and Harvey (2010) suggests that financially constrained firms suffered the most during

the crisis. Moreover, Becker and Ivashina (2014) show that firms with access to bond markets are able to substitute the decrease in bank debt during economic downturns with corporate bond issues, while firms that depend on private debt cannot.

Based on a large panel dataset of US firms from 1990 to 2010, we investigate the cross-sectional and time-varying importance of the collateral channel. First, we find a strong and positive relation between firms' leverage at time t and their asset structure at time t-1. We show that property, plant and equipment are the major determinants of the collateral channel. Other redeployable assets such as inventories and receivables also matter, but to a lesser extent. We control for firms' growth and investment opportunities, bank-dependence, profitability, time fixed effects, and industry fixed effects. Moreover, we obtain similar results when we use first differences of the asset structure variables and leverage. Various robustness tests, including Granger causality tests (Granger, 1969), indicate that our results are not driven by autocorrelation or endogeneity problems. Second, we show that property, plant and equipment are significantly positively related to long-term leverage (but not to short-term leverage), and receivables are positively related to short-term leverage. Third, we document that the collateral channel is more important for firms that cannot access public debt markets but have to rely on banks and trade creditors to raise debt. Fourth, we provide new evidence that the collateral channel has become weaker for bank-dependent firms after the start of the global financial crisis, while it remained unchanged for firms that can access public debt markets.

The rest of the paper proceeds as follows. In Section 2.2 we develop our main hypotheses about the collateral channel. In Section 2.3 we describe the data and explain the methodology. In Section 2.4 we report the results of our analysis of the link between corporate asset structure and leverage, the influence of bank-dependence, changes during the global financial crisis, and further empirical checks. Section 2.5 concludes.

2.2 Literature and Hypotheses

Related studies suggest that the functioning of the collateral channel depends on the redeployability of the pledged assets (e.g., Campello and Giambona, 2013, Campello and Hackbarth, 2012; Chaney et al., 2012). Most obvious candidates for easily redeployable collateral are real estate, inventories and accounts receivable. It has been well-documented that certain assets frequently serve as collateral in the asset-based finance (e.g., Udell, 2004). While real estate and inventories are tangible assets, accounts receivable are financial claims on the firms' customers that emerge from standardized trade credit agreements. Despite their intangible nature, receivables are relatively liquid because they can be assigned to the bank and/or sold to factoring companies. Counter-examples of assets that exhibit a low redeployability are firm-specific machinery, and various types of (opaque) intangibles (e.g., goodwill, brand names, patents, etc.). Asset redeployability requires a low asset-specificity, low informational asymmetry about the asset value, and as a consequence of the first two characteristics, liquid asset markets. As a side note, we do not consider firms' cash holdings here since they do usually not serve as collateral; we will come back to the role of cash in Section 2.4.4. Following this

reasoning we propose H1 to examine how corporate asset structure influences the functioning of the collateral channel.

H1: A higher fraction of redeployable assets (property, plant and equipment; inventories; and receivables) is associated with higher total leverage.

Conventional wisdom suggests that the life of corporate assets and the maturity of corporate liabilities are matched. Short-term assets (working capital: inventories and receivables) should be funded with short-term finance (e.g., trade credit or lines of credit from banks), and long-term assets (property, plant and equipment) should be funded with long-term finance (e.g., equity, long-term bonds, or long-term bank loans). This rationale is confirmed in many studies (e.g. Chung, 1993). However, this reasoning might differ in the case of secured debt finance. The borrower's risk of default and lender's collateral requirements might weaken the maturity match of assets and liabilities but strengthen the collateral channel. In other words, firms with a higher fraction of deployable assets exhibit a higher leverage independent of the asset-liability maturity structure. To investigate this issue, we test whether a higher fraction of short-term (long-term) assets is associated with a higher short-term (long-term) leverage.

H2a: Long-term assets (property, plant and equipment) are positively related with long-term leverage.
H2b: Short-term assets (inventories and receivables) are positively related with short-term leverage.

In a next step, we take firms' main sources of finance into account (i.e., issuing bonds vs. borrowing from banks and trade creditors). The existence of a bond rating indicates that the firm has access to public debt markets. Given that straight corporate bonds are typically unsecured, bond issuers are not or less dependent on the collateral channel. In contrast, firms without a bond rating have to rely on bank loans (and to a smaller extent on trade credit) to finance their business. Bank loans are often partially secured debt, and trade credit is almost always fully secured. Related studies have considered the non-existence of a bond rating as a proxy of firms' bank-dependence, credit constraints and financial constraints (e.g., Faulkender and Petersen, 2006; Denis and Sibilkov, 2010; Chava and Purnanandam, 2011). Thus, we propose H3 to study the importance of the collateral channel conditional on firms' bank dependence.

H3: The collateral channel matters more for bank-dependent firms than for other firms.

In a final step, we examine whether the functioning of the collateral channel has changed during the global financial crisis of 2007-2009. On the one hand, the severity of the financial crisis might have led to a strengthening of the collateral channel. Banks tightened their lending standards, increasingly switched from relationship lending to arm's length lending and asset-based finance, and therefore might have increased their collateral requirements. Campello and Giambona (2013) find that the relationship between asset redeployability and leverage is stronger in recessionary times. Gertler and Gilchrist (1994) show that binding credit

restrictions are the result of the state of the economy. This reasoning suggests a strengthening of the collateral channel in hard times.

On the other hand, the collateral channel could have become weaker during the financial crisis for the following reasons. First, given that banks reduced their new lending during the crisis, it is possible that the link between the level of corporate leverage and the level of redeployable assets has become weaker, in particular for bank-dependent borrowers. Second, Campello, Graham and Harvey (2010) provide survey evidence that financially constrained firms, because of the unavailability of external finance and shortfalls in cash flows, used asset sales to fund to their operations. It is likely that those firms sold the most redeployable assets, which further reduces the link between asset structure and leverage. Third, the market value of corporate assets dropped substantially (for real estate faster than for others), reducing their suitability as collateral for new bank loans. Fourth, firms that managed to obtain new bank loans during the crisis might belong to the highest credit quality in the market and therefore collateral requirements could actually have decreased. In other words, the average credit quality of those firms that continued to be active borrowers during the crisis might be higher compared to pre-crisis times, therefore the average collateral requirements lower. Related, there is evidence that high-quality borrowers indeed managed to issue (unsecured) corporate bonds during the crisis to compensate for the reduction of credit supply by banks (e.g., Becker and Ivashina, 2014). As explained above, the collateral channel plays no important role for firms that can issue unsecured debt such as corporate bonds or commercial papers. Based on this reasoning, we propose H4.

H4: The collateral channel (i.e., the link between redeployable assets and leverage) became weaker during the crisis, especially for bank-dependent borrowers.

2.3 Data and empirical method

2.3.1 Data

We base our study on quarterly accounting data for US firms from the database COMPUSTAT North America covering the period from 1990 to 2010. We apply the following filter rules and data processing steps. First, we only consider firms that are constituents of the S&P 1,500 index in COMPUSTAT. We only select companies that are included in the S&P 1,500 for at least 14 years in our 21 year sample period to obtain a strongly balanced panel. A strongly balanced panel has the advantage that we can study the relationship between leverage and asset structure of the same firms over time. An unbalanced panel would complicate the time-series analysis and make the interpretation of the results difficult. Second, we follow the common practice in corporate finance research and exclude firms with two-digit SIC codes 40-49 (utilities) and 60-64 (financials) (e.g. Fama and French, 2001; Kisgen, 2006; Bates, Kahle and Stulz, 2009). The reason for excluding these types of industries is because they are heavily regulated and exhibit a very special asset-liability structure, which could distort our analysis. Third, we also drop firms with discontinued time series because of financial distress, bankruptcy, and leveraged buy-outs. Fourth, we winsorize all variables at the 1% and 99% percentile, which is a widely

used approach to deal with outliers in empirical corporate finance and accounting research (e.g., Kale and Shahrur, 2007; Byoun, 2008; Frank and Goyal, 2009). Our final sample comprises 553 listed US firms.

2.3.2 Main variables and descriptive statistics

To study the functioning of the collateral channel we collected the following variables on firms' debt financing; (i) leverage, defined as total debt over total assets of the firm in year-quarter t, (ii) short-term leverage, defined as debt with maturities of less than one year over total assets of the firm in year-quarter t, and (iii) long-term leverage, defined as debt with maturities of more than one year over total assets of the firm in year-quarter t.

Furthermore, we collect information on the asset structure of the firms in our sample and consider the corresponding variables as proxies for the (actual and potential) collateral used in debt finance. All these variables are normalized over total assets from the same firm and year-quarter. The most important asset item is property, plant and equipment (PPE). In the baseline analysis we take the net value of PPE and not the gross value of PPE because the net value is likely more closely related to the market value of PPE. Nonetheless, we also use gross PPE in a robustness test. If a firm defaults and has pledged PPE as collateral, the collateral value tends to be closer to the net PPE from the most recent financial statement than to the gross PPE. This is supported by Desai, Fritz Foley and Hiner Jr. (2004) and Wang and Thornhill (2010) who use the net PPE as a proxy for asset tangibility and collateral, respectively. Moreover, Herrmann, Saudagaran and Thomas (2006) conclude that financial decision makers find it very

important to know the fair value of a firm's fixed assets. This indicates that net PPE is a better proxy than gross PPE because net PPE is more related to the fair value of the fixed assets rather than the gross PPE. Based on these findings we conclude that using net PPE is an appropriate choice for our baseline regression model.

Nonetheless, we also use gross PPE in a robustness check because companies have some discretion in determining how they depreciate their assets. In that respect, gross PPE is less influenced by firm-specific depreciation policies. Moreover, gross PPE is less likely to create multicollinearity problems with other assets. This is because all other asset variables are bounded between zero and one, while gross PPE can exceed one. This is due to the fact that all asset variables other than gross PPE have the same denominator in each time-section and this denominator is always bigger than the numerator. In turn, this means that the asset variables have a natural relationship with each other, which could yield in high correlations. Because gross PPE can exceed a value of one (because the value of gross PPE can be bigger than the value of total assets in the same year-quarter) the link between the asset variables becomes weaker when including gross PPE in the model, which ultimately reduces potential effects from multicollinearity. In unreported analysis, we have checked the variance inflation factors (VIFs) for the asset variables. We find that, as expected, taking gross PPE decreases the VIFs. However, the VIFs for the regressions with net PPE are also not high (between 1.6 and 2.6) indicating that including net PPE in the regression is unlikely to create multicollinearity. This allows us to include net PPE in our main analysis. Another reason to consider the gross PPE is that Tuzel (2010) found that firms with a high

amount of real estate assets (with PPE as a proxy) are more risky because it is difficult for them to change their asset structure due to the fact that PPE depreciates slowly. Thus, it could be that the relation between corporate leverage and collateral changes when the difference between gross PPE and net PPE gets bigger over time.

Furthermore, we consider firms' inventories. The value of inventories is equal to the sum of raw materials, work-in-progress and finished goods. Since many firms do not distinguish between several types of inventories in their financial statements we consider the aggregate value. We also consider firms' receivables, which correspond to the total amount to be received from their customers. Receivables correspond to the value of goods the firm has delivered to its customers under trade credit agreements. In an additional empirical test, we also examine the role of cash holdings, which is the amount of cash and liquid short-term investments.

The following variables are used as controls and/or in further empirical checks. We use the logarithm of Tobin's Q (market-to-book ratio) to control for firms' growth and investment opportunities that might affect firms' capital structure. We also control for profitability by including the logarithm of net income. The dummy variable "Rated" indicates whether firms have a bond rating in a particular year-quarter. "Rating" indicates the bond rating level and is measured on an ordinal scale from 1 (AAA) to 26 (D). The rating corresponds to the S&P Domestic Long Term Issuer Credit Rating from COMPUSTAT. We also define two indicator variables to capture potential effects of the global financial crisis on the importance of the collateral channel. "Subprime crisis" is a dummy variable equals one for the period from August 2007 to August 2008, and zero otherwise.

"Post-Lehman crisis" is a dummy variable equals one for the period from September 2008 to December 2010, and zero otherwise.

Table 2.1 provides descriptive statistics of our main variables (the leverage and asset structure variables are normalized by total assets). It indicates that the mean leverage is 0.22. The mean of long-term leverage is 0.18 and thus accounts for the biggest part of firms' debt financing. The mean of net PPE (gross PPE) is 0.30 (0.60), inventories is 0.16, and the mean of receivables is 0.17. The mean cash holdings amount to 0.11. The skewness levels are very low and most kurtosis levels are not much bigger than 3 (below 3 most of the times). Hence, there is no reason to assume severe non-normality. Only short-term leverage and cash have higher kurtosis values, which is because this are the only leverage and asset structure variables where the standard error is bigger than the mean (thus that have a CV which is bigger than 1). Given that the average deviation from the mean and the median are highly similar and the asymmetry values are low, we assume that the variables are approximately normally distributed. The metrics we have used to determine the distribution of the variables are based on the work of Calabrese and Zenga (2008). The mean log of Tobin's Q is 0.76. Table 2.1 presents the winsorized values of all our variables. All variables are winsorized at the 1% and 99% centile, which means that if an observation has a value that is smaller (bigger) than the 1% (99%) centile this observation gets a value equal to the value of the 1% (99%) centile. This is done to diminish the influence of outliers. Because table 2.1 is winsorized already, the winsorized values for the variables equal the minimum and maximum values. Furthermore, Figure 2.1 displays

the time series of the quarterly cross-sectional means of leverage (Figure 2.1a) and asset structure (Figure 2.1b) of the firms in our sample.

We observe credit ratings from S&P in COMPUSTAT for 43% of the firms and the mean rating is 8 (= BBB+) on an ordinal scale from 1 (= AAA) to 26 (= D). Figure 2.2 displays a histogram of the firms' credit ratings. The vast majority of the rated firms in our dataset are from the investment grade category (AAA-BBB).

Table 2.1: Descriptive statistics

This table reports descriptive statistics of leverage and asset structure. All variables are collected from COMPUSTAT. The sample comprises a panel of 553 US firms for the period 1990-2010. We exclude firms with two-digit SIC codes 40-49 (utilities) and 60-64 (financials). All variables are winsorized at the 1%-99% level and standardized by firms' total assets. The winsorized values are thus equals the reported minimum and maximum. The last four columns provide additional information on the distribution of the variables (see Calabrese and Zenga (2008)). S_μ and S_{Me} stand for the mean deviation from the mean and median, respectively. CV is the coefficient of variation and Asym (asymmetry) is measured as (mean - median) / S_{Me}.

Variable	Mean	St.Dev.	Min	p25	p50	p75	Max	Skew	Kurt	S_μ	S_{Me}	CV	Asym	Obs.
Leverage														
Leverage	0.22	0.15	0.00	0.10	0.21	0.32	0.66	0.43	2.76	0.12	0.12	0.69	0.08	42,953
Long-term leverage	0.18	0.14	0.00	0.06	0.17	0.27	0.61	0.64	2.96	0.12	0.12	0.78	0.08	44,456
Short-term leverage	0.04	0.06	0.00	0.00	0.02	0.05	0.28	2.16	8.05	0.04	0.04	1.39	0.50	43,211
Asset structure														
Net PPE	0.30	0.20	0.02	0.15	0.25	0.40	0.88	0.98	3.39	0.16	0.15	0.67	0.33	44,673
Gross PPE	0.60	0.35	0.07	0.32	0.53	0.80	1.61	0.79	3.06	0.28	0.28	0.59	0.25	35,291
Inventories	0.16	0.14	0.00	0.06	0.13	0.22	0.70	1.47	5.69	0.10	0.10	0.86	0.30	44,434
Receivables	0.17	0.11	0.00	0.09	0.15	0.22	0.56	1.06	4.69	0.08	0.08	0.64	0.25	44,171
Cash	0.11	0.14	0.00	0.02	0.05	0.15	0.68	2.10	7.41	0.10	0.09	1.27	0.67	44,865
Other variables														
Log Tobin's Q (market-to-book ratio)	0.76	0.58	-1.31	0.35	0.68	1.08	5.92	0.83	4.42	0.45	0.45	0.76	0.18	42,299
Rated (1 if rated, 0 otherwise)	0.43	0.50	0.00	0.00	0.00	1.00	1.00	0.27	1.07	0.49	0.43	1.15	1.00	45,175
Rating (S&P; 1 = AAA, 2 = AA+, …, 26 = D)	8.03	3.21	1.00	6.00	8.00	10.00	26.00	0.22	3.24	2.55	2.55	0.40	0.01	19,537
Log net income	3.33	1.72	-0.88	2.17	3.29	4.46	7.55	0.09	2.84	1.37	1.37	0.51	0.03	39,539

Figure 2.1:

Cross-sectional mean of leverage and asset structure over time

Figure 1a: leverage
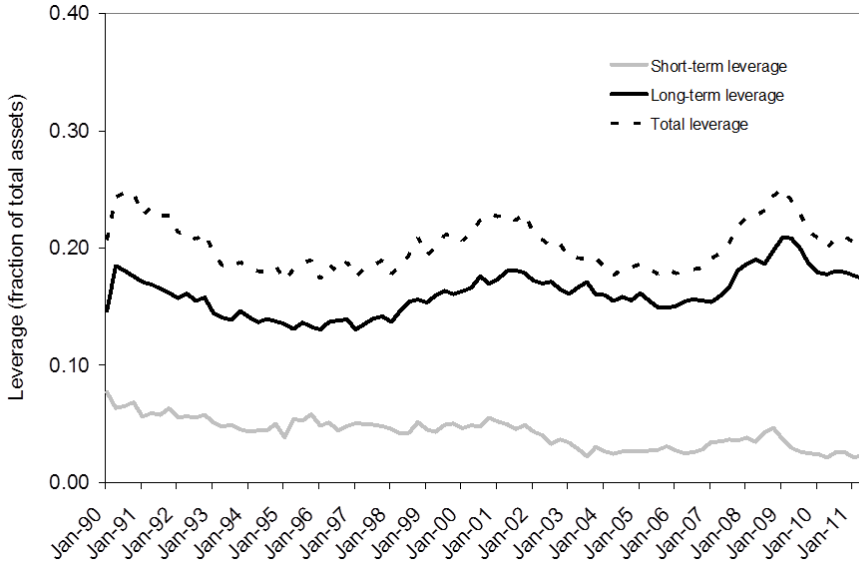
Figure 1b: asset structure
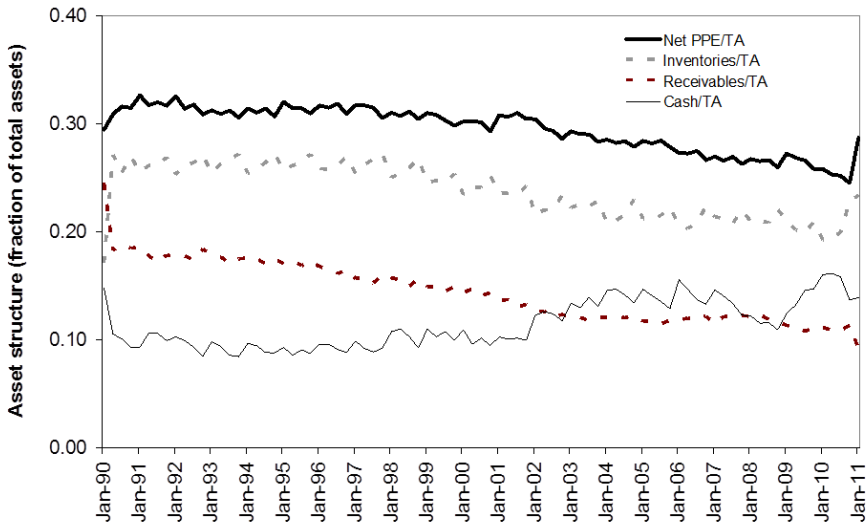
Figure 2.2: Histogram of firms' credit ratings from S&P
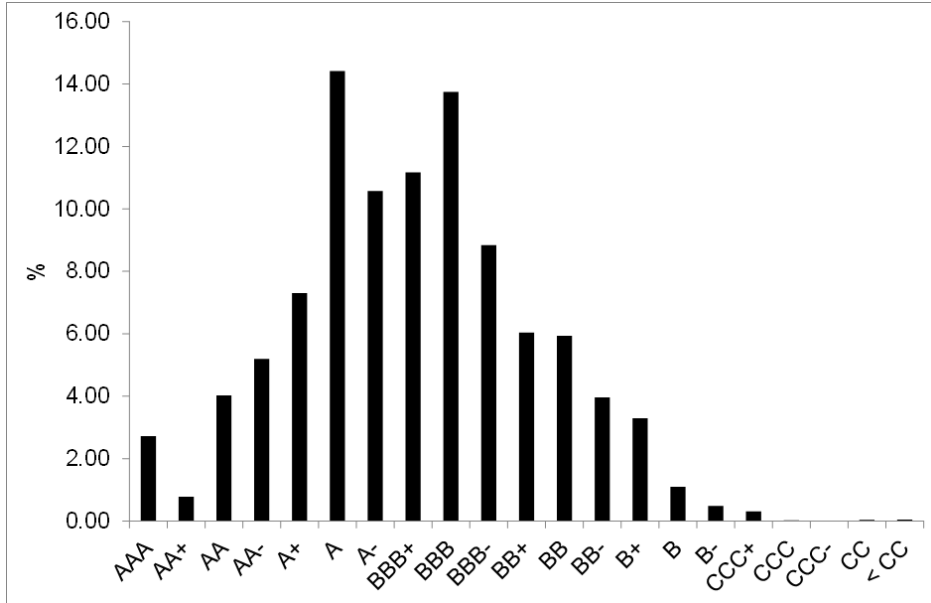
2.3.3 Empirical Method

We investigate whether a higher fraction of redeployable assets is associated with higher leverage, as proposed by H1. Specifically, we estimate a multivariate regression model to investigate whether firms' PPE, inventories, and receivables at time t-1 are significantly positively related to total leverage at time t, as shown in Equation (2.1).

$$Lev_{it} = \beta_0 + \beta_1 PPE_{it-1} + \beta_2 Inv_{it-1} + \beta_3 Rec_{it-1} + \phi C_{it-1} + \eta_{jt} + \lambda_t + \varepsilon_{it} \tag{2.1}$$

In Equation (2.1), C represents a vector of control variables (Tobin's Q, the "Rated" dummy and profitability), η represents the industry fixed effects and λ the year-quarter fixed effects. The asset variables are normalized by total assets and lagged by one quarter to avoid potential endogeneity problems (i.e., assets in t-1 might serve as collateral for debt finance in t but debt at time t could not have been used to finance assets that were already in place at time t-1; we will revisit this point in more detail in Section 2.4.4). PPE is measured by its net value from the balance sheet but alternatively we also use gross PPE because the latter has a lower correlation with the other asset variables, reducing potential problems due to multicollinearity, as explained in Section 2.3.2. Equation (2.1) is also used to test the maturity-matching hypothesis, as discussed in H2. In order to do so we reestimate the regression model from Equation (2.1) for long-term and short-term leverage separately. Equation (2.1) is estimated with two model specifications. Our base specification is a cross-sectional time-series pooled OLS regression model with year-quarter fixed effects and industry fixed effects to control for unobserved time and industry-specific heterogeneity. We also estimate panel data regressions with year-quarter fixed effects and industry fixed effects to check the robustness of our results (see, for example, Greene (2008), Verbeek (2012) for background information on both types of regressions). In both models we use robust standard errors that are clustered at the firm level to deal with heteroskedasticity.

As the panel covers 84 year-quarters and both corporate leverage and the asset structure of firms do not change very much in the short run, the regression with the variable levels as shown in equation (2.1) might be affected by autocorrelation. In order to circumvent potential problems due to of autocorrelation in the variable levels, we repeat the regression in Equation (2.1) as a first-difference regression, as shown in Equation (2.2).

$$\Delta Lev_{it} = \beta_0 + \beta_1 \Delta PPE_{it-1} + \beta_2 \Delta Inv_{it-1} + \beta_3 \Delta Rec_{it-1} + \eta_{jt} + \lambda_t + \varepsilon_{it}$$

$$(2.2)$$

In the next step, we estimate the effect of bank dependence by adding the dummy variable "Rated" to the analysis, as proposed by H3. To test the impact of bank dependence on the collateral channel we add the dummy variable "Rated" and its interaction terms with all asset structure variables, as shown in Equation (2.3).

$$Lev_{it} = \beta_0 + \beta_1 PPE_{it-1} + \beta_2 Inv_{it-1} + \beta_3 Rec_{it-1} + \beta_4 (PPE_{it-1} * Rated) + \beta_5 (Inv_{it-1} * Rated) + \beta_6 (Rec_{it-1} * Rated) + \beta_7 Rated + \eta_{jt} + \lambda_t + \varepsilon_{it} \qquad (2.3)$$

As stated in H4, we want to test the impact of the interplay of the financial crisis and firms' bank dependence on the functioning of the collateral channel. To do so, we add an indicator variable for the financial crisis and its interactions with the asset structure variables to the model, as shown in Equation (2.4). For expositional reasons "Crisis" in Equation (2.4) stands for the dummy variable "Subprime Crisis" and the dummy variable "Post-Lehman Crisis", which we add simultaneously to the model to take

into account the different stages of the financial crisis. The regression for equation (2.4) is performed separately for rated and unrated firms.

$$Lev_{it} = \beta_0 + \beta_1 PPE_{it-1} + \beta_2 Inv_{it-1} + \beta_3 Rec_{it-1} + \beta_4(PPE_{it-1} * Crisis) + \beta_5(Inv_{it-1} * Crisis) + \beta_6(Rec_{it-1} * Crisis) + \beta_7 Crisis + \eta_{jt} + \lambda_t + \varepsilon_{it} \qquad (2.4)$$

2.4 Empirical analysis

2.4.1 The relationship between asset structure and leverage

The baseline analysis on the relationship between asset structure and leverage has been formulated in equation (2.1), explained in section 2.3.3. Table 2 reports the results for equation (2.1).

Model (1) in Table 2.2 shows that firms' net PPE and receivables are significantly positively related with leverage, while there is no effect for inventories. The coefficient of net PPE equals 0.165 and the one of receivables 0.120. This means that an increase of 1% in net PPE (receivables) results in a 0.165% (0.120%) increase in leverage. The effect of net PPE on leverage is also economically significant because an increase from the 25th to the 75th percentile would result in a 4.125%=(0.40-0.15)*0.165 increase in leverage. Considering that the average value of total assets in our sample is 7.269 billion dollars, we obtain 0.3 billion dollars of additional debt (=0.04125*7.269 billion). The economic significance is lower for receivables because an increase from the 25th to the 75th percentile results in a 1.56%=(0.22-0.09)*0.12 increase in leverage, corresponding to 0.113 billion dollars of additional debt. Model

(2) shows the estimation results of a panel regression with time and industry fixed effects and confirms the findings for net PPE and inventories, while receivables loses its significance. Model (3) indicates that also gross PPE is positively related to leverage, confirming the earlier results on net PPE but the significance of the estimated coefficients (but not the sign) of inventories and receivables changes. In Model (3) we demonstrate that the PPE variable is robust for the type of measurement. However, we also find that net PPE better explains total leverage because the adjusted R^2 decreases from 18.8% to 16.4% when we use gross PPE. When we control for growth opportunities by adding Tobin's Q, the rating indicator variable and firms' lagged profitability, the estimated coefficients of net PPE, inventories and receivables in Model (4) are similar to those in Model (1).

In addition, the coefficient of "Rated" is significantly positive and the coefficient of Tobin's Q is significantly negative. This means that firms with access to the public debt market have a higher leverage and that firms with higher growth opportunities have a lower leverage, which is in line with the related literature. In our sample, rated firms have a 9.1% higher leverage than unrated firms, while firms with a Tobin's Q at the 75th percentile have 5.3% lower leverage than those at the 25th percentile (=-0.073(1.08-0.35)). Profitability barely plays a role because it is both statistically and economically not significant.

In Model (5) we re-estimate Model (1) with leverage and all explanatory variables adjusted by the corresponding median values of firms that are rated (i) AAA-A, (ii) BBB, (iii) BB and lower, and (iv) unrated

Table 2.2: Leverage and asset structure

This table reports results from regression analyses with leverage at time t as dependent variable and net property, plant and equipment (net PPE; alternatively gross PPE), inventories, and receivables measured at time t-1 as explanatory variables. We also include Tobin's Q (market-to-book ratio), the indicator variable Rated (equals one if the firms exhibits a bond rating) and the logarithm of net income measured at time t-1 as control variables in Model (4). All variables in Model (5) are adjusted by the median of the variables for the categories AAA-A, BBB, BB or below and unrated, respectively. We report the results for cross-sectional time-series pooled OLS regressions with industry and time fixed effects (Models (1), (3), (4) and (5)), and panel data regressions with industry fixed effects (Model (2)). The analysis is based on 553 US firms for the period 1990-2010. ***, **, * indicate coefficients that are statistically significant at the 1%, 5%, and 10%-level, using robust standard errors clustered within firms. A1 stands for the average absolute error term and A2 for the square root of the mean squared error term.

	(1) OLS		(2) Panel fixed effects		(3) OLS		(4) OLS		(5) OLS	
Dep. Var.: Leverage_t	Coeff.	p-val	Coeff.	p-val	Coeff.	p-val	Coeff.	p-val	Coeff.	p-val
Net PPE$_{t-1}$	0.165	0.000***	0.165	0.000***			0.094	0.001***	0.129	0.000***
Gross PPE$_{t-1}$					0.049	0.003***				
Inventories$_{t-1}$	-0.063	0.202	-0.063	0.260	-0.115	0.037**	-0.033	0.461	-0.033	0.471
Receivables$_{t-1}$	0.120	0.026**	0.120	0.178	0.049	0.358	0.112	0.034**	0.147	0.005***
Log Tobin's Q$_{t-1}$							-0.073	0.000***		
Rated$_{t-1}$							0.091	0.000***		
Log Net Income$_{t-1}$							0.001	0.473		
Industry fixed effects	Yes		Yes		Yes		Yes		Yes	
Year-quarter fixed effects	Yes		Yes		Yes		Yes		Yes	
Obs.	41,420		41,420		32,893		35,383		41,420	
Adj. R^2	0.188				0.164		0.320		0.169	
Overall R^2			0.049							
Within R^2			0.040							
A1	0.110		0.120		0.109		0.095		0.101	
A2	0.136		0.148		0.136		0.121		0.127	

firms. Using these median-adjusted variables we find similar results than in Model (1). In unreported analysis we re-estimate all five models on yearly data to reduce potential problems associated with autocorrelation and obtain qualitatively similar results. The evidence suggests that property, plant and equipment are the key driver of the collateral channel. Moreover, higher receivables are also associated with more total leverage, while the role of inventories is less clear. Our findings on net PPE, and to a lesser extent those on receivables, provide evidence in favor of Hypothesis H1, while the findings on inventories do not allow us to corroborate H1.

In a next step we investigate whether these results change, as stated in Hypothesis H2, when we use long-term and short-term leverage instead of total leverage as dependent variable in our regression models. Table 2.3 presents the corresponding results.

This analysis yields three results. First, we find a significantly positive coefficient for net PPE in the OLS and panel regressions for long-term leverage, but no significant coefficient in the regressions for short-term leverage. This result is support for Hypothesis H2, suggesting that long-term assets are used as collateral for long-term debt but not short-term debt. Second, inventories display a significantly negative coefficient in the long-term leverage regression, indicating that inventories are not or little used as collateral for long-term debt. Surprisingly, we cannot find a positive effect of inventories on short-term leverage. Thus, the findings on inventories are rather mixed. Third, receivables are unrelated to long-term leverage but significantly positively related to short-term leverage, which is in line with Hypothesis H2. Overall, our findings on net PPE and receivables are largely consistent with the view that asset maturity (i.e., the life of the collateral) is

Table 2.3: The relationship between long-term and short-term leverage and asset structure

This table reports results from regression analyses with long-term and short-leverage at time t as dependent variable and net property, plant and equipment (net PPE; alternatively gross PPE), inventories, and receivables measured at time t-1 as explanatory variables. We report the estimation results for cross-sectional time-series pooled OLS regressions with industry and time fixed effects, and panel data regressions with industry fixed effects. The analysis is based on 553 US firms for the period 1990-2010. ***, **, * indicate coefficients that are statistically significant at the 1%, 5%, and 10%-level, using robust standard errors clustered within firms. A1 stands for the average absolute error term and A2 for the square root of the mean squared error term.

	(1)				(2)			
Dep. Var.:	Long-term leverage$_t$				Short-term leverage$_t$			
	OLS		Panel fixed effects		OLS		Panel fixed effects	
	Coeff.	p-val	Coeff.	p-val	Coeff.	p-val	Coeff.	p-val
Net PPE$_{t-1}$	0.156	0.000***	0.156	0.000***	0.010	0.219	0.010	0.361
Inventories$_{t-1}$	-0.095	0.033**	-0.095	0.113	0.005	0.790	0.005	0.815
Receivables$_{t-1}$	0.044	0.331	0.044	0.562	0.118	0.000***	0.118	0.006***
Industry fixed effects	Yes		Yes		Yes		Yes	
Year-quarter fixed effects	Yes		Yes		Yes		Yes	
Obs.	42,648		42,648		41,673		41,673	
Adj. R^2	0.186				0.121			
Overall R^2			0.061				0.046	
Within R^2			0.046				0.054	
A1	0.102		0.110		0.036		0.038	
A2	0.127		0.137		0.051		0.053	

related to the maturity of corporate debt. However, we do neither find negative effects of long-term assets on short-term leverage nor negative effects of short-term assets on long-term leverage. The only exception are inventories – we find such effect in Model (1), but not the expected positive effect in Model (2). Thus, we conclude that there is a significant but not perfect link between asset and debt maturity.

So far we have investigated the link between the levels of asset structure and corporate leverage. Because both asset structure and corporate leverage are likely to exhibit autocorrelation we use lagged first differences of all variables (i.e., the changes from time t-2 to t-1) and re-estimate the previous models for all types of leverage at time t. Table 2.4 reports the findings from the first-difference regressions.

Table 2.4: Changes in leverage and asset structure

This table reports results from regression analyses with quarterly changes in total leverage, long-term and short-leverage at time t as dependent variable and quarterly changes in net property, plant and equipment (net PPE; alternatively gross PPE), inventories, and receivables measured at time t-1 as explanatory variables. We report the estimation results for cross-sectional time-series pooled OLS regressions with industry and time fixed effects, and panel data regressions with industry fixed effects. The analysis is based on 553 US firms for the period 1990-2010. ***, **, * indicate coefficients that are statistically significant at the 1%, 5%, and 10%-level, using robust standard errors clustered within firms. A1 stands for the average absolute error term and A2 for the square root of the mean squared error term.

Dep. Var.:	(1) ΔLeverage$_t$ OLS		(2) ΔLong-term leverage$_t$ OLS		(3) ΔShort-term leverage$_t$ OLS	
	Coeff.	p-val	Coeff.	p-val	Coeff.	p-val
ΔNet PPE$_{t-1}$	0.084	0.000***	0.024	0.200	0.056	0.000***
ΔInventories$_{t-1}$	0.068	0.001***	0.002	0.888	0.062	0.001***
ΔReceivables$_{t-1}$	-0.075	0.011**	-0.008	0.680	-0.063	0.000***
Industry fixed effects	Yes		Yes		Yes	
Year-quarter fixed effects	Yes		Yes		Yes	
Obs.	40,218		41,759		40,532	
Adj. R^2	0.026		0.007		0.017	
A1	0.021		0.020		0.015	
A2	0.039		0.042		0.031	

We obtain qualitatively similar (and quantitatively weaker) results for the relationship between changes in leverage and changes in net PPE. Changes in long-term leverage cannot be explained with changes in any of the asset variables. The insignificant results for the changes in long-term leverage can be explained with the fact that long-term leverage changes little from one quarter to another. In contrast, for short-term leverage, we obtain positive coefficients for changes in net PPE and inventories, and a significantly negative coefficient for receivables. We repeated all regressions for each asset variable separately (with controls) and confirm that the results are not affected by multicollinearity. We interpret the results on net PPE and inventories as supportive for the collateral channel, with collateral pledged to bank lenders or trade creditors. The negative effect of receivables can be explained if a large part of the change in short-term debt is due to an increase in accounts payable, which are typically secured with inventories.

2.4.2 The collateral channel and bank dependence

Our previous findings indicate that net property, plant and equipment, and to a lesser extent inventories and receivables, affect the functioning of the collateral channel. In our next set of tests, we investigate whether there is a direct relationship between firms' overall availability of debt finance and the strength of the collateral channel. For this purpose, we distinguish in our analysis between firms that are bank-dependent (firms with no bond rating and therefore no access to public debt markets) and those that are not (firms with a bond rating which allows issuing corporate bonds and/or commercial papers). The existence of a bond rating has been widely used as

a proxy of financial constraints, credit constraints and bank-dependence in the corporate finance and banking literature (e.g., Faulkender and Petersen, 2006; Denis and Sibilkov, 2010; Chava and Purnanandam, 2011). Note that corporate bonds are typically unsecured, while bank loans and trade credit are often at least partially secured. Thus, we can take advantage of the information about firms' bond ratings to identify whether their debt is likely to be unsecured (corporate bonds and commercial papers) or secured (bank loans and trade credit). The collateral channel should only be important for firms that are likely to depend on secured debt finance. Similar to Faulkender and Petersen (2006) we find for our dataset that firms with a bond rating exhibit a significantly higher leverage than firms without a bond rating (means: 0.27 vs. 0.17, medians: 0.26 vs. 0.15; both differences are significant at the 1% level). Moreover, rated firms are bigger than unrated ones (means of log total assets: 5.55 vs. 6.98; the difference is significant at the 1%-level). To examine the impact of bank dependence we interact each of the three asset variables with the dummy variable "Rated" (which is one if the firm has a bond rating from S&P, and zero otherwise), as explained in equation 2.3. The coefficient of these three interaction terms indicates whether bank dependence affects the strength of the collateral channel. Table 2.5 reports the regression results.

This analysis yields clear results. The coefficients of all three interaction terms are negative. The effect of net PPE on leverage is 0.175 for bank-dependent firms, but substantially reduced for firms that do not depend on banks (0.088 = 0.175 – 0.087). While inventories have no effect on leverage of bank-dependent firms, they do have a significantly negative effect on leverage of firms that do not depend on banks (-0.123 = 0.035 –

0.158). For receivables, we find a significant and positive effect for bank-dependent firms, while the coefficient of the interaction term is negative but not significant. In unreported analysis, we split the sample in two categories and repeat our baseline regression (see equation 2.1). As expected, this approach yields identical findings as the analysis based on interaction terms. We interpret these results as evidence in favor of Hypothesis H3, which states that the collateral channel matters more for bank-dependent firms.

Table 2.5: Leverage, asset structure and bank-dependence

This table reports results from regression analyses with leverage at time t as dependent variable and net property, plant and equipment (net PPE; alternatively gross PPE), inventories, and receivables measured at time t-1 as explanatory variables. We interact each of the asset variables with the indicator variable Rated, which equals one if a firm exhibits a bond rating from S&P in quarter t. We report the estimation results for cross-sectional time-series pooled OLS regressions with industry fixed effects and time fixed effects. The analysis is based on 553 US firms for the period 1990-2010. ***, **, * indicate coefficients that are statistically significant at the 1%, 5%, and 10%-level, using robust standard errors clustered within firms. A1 stands for the average absolute error term and A2 for the square root of the mean squared error term.

	OLS	
Dep. Var.: Leverage_t	Coeff.	p-val
Net PPE_{t-1}	0.175	0.000***
Net PPE_{t-1}*Rated	-0.087	0.026**
Inventories_{t-1}	0.035	0.484
Inventories_{t-1}*Rated	-0.158	0.019**
Receivables_{t-1}	0.165	0.011**
Receivables_{t-1}*Rated	-0.087	0.294
Rated	0.160	0.000***
Industry fixed effects	Yes	
Year-quarter fixed effects	Yes	
Obs.	41,420	
Adj. R^2	0.270	
A1	0.103	
A2	0.129	

2.4.3 The collateral channel before and during the financial crisis

We now take a dynamic perspective on the interplay of firms' bank dependence and the importance of the collateral channel. Specifically, we investigate whether and how the channel has changed during the global financial crisis and whether these changes differ between firms who depend on banks to raise external finance and those who do not depend on banks. For this purpose, we interact the variable "Subprime crisis" (equals one from August 2007 to August 2008, and zero otherwise) and "Post-Lehman crisis" (equals one from September 2008 to December 2010, and zero otherwise; the results are similar if the dummy switches already to zero again in January 2010), respectively, with the three asset variables and re-estimate our model for rated and unrated firms separately, as proposed by Hypothesis H4. Table 2.6 presents the results.

We obtain two important results. First, Column (1) shows that the link between inventories (receivables) and leverage for unrated firms (=bank-dependent firms) is significantly reduced during the subprime mortgage crisis period. The coefficients of the interaction terms for inventories and receivables are negative and significant at the 1%-level, resulting in a significantly negative overall effect for inventories and an insignificant effect for receivables. The coefficient of net PPE (0.18) has not significantly changed during the subprime crisis. For comparison, Column (2) shows that the collateral channel is weaker for rated firms and limited to net PPE as collateral, but there was no change during the subprime mortgage crisis period. Second, Column (3) reports again significantly negative interaction terms for the post-Lehman failure period for unrated firms. The main difference compared to Column (1) is that now the

influence of net PPE is substantially reduced. Even stronger effects are found for inventories and receivables. Interestingly, the findings for rated firms during the post-Lehman failure period are similar to those during the subprime mortgage crisis: we find a significantly positive effect of net PPE, but there is no change in the importance of the collateral channel when comparing the periods before and after the failure of Lehman Brothers. These results confirm that the collateral channel is more important for bank-dependent firms, as suggested by Hypothesis H3 and found in the previous section. However, we also find that the collateral channel at bank-dependent firms was gradually weakened during the financial crisis. We observe that the importance of inventories and receivables at bank-dependent firms declined during the subprime mortgage crisis (and continued to do so after the failure of Lehman Brothers), whereas the decline in importance of net property, plant and equipment only started after the failure of Lehman Brothers. In terms of magnitude, the total effect of net PPE at unrated and rated firms is similar in the post Lehman crisis period.

These results indicate that bank-dependent firms experienced a negative second-order shock during the financial crisis. This finding supports our Hypothesis H4. Next to the first order-effect that banks tightened their general lending standards and gradually reduced credit supply to the corporate sector, bank-dependent firms could not benefit to the same extent as in pre-crisis times from pledging redeployable assets as collateral to raise external finance.

Table 2.6: Leverage, asset structure, and bank dependence before and during the global financial crisis

This table reports results from regression analyses with leverage at time t as dependent variable and net property, plant and equipment (net PPE; alternatively gross PPE), inventories, and receivables measured at time t-1 as explanatory variables. We interact each of the asset variables with the indicator variable "Subprime Crisis" ("Post-Lehman Crisis"), which equals one from 2007Q3 to 2009Q2 (from 2008Q4 to 2010Q4) and show the results all firms, unrated firms and rated firms. We report the estimation results for cross-sectional time-series pooled OLS regressions with industry and time fixed effects. The analysis is based on 553 US firms for the period 1990-2010. ***, **, * indicate coefficients that are statistically significant at the 1%, 5%, and 10%-level, using robust standard errors clustered within firms. A1 stands for the average absolute error term and A2 for the square root of the mean squared error term.

	(1)		(2)		(3)		(4)	
	Impact of the subprime mortgage crisis				Impact of the post-Lehman crisis			
	Unrated firms		Rated firms		Unrated firms		Rated firms	
	OLS		OLS		OLS		OLS	
Dep. Var: Leverage$_t$	Coeff.	p-val	Coeff.	p-val	Coeff.	p-val	Coeff.	p-val
Net PPE$_{t-1}$	0.185	0.000***	0.091	0.032**	0.197	0.000***	0.088	0.039**
Net PPE$_{t-1}$*Subprime Crisis	-0.037	0.407	-0.044	0.224				
Net PPE$_{t-1}$*Post-Lehman					-0.087	0.019**	-0.015	0.703
Inventories$_{t-1}$	0.018	0.738	-0.092	0.25	0.032	0.563	-0.097	0.23
Inventories$_{t-1}$* Subprime	-0.259	0.000***	-0.062	0.291				
Inventories$_{t-1}$*Post-Lehman					-0.271	0.000***	-0.001	0.988
Receivables$_{t-1}$	0.172	0.011**	0.068	0.365	0.188	0.005***	0.065	0.379
Receivables$_{t-1}$*Subprime	-0.225	0.002***	0.037	0.603				
Receivables$_{t-1}$*Post-Lehman					-0.212	0.008***	0.068	0.454
Subprime Crisis	0.068	0.002***	0.006	0.796				
Post-Lehman Crisis					0.127	0.000***	0.051	0.108
Industry fixed effects	Yes		Yes		Yes		Yes	
Year-quarter fixed effects	Yes		Yes		Yes		Yes	
Obs.	23,333		18,087		23,333		18,087	
Adj. R^2	0.209		0.162		0.213		0.163	
A1	0.106		0.096		0.105		0.096	
A2	0.132		0.122		0.131		0.122	

2.4.4 Further empirical checks

We carried out further empirical checks to examine potential endogeneity problems, the goodness-of-fit of our main empirical models, the role of cash holdings, and potential effects of credit rating changes.

First, we conduct Granger causality tests to shed light on potential endogeneity problems (Granger, 1969). For this purpose, we estimate a two-equation vector autoregressive (VAR-1) model for leverage and net property, plant and equipment, which turned out to be most important for the collateral channel in previous analyses. In one specification we take the variable levels, and in the other we take the first differences of the variables. Table 2.7 presents the estimation results.

As shown in Models (1) and (2), we find that the coefficient of net PPE from time t-1 is positive and significantly related to leverage at time t, but leverage from time t-1 is not related to net PPE at time t. We obtain the same result for the analysis based on first differences. Again, the relationship goes from assets to leverage and not the other way round. These findings indicate that our previous results are robust to autocorrelation and not driven by endogeneity of leverage and assets.

Second, we investigate the goodness-of-fit of our empirical models in more detail. For this purpose, we consider two alternative approaches. Under the first approach we define decile dummies for the variables net PPE, Inventories and Receivables, respectively. We then estimate a regression model with 27 (= 30 – 3) dummy variables and the same controls and fixed effects as previously. The change of the R^2 compared to the baseline model shown in Equation (2.1) indicates whether the specification

Table 2.7: Granger causality regressions

This table reports results from regression analyses with leverage or net PPE at time t as dependent variable and leverage and net property, plant and equipment (net PPE; alternatively gross PPE) measured at time t-1 as explanatory variables (Models (1) and (2)). We report the same models with all variables in first differences in Models (3) and (4). We report the estimation results for cross-sectional time-series pooled OLS regressions with industry and time fixed effects. The analysis is based on 553 US firms for the period 1990-2010. ***, **, * indicate coefficients that are statistically significant at the 1%, 5%, and 10%-level, using robust standard errors clustered within firms. A1 stands for the average absolute error term and A2 for the square root of the mean squared error term.

	(1) Leverage$_t$ OLS		(2) Net PPE$_t$ OLS		(3) ΔLeverage$_t$ OLS		(4) ΔNet PPE$_t$ OLS	
Dep. Var.:	Coeff.	p-val	Coeff.	p-val	Coeff.	p-val	Coeff.	p-val
Leverage$_{t-1}$	0.954	0.000***	0.001	0.371				
Net PPE$_{t-1}$	0.013	0.000***	0.982	0.000***				
ΔLeverage$_{t-1}$					-0.085	0.000***	-0.005	0.462
ΔNet PPE$_{t-1}$					0.081	0.001***	-0.113	0.000***
Industry fixed effects	Yes		Yes		Yes		Yes	
Year-quarter fixed effects	Yes		Yes		Yes		Yes	
Obs.	41,733		42,208		41,016		41,149	
Adj. R^2	0.931		0.987		0.028		0.024	
A1	0.021		0.012		0.021		0.012	
A2	0.040		0.023		0.039		0.023	

with decile dummy variables improves the goodness-of-fit. The latter would be the case if the relation between leverage and asset structure variables varies substantially in the decile subsamples. We find that the R^2 never increases by more than 1.7 percentage points. In seven of the eight regression models (four models from Table 2.2 and four models from Table 2.3) the absolute increase is smaller than 1 percentage point. Under the second approach we estimate our baseline model from Equation (2.1) on the 30 decile groups separately. The results again confirm that the R^2 values vary in a reasonably close range across the deciles of each variable.

Third, we examine the relation between firms' cash holdings and leverage. The pecking order theory predicts a strong negative relation that suggests that when firms need to invest they prefer using internal funding (cash) over external funding (debt and equity). We did not include cash in the previous analyses because it is strongly negatively correlated with the other assets variables, causing a severe multicollinearity problem. Subsequently, we estimate regression models with leverage at time t as dependent variable and cash holdings at time t-1, time fixed effects and industry fixed effects as explanatory variables. We further differentiate between rated and unrated firms and interact cash with the crisis indicator variables. Table 2.8 reports the results.

The analysis indicates, in line with theory, that there is a strongly negative relation between cash holdings and leverage. The coefficient of cash is -0.355 and significant at the 1%-level. The relation is more pronounced for rated firms (firms that are not bank-dependent) than for unrated firms (Model 2 vs. Model 3), and it becomes weaker for unrated (bank-dependent) firms during the subprime mortgage crisis (see Model 2).

There are no effects associated with the post-Lehman failure. The weakening of the cash-leverage relation for unrated (bank-dependent) firms during the subprime crisis can be explained by pre-cautionary hoarding of cash without reducing leverage.

Fourth, for the subsample of rated firms (19,537 firm-quarter observations) we investigate potential changes in the strength of the collateral channel around credit rating changes. This test is motivated by the study of Kisgen (2009) who shows that firms' financing decisions are influenced by previous rating changes. We define the indicator variables "downgrade" (747 events) and "upgrade" (629 events) that equal one when a firm experiences a credit rating downgrade (upgrade) in quarter t. Alternatively, we create the variables "post downgrade" and "post upgrade", which equal one in the fourth quarter after the quarter in which the rating change took place. We then interact these indicator variables with all three asset variables, respectively (net PPE, inventories and receivables). We do not find any effect for "downgrade" and "post downgrade" but we obtain a significantly positive coefficient for the interaction terms of the upgrade indicator variable with all three asset variables (+0.10 for net PPE, p-value=0.00; +0.10 for inventories, p-value=0.09; and +0.14 for receivables, p-val=0.05). We obtain similar coefficients for the interaction terms with "post upgrade" with net PPE and inventories.

Table 2.8: Leverage and cash holdings

This table reports results from regression analyses with leverage at time t as dependent variable and cash (over total assets) measured at time t-1 as explanatory variable. We interact the variable cash with the indicator variable "Subprime Crisis" ("Post-Lehman Crisis"), which equals one from 2007Q3 to 2009Q2 (from 2008Q4 to 2010Q4) and show the results all firms, unrated firms and rated firms. We report the estimation results for cross-sectional time-series pooled OLS regressions with industry and time fixed effects. The analysis is based on 553 US firms for the period 1990-2010. ***, **, * indicate coefficients that are statistically significant at the 1%, 5%, and 10%-level, using robust standard errors clustered within firms. A1 stands for the average absolute error term and A2 for the square root of the mean squared error term.

	(1) General Effect All firms OLS		(2) Impact of the subprime mortgage crisis Unrated firms OLS		(3) Impact of the subprime mortgage crisis Rated firms OLS		(4) Impact of the post-Lehman crisis Unrated firms OLS		(5) Impact of the post-Lehman crisis Rated firms OLS	
Dep. Var.: Leverage$_t$	Coeff.	p-val	Coeff.	p-val	Coeff.	p-val	Coeff.	p-val	Coeff.	p-val
Cash$_{t-1}$	-0.355	0.000***	-0.351	0.000***	-0.404	0.000***	-0.350	0.000***	-0.410	0.000***
Cash$_{t-1}$*Rated	-0.040	0.456								
Cash$_{t-1}$*Subprime Crisis			0.130	0.025**	-0.012	0.877				
Cash$_{t-1}$*Post-Lehman Crisis							0.053	0.298	0.070	0.441
Rated	0.076	0.000***								
Subprime Crisis			-0.031	0.000***	-0.011	0.209				
Post-Lehman Crisis							0.020	0.380	0.049	0.025**
Industry fixed effects	Yes		Yes		Yes		Yes		Yes	
Year-quarter fixed effects	Yes		Yes		Yes		Yes		Yes	
Obs.	42,364		23,760		18,604		23,760		18,604	
Adj. R^2	0.341		0.294		0.215		0.293		0.216	
A1	0.097		0.098		0.094		0.098		0.093	
A2	0.123		0.125		0.119		0.125		0.119	

2.5 Conclusion

Our study provides new evidence on the cross-sectional and time-varying importance of the collateral channel for corporate leverage. We study the link between corporate asset structure and leverage, the link between asset and debt maturity, the influence of limited access to external finance, and the impact of the global financial crisis. Our analysis is based on a large quarterly panel dataset of US firms from 1990 to 2010.

We find that redeployable assets, especially property, plant and equipment, are of key importance for the collateral channel, while inventories and receivables matter to a lesser extent. The collateral channel is more important for firms that depend on private debt compared to firms that have the choice between issuing public or private debt. Finally, we document that the collateral channel has become weaker for bank-dependent firms after the start of the financial crisis, while there is no such effect for other firms.

Chapter 3
Substitution effects in SME Finance[4]

3.1 Introduction

Financing small- and medium-sized enterprises (SMEs) is challenging because these firms are more informationally opaque, risky, financially constrained, and bank-dependent than large firms. SMEs mainly rely on bank credit and trade credit from suppliers to raise external finance (e.g., Petersen and Rajan, 1994; Petersen and Rajan, 1997). They generally prefer bank credit over trade credit because the former tends to be less expensive and more flexible than the latter. But, how do SMEs respond when banks cut their lending? Is trade credit the appropriate response? Are there substitution effects between bank credit and trade credit? In this study, we investigate whether SMEs that have demand for debt finance increase trade credit (accounts payable) after a supply-side driven shock to their bank credit and which factors influence their response. We base the analysis on a large sample of SMEs from France, Germany, Italy, Spain and the U.K. and a subsample with matched bank-firm data.

   The topic of our study is relevant for several reasons. First, SMEs

represent a large fraction of all firms in many countries and contribute significantly to employment and growth. However, little is known about the dynamic interplay of bank credit and trade credit at individual SMEs. Second, variation in the availability of private debt can amplify or weaken the business cycle (e.g., King and Levine, 1993; Beck, Levine and Loayza, 2000). If firms counter a negative shock to their bank credit by employing trade credit, they stabilize their access to credit throughout the cycle. However, if bank credit and trade credit are complementary (i.e., they increase or decrease at the same time), then booms and recessions are amplified, resulting in more volatile economic activity over time. Therefore, the question of whether the components of SMEs private debt finance are complements or substitutes are of first order importance. Third, if employing trade credit is not a sufficient response to a negative shock to bank credit supply, then policymakers should focus on stabilizing bank credit supply and improving the bank lending environment in the first place, not consider trade credit as alternative to bank credit. SMEs can also stabilize bank credit supply at the micro level by combining forward and spot lending, different loan types and loans from institutions with different lending policies.

Researchers are examining the importance of trade credit provision (accounts receivable) and SMEs' use of trade credit (accounts payable) in different contexts, such as the effects of the recent financial crisis, trade credit chains, cost of capital, and economic growth (e.g., Garcia-Appendini and Montoriol-Garriga, 2013; Murfin and Njoroge, 2014; Jacobson and von Schedvin, 2015; Carbo-Valverde, Rodriguez-Fernandez and Udell, 2016). The evidence is rather mixed. On the one hand, Carbo-Valverde et al.

(2016) show that unconstrained firms in Spain mainly fund their investments with bank finance, while strongly constrained firms fund their investments with trade credit and this dependency increased during the recent financial crisis. Hence, trade credit can play a positive role because it helps to mitigate the adverse effects of a contraction of bank credit supply. On the other hand, Jacobson and von Schedvin (2015) analyze data from the Swedish credit bureau and highlight a negative role of trade credit. They document strong negative propagation effects in trade credit chains, arising from direct credit losses, negative credit quality spillover, and the loss of future business for suppliers.

Biais and Gollier (1997) and Petersen and Rajan (1997) suggest that there is a substitution relation between bank credit and trade credit. Substitution may occur because trade credit represents external finance for firms that are unable to attract sufficient bank credit because of severe informational asymmetries. The substitution hypothesis coincides with the redistribution view on trade credit (e.g., Love, Preve and Sarria-Allende, 2007). Financially unconstrained firms redistribute part of their bank credit to financially constrained client firms by providing trade credit (e.g., Garcia-Appendini and Montoriol-Garriga, 2013).

However, there are also arguments and evidence against a substitution relation between bank credit and trade credit. Bank credit creates a cash inflow that can be used for any purpose, while trade credit corresponds to a delayed payment for inputs for the production process. This fundamental difference might limit the possibility that these two forms of credit serve as substitutes for one another. Breza and Liberman (2017) find that trade credit does not create a special financing advantage but rather serves as

mechanism to overcome contracting frictions between customers and suppliers. Murfin and Njoroge (2014) show the implicit costs of trade credit that have been neglected in earlier research. They focus on the retail industry and show that large, financially unconstrained buyers employ their bargaining power vis-à-vis small, financially constrained suppliers to obtain better terms in trade credit. Cuñat (2007) develops a model of trade credit and tests its predictions on a sample of firms from the U.K. He finds that trade credit insures firms against liquidity shocks and that it is mainly used when other forms of finance have been exhausted. These results are more pronounced when the links between supplier and customer are tight and the production process very specific. Fabbri and Menichini (2010) find that when the purchased goods are sufficiently liquid trade credit does not depend on the degree of financial constraints of the customer. The findings of these studies imply that trade credit is not a mere substitute for bank credit.

To identify a causal relation between a negative shock to SMEs' bank credit and their potential response in trade credit we apply a twofold strategy. First, we consider SMEs that have demand for external finance but experience a negative shock to bank credit supply. In this way, we study whether firms *can substitute* since we rule out the situation that firms *do not want to substitute* because they have sufficient alternative funding sources available. Our setting allows us to interpret the negative complementary relation between bank credit and trade credit as evidence for firms' inability to substitute because we focus on external finance-dependent firms that have demand for external finance (Becker and Ivashina, 2014). Following the rationale of Rajan and Zingales (1998), we classify firm-year

observations as external finance dependent if the cash flows are insufficient to cover the firm's investments. We measure the probability of substitution (firms exhibit an increase in trade credit after a negative shock to their bank credit) relative to a negative complementary relation (firms exhibit a decrease of trade credit and bank credit) with a novel firm-specific time-varying substitution indicator and study the factors that influence this probability. We base our analysis on a large dataset on SMEs from France, Germany, Italy, Spain, and the United Kingdom during 2006-2011. Second, we carry out an additional analysis with rich matched bank-firm data from Spain that allows us to establish a causal effect between the negative shock to SMEs' bank credit during the recent financial crisis and SMEs' ability to replace the funding gap with trade credit.

We obtain the following principal results. First, we find that substitution is more likely the higher the credit quality of the firm. Second, substitution decreased during the financial crisis of 2007-09 and further declined as the crisis deepened. Third, the impact of credit quality on the probability of substitution exhibits an inverse U-shaped relation with financial constraints. It is less important for the firms with low or no financial constraints because they are more likely to attract alternative forms of finance. It is also less important for the firms with high financial constraints because they are likely credit-rationed and therefore cannot borrow anyway. We confirm these results in a subsample analysis with matched bank-firm data from Spain.

Overall, the evidence suggests that trade credit is not the appropriate response to fill the funding gap of SMEs when banks cut their lending. Firms with a lower credit quality have more difficulty to replace bank credit

with trade credit, which contradicts the substitution hypothesis and the redistribution view. The probability of substitution decreased significantly when the recent financial crisis deepened. The substitution relation between bank credit and trade credit is time-varying and ultimately pro-cyclical, potentially amplifying the effect of recessions.

Our paper contributes to the SME finance literature in several ways. First, the substitution indicator makes it possible for us to examine the cross-sectional and time variation and allows us in combination with the other elements of our investigation (negative shock to bank credit and SMEs' external finance dependence), to identify a causal effect.

Second, we fill an important gap left by the study of Garcia-Appendini and Montoriol-Garriga (2013). We investigate SMEs' use of trade credit (accounts payable), whereas Garcia-Appendini and Montoriol-Garriga (2013) focus on relatively large U.S. firms from Compustat and investigate their provision of trade credit (accounts receivable). Because SMEs cannot access public debt markets, their external finance is largely limited to bank credit and trade credit. Thus, SMEs are the ideal testing ground to study substitution effects in private debt.

Third, we use data from the five biggest EU countries. Considering cross-country data is important because the firm characteristics, financial systems, and legal environments differ and affect the supply and demand for different types of debt (e.g., La Porta, Lopez-de-Silanes, Shleifer and Vishny, 1997; Demirgüç-Kunt and Maksimovic, 2002; Beck, Demirgüç-Kunt and Maksimovic, 2004; Berger and Udell, 2006; Haselmann, Pistor and Vig, 2010).

The remainder of the paper is organized as follows. In Section 3.2, we

present the related literature and develop our hypotheses. In Section 3.3, we describe the data and show summary statistics. In Section 3.4, we report the main results. In Section 3.5, we report additional analyses based on matched-bank firm data. We conclude in Section 3.6.

3.2 Literature and Hypotheses

The literature has proposed several supply- and demand-side rationales as to why trade credit is a pervasive component on the firm's balance sheet. According to *supply-side* rationales, trade credit helps a firm to: (1) acquire private information about the customer (e.g., Smith, 1989; Mian and Smith, 1992; Petersen and Rajan, 1997); (2) enhance strong bargaining positions with customers (e.g., Giannetti, Burkart and Ellingsen, 2011; Cuñat, 2007); (3) decrease warehouse costs (Emery, 1987); and (4) facilitate a long-term supplier-customer relationship leading to future business opportunities (Ng, Smith and Smith, 1999).

The most important *demand-side* rationale for trade credit is that many firms, and in particular SMEs, resort to trade credit for financing because they are financially constrained and thus have limited or no access to other forms of external funding (e.g., Biais and Gollier, 1997; Petersen and Rajan, 1997). This rationale implies that bank credit and trade credit are substitutes for one another because these firms attract trade credit if they cannot secure bank credit. This interchangeability coincides with the redistribution view on trade credit (e.g., Love et al., 2007). The redistribution view implies that companies that borrow from financial intermediaries redistribute partly their borrowings to those who do not have access to financial intermediaries. The study of Garcia-Appendini and

Montoriol-Garriga (2013) examines the provision of trade credit among large listed U.S. firms during 2005-2010 and confirms this mechanism.

Researchers further show that macroeconomic conditions have a significant influence on credit relationships (e.g., Petersen and Rajan, 1994; Berger and Udell, 2002; Nilsen, 2002; Ivashina and Scharfstein, 2010). Access to credit deteriorates during recessions because creditors become more risk averse and therefore restrict credit extensions (Gertler and Gilchrist, 1994), implying that the relation between bank credit and trade credit varies with the state of the economy. A financial crisis will trigger liquidity shocks for certain firms, which will make them less creditworthy, thereby reducing their access to bank credit. This can lead to two opposite scenarios. The good scenario follows the substitution theory. In this case, firms experiencing credit constraints due to liquidity shocks will be able to secure more trade credit. The bad scenario holds that bank credit and trade credit exhibit a complementary relation. In this scenario, firms facing liquidity shocks will see their access to bank credit decline, along with their access to trade credit due to risk related to credit contagion (e.g., Jorion and Zhang, 2009). Deutsche Bundesbank (2012) and Kestens, Van Cauwenberge and Van Der Bauwhede (2012) document that trade credit extension decreased progressively during the recent financial crisis.

The common view in the earlier literature has been that trade credit (accounts payable) and short-term bank credit are substitutes for one another. However, there are arguments and evidence that challenge this view: (1) Firms cannot use trade credit in the same way as they can use bank credit. Trade credit does not create a cash inflow; it results from a delayed *cash outflow* for a specific purpose. In contrast, bank credit creates

a *cash inflow* that can be used for any purpose. Hence, firms can use bank credit in a more flexible way than trade credit. (2) In many studies on trade credit, its interplay with short-term bank credit is not considered, nor is the potential endogeneity between trade credit and bank credit addressed. Uesugi and Yamashiro (2008) and Yang (2011) estimate the determinants of bank credit and trade credit in simultaneous equation models. The evidence provided by these studies casts doubt on the substitution hypothesis. (3) The common view that trade credit is less preferred than bank credit because of its higher price has been questioned in the recent literature. Giannetti et al. (2011) find that creditworthy firms with some bargaining power in the market do obtain trade credit at a low cost. Fabbri and Menichini (2010) find that trade credit becomes cheaper than bank credit if the liquidation value of the purchased goods is relatively high. Relatedly, the redistribution view of trade credit implies that customers are weaker and more dependent than their suppliers. However, large customers usually have a significant bargaining power vis-a-vis smaller suppliers, indicating that suppliers can also be highly dependent on their customers (e.g., Giannetti et al., 2011; Albuquerque, Ramadorai and Watugala, 2015). (4) Many studies are based on single country data (e.g., Jacobson and von Schedvin, 2015; Boissay and Gropp, 2013; Kestens et al., 2012; Yang, 2011; Cuñat, 2007; Biais and Gollier, 1997; Petersen and Rajan, 1997). Haselmann et al. (2010) show that differences in the legal environment across countries influence credit markets. (5) Petersen and Rajan (1997) find that both the most and least profitable firms strongly use trade credit. (6) Fisman and Love (2003) find it is difficult for young firms to obtain trade credit. The substitution hypothesis implies that these firms cannot

borrow from banks and therefore have to rely on trade credit.

We derive a set of hypotheses on the determinants of the interplay between bank credit and trade credit (accounts payable). We note that the determinants of the probability of substitution between trade credit and short-term bank credit have not been directly examined in any of the related studies (e.g., Jacobson and von Schedvin, 2015; Carbo-Valverde, Rodriguez-Fernandez, and Udell, 2016; Garcia-Appendini and Montoriol-Garriga, 2013).

There are several firm characteristics that could affect the probability of substitution between bank credit and trade credit. We argue that credit quality is the most important factor to influence the probability of substitution. It should explain most of the cross-sectional and time variation in individual firms' substitution behavior. We expect credit quality to have a positive impact on the probability of substitution because the higher the credit quality, the lower the default risk for the supplier and, as a result, the more likely that suppliers are willing to provide trade credit. This expectation is not trivial because trade credit is fully secured debt, implying that suppliers might be indifferent about the credit quality of their customer. In our analysis, we consider the reaction of firms in trade credit that experience a decrease in bank credit. We state Hypothesis 1 as follows:

Hypothesis 1: Credit quality has a positive impact on the probability of substitution between bank credit and trade credit.

Furthermore, we consider the time-series variation of the interplay between trade credit and bank credit. Earlier studies show that a financial

crisis leads to a decrease in bank lending because banks are concerned about their liquidity and solvency (e.g., Ivashina and Scharfstein, 2010). Banks contract their credit supply in poor economic periods, resulting in an overall increase of financial constraints for firms. Highly constrained firms and firms with low credit quality might be the most affected by this mechanism. Yang (2011) shows that substituting bank credit for trade credit becomes more difficult during times of crisis due to credit contagion.

The impact that a financial crisis has on the interplay of bank credit and trade credit could vary during the different stages of the crisis. In the first stage of the recent financial crisis (i.e., the subprime mortgage crisis), banks had to build up capital that was eliminated by unprecedented losses. As a result, banks had to reduce lending, leading to a negative credit supply shock, as shown by Ivashina and Scharfstein (2010). After the collapse of Lehman Brothers (the second stage), the financial crisis evolved into a deep global recession, and bank lending problems got significantly worse. We state Hypothesis 2 as follows:

Hypothesis 2: The probability of substitution between bank credit and trade credit decreased during the first stage of the recent financial crisis (H2a) and decreased more strongly during the second stage of the financial crisis (H2b).

Moreover, the impact of the firm's credit quality on the probability of substitution might interact with the firm's level of financial constraints. Firms that are either unconstrained or highly constrained are less likely to substitute sources of credit. We note that financial constraints and credit

quality are related to each other, but not the same (e.g., Fazzari, Hubbard and Petersen, 1988; Kaplan and Zingales, 1997). Firms that are financially constrained have difficulties in acquiring external finance because they are more opaque. Due to this opaqueness they have difficulties in signaling their true credit quality, which results in higher costs of debt. Therefore, the impact of the credit quality on the probability of substitution should be lower for unconstrained firms and for highly constrained firms. The first group is unlikely to substitute because they have access to alternative forms of external finance, while the second group is credit-rationed. The latter firms do not get any credit; lenders ignore differences in the risk of default of these firms. However, high credit quality firms with intermediate financial constraints might be able to substitute. Our hypothesis is partially supported by Atanasova (2007) who finds that financially constrained firms are more likely to resort to trade credit, while unconstrained firms avoid trade credit. A potential non-monotonic effect is not considered in that study. We state Hypothesis 3 as follows:

Hypothesis 3: Credit quality and financial constraints have a significant and non-monotonic interaction effect on the probability of substitution between bank credit and trade credit.

3.3 Data and Empirical Method

3.3.1 Data source and selection criteria

We collect firm data from the Orbis and SABI databases, both provided by Bureau van Dijk. These databases contain firm-year observations from

the five biggest countries in the EU (Germany, France, Italy, Spain, and the United Kingdom). Data for Spain comes from the SABI database, while the data from the other four countries are gathered from Orbis. We restrict our analysis to non-financial firms that are not publicly listed and that exhibit total assets not larger than €43 million in the last available year, consistent with the definition of SMEs from the European Commission (European Commission, 2005). Moreover, in Orbis there are many data points that report values of zero, potentially having an ambiguous meaning; they can either mean zero, "missing," or "unknown." To prevent this ambiguity in our dataset, we only include firms where the value of accounts payable, accounts receivable, and short-term bank credit equals at least €1,000 in any of the years in our sample period.

Applying these selection criteria results in our dataset with yearly data from 2006 to 2011 (2006 to 2010 for Spain). Since we use financial statement information we do not know the identity and number of firms' suppliers and banks. Nevertheless, we use a matched bank-firm dataset for Spain in an additional analysis.

In Orbis, the number of firms included in the database differs for each country, which results in certain countries being heavily over- or underrepresented in the raw dataset. Therefore, we construct the dataset in a way that gives each country a weight that is proportional to its average GDP over the sample period. The final dataset is comprised of 1,186 SMEs from Germany (28%), 922 from France (22%), 920 from the U.K. (21%), 751 from Italy (17%), and 501 from Spain (12%). In that sample, we include the largest SMEs from each country. To rule out that our results are driven by a selection bias, we also stratify the raw sample in size quintiles

and randomly draw a number of firms (equal to the number of firms for each country in the main dataset divided by five) within each country-quintile and repeat this procedure 100 times.

3.3.2 Empirical strategy

A major challenge in studying the relation between bank credit and trade credit at the firm level is that both variables may change simultaneously. The resulting potential endogeneity has not been addressed in many studies (e.g., Kestens et al., 2012; Nilsen, 2002) because they either regress trade credit on bank credit (or the other way around) or do not control for bank credit, making it difficult to draw conclusions about the complementary or substitution relation between trade credit and bank credit.

We focus on the probability of substitution between the components of SMEs' private debt and its determinants, while earlier studies examine the determinants of trade credit or bank credit (e.g., Garcia-Appendini and Montoriol-Garriga, 2013; Petersen and Rajan, 1997). The substitution indicator (SI_{it}) equals zero for a negative complementary relation between changes in bank credit (ΔB_{it-1}) and changes in trade credit (ΔT_{it}), and one for a substitution relation between changes in bank credit and changes in trade credit, both conditional on a negative shock to short-term bank credit in the previous year. It is defined as shown in Equation (3.1)[5]. In this specification we define trade credit as the accounts payable.

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[5] In a robustness test we consider a modified substitution indicator that takes also contemporaneous shocks to bank credit into account (Section 3.4.5 and Table 3.9).

$$SI_{it} = \begin{cases} 0 \text{ if } \Delta B_{it-1}<0 \cap \Delta T_{it}<0 \\ \\ 1 \text{ if } \Delta B_{it-1}<0 \cap \Delta T_{it}>0 \end{cases} \quad (3.1)$$

Our identification strategy is twofold. First, we focus on firms that have demand for external finance to ensure that they want to substitute bank credit for trade credit. To identify firms with demand for credit, we use the concept of external finance dependence proposed by Rajan and Zingales (1998). Firms that have no demand for external finance do not need to substitute bank credit because they have sufficient internal finance to fund their operations (Becker and Ivashina, 2014; Duchin et al., 2010). External finance dependence is calculated as formulated in Equation (3.2):

$$EFD_{it} = \frac{\Delta TA_{it}-CF_{it}}{\Delta TA_{it}} \quad (3.2)$$

ΔTA_{it} is a proxy for a firm's yearly level of investments and CF_{it} represents the firm's annual cash flows. Only observations with a positive outcome are included in the analyses because these are the firms that theoretically need credit.[6] We calculate EFD_{it} at the firm level and, alternatively, at the industry-country level. For the latter, we use the median values of ΔTA_{it} and CF_{it} at the industry-country level. On the one hand, EFD_{it} at the firm level is more informative about a firm's specific needs for external finance than EFD_{it} at the country-industry level. On the other hand, the level of

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[6] Alternatively, we computed *EFD* only for observations with $\Delta TA>0$ because *EFD* becomes positive for $\Delta TA<0$ and $CF>0$. The results are similar.

investments depends on a firm's access to finance, making EFD_{it} potentially endogenous at the firm level, but not at the country-industry level. Because of these reasons we decided to consider both measures of $EFD_{it.}$

We note that our sample period of 2006-2011 includes a severe macroeconomic recession, during which many banks had to reduce their lending significantly because of large losses, illiquidity, and insolvency concerns (Ivashina and Scharfstein, 2010; Duchin et al., 2010; Puri, Rocholl and Steffen, 2011). Therefore, we study the response of trade credit after a negative shock to SMEs' bank credit, which is for the vast majority of SMEs an exogenous and credit supply-side driven shock.

Second, we conduct an additional analysis with rich matched bank-firm on Spain that allows a direct identification of firms that were facing a negative shock to bank credit during our sample period. We distinguish between SMEs that have a relationship with an unhealthy bank (measured by the incidence of being bailed out by the government) and firms that do not have a relationship with an unhealthy bank. SMEs that borrow from unhealthy banks were facing a stronger reduction in credit supply and therefore had a higher need for substitution during the recent financial crisis. We examine whether trade credit helped these firms to replace the funding gap.

3.3.3 Variables and descriptive statistics

Our dependent variable is the substitution indicator SI_{it}, as explained above. Figure 3.1 shows the relative frequency of substitution ($SI_{it}=1$) by country and over time. There is a sharp decrease in the fractions of substitution relations throughout the financial crisis until 2009, as well as

an increase during the recovery in 2010. All five countries show a similar pattern but the effects vary in terms of their magnitude. The mean of SI in the entire sample equals to 0.49, indicating that substitution and complementary relationships are on average almost equally likely to occur. However, the overall mean value clouds that there is substantial variation over time (e.g., the yearly mean of SI in the U.K. changes from 0.28 in 2008 to 0.65 in 2010) that indicates that the probability of substitution depends on the state of the economy.
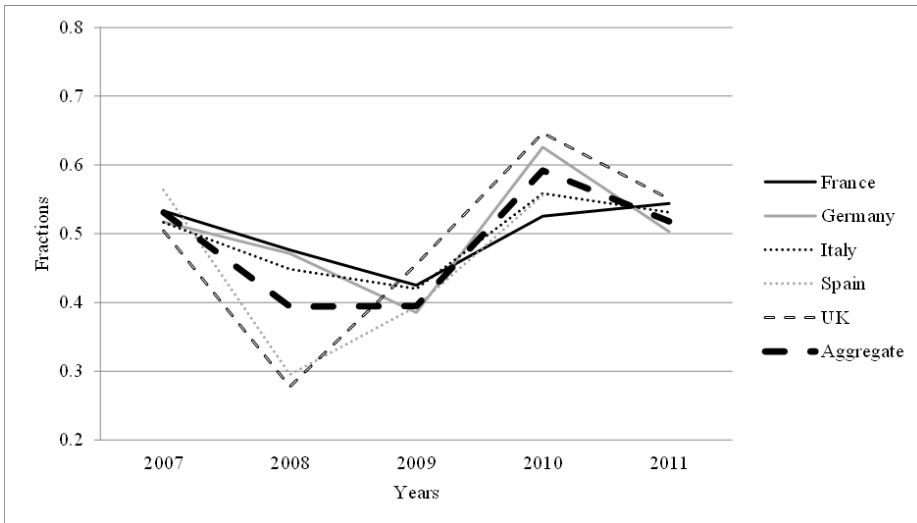
Figure 3.1: Substitution Indicator over time

The explanatory variables are the potential factors that might influence the substitution indicator as posited in Hypotheses 1-3. The main explanatory variable is the credit quality of the firm, which we measure with the Altman Z-score (Z) for private firms (Altman, 1968). The Z-score is a widely used composite measure of credit quality (firm default risk) and is based on several factors, such as liquidity, retained earnings, profitability,

leverage, sales, and size. Agarwal and Taffler (2007) show that the Z-score is predictive of the default risk of firms in different time periods and different countries. Altman's Z-score[7] for private companies is computed as shown in Equation (3.3). All components are winsorized at the 1st and 99th percentile to ensure that the Z-score is not driven by extreme observations.

$$Z_{it} = 0.7 \frac{WorkingCapital_{it}}{TA_{it}} + 0.85 \frac{RetainedEarnings_{it}}{TA_{it}} + 3.1 \frac{EBIT_{it}}{TA_{it}} + 0.4 \frac{TA_{it}}{TL_{it}} + \frac{Sales_{it}}{TA_{it}} \quad (3.3)$$

As stated in Hypothesis 3, the influence of Altman's Z-score on the probability of substitution might be dependent on the level of financial constraints of the firm. We measure financial constraints with a widely used measure, the KZ index (Kaplan and Zingales, 1997; Lamont, Polk, Saá-Requejo, 2001), which is defined in Equation (3.4).[8] All components are winsorized at the 1st and 99th percentile. In order to measure the non-monotonicity between the Z-score and the KZ index, we create quintile dummies for the latter (*KZ_Q*).

$$KZ_{it} = -1.002 \frac{CF_{it}}{TA_{it-1}} + 3.139 \frac{TL_{it}}{TA_{it-1}} + 39.368 \frac{Div_{it}}{TA_{it-1}} - 1.315 \frac{Cash_{it}}{TA_{it-1}} \quad (3.4)$$

Because there has been debate about how to measure financial constraints (e.g., Farre-Mensa and Ljungqvist, 2016), we consider the WW index (Whited and Wu, 2006) and the SA index (Hadlock and Pierce, 2010)

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[7] Sales are not available for firms from the U.K. We therefore use operating revenues in all countries. For EBIT, we take ROA before taxes instead. Retained earnings are not directly available in Orbis. We have estimated them as equity minus capital (firm wealth minus the value of the shares).

[8] Dividends are not available in Orbis. We estimate dividends as net income minus the change in equity (i.e., the proportion of income that is not retained by the company).

as alternative measures in robustness tests.

Moreover, we examine the impact of the recent financial crisis, using a set of dummy variables that indicate different stages of the crisis. In continental Europe, the first (second) stage of the crisis, *D_Crisis1* (*D_Crisis2*), is a dummy variable equal to one in the year 2008 (2009), and zero otherwise. We consider 2009 as the second stage of the crisis because Lehman Brothers collapsed in September 2008, which is the trigger event of the deep global recession. In the U.K., we consider 2007 (2008) as the first (second) stage of the crisis because the crisis started earlier and evolved faster in the U.K. due to its stronger ties with the U.S. The post-crisis period is indicated by a dummy variable (*D_Aftermath*) that equals one in the years 2010-2011 (2009-2011 for the U.K.) and zero otherwise.

We add several control variables that might influence the substitution indicator. The first variable is firm size (*LnTA*), measured by the natural logarithm of total assets. The second variable is collateral, motived by the study of Cuñat (2007), and measured in two ways. Long-term collateral is measured with fixed tangible assets (*TangFA*) and short-term collateral with inventories (*Inv*) (e.g., Norden and van Kampen, 2013), both scaled by total assets. The third variable is the sum of cash and cash equivalents divided by total assets (*Cash*). The last variable is profitability measured by ROA. In all regressions, we control for industry and country fixed effects, where industry is derived from the two digit SIC code. Industry fixed effects are important because suppliers are more willing two extend trade credit to customers in industries with high product specificity (Cuñat, 2007). Country fixed effects are important because heterogeneity in financial and legal systems creates heterogeneity in financial markets (e.g.,

La Porta et al., 1997; Haselmann et al., 2010). Z and ROA are highly sensitive to outliers and are winsorized at the 1st and 99th percentile at the country level.

Table 3.1: Summary Statistics

This table reports descriptive statistics for all non-indicator variables. We present the number of firm years for each variable and the mean, median, and standard deviation for both outcomes of SI_{it}. Panel A presents the descriptive statistics for all firms that were facing a negative shock to bank credit in year t-1, while Panel B presents the descriptive statistics only for the firms that are externally finance-dependent (hereinafter: EFD firms; the increase in total assets exceeds the value of operating cash flows, as is proposed by Rajan and Zingales 1998).

	Firm-Years	Mean		Median		St. Dev.	
Panel A: All firms							
		(0)	(1)	(0)	(1)	(0)	(1)
Z	9,222	2.72	2.89	2.58	2.71	1.36	1.47
KZ	8,808	-0.24	-0.12	0.01	0.29	3.45	3.33
KZ_Q	8,808	2.85	3.03	3.00	3.00	1.40	1.42
Size	9,672	9.63	9.44	10.14	9.98	1.22	1.25
Cash	9,434	0.08	0.08	0.03	0.03	0.12	0.11
Inventories	9,570	0.20	0.20	0.14	0.14	0.22	0.21
Tangibles	9,618	0.27	0.28	0.20	0.20	0.26	0.26
ROA	9,392	0.03	0.03	0.02	0.02	0.08	0.08

	Firm-Years	Mean		Median		St. Dev.	
Panel B: External finance-dependent firms (EFD firms)							
		(0)	(1)	(0)	(1)	(0)	(1)
Z	7,365	2.65	2.86	2.49	2.66	1.35	1.50
KZ	7,011	-0.22	0.09	0.06	0.45	3.49	3.33
KZ_Q	7,011	2.88	3.13	3.00	3.00	1.41	1.42
Size	7,746	9.68	9.42	10.19	9.98	1.24	1.29
Cash	7,561	0.07	0.07	0.03	0.03	0.11	0.11
Inventories	7,663	0.21	0.22	0.15	0.15	0.22	0.22
Tangibles	7,693	0.27	0.26	0.19	0.18	0.26	0.26
ROA	7,479	0.02	0.03	0.02	0.02	0.07	0.07

The summary statistics in Table 3.1 are reported separately for the firms that exhibit a complementary relation (column (0)) and those that exhibit a substitution relation (column (1)). Panel A reports the descriptive statistics for *all firms* experiencing a negative shock in bank credit, while Panel B reports the statistics for the *firms that have demand for external finance* (EFD firms). The mean and median values of the Z-score are higher for the substitution firms, indicating that firms of higher credit quality substitute credit more often. The mean and median of the Z-score differ substantially across countries (not reported); German firms have the highest credit quality with a mean (median) Z-score of 3.36 (3.13), while Italian firms have the lowest credit quality with a mean (median) Z-score of 1.78 (1.68). The other three countries have Z-scores between 2 and 3. In addition, the value for Z (KZ) drops (rises) when we exclude firms that have no demand for external finance. This is intuitive because firms that do not need external finance display usually a higher credit quality and lower financial constraints.

3.4 Empirical Analysis

3.4.1 Baseline Analysis

First, we investigate which factors influence whether SMEs increase trade credit after they have experienced a negative shock to their bank credit by regressing the SI_{it} on the lagged Z-score, the crisis dummies, and lags of the control variables. Table 3.2 presents our baseline results.

Table 3.2: The determinants of the probability of substitution

This table reports results from the logit regression analyses where SI_{it} is regressed on the Z-score, the different stages of the crisis, cash holdings, tangible fixed assets, inventories, firm size, ROA and a set of country and industry dummies. This regression analysis informs how the explanatory variables increase or decrease the probability of substitution between short term bank credit and accounts payable. We report the odds ratios with the p-values in parentheses for each explanatory variable. ***, **, * indicate coefficients that are statistically significant at the 1%, 5%, and 10% levels, respectively, using robust standard errors clustered at the firm level.

	(1)		(2)		(3)		(4)		(5)	
	Full Sample		Full Sample		EFD Firms		EFD Firms demeaned		EFD Ind.	
Z(t-1)	1.078	***	1.087	***	1.099	***	1.093	***	1.067	*
	(0.000)		(0.000)		(0.000)		(0.000)		(0.068)	
D_Crisis1	0.719	***	0.724	***	0.671	***	0.634	***	0.581	***
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
D_Crisis2	0.480	***	0.485	***	0.441	***	0.410	***	0.492	***
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
D_Aftermath	1.084		1.084		1.014		0.933		1.050	
	(0.222)		(0.232)		(0.852)		(0.345)		(0.657)	
Size(t-1)			0.900	***	0.876	***	0.882	***	0.628	***
			(0.000)		(0.000)		(0.000)		(0.000)	
Cash(t-1)			1.120		1.294		1.199		0.802	
			(0.571)		(0.303)		(0.453)		(0.531)	
Inv(t-1)			0.982		1.052		1.008		1.173	
			(0.888)		(0.718)		(0.953)		(0.382)	
TangFA(t-1)			1.253	**	1.224		1.119		1.188	
			(0.038)		(0.101)		(0.351)		(0.330)	
ROA(t-1)			0.730		0.574		0.582		1.217	
			(0.332)		(0.150)		(0.161)		(0.703)	
Industry dummies	Yes		Yes		Yes		Yes		Yes	
Country dummies	Yes		Yes		Yes		No		Yes	
Pseudo R²	0.026		0.028		0.034		0.031		0.044	
Number of obs.	9,215		8,825		7,040		7,040		3,651	

We find that the credit quality measure Z_{it-1} has a consistently positive impact on the probability of substitution. As shown in Table 3.2, a one-unit increase in Z_{it-1} is associated with a 7.8% increase in the probability of substitution. The result indicates that credit substitution for low credit quality SMEs is difficult because suppliers care about the ex ante default risk of their customers although trade credit is fully secured debt. Moreover, the probability of substitution went down significantly during the crisis: it is 28.1% lower during the first stage of the financial crisis and 52.0% during the second stage compared to the pre-crisis level, respectively. These findings remain similar if we add control variables in column (2) and become even stronger if we only consider firms that have demand for external finance in column (3). We note that the sample size decreases only slightly when we exclude firms that do not depend on external finance (from 8,825 to 7,040). This is not surprising because SMEs are in general strongly dependent on external finance. In column (3), a one-unit increase in Z_{it-1} is associated with a 9.9% increase in the probability of substitution. We thus conclude that, all else being equal, the relation between credit quality and substitution is monotonic. In column (4), we present the results of a regression when the variables are demeaned at the country-level median and obtain similar results. In column (5) we report the results for firms located in external finance-dependent industries. A one unit increase in Altman's Z increases the probability of substitution with 6.7%, the result becomes weakly significant though (p=0.068). The impact of the crisis dummies stay similar in both economic and statistical significance. Overall, the results are consistent with Hypotheses 1 and 2.

We repeat the baseline analysis on a country-by-country basis for the

external finance-dependent firms to ensure that our effects are not driven by one particular country. The results are presented in Table 3.3. For this analysis, we employ the larger raw samples from each country to make full use of the data (we do not use the aggregate sample based on GDP shares, as explained at the end of Section 3.3.1).

The findings in Table 3.3 confirm our aggregate analysis shown in Table 3.2 and are consistent across all five countries. However, the magnitude of the effects varies substantially. The Z-score has a positive and significant impact on the probability of substitution. A one unit increase in the Z-score is related to an increase in the probability of credit substitution between 8.2% (Germany) and 18.4% (France). The effect is the smallest in Germany because its financial system was less strongly hit by the financial crisis and long-term bank credit to SMEs is more common than in the other four countries. Also the results for the financial crisis are consistent for all countries, confirming that substitution is strongly dependent on the state of the economy as shown in Figure 3.1. The probability of credit substitution decreased significantly in both stages of the financial crisis in all five countries; the second stage of the crisis always has an even more negative impact than the first stage of the crisis. The probability of credit substitution during the second stage of the crisis decreases between 36.5% (Italy) and 72.6% (U.K.). In additional analyses[9] we find that the results are similar for the Altman's Z-score and D_Crisis2 when we investigate firms from external finance-dependent industries: D_Crisis2 is significant in all five countries and the Altman's Z-score in four countries (Germany is the only exception). Furthermore, we estimated the baseline model with interaction

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[9] Results are available from the authors on request.

Table 3.3: The determinants of the probability of substitution by country

This table reports results from the logit regression analyses where SI_{it} is regressed on the Z-score, the different stages of the crisis, cash holdings, tangible fixed assets, inventories, firm size, ROA, and a set of industry dummies for each country separately. This regression analysis informs how the explanatory variables increase or decrease the probability of substitution between short term bank credit and accounts payable. We report the odds ratios with the *p*-values in parentheses for each explanatory variable. ***, **, * indicate coefficients that are statistically significant at the 1%, 5%, and 10% levels, respectively, using robust standard errors clustered at the firm level. All regressions in this table are conducted for external finance-dependent firms (EFD firms), as proposed by Rajan and Zingales (1998).

	(1) France	(2) Germany	(3) Italy	(4) Spain	(5) U.K.
Z(t-1)	1.184 *** (0.000)	1.082 * (0.059)	1.156 *** (0.000)	1.087 *** 0.000	1.099 *** 0.000
D_Crisis1	0.762 *** (0.000)	0.746 * (0.082)	0.749 *** (0.000)	0.309 *** 0.000	0.774 *** 0.000
D_Crisis2	0.576 *** (0.000)	0.449 *** (0.000)	0.635 *** (0.000)	0.480 *** 0.000	0.274 *** 0.000
D_Aftermath	0.956 (0.157)	1.132 (0.374)	1.121 *** (0.000)	0.994 -0.906	
Size(t-1)	0.981 * (0.099)	0.990 (0.794)	0.964 *** (0.000)	0.919 *** -0.005	0.991 -0.405
Cash(t-1)	0.708 *** (0.000)	1.922 (0.249)	0.639 *** (0.000)	0.628 -0.109	1.060 -0.548
Inv(t-1)	0.859 ** (0.023)	0.855 (0.644)	0.949 (0.161)	0.622 *** 0.000	1.127 -0.187
TangFA(t-1)	1.268 *** (0.002)	1.617 (0.111)	1.219 *** (0.000)	1.142 -0.191	1.245 *** -0.001
ROA(t-1)	0.685 *** (0.009)	1.074 (0.931)	0.365 *** (0.000)	0.882 ** -0.704	0.729 ** -0.027
Industry dummies	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.014	0.028	0.012	0.043	0.047
Number of obs.	31,741	1,603	81,367	12,184	20,243

effects between the explanatory variables and country dummies on the (unweighted) aggregate sample that consists of the country-specific raw samples. The results are in line with the ones we report in Table 3.3. We conclude that the effects of credit quality and the crisis on the substitution of bank credit for trade credit after a negative shock to bank credit are qualitatively similar but the magnitudes vary across countries.

In the next step, we investigate how much SMEs could substitute, using a modified version of the substitution indicator: the three-outcome $SI3_{it}$.[10] This modified version has three possible outcomes: (1) negative complementary relation; (2) partial substitution; and (3) perfect substitution. Partial substitution refers to the situation where trade credit increases in year t to a lower extent than bank credit decreased in year t-1, while perfect substitution refers to the situation where trade credit increases in year t at least as much as bank credit decreased in year t-1. In other words, we investigate two different forms of substitution; the situation where firms do not fully fill the funding gap resulting from the decrease in bank credit and the situation where they do fully fill this gap. Table 3.4 presents the results. We estimate the probability of partial or perfect credit substitution relative to the probability of a negative complementary relation.

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[10] We also considered the elasticity of trade credit to bank credit as an alternative version of the substitution indicator. However, it turned out that the elasticity measured at the firm level is too volatile. The discrete SI3 indicator is more robust and implicitly depends on the elasticity as input.

Table 3.4: The determinants of the probability of partial or perfect substitution

This table reports results from the multinomial regression analyses where the three-outcome variable $SI3_{it}$ is regressed on the Z-score, the different stages of the crisis, cash holdings, tangible fixed assets, inventories, firm size, ROA and a set of country and industry dummies. This regression analysis informs how the explanatory variables increase or decrease the probability of having partial or perfect substitution between short term bank credit and accounts payable relative to the base category. We report the odds ratios with the p-values in parentheses for each explanatory variable. ***, **, * indicate coefficients that are statistically significant at the 1%, 5%, and 10% levels, respectively, using robust standard errors clustered within firms.

	(1) Full Sample		(2) Full Sample		(3) EFD Firms		(4) EFD Ind.	
Dep. Var:	partial	perfect	partial	perfect	partial	perfect	partial	perfect
$Z(t-1)$	1.001	1.161 ***	1.009	1.166 ***	1.027	1.174 ***	0.991	1.151 ***
	(0.961)	(0.000)	(0.739)	(0.000)	(0.372)	(0.000)	(0.851)	(0.002)
$D\_Crisis1$	0.741 ***	0.710 ***	0.750 ***	0.709 ***	0.726 ***	0.640 ***	0.616 ***	0.560 ***
	(0.002)	(0.000)	(0.004)	(0.000)	(0.005)	(0.000)	(0.003)	(0.000)
$D\_Crisis2$	0.548 ***	0.427 ***	0.558 ***	0.429 ***	0.541 ***	0.371 ***	0.596 ***	0.418 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
$D\_Aftermath$	1.231 **	0.972	1.248 ***	0.960	1.228 **	0.871	1.399 **	0.805 *
	(0.013)	(0.719)	(0.009)	(0.610)	(0.034)	(0.118)	(0.016)	(0.087)
$Size(t-1)$			0.937 *	0.872 ***	0.921 *	0.841 ***	0.713 ***	0.572 ***
			(0.095)	(0.000)	(0.065)	(0.000)	(0.006)	(0.000)
$Cash(t-1)$			0.621 *	1.739 **	0.709	2.039 **	0.546	1.219
			(0.099)	(0.019)	(0.314)	(0.016)	(0.194)	(0.671)
$Inv(t-1)$			1.308 *	0.735 *	1.373 *	0.801	1.546 *	0.861
			(0.099)	(0.066)	(0.079)	(0.225)	(0.055)	(0.540)
$TangFA(t-1)$			1.236	1.241	1.185	1.236	1.332	1.054
			(0.129)	(0.128)	(0.291)	(0.185)	(0.205)	(0.821)
$ROA(t-1)$			1.102	0.507 *	0.721	0.493	2.492	0.536
			(0.817)	(0.084)	(0.501)	(0.137)	(0.142)	(0.345)
Industry dummies	Yes		Yes		Yes		Yes	
Country dummies	Yes		Yes		Yes		Yes	
Pseudo R^2	0.039		0.041		0.049		0.057	
Number of obs.	9,216		8,827		7,045		3,654	

We find in Table 3.4 that perfect credit substitution is more likely the higher the credit quality of the firm. For firms with external finance dependence at the firm (industry) level a one-unit increase in the Altman Z-Score increases the probability of substitution with 17.4% (15.1%). Furthermore, substitution decreased in both the first and second stages of the financial crisis. There is a sharp drop in substitution in the second stage of the crisis (odds ratios of 0.35-0.55 in most specifications). By and large, these results are consistent with those from Table 3.2 and 3.3.

3.4.2 Credit quality and stages of the crisis

We have shown that the probability of substitution went down significantly during both stages of the financial crisis, but it declined more strongly during the second stage, as posited in Hypothesis 2. We now investigate in Table 3.5 whether the impact of credit quality on the probability of substitution varies during the different stages of the financial crisis. We perform this analysis for the full sample and the sample of firms/industries that have demand for credit (EFD firms/industries).

We obtain three results. First, there is a significant and negative impact of the second stage of the crisis on the probability of substitution in all samples. Hence, after the failure of Lehman Brothers in fall 2008 the probability of substitution decreased significantly compared to the pre-crisis period. Second, for the full sample the interaction term between Z_{it-1} and *D_Crisis1* is significantly negative, suggesting that high credit quality firms are less likely to substitute bank credit for trade credit. This finding is plausible for the full sample where we do not limit the analysis to firms that have demand for credit. High credit quality SMEs are likely to have

Table 3.5: The impact of credit quality during the financial crisis

This table reports results from the logit regression analyses where SI_{it} is regressed on the Z-score, a dummy indicator for the first and the second stage of the crisis, the interaction terms between the previous two, a vector of control variables (cash holdings, tangible fixed assets, inventories, firm size, and ROA), and a set of country and industry dummies. This regression analysis informs how the explanatory variables increase or decrease the probability of substitution between short-term bank credit and accounts payable. We report the Odds-ratios with the p-values in parentheses for each explanatory variable. ***, **, * indicate coefficients that are statistically significant at the 1%, 5%, and 10% levels, respectively, using robust standard errors clustered at the firm level.

	(1)		(2)		(3)	
	Full Sample		EFD Firms		EFD Ind.	
$Z(t-1)$	1.125		1.139		1.119	
	(0.000)	***	(0.000)	***	(0.007)	***
$D\_Crisis1$	0.900		0.810		0.837	
	(0.424)		(0.149)		(0.393)	
$D\_Crisis2$	0.565		0.587		0.597	
	(0.000)	***	(0.000)	***	(0.009)	***
$D\_Crisis1*Z(t-1)$	0.906		0.930		0.847	
	(0.018)	**	(0.126)		(0.028)	**
$D\_Crisis2*Z(t-1)$	0.928		0.899		0.909	
	(0.070)	*	(0.022)	**	(0.186)	
Control Variables	Yes		Yes		Yes	
Industry dummies	Yes		Yes		Yes	
Country dummies	Yes		Yes		Yes	
Pseudo R^2	0.028		0.034		0.045	
Number of obs.	8,825		7,040		3,651	

alternative sources of debt available (e.g., credit from the owners, friends or family) during the first stage of the financial crisis, likely to retain sufficient earnings to fund their operations, or they simply shrink by decreasing leverage. Consistent with this reasoning, this effect disappears in the analysis for EFD firms. Third, for the sample of firms with demand for credit (EFD firms, both at the firm and industry level) the interaction term between Z_{it-1} and *D_Crisis2* has a significantly negative impact on the probability of substitution, suggesting that even high credit quality firms had difficulties in compensating for the negative shock to bank credit supply with trade credit. Hence, suppliers' willingness to lend shows a similar pattern as the one of banks. Moreover, the findings are consistent with the fact that trade credit insurers reduced their coverage, increased retention amounts and risk premiums when the crisis deepened (e.g., Deutsche Bundesbank, 2012).

3.4.3 Credit quality and financial constraints

It is possible that the observed effect of credit quality on the probability of substitution is non-monotonically related to the level of financial constraints, as stated in Hypothesis 3. The concept of financial constaints is related but not the same as financial distress, as pointed out in the literature (e.g., Fazzari et al., 1988; Kaplan and Zingales, 1997). To analyze this issue, we interact the Z-score (Z_{it-1}) with the KZ index quintile dummies (*KZ_Q$_{it}$*), using the first quintile as reference category. Table 3.6 reports the results.

Table 3.6: The interaction of credit quality and financial constraints

This table reports results from the logit regression analyses where SI_{it} is regressed on the interaction terms between the Z-score and the quintile dummies for the KZ index, the quintile dummies for the KZ index separately, a vector of control variables (the different stages of the crisis, cash holdings, tangible fixed assets, inventories, firm size and ROA) and a set of country and industry dummies. This regression analysis indicates how the explanatory variables increase or decrease the probability of substitution between short term bank credit and trade credit. We report the odds ratios with the *p*-values in parentheses for each explanatory variable. ***, **, * indicate coefficients that are statistically significant at the 1%, 5%, and 10% levels respectively, using robust standard errors clustered within firms.

	(1)	(2)
	Full Sample	EFD Firms
Z(t-1)	1.155	1.166
	(0.000) ***	(0.000) ***
KZ_Q2*Z(t-1)	1.036	1.080
	(0.533)	(0.249)
KZ_Q3*Z(t-1)	1.096	1.151
	(0.193)	(0.072) *
KZ_Q4*Z(t-1)	1.163	1.238
	(0.040) **	(0.009) ***
KZ_Q5*Z(t-1)	0.953	0.975
	(0.430)	(0.707)
Control Variables	Yes	Yes
KZ_Q Dummies	Yes	Yes
Industry dummies	Yes	Yes
Country dummies	Yes	Yes
Pseudo R^2	0.031	0.040
Number of obs.	8,561	6,822

The regression results indicate an inversely U-shaped relation between the probability of credit substitution and the interaction term for the full sample (column 1) and the sample of the external finance dependent firms (column 2). The finding indicates that credit quality is most important for the firms with intermediate financial constraints. For firms in quintile 3 (4), a one-unit increase in the Z-score of EFD firms increases the probability of substitution by 15.1% (23.8%) relative to quintile 1. The effect is statistically significant but less pronounced for the firms with no financial constraints because these firms have access to alternative forms of finance. In contrast, the Z-score matters less for the firms with the highest financial constraints because these firms are likely subject to credit rationing.

In addition, we repeated the regression with the quintile dummies for the WW index. The results for the interaction effects with the WW index are similar to those for the KZ index, indicating that the probability of substitution exhibits the highest sensitivity to credit quality for the firms in the fourth quintile. We also considered the SA index (Hadlock and Pierce, 2010), but we do not find any significant interaction effects of this index with credit quality. One explanation is that the SA index does not sufficiently discriminate between the firms in our sample because they are all relatively small.

Finally, we conduct the baseline regression from Table 3.2 for external finance-dependent firms separately for each KZ quintile by country. The odds ratios of the Z-score in each KZ quintile group in the raw sample are plotted in Figure 3.2. All five EU countries display an inversely U-shaped pattern. The results are consistent with Hypothesis 3, confirming that firms

with a high credit quality and intermediate financial constraints exhibit a higher probability of credit substitution than others.
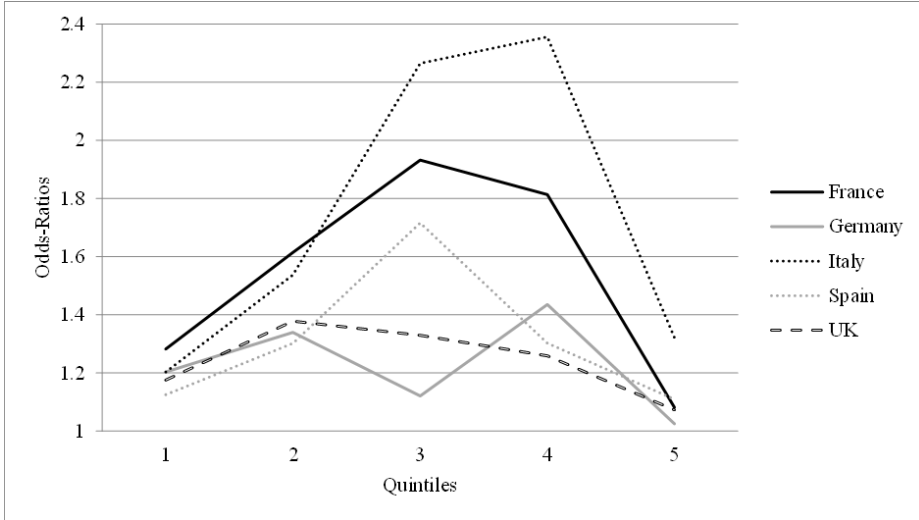
Figure 3.2: Odds ratios of the interaction terms between Z-score and KZ index quintiles

3.4.4 Substitution between total bank credit and trade credit

In the previous analyses, we investigated SMEs' reaction with trade credit in year t after a negative shock to their short-term bank credit in year t-1. On the one hand, it is possible that SMEs were also facing a negative shock to their long-term bank credit, especially those firms that had long-term bank credit expiring during the recent financial crisis (Campello, Giambona, Graham and Harvey, 2012). On the other hand, it is most likely that firms substitute short-term bank credit (and not long-term bank credit) with trade credit (and vice versa). In other words, it is unlikely that firms substitute a permanent drop in long-term bank credit with a permanent increase in trade credit as the purpose and the cash flow effects of these two

types of debt finance are very different.

To provide further evidence on the substitution effects between bank credit and trade credit, we examine the response of trade credit in year t after a negative shock to total bank credit (short-term and long-term bank credit) in year t-1 (SI_{it}^{total}).

When comparing the results for the shock to total bank credit reported in Table 3.7 with the baseline results from Table 3.2, we see that the Z-score and the financial crisis have a similar impact on the probability of credit substitution. For external finance-dependent firms, a one-unit increase in the Z-score increases the probability of substituting total (short-term) bank credit for trade credit by 7.7% (9.9%). In addition, the probability of substituting total (short-term) bank credit decreases 34.0% (32.9%) during the first stage of the financial crisis and 55.2% (55.9%) during the second stage. The fact that the results do not change when we use long-term debt as input for the substitution indicator increases the reliability of the evidence because trade credit is a better substitute for short-term bank credit than for long-term bank credit because of its maturity match.

Table 3.7: The determinants of the probability of substitution for total debt

This table reports results from the logit regression analyses where SI_{it}^{total} is regressed on the Z-score, the different stages of the crisis, cash holdings, tangible fixed assets, inventories, firm size, ROA and a set of country and industry dummies. This regression analysis informs how the explanatory variables increase or decrease the probability of substitution between total bank credit and accounts payable. We report the odds ratios with the *p*-values in parentheses for each explanatory variable. ***, **, * indicate coefficients that are statistically significant at the 1%, 5%, and 10% levels, respectively, using robust standard errors clustered within firms.

| | (1) | | (2) | | (3) | | (4) EFD Firms | |
	Full Sample		Full Sample		EFD Firms		demeaned	
Z(t-1)	1.060 (0.000)	***	1.064 (0.001)	***	1.077 (0.001)	***	1.073 (0.001)	***
D_Crisis1	0.689 (0.000)	***	0.693 (0.000)	***	0.660 (0.000)	***	0.625 (0.000)	***
D_Crisis2	0.485 (0.000)	***	0.490 (0.000)	***	0.448 (0.000)	***	0.419 (0.000)	***
D_Aftermath	1.014 (0.825)		1.007 (0.914)		0.968 (0.652)		0.896 (0.117)	
Size(t-1)			0.914 (0.001)	***	0.877 (0.000)	***	0.878 (0.000)	***
Cash(t-1)			1.062 (0.751)		1.156 (0.537)		0.129 (0.596)	
Inv(t-1)			0.835 (0.154)		0.899 (0.447)		0.868 (0.302)	
TangFA(t-1)			1.177 (0.106)		1.162 (0.196)		1.069 (0.558)	
ROA(t-1)			0.911 (0.770)		0.773 (0.504)		0.798 (0.557)	
Industry dummies	Yes		Yes		Yes		Yes	
Country dummies	Yes		Yes		Yes		No	
Pseudo R²	0.025		0.025		0.032		0.029	
Number of obs.	10,060		9,668		7,637		7,637	

3.4.5 Modified versions of the substitution indicator

In the above analyses we investigated SMEs' substitution conditional on a *negative* shock to bank credit. We now consider two modified versions of the substitution indicator. First, to rule out that our results are driven by a selection bias, we repeat the baseline analysis with a substitution indicator that is unconditional on the nature of the shock to bank credit in year t-1 ($SI4_{it}$) as shown below. In other words, we now consider *positive and negative shocks* to SMEs' bank credit in year t-1 to study their response in trade credit, as presented in Equation (3.5).

$$SI4_{it} = \begin{cases} 1 & \text{if } \Delta B_{it-1}<0 \cap \Delta T_{it}<0 \text{ (complementary)} \\ 2 & \text{if } \Delta B_{it-1}<0 \cap \Delta T_{it}\geq0 \text{ (substitution)} \\ \\ 3 & \text{if } \Delta B_{it-1}\geq0 \cap \Delta T_{it}<0 \text{ (substitution)} \\ 4 & \text{if } \Delta B_{it-1}\geq0 \cap \Delta T_{it}\geq0 \text{ (complementary)} \end{cases} \qquad (3.5)$$

The results of the multinomial regression are presented in Table 3.8. All probabilities are relative to having a negative complementary relation. In the least restrictive sample, we find that a one-unit increase in Altman's Z increases (decreases) the probability of substituting bank credit (trade credit) for trade credit (bank credit) with 8.4% (10.3%). This means that firms with higher credit quality are more likely to use trade credit when bank credit is unavailable and that these firms are less dependent on trade credit when bank credit is available. Furthermore, we show that the

occurrence of a crisis decreases the probability of being in group 2, 3 or 4. In other words, a negative complementary relation is most likely to occur during a crisis.

Table 3.8: Analysis on the probability of substitution based on SI4

This table reports results from the multinomial regression analyses where the four-outcome variable $SI4_{it}$ is regressed on the Z-score, the different stages of the crisis, cash holdings, tangible fixed assets, inventories, firm size, ROA and a set of country and industry dummies. This regression analysis informs how the explanatory variables increase or decrease the probability of having a substitution relation (SI=2 or SI=3) or a positive complementary relation (SI=4) relative to having a negative complementary relation (SI=1). We report the odds ratios with the *p*-values in parentheses for each explanatory variable. ***, **, * indicate coefficients that are statistically significant at the 1%, 5%, and 10% levels, respectively, using robust standard errors clustered within firms.

	(1)						(2)				
	Full Sample						EFD Firms				
Dep. Var:	SI=2		SI=3		SI=4		SI=2		SI=3		SI=4	
Z(t-1)	1.084		0.897		0.965		1.097		0.889		0.966	
	(0.000)	***	(0.000)	***	(0.057)	*	(0.000)	***	(0.000)	***	(0.119)	
D_Crisis1	0.734		1.011		0.698		0.685		0.992		0.648	
	(0.000)	***	(0.883)		(0.000)	***	(0.000)	***	(0.926)		(0.000)	***
D_Crisis2	0.488		0.768		0.374		0.443		0.770		0.321	
	(0.000)	***	(0.000)	***	(0.000)	***	(0.000)	***	(0.001)	***	(0.000)	***
Control Variables			Yes						Yes			
Industry dummies			Yes						Yes			
Country Dummies			Yes						Yes			
Pseudo R^2			0.022						0.026			
Number of obs.			18,802						15,070			

Second, the substitution indicator in Equation (1) does not take into account a potential change in bank credit in year *t*. However, this could impact the probability of substitution because if a decrease in bank credit in the previous year is fully offset by an increase in bank credit in the current year, then substitution is not necessary (and hence a complementary

relation becomes more likely). For this reason, we additionally condition the substitution indicator on either $\Delta B_{it} < 0$ or $|\Delta B_{it}| < |\Delta B_{it-1}| \cap \Delta B_{it} > 0$. In other words, we only include cases where the negative shock to bank credit in year t-1 is not fully offset by a positive shock in year t. The results are presented in Table 3.9 and qualitatively confirm our previous findings.

Table 3.9: Substitution controlling for contemporaneous shocks to bank credit

This table reports results from the logit regression analyses where SI_{it} (with an aggregate negative shock to bank credit in year t-1 and year t) is regressed on the Z-score, the different stages of the crisis, cash holdings, tangible fixed assets, inventories, firm size, ROA and a set of country and industry dummies. This regression analysis informs how the explanatory variables increase or decrease the probability of substitution of short term bank credit for accounts payable. We report the odds ratios with the *p*-values in parentheses for each explanatory variable. ***, **, * indicate coefficients that are statistically significant at the 1%, 5%, and 10% levels, respectively, using robust standard errors clustered at the firm level.

	(1)		(2)	
	Full Sample		EFD Firms	
Z(t-1)	1.094		1.101	
	(0.000)	***	(0.000)	***
D_Crisis1	0.730		0.679	
	(0.001)	***	(0.001)	***
D_Crisis2	0.481		0.447	
	(0.000)	***	(0.000)	***
Control Variables	Yes		Yes	
Industry dummies	Yes		Yes	
Country dummies	Yes		Yes	
Pseudo R ^{2}	0.029		0.034	
Number of obs.	6,346		5,041	

3.4.6 Stratified random sampling

The previous analyses are based on a sample comprised of the largest SMEs from the five biggest EU countries. To rule out that there are selection effects due to firm size, we stratified our raw sample using firm size quintiles. For each country we select a number of firms by random sampling within each size quintile. This number equals the number of firms per country in the raw sample divided by five. We repeat this procedure 100 times. We then re-estimate our main regressions for firms that are externally financially dependent for each of the 100 subsamples and report the mean regression statistics in Table 3.10.

For the regression corresponding to Table 3.2, we find in Table 3.10 that the Z-score has a significantly positive impact on the probability of credit substitution, where the mean odds ratio is 1.113 (p=.000). In addition, in all 100 reiterations, the first and second stages of the financial crisis have a significantly negative impact on the probability of credit substitution, where the magnitude of the second stage is always larger than the first stage. The mean odds ratios are 0.681 (p=.000) and 0.478 (p=.000), respectively. When we repeat the analysis for the regression corresponding to Table 3.5, we obtain similar results on both the Z-score and the crisis dummies. The mean odds ratio of the Z-score is 1.123 (p=.000) and is positively significant in all 100 subsamples. For the first and second stages, the mean odds ratios are 0.685 (p=.024) and 0.549 (p=.000), respectively. The crisis dummies have a significant negative effect in 79 and 98 of the subsamples, respectively. The interaction terms between the Z-score and both crisis dummies are insignificant though. In the regression corresponding to Table 3.6 and Figure 3.2 (not reported here to conserve

space), we confirm the inversely U-shaped pattern for the interactions between the KZ index quintiles and the Z-score after the stratified random sampling.

Overall, our baseline results from Table 3.2, 3.5 and 3.6 remain robust when we repeat the analysis on the stratified random sample.

Table 3.10: Stratified Random Sampling

This table reports the average estimation results from the logit regressions in which we regress SI_{it} on the Z-score, a dummy variable for the first and the second stage of the crisis, the interaction terms between the previous two, a vector of control variables (cash holdings, tangible fixed assets, inventories, firm size, and ROA), and a set of country and industry dummies for 100 randomly drawn stratified samples. For each country, the firms are divided in size quintiles and within each quintile we have drawn a fixed number of firms. The sample includes firms that are external finance-dependent (EFD firms), as proposed by Rajan and Zingales (1998) or only external finance-dependent firms conditional on non-negative change in total assets. The table reports the mean odds ratios, the mean *p*-values, and the mean pseudo R-squares for the 100 regression analysis. ***, **, * indicate coefficients that are statistically significant at the 1%, 5%, and 10% levels, respectively, using robust standard errors clustered at the firm level.

	Replication Table 3.2				Replication Table 3.5			
	(1)		(2)		(3)		(4)	
	EFD Firms		EFD Firms, dTA≥0		EFD Firms		EFD Firms, dTA≥0	
Z(t-1)	1.110		1.092		1.119		1.058	
	(0.000)	***	(0.013)	**	(0.000)	***	(0.107)	
D_Crisis1	0.681		0.676		0.682		0.417	
	(0.000)	***	(0.001)	***	(0.023)	**	(0.001)	***
D_Crisis2	0.477		0.740		0.549		0.725	
	(0.000)	***	(0.004)	***	(0.000)	***	(0.106)	
D_Crisis1*Z(t-1)					1.000		1.177	
					(0.986)		(0.022)	**
D_Crisis2*Z(t-1)					0.961		1.018	
					(0.378)		(0.421)	
Control Variables	Yes		Yes		Yes		Yes	
Industry Dummies	Yes		Yes		Yes		Yes	
Country Dummies	Yes		Yes		Yes		Yes	
Pseudo R2	0.029		0.040		0.029		0.040	

3.5 Analysis with matched bank-firm data

We carry out one more analysis that complements our previous evidence. The following analysis allows us to directly identify a causal relation between a decrease of bank credit supply in year t-1 and the potential response in trade credit in year t at the individual firm level. We do so by using rich matched bank-firm data on SMEs from Spain.[11]

For each firm and year, we observe the number and names of banks from which the SMEs obtain credit, resulting in a dataset comprised of 59,534 bank-firm-year observations for the period 2005-2010. The changes in credit we observe in this dataset are effective changes in credit used by firms. This approach is consistent with the earlier analysis based on the substitution indicator that captures firms' response to a negative shock to bank credit supply.[12]

To ensure that firms did not decrease their borrowings voluntarily (credit demand-side effect), but that banks cut lending to the firms (credit supply-side effect), we collect information on bank bailouts in the Spanish banking sector. The indicator variable *Bailout* equals one if the bank was eventually bailed out during the recent financial crisis, and zero otherwise. We follow the Bank of Spain and consider all types of government intervention: full bailout, capital infusion, debt guarantees, and other

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[11] For the other EU countries we cannot use matched bank-firm data because either the information on the firms' bank relationships is not available in ORBIS or it is time-invariant and therefore not reliable.

[12] It would be interesting to distinguish binding and non-binding shocks to bank credit supply. Unfortunately, information on unused lines of credit is not available in our database. We focus on binding shocks to bank credit supply, as the substitution indicator is based on changes in bank credit and trade credit.

instruments.[13] The Spanish banks that were eventually bailed out, which are almost all the savings banks and some commercial banks, started to experience dramatic losses in 2007-2008. This situation arose due to the collapse of the Spanish housing bubble and the resulting losses from domestic mortgage lending and banks' credit exposure to securitized U.S. subprime mortgages, which forced these banks to significantly reduce their lending activities (Illueca, Norden and Udell, 2014). This decrease in lending of bailed out banks was significantly stronger than that of banks that were not bailed out. Firms borrowing from bailed out banks faced an exogenous supply-side driven shock to their bank credit. Our identification strategy follows Puri et al. (2011), who study the change in rejection rates of German savings banks that are connected with Landesbanks that were (or were not) affected by the U.S. subprime mortgage crisis. We consider only firms having demand for credit, i.e., those that are considered as external finance dependent (Rajan and Zingales, 1998).

The *Bailout* dummy is an ex-post indicator for banks that were forced to cut lending due to financial distress. However, being bailed out by the government is a result of fundamental financial problems. Therefore, it is reasonable to assume that the bailout banks had to cut lending during this time period. We also create a dummy indicator for savings banks that serves as an ex ante indicator of unhealthy banks. Savings banks in Spain were taking substantial risks before the 2008 financial crisis through aggressive loan growth. Their loan growth came to an abrupt end in 2007-

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[13] Details on the total amount of public money injected into troubled banks are available at the Bank of Spain's website:
http://www.bde.es/f/webbde/GAP/Secciones/SalaPrensa/NotasInformativas/Briefing_notes/es/notabe040515.pdf.

Table 3.11: Analysis with matched bank-firm data

This table reports the logit regression with matched bank-firm data from Spain. We regress SI_{it} on a dummy variable for the financial crisis (*Crisis*), a dummy for banks that were bailed out (*Bailout*), the interaction variable *Bailout*Crisis*, time-varying firm controls, time-varying bank controls, and industry fixed effects. The variable *NumberRel* indicates the number of bank relationships per firm and year. In column 4 we replace the *Bailout* dummy with the *SavingsBank* dummy. We report odds ratios and *p*-values in parentheses. All firms are dependent on external finance following Rajan and Zingales (1998). ***, **, * indicate coefficients that are statistically significant at the 1%, 5%, and 10% levels, respectively, using robust standard errors clustered at the bank-firm level.

	(1)		(2)		(3)		(4)	
Crisis	0.717		0.857		0.860		0.879	
	(0.000)	***	(0.000)	***	(0.000)	***	(0.000)	***
Bailout	1.080	**	1.117		1.096	***		
	(0.018)		(0.001)	***	(0.010)			
Bailout*Crisis	0.841		0.842		0.837			
	(0.000)	***	(0.000)	***	(0.000)	***		
SavingsBank							1.122	***
							(0.001)	
SavingsBank*Crisis							0.828	
							(0.000)	***
Z(t-1)			1.329		1.335		1.336	
			(0.000)	***	(0.000)	***	(0.000)	***
Size(t-1)			1.459		1.452		1.452	
			(0.000)	***	(0.000)	***	(0.000)	***
Cash(t-1)			0.356		0.366		0.366	
			(0.000)	***	(0.000)	***	(0.000)	***
TangFA(t-1)			1.087		1.097		1.099	
			(0.088)	*	(0.078)	*	(0.075)	*
Inv(t-1)			0.550		0.544		0.545	
			(0.000)	***	(0.000)	***	(0.000)	***
ROA(t-1)			0.292		0.292		0.294	
			(0.000)	***	(0.000)	***	(0.000)	***
NumberRel					1.052		1.052	
					(0.000)	***	(0.000)	***
Bank_ROA					0.061		0.095	
					(0.399)		(0.476)	
Bank_eqta					1.402		1.388	
					(0.534)		(0.557)	
Bank_depta					1.180		1.065	
					(0.175)		(0.527)	
Industry Dummies	Yes		Yes		Yes		Yes	
Pseudo R^2	0.011		0.028		0.029		0.029	
Number of obs.	59,534		51,304		51,304		51,304	

2008. As consequence of substantial losses, the savings banks were forced to cut lending, resulting in a significant credit crunch for SMEs in Spain.

We estimate the probability of credit substitution with the indicator variables for the financial crisis (*Crisis*), for either bailed out banks (*Bailout*) or savings banks (*Savingsbank)*, the interaction term (*Crisis*Bailout*) or *(Crisis*Savingsbank)*, firm controls, bank controls, and industry fixed effects. We cluster the standard errors at the bank-firm level. Table 3.11 reports the odds ratios and *p*-values from three specifications of the logit regression model.[14]

This analysis yields a clear result. The odds ratios of the interaction term *Bailout*Crisis* is significantly below one in all three specifications in Table 3.11. This finding indicates that firms borrowing from bailed out banks during the recent financial crisis had a lower probability of credit substitution than other firms. The effect is significant at the 1% level for the baseline model reported in column (1); it remains significant at the 1% level when we add a comprehensive set of time-varying firm and bank controls in columns (2) and (3) and when we change the *Bailout* dummy into the *Savingsbank* dummy in column (4). We also find that the probability of credit substitution significantly decreases during the financial crisis, as indicated by odds ratios for the variable crisis that range between 0.71 and 0.88. Moreover, the odds ratio for the firms' Z-score is above one and significant, confirming our earlier result that higher credit quality increases the probability of substitution. These results are consistent with

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[14] An alternative model specification, in which the bailout indicator is defined as the ratio of total amount of funds injected by the government to total banks' equity at the beginning of the financial crisis, leads to similar results. This alternative analysis is available from the authors upon request.

the previous ones for the five largest EU countries and the aggregate sample, as shown in Table 3.2 and 3.3.

We consider the analysis with matched bank-firm data as an additional piece of evidence for a causal effect: SMEs with demand for credit found it difficult during the recent financial crisis to (sufficiently) replace the drop in bank credit with trade credit. In other words, trade credit did not help to fill SMEs' funding gap caused by the negative shock to bank credit supply.

3.6 Conclusion

We investigate whether SMEs that have demand for debt finance use trade credit when they experience a negative shock to their bank credit and which factors influence their response over time and across countries. We base our analysis on a large sample of SMEs from France, Germany, Italy, Spain and the U.K.

We find that substitution and complementary relationships between bank credit and trade credit are on average equally likely during 2006-2011, but their importance varies substantially over time and across countries. Firms with higher credit quality are generally more likely to substitute credit. Substitution became less likely during the financial crisis and it further declined as the crisis deepened. High credit quality firms with intermediate financial constraints are the ones that are most likely to substitute. We carry out an additional analysis with matched bank-firm data and find that the SMEs that are hit more by the shock to bank credit supply are less likely to substitute.

We show that the probability of credit substitution depends on firms' credit quality, financial constraints, macroeconomic conditions, and country

effects. Our study provides evidence on the dynamic interplay of the components of private debt in SME finance and has implications for the institutional design of the lending environment, economic policy and individual firm behaviour. The evidence suggests that substitution between the components of private debt is more difficult than considered in prior research. Trade credit is *not* the appropriate response to fill the funding gap that emerges when banks cut lending to SMEs. Policymakers should focus on enhancing financial stability, and thereby stabilize bank credit supply and the bank lending environment, rather than considering trade credit as alternative mode of external finance to mitigate the adverse effects on the real economy. SMEs can stabilize their access to bank credit by combining forward lending and spot lending and by diversifying across loan types and financial institutions.

Chapter 4

Country and Time variation in European SME Finance

4.1 Introduction

SMEs are considered as one of the most important contributors to economic development, due to their high growth opportunities. Therefore, it is very important that they have sufficient access to external finance to fund these growth opportunities. (Ayyagari, Beck and Demirgüç-Kunt, 2007; Beck, Demirgüç-Kunt and Levine, 2005). However, the access to finance for SMEs is limited compared to big publicly listed firms, mainly due to reasons related to information asymmetry (e.g. Stiglitz and Weiss, 1981; Beck and Demirgüç-Kunt, 2006). In addition to this, also cross-country variation and time variation affects the access to finance for firms (e.g. La Porta, Lopez-de-Silanes, Shleifer and Vishny, 1997; Ferrando, Popov and Udell, 2015).

This paper investigates how country variation and time variation affects the access to finance for SMEs in Europe. Europe is an interesting market due to the institutional heterogeneity across countries and the rapid changes in the recent economic environment (e.g. economic booms that were interspersed with the 2007-09 financial crisis and the 2012-13

sovereign debt crisis)[15]. The first two research questions of this paper are therefore: *1) How does the access to and the use of external finance differ across countries in Europe?* and *2) In which countries are SMEs more likely to attract external finance during times of crisis in Europe?*

In these research questions the focus is mainly on two things: (a) the access to external finance in general and (b) the access to individual sources of finance. The latter is important because SMEs use a different mix of financial sources than large firms due to a higher level of financial constraints (e.g. Ayyagari, Demirgüç-Kunt and Maskimovic, 2010; Carbo-Valverde, Rodriguez-Fernandez and Udell, 2016). In this context it is especially interesting to investigate the access to bank finance on the one side and alternative finance on the other side because the costs of capital are generally lower than for alternative forms of finance, making it interesting to see if institutional development also results in SMEs having access to cheaper sources of external finance (e.g. Morris, 1976; Denis and Mihov, 2003). Related, when banks cut their lending firms try to compensate this loss in credit availability by borrowing from alternative credit providers, such as suppliers (e.g. Petersen and Rajan, 1997; Garcia-Appendini and Montoriol-Garriga, 2013). However, Norden, van Kampen and Illueca (2017) and Casey and O'Toole (2014) report that the willingness of suppliers to behave as alternative lenders for SMEs differs across countries and during different stages of the economy. These papers barely reflect on

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[15] This paper compares crisis-samples with post-crisis samples. The situation before the financial crisis is not considered because the data used in this paper starts in 2009. This means that I can compare how things have changed after the crisis, but I cannot compare how the crisis affected SME lending relative to the period directly before the crisis.

the different country characteristics that explain the likelihood of substitution though. Therefore, the third research question is formulated as following: *In which countries are SMEs able to attract alternative forms of finance when bank debt is denied?*

The country characteristics that this paper focuses on are banking sector development, stock market development and legal development because former literature confirms that these are (together with GDP per capita) the most important factors at the country level that influence firm finance (e.g. Giannetti, 2003; Bancel and Mittoo, 2004; Beck, Demirgüç-Kunt and Maksimovic, 2008; Fan, Titman and Twite, 2012). This paper uses a broad set of proxies that are related to the three factors mentioned above[16]. The SME data is collected from the Survey of Access to Finance (SAFE) provided by the European Central Bank (EC/ECB Survey on the access to finance for enterprises). This survey offers repeated cross-sectional data since 2009 and asks European firms if they have made use of a particular form of finance (bank loans, lines of credit, trade credit, subordinated debt, informal finance, equity and internal finance) in the past six months. The answer could be "*yes*", "*no*" and "*this source of funding is not relevant for my firm*". Respondents that answer a question with "no" are firms who have demand for external finance but are unable to attract it, while respondents that answer with "not relevant" are firms that have no demand for external finance. The latter group is discarded from the sample ensuring that all firms have demand for external finance. In addition, this paper ensures that all firms have demand for external finance by excluding firms who reply that the investment needs of the firm have affected the

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[16] See Table 4.2 and section 4.2 and 4.3 for more information about the country variables.

demand for external finance in a negative way. The access to finance for firms is affected by both supply and demand side rationales, while this paper is from a supplying perspective. For this reason, it is important to minimize the variation in demand in order to interpret the results from a supplying perspective.

This paper yields several results. First, it appears that most variables reflecting banking sector development and stock market development improve the access to external finance for SMEs. This also holds for creditor protection rights. From the banking sector variables, it appears that strongly competitive banking sectors, long debt maturity and high quality credit registries are the most important contributors. From the stock market variables, a high liquidity and a low volatility are the most important. Second, supplying firms located in countries with developed banking sectors, developed stock markets and strong creditor protection rights are more willing to step in as alte rnative lenders if their clients do not have access to bank credit. Third, it appears that bank finance (e.g. bank loans and lines of credit) is much more dependent on bank sector development than most alternative forms of finance, trade credit being a noteworthy exception. Fourth, it seems to be very difficult for SMEs to attract external finance during a crisis, but banking finance is easier to attract during a crisis in countries with highly developed banking sectors. Stock market development and legal development do not seem to help SMEs in attracting finance during a crisis.

This paper makes several contributions. Firstly, it is to the best of my knowledge the first paper on SME finance that combines cross-country and time variation. Related studies (e.g. Beck et al., 2008a) are conducted

during a relatively stable time period while the economic situation in many European countries has been rather volatile over the last decade. The 2007-09 financial crisis resulted is a large shock in credit supply (Ivashina and Scharfstein, 2010). Considering that SMEs are already more financially constrained than large firms this would imply that SMEs are most likely to be affected by this credit supply shock (Cowling, Liu and Ledger, 2012). Indeed, Ferrando et al. (2015) confirm that SMEs are more likely to be credit rationed during a crisis and that this probability is higher within the GIIPS countries. For this reason, it is relevant to know in which countries SMEs have more opportunities to acquire external finance during a recession because it provides suggestions for governmental actions that should be taken in order to prevent bankruptcies or shrinkage of SMEs on a large scale the next time when a crisis occurs.

Secondly, it investigates the effects of cross-country variation on SME finance more widely than in related research, because a more diverse set of country characteristics are considered. There is not yet a clear picture on how several factors jointly affect the access to SME finance, in spite of the consensus from the literature that proofs that banking sector development, stock market development and legal development are important drivers of the access to finance for firms (e.g. Rajan and Zingales, 1995; Demirgüç-Kunt and Maksimovic, 1998, 1999; Giannetti, 2003; Bancel and Mittoo, 2004; De Jong, Kabir and Nguyen. 2008). Previous works either consider only one of the three factors above or measure those three factors in a narrow way. For example, Beck et al. (2008a) measures banking sector development by the amount of private credit provided in the commercial sector, while a developed banking sector is not only characterized by its

size but also characterized by its competition, loan maturity, risk and information asymmetry. It is important for policy implications to investigate how these set of variables jointly affect the access to finance to find out which variables have the most dominant effects on SME finance. In this way, policy makers know which components are most important to be influenced in order to improve the access to finance for SMEs.

Thirdly, this paper is one of the first to investigate cross-country variation on debt substitution. Several papers have investigated substitution between bank debt and trade credit at the firm level (e.g. Biais and Gollier, 1997; Petersen and Rajan, 1997) but did not investigate how debt substitution varies across countries. Debt substitution at the aggregate level alleviates the consequences of a negative shock to bank credit supply and therefore helps to either maintain macroeconomic growth or at least limit the macroeconomic decline (Norden et al., 2017). In addition, the abilities of SMEs to substitute different forms of external finance for each other serves as an indicator for financial flexibility. Investigating which country factors impact the financial flexibility of SMEs therefore has again important policy implications. This paper is also complementary to the works of Casey and O'Toole (2014) and Ferrando et al. (2015). Similar to this paper, Casey and O'Toole investigate the substitution of bank credit for alternative forms of finance with the SAFE survey. However, they focus on demand side rationales at the firm level (e.g. how does the level of financial constraints affect the likelihood of substitution), while this paper focuses on the supply sides at the country level [17]. Ferrando et al. (2015) uses the

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[17] The variation at the country level investigated by Casey and O'Toole is limited to country dummies.

SAFE survey to investigate the effect of several supply shocks (i.e. different stages of the crisis) on the likelihood of SME's being rationed from bank credit and on the likelihood that SME's are resorting to alternative forms of finance. In addition, they investigate how these effects differ between the GIIPS and non-GIIPS countries. This paper provides a more detailed framework (that goes deeper that the GIIPS versus non-GIIPS classification) on which country characteristics explain the differences in the access to and the use of finance for European SME's.

This paper proceeds as following. Section 4.2 provides an overview of the related literature and presents the hypotheses. Section 4.3 elaborates on the data and empirical method. Section 4.4 provides the results and section 4.5 concludes.

4.2 Literature and Hypotheses

4.2.1 Country Variation

The literature on how cross-country variation affects the access to finance has three limitations. First, most of the research is based on large publicly listed firms (e.g. Rajan and Zingales, 1995; Bancel and Mittoo, 2004). The general consensus from these papers is that cross-country differences in finance are largely explained by three sources of institutional heterogeneity; banking sector development, stock market development and the legal framework (e.g. Rajan and Zingales, 1995; La-Porta et al, 1997; Demirgüç-Kunt and Maksimovic, 1998, 1999; Bancel and Mittoo, 2004; De Jong et al, 2008). Since these articles are mainly based on large publicly listed firms one cannot conclude that that SMEs are affected in the same

way. Second, most literature focuses on either the choice between debt versus equity or on short-term debt versus long-term debt. Alternative sources of finance like trade credit and informal finance are not considered while they are more relevant for SMEs because they have less access to bank finance and are unable to issue public securities (e.g. Ayyagari et al., 2010; Carbo-Valverde et al., 2016; Norden et al., 2017). Moreover, for SMEs it is much more relevant to investigate the different forms of debt rather than the debt versus equity choice because the possibilities to issue equity are limited for SMEs since they do not have access to public markets and can only retrieve equity via venture capitalists, business angels and private equity (e.g. Cressy and Olofsson, 1997; Mason and Harrison, 1997; Poutziouris, 2001; Smolarski and Kut, 2009; Engel and Stiebale, 2014). Third, related papers only consider one of the three sources of institutional heterogeneity that were mentioned above or measure those three sources in a narrow way. For example, Beck et al. (2008a) and De Jong et al. (2008) measure banking sector development by the amount of credit that has been provided to the private sector while a developed banking sector is not only characterized by its size but also characterized by its competition, loan maturity, risk and information asymmetry.

Regarding banking sector development there is empirical evidence that firms located in countries with a more developed banking sector have faster growth rates because they can acquire debt more easily (e.g. King and Levine, 1993; Levine, 1997; Demirgüç-Kunt and Maksimovic, 1998, 1999). However, SMEs might not benefit as much as large firms from a developed banking sector because of their higher levels of information asymmetry. Also, if a banking sector is dominated by a lot of big banks, SMEs might

not benefit from aggregately big banking sectors because there is empirical evidence that big banks mainly lend to big firms (e.g. Berger, Kashyap and Scalise, 1995; Strahan and Weston, 1996; Peek and Rosengren, 1998). Hypotheses 1.1 and 1.1´ are formulated as following:

H1.1: Banking sector development has a positive effect on the access to external finance

H1.1´: Banking sector development has a stronger positive effect on bank finance than on alternative forms of finance.

As mentioned before, banking sector development is estimated by several proxies that are not only related to the size of the banking sector. A developed banking sector has the following characteristics: (a) it is big in size, (b) it is big in scope, (c) it is competitive, (d) it provides loans with longer maturities, (e) it has a low risk profile, (f) many bank clients are covered by credit registries and (g) the credit registries are of high quality. These seven proxies are used to estimate banking sector development. In Panel A of Table A1 the sub-hypotheses for H1.1 and H1.1´ are formulated for clarification purposes.

Regarding the effect of stock market development on the access to finance there is not that much consensus in the literature. Demirgüç-Kunt and Maksimovic (1996) report that large firms located in developed countries with developed stock markets rely less on debt and more on equity, while the opposite is true for developing countries. On the one hand, this could mean that SMEs also rely less on debt because they would have easier access to private equity in countries with more developed stock markets. On the other hand, there are also papers that report a positive

correlation between banking sector development and stock market development (Demirgüç-Kunt and Levine, 1996; Levine and Zervos, 1998). Indeed, Demirgüç-Kunt and Maksimovic (1996) also reports that stock market development diminishes information asymmetries in bank-customer relationships. Lastly, it is also possible that SMEs are not affected by stock market development at all because their opportunities to trade publicly are limited and many SMEs do not have the goal to get publicly listed anyway. Most plausible reasoning would be that SMEs do benefit from developed stock markets in two ways. First, in developed stock markets SMEs have easier access to venture capitalists and business angels. Second, lenders (of any kind) are more likely to provide credit in countries with stable and developed stock markets, because a good performing stock market indicates that market participants are optimistic about the current business climate and therefore creditors are anticipating low probabilities of default. Hypotheses 1.2 and 1.2´ are formulated as following:

H1.2: Stock market development has a positive effect on the access to external finance

H1.2´: Stock market development has a stronger positive effect on bank finance than on alternative forms of finance.

A developed stock market has the following characteristics: (a) it is big in size, (b) initial public offerings occur more often (La-Porta et al., 1997), (c) has a strong liquidity and (d) has a low risk. These four proxies are used to estimate stock market development. In Panel A of Table A1 the sub-hypotheses for H1.2 and H1.2´ are formulated for clarification purposes.

Regarding the legal framework Demirgüç-Kunt and Maksimovic

(1998) report that the enforceability of debt contracts is an important contributor for firm growth. In other words, a stronger investment climate is created when the rights of creditors are better protected. Related, La-Porta et al. (1997) conclude that firms located in countries with French civil law, which are characterized by low investor protection and contract enforceability, have inferior access to external finance. Hypotheses 1.3 and 1.3´ are formulated as following:

H1.3: Legal development has a positive effect on the access to external finance

H1.3´: Legal development has a stronger positive effect on bank finance than on alternative forms of finance.

For the legal framework three characteristics are used; (a) the quality of the rule of law, (b) the quality and enforcement of creditor protection rights and (c) the quality of disclosure. These four proxies are used to estimate stock market development. In Panel A of Table A1 the sub- hypotheses for H1.3 and H1.3´ are formulated for clarification purposes.

4.2.2 Time variation

It is known that banks cut their lending during recessionary times (Gertler and Gilchrist, 1994; Kashyap, Lamont and Stein, 1994; Becker and Ivashina, 2014; Bertay, Demirgüç-Kunt and Huizinga, 2015) due to the increased levels of insecurity and the higher default probabilities of borrowers. This holds even more for the banks that are facing liquidity problems themselves (e.g. Ivashina and Scharfstein, 2010). This bank debt contraction further amplifies the adverse effects of the crisis resulting in a vicious circle because borrowers are eventually forced to shrink and forego

investment opportunities without sufficient access to bank credit (e.g. King and Levine, 1993; Beck, Levine and Loayza, 2000, Norden et al., 2017).

Before the 2007-09 financial crisis there where already great differences in the use of bank credit and the access to financial services at an aggregate level (e.g. Beck, Demirgüç-Kunt and Martinez Peria 2007, 2008; Beck et al, 2008a) even within Europe. It is likely that these differences where further amplified by the financial crisis because the severity and the length of the financial crisis differed a lot across the countries in Europe. For example, the German economy recovered in 2010 with a 4.1% GDP growth while Greece experienced a drop of 5.5% in the same year (Eurostat, 2016). Given that SMEs already have difficulties in attracting external finance in combination with the fact that SMEs are more severely hit by negative economic shocks (e.g. Cowling et al, 2012) it is expected that SMEs have had disproportionally more difficulties in acquiring external finance during the recent financial crisis in 2007-09 and the sovereign debt crisis in 2012-13 (e.g. Behr, Foos and Norden, 2017). Ferrando et al. (2015) report that SMEs are more likely to get credit rationed during a crisis and that the probability of getting rationed is higher within the GIIPS countries. This indicates that countries with better financial systems and institutions should be more able to guarantee that SMEs can attract sufficient financing during recessionary times. Hypotheses 2.1-2.3 are formulated as following (see panel B of Table A1 for the related sub-hypotheses if further clarification is necessary):

H2.1: SMEs have easier access to finance during a crisis in countries with developed banking sectors; relative to SMEs in countries with underdeveloped banking sectors.

H2.2: SMEs have easier access to finance in countries during a crisis with developed stock markets; relative to SMEs in countries with underdeveloped stock markets.

H2.3: SMEs have easier access to finance in countries during a crisis with strong legal development; relative to SMEs in countries with weak legal development.

4.2.3 Substitution

Generally, firms prefer long term debt to short term debt and bank finance over alternative forms of finance (e.g. Morris, 1976; Diamond, 1991; Petersen and Rajan, 1997; Denis and Mihov, 2003) due to the associated costs of capital.

The importance of bank credit relative to other forms of finance is highly dependent on the used lending technology[18]. In the context of SMEs, the importance of bank credit is highly dependent on relationship lending. In general, it can be stated that the importance of bank credit depends on the nature of the relationship between the bank and the borrower (e.g. Petersen and Rajan, 1994; Berger and Udell, 1995, 2006; Berger, Miller, Petersen, Rajan and Stein, 2005; Behr, Norden and Noth, 2013; Kysucky and Norden, 2016; Bolton, Freixas, Gambacorta and Mistrulli, 2016). In other words, the stronger the relationship between the bank and the firm, the higher the importance of bank credit relative to alternative forms of finance.

However, bank-firm relationships and the importance of bank credit

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[18] This issue is further addressed in section 4.4.5 Robustness

thereof differ across countries and over time. During the recent crises many banks were forced to cut lending to their clients, making their clients more dependent on bank debt with shorter maturities or alternative forms of finance such as trade credit and informal finance (e.g. Biais and Gollier, 1997; Petersen and Rajan, 1997; Love et al., 2007; Garcia-Appendini and Montoriol-Garriga, 2013). In addition to this, bigger firms also have the opportunity to fall back on public debt (Becker and Ivashina, 2014). Casey and O'Toole (2014) investigate bank debt substitution for several alternative forms of finance[19] from a demand-driven perspective for the initial euro countries (except Luxembourg). They conclude that firms who are either bank credit-rationed or self-rationed have a higher probability of using alternative forms of finance. They also report that the likelihood of substitution differs across the countries in the sample, but without elaborating on which characteristics explain these differences at the country level. Relatedly, Norden et al. (2017) report that the probability that a firm is able to attract trade credit after a reduction in bank credit is different across several countries. For example, the authors report that the likelihood of compensating a negative shock to bank credit with a positive shock to trade credit is higher in countries with a strong banking sector (e.g. Germany) compared to countries with a relatively weak banking sector (e.g. Spain and Italy). Therefore, it seems that strong banking sector development makes it easier to switch between different sources of finance. Also a developed stock market and a developed legal framework are important. When banks cut their lending in a stable stock market, alternative creditors are still able to estimate the future market conditions.

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[19] The same used in this paper.

Moreover, in a developed stock market SMEs might substitute bank credit for finance from venture capitalists. A developed legal framework is important because alternative providers of finance are more likely to extend credit when their rights are better protected. Hypotheses 3.1-3.3 are formulated as following (see panel C of Table A1 for the related sub-hypotheses if further clarification is necessary):

H3.1: SMEs in countries with developed banking sectors are more likely to substitute a negative shock to bank credit with alternative sources of finance.

H3.2: SMEs in countries with developed stock markets are more likely to substitute a negative shock to bank credit with alternative sources of finance.

H3.3: SMEs in countries with a strong legal development are more likely to substitute a negative shock to bank credit with alternative sources of finance.

4.3 Data and Empirical Method

4.3.1 Data

The data on the forms of finance that are used by SMEs is obtained from the Survey of the Access to Finance (SAFE) by the European Central Bank. This survey asks European firms about their access to different forms of finance. The survey offers repeated cross-sectional data and is conducted

semi-annually since 2009[20]. Large firms and firms in the financial sector are discarded from the sample. The survey data has three advantages over financial statement data. First, it is possible to retrieve data on whether the firm has made use of a particular form of finance within the past six months. This is not always possible for financial statement data, for example because a stable value in short-term bank debt could either hold that the firm did not attract new debt or that the firm has rolled over debt. Moreover, it is possible to distinguish between firms that did not need to attract external finance or firms that could not get external finance. By excluding the cases where firms did not need external finance it ensures that all firms in the sample have demand for external finance. As a result, I can neutralize the supply side rationales from the demand side rationales. Second, the survey provides data on the firm's investment needs, which enables me to align the use of external finance with the investment needs of the firm. Through the exclusion of firms that have no investment needs (and therefore do not need external finance) a second method to disentangle supply and demand side rationales has been developed. Third, the SAFE survey includes data on the use of diverse forms of external finance like bank debt, banks overdrafts, subordinated debt, trade credit, subsidies and informal finance. This variety cannot be found for SMEs with financial statement data because of their limited reporting duties.

Since this dataset offers repeated cross-sectional data it was possible to

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[20] In the survey of the first half of 2014 the SAFE survey reformulated some questions on the use of external finance, which resulted in a big non-response bias and therefore creating a large break in the series. This was resolved in the survey for the second half of 2014. For this reason, the first survey from 2014 is excluded from the sample. (https://www.ecb.europa.eu/stats/pdf/surveys/sme/methodological_information_survey_and_user_guide.pdf?e087e14f81422c89c80805263e1453ea)

investigate how frictions at the country level affect the access to finance in different time samples, putting a strong emphasis on crisis-samples versus non-crisis-samples. However, the SAFE survey does not offer sufficient longitudinal data[21] (i.e. every survey round contains different firms) and therefore this study does not say anything on how sensitive firms are to changes in national frictions over time.

The SAFE survey is conducted semi-annually for the initial euro countries minus Luxembourg[22] while the survey is conducted bi-annually (annually since 2013) for the other European countries. This results in particular countries being over- or underrepresented in the dataset. For this reason, 1,000 firms were selected at random for most countries that have more than 1,000 observations in the raw sample. For the biggest five European countries (Germany, France, UK, Italy and Spain) 2,000 firms were selected and for the Netherlands 1,500 were selected [23] in order to enhance the relative sizes of the countries in the sample. This procedure is repeated 100 times in order to rule out that the results are driven by a selection bias. The number of observations for every country is reported in Table A2 (EC/ECB Survey on the access to finance for enterprises).

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[21] Some firms in the sample do come back in several surveys so it is possible to obtain a small panel dataset from the SAFE survey, which has been done by Casey and O'Toole (2014). However, this would severely reduce the data coverage because only 10% of the firms are included in at least three of the fourteen surveys. In addition, the panel data is only available for 11 countries (see footnote 24), eliminating too much variation at the country level.

[22] Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal and Spain.

[23] The GDP of the Netherlands is much smaller than that of the big five, but much larger than that of the remaining countries. In 2013, Spain (#5) had a GDP of € 1.023 trillion, the Netherlands (#6) had a GDP of € 0.603 trillion and Sweden (#7) had a GDP of € 0.402 billion.

4.3.2 Empirical Method

The main dependent variables from the SAFE survey are dummy variables that indicate whether or not a firm has made use of a particular form of finance (see section 4.3.1) in the past six months. In addition, the variable D_External is constructed that equals 0 if the firm has no access to any of the financing sources that are mentioned above and 1 otherwise. In the survey the following question is asked for all available forms of finance: *"Can you indicate whether or not the firm has used the particular form of finance in the past six months?"* (EC/ECB Survey on the access to finance for enterprises). The dummy equals 1 if this question is answered with yes and 0 if answered with no. As indicated in section 4.3.1, respondents with the answer "*this source of finance is not relevant for my firm*" (EC/ECB Survey on the access to finance for enterprises) are excluded from the sample, together with firms who report that their current investment needs have a negative effect on their use of external finance.[24] [25] In order to investigate if SMEs are more likely to attract bank finance over alternative forms of finance the results for the two forms of bank finance that are available from the survey (bank loans and lines of credit) are compared with the other forms of finance.

In order to investigate debt substitution, the substitution indicator (SI)

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[24] For the SAFE survey the method of excluding firms that answer "*this source of finance is not relevant to my firm*" and the method of excluding firms that experience a deterioration in their investment needs are combined. Which means that I have a double identification strategy for the SAFE survey.

[25] The survey provides a categorical variable on whether investments in fixed assets, working capital or corporate restructuring have impacted the demand for external finance in a positive, neutral or negative way. Firms who reply with "negative" on all three questions are excluded from the sample. See section 4.4.5 for more information.

of Norden et al. (2017) is adopted. This indicator is a dummy equal to 1 if a decrease in bank credit is accompanied with an increase in alternative forms of finance and 0 otherwise. This implies that the investigation of the probability that a firm has made use of alternative forms of external finance is conditional on a firm being unable to attract bank credit. For the SAFE survey, this means that SI equals 1 (0) if the firm responds with "*yes*" ("*no*") on the question "*Can you indicate whether or not the firm has used the particular form of finance in the past six months?*" (EC/ECB Survey on the access to finance for enterprises) conditional on the answer to this question for bank credit being "*no*". This dummy indicator is also comparable with the measurement of Casey and O'Toole (2014), where the use of alternative forms of finance is regressed on a dummy variable indicating a negative shock to bank credit. In my study, bank credit and alternative forms of finance are merged together in one variable. This has the benefit that it circumvents the endogenous relationship between both forms of finance. Also, the goal of the work of Casey and O'Toole (2014) is to address the relationship between bank constraints and the likelihood of attracting alternative sources of finance (demand driven), while the goal of this study is to explain which country characteristics affect the likelihood of substitution for bank constrained firms (supply driven), which naturally requires a different measurement.

The measurement of the financing variables introduces the limitation of the SAFE survey; it only provides the opportunity to investigate if firms made use of a particular source of finance, but not the volume of this source. Therefore, the survey is very useful to investigate to which forms of finance SMEs have access but it does not help to provide an answer on the

amount of finance that SMEs can acquire. However, the advantages mentioned in the previous section outweigh this limitation. The SAFE survey asks respondents what the result of the applications were if they applied for a particular source of finance; (1) got everything, (2) got between 75 and 99.9%, (3) got less than 75%, (4) refused because of high costs and (5) got fully rejected (EC/ECB Survey on the access to finance for enterprises). The data confirms that approximately 75% of the firms that were not rejected received everything, and approximately 86% of the firms received at least 75% of the requested amount. These numbers indicate that the vast majority of firms who use a particular form of finance are able to attract a significant part of the required amount. For this reason, I can make the assumption that the impact of the variation in the volume does not have a big impact on the results.[26] This study controls for firm size (approximated by sales) and firm profitability for the data from the SAFE survey. Firm size is a very important control variable because it captures many different things for SME's. First of all, bigger firms are less sensitive to problems related to information asymmetry because they have a longer track record. Secondly, the access to finance is generally better for bigger firms. Moreover, firm size is one of the most important measurements of financial constraints as found by Hadlock and Pierce (2010). Thirdly, bigger firms generally have more opportunities to generate positive cash flows making them less dependent on external finance. The natural

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[26] The data on the outcomes of the loan applications is not used in the regression analyses for two reasons. First, this data is only available for bank loans, lines of credit and trade credit. Second, the vast majority of answers that are given are either "applied and got everything" or "applied and got rejected". For this reason, it is still difficult to make a classification between small and big volumes because the cases between "getting nothing" and "getting everything" are rare in the sample.

logarithm of the country's GDP is added to the regression to control for the general economic development. Since the access to finance and the forms of finance that are used are also different across industries, industry fixed effects are added to the model. Country fixed effects are not included in the baseline analyses because some country characteristics barely vary over time. However, they are considered in the robustness section 4.4.5.

This study has three groups of country variables: banking sector development, stock market development and the legal framework. The variables representing banking sector development were explained when elaborating on Hypotheses 1.1 and 1.1´. These variables are obtained from either the Global Financial Development Database (GFDD) or the Doing Business Survey (DB), both provided by the World Bank. The variables representing stock market development were explained when elaborating on Hypotheses 1.1 and 1.2´. These variables are obtained from either the SDC Database or DataStream. The variables representing legal development were explained when elaborating on 1.3 and 1.3´. These variables are obtained from the World Development Indicators Database, provided by the World Bank.

The time variable, crisis, is identified by a dummy variable equal to 1 in the year 2009 (and 2012 and 2013 in an alternative measurement to address the effects of the sovereign debt crisis). Almost all European countries experienced a declining GDP per capita in those three years (Eurostat, 2016). An overview of the firm variables and country variables is reported in Table 4.1 and Table 4.2 respectively. In Table 4.1 I use the definitions of the SAFE survey (EC/ECB Survey on the access to finance

for enterprises) and in Table 4.2 I use the definitions by the World Bank (2016a, 2016b, 2016c).

On several variables in Table 4.2 several notes have to be made. For HI, the observations in 2009 were set equal to the value for HI in 2010 because data was unavailable. This is a fair adjustment, because the H-index is very stable over time. For the measurement of and more information about the Z-score for banks I refer to the works of Boyd and Graham (1986), Hannan and Hanweck (1988) and Boyd, Graham and Hewitt (1993). For more information about the importance of credit registries I refer to the works of Houston, Lin and Ma (2010) and Beck, Kysucky and Norden (2015). The variable RISK has been multiplied with 100 to make the scaling more comparable with the other variables. For the variables PROTECT and DISCLOSURE data was unavailable prior to 2011. The values of these variables prior to 2011 are set equal to the value in 2011. These variables remain stable in the period 2011-2014 for 95% of the countries.

Table 4.1: Firm-Level Variables

This table describes the measurement of the firm-level variables that have been obtained from the SAFE survey. The financing variables are the dependent variables used in this research, while the remaining variables are used as control variables in the regression models.

Financing Variables

D_Loans	Dummy equal to 1 if the firm used short-term bank loans in the past 6 months
D_CreditLines	Dummy equal to 1 if the firm used lines of credit or bank overdrafts in the past 6 months
D_Trade	Dummy equal to 1 if the firm used trade credit in the past 6 months
D_SubDebt	Dummy equal to 1 if the firm used subordinated bank debt in the past 6 months
D_Informal	Dummy equal to 1 if the firm used debt from friends or family in the past 6 months
D_Equity	Dummy equal to 1 if the owner of the firms used his own capital in the past 6 months
D_Internal	Dummy equal to 1 if the firm used internal finance in the past 6 months
D_External	Dummy equal to 1 if the firm used any source of external finance in the past 6 months
SI_Trade	Dummy equal to 1 if the firm has used trade credit in the past 6 months after facing a rejection in bank debt
SI_Informal	Dummy equal to 1 if the firm has used informal finance in the past 6 months after facing a rejection in bank debt
SI_Equity	Dummy equal to 1 if the firm has used equity finance in the past 6 months after facing a rejection in bank debt

Remaining Variables

Sales	Categorical variable regarding the sales that where generated in the previous year which equals:
	1- for sales below 2 million euros
	2- for sales between 2 and 10 millions euros
	3- for sales between 10 and 50 milllions euros
	4- for sales above 50 millions euros
Profit_Outlook	A categorical variable that indicates the firm's outlook regarding it's profitability which equals:
	1- for a negative outlook
	2- for a stable outlook
	3- for a positive outlook
Industry	A dummy equal to 1 if the firm is located in a particular industry and 0 otherwise.
	The following industries are classified by SAFE: mining, construction, manufacturing, wholesale and retail, transport, real estate and miscellaneous

Table 4.2: Country-Level Variables

This table describes the measurement of the country-level variables that are the independent variables in this research. The first column presents the name of the variable, the second defines it's measurement and the last column reports the data source that has been used to obtain this variable.

Banking Sector Variables

Name	Definition	Source
BSIZE	Size of the banking sector: total domestic credit provided to the private sector by banks as a percentage of GDP	GFDD
BRANCH	Scope of the banking sector: number of bank branches in a country per 100,000 adults	GFDD
HI	H-index (competition) of the banking sector: elasticity of bank revenues to input prices; a value of 0 (1) represent a monopoly (perfect competition)	GFDD
MATURITY	Aggregate value for loan maturity: median maturity of the issued syndicated loans in a country	GFDD
BANKZ	Aggregate value for bank risk: median Z-score of the banks in a country	GFDD
CR_COVERAGE	Coverage by credit registries (CR): number of firms and individuals covered by a CR as a percentage of the adult population	DB
CR_QUALITY	Quality of CR's: depth of the information from the credit registries on a scale from 0-8	DB

Stock Market Variables

Name	Definition	Source
MARKETCAP	Size of the stock market: natural logarithm of the all-share-index value of the country at the end of the year	Datastream
NR_IPO	Occurrence of IPO's: the number of IPO's that occurred in the country in the particular year	SDC
LIQUIDITY	Liquidity of the stock market: natural logarithm of the average numbers of trades per trading day in a year	Datastream
RISK	Volatility of the Stock Market: Standard Deviation of the stock returns during the year multiplied by 100	Datastream

Institutional Variables

Name	Definition	Source
RULE_LAW	Yearly percentile score regarding the quality of the rule of law in a country, where 0 (100) represents the country with the lowest (highest) score	WDI
PROTECT	The quality and enforcement of creditor protection rights on a scale from 1-12	WDI
DISCLOSURE	The extent to which investors are protected by disclosure, measured on a scale from 0-10	WDI

Macro-economic variables

Name	Definition	Source
GDP per Capita	LN of the GDP scaled by the total population	WDI
D_Crisis	Dummy equals to 1 in the year 2009 (and 2012-2013 for the sovereign debt crisis)	WDI

4.3.3 Descriptive Statistics

Table 4.3 presents the percentages of the firms in every country that have used a particular form of finance in the preceding six months before the SAFE survey was conducted (EC/ECB Survey on the access to finance for enterprises). Countries with a similar legal origin are classified together in the table. This classification is based on the work of La-Porta et al. (1997) and Djankov, McLiesh and Shleifer (2007). Table 4.3 reports large variation in the use of different forms of finance both across and within samples of different legal origins. For example, only 34% of the firms in Scandinavian countries report that they made use of bank loans, while this is between 43% and 47% for the other types of legal origins. However, the variation within the other three samples is also bigger. For example, in Ireland 64% of the firms indicate that they made use of bank loans while in the UK only 36% reported to do so. The variation is bigger for alternative forms of finance, especially for trade credit and informal finance. For example, 84% of the firms in Ireland reported that they make use of trade credit while only 19%[27] of the firms in Croatia and Slovenia reported that they make use of trade credit. There are also big differences between countries that are having the same legal origin regarding the use of trade credit. For example, 77% of the firms in Finland rely on trade credit while this is only 38% in Norway. In Poland, 66% of the firms reported trade

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[27] This number may look unrealistically low. However, the survey conducted in 2009 drastically decreases the sample mean for all countries as shown in Figure 4.1. The numbers for the initial euro countries minus Luxembourg are highly similar to the numbers reported in the study of Casey and O'Toole (2014) who have used a subset of the SAFE survey rounds.

credit while only 31% did so in Hungary. The use of subordinated bank debt is generally low in most countries, as is the use of equity. The latter is not surprising because SMEs have limited possibilities in issuing equity. Despite of this, there is still a substantial variation across countries. When focusing on the big EU countries it appears that in Germany 30% of the owners have invested new equity in the firm, while this number is only 12% in France.

Table 4.3: Descriptive Statistics for Financing

This table presents the average percentage of firms that have used a particular form of finance from the period 2009-2015 within every country. The countries are classified on their legal origin, which is based on La-Porta et al. (1997) and Djankov et al. (2007). In the table, the cross-country mean for every legal origin is presented, together with the standard deviation and the variation width.

	D_Loans	D_CreditLines	D_Trade	D_SubDebt	D_Informal	D_Equity	D_Internal	D_External
Common Law countries								
Ireland	0.64	0.73	0.84	0.11	0.56	0.57	0.54	0.90
Israel	0.41	0.76	0.83	0.13	0.43	0.22	0.71	0.91
United Kingdom	0.36	0.68	0.72	0.08	0.43	0.19	0.71	0.81
Mean	0.47	0.72	0.80	0.11	0.47	0.33	0.65	0.80
standard deviation	0.12	0.03	0.06	0.02	0.06	0.17	0.08	0.05
max – min	0.28	0.08	0.13	0.06	0.13	0.37	0.17	0.11
French-Roman countries								
Albania	0.58	0.63	0.41	0.38	0.61	0.43	0.61	0.67
Belgium	0.48	0.59	0.42	0.14	0.33	0.16	0.44	0.72
Cyprus	0.33	0.65	0.56	0.05	0.14	0.05	0.48	0.76
France	0.40	0.54	0.31	0.03	0.19	0.12	0.47	0.67
Greece	0.42	0.39	0.66	0.09	0.21	0.20	0.54	0.72
Italy	0.48	0.71	0.64	0.05	0.26	0.19	0.52	0.80
Lithuania	0.44	0.56	0.56	0.13	0.45	0.45	0.56	0.74
Luxembourg	0.37	0.55	0.23	0.01	0.17	0.15	0.46	0.65
Malta	0.40	0.76	0.59	0.06	0.27	0.13	0.63	0.94
Netherlands	0.42	0.73	0.59	0.32	0.47	0.13	0.55	0.68
Portugal	0.40	0.64	0.52	0.07	0.28	0.09	0.32	0.71
Romania	0.37	0.62	0.50	0.07	0.42	0.11	0.57	0.70
Spain	0.46	0.58	0.58	0.12	0.34	0.13	0.53	0.73
Turkey	0.74	0.43	0.68	0.26	0.44	0.35	0.40	0.79
Mean	0.45	0.60	0.52	0.13	0.33	0.19	0.50	0.66
standard deviation	0.10	0.10	0.13	0.11	0.13	0.12	0.08	0.09
max – min	0.41	0.37	0.45	0.37	0.46	0.40	0.31	0.36

Table 4.3 (cont'd)

	D_Loans	D_CreditLines	D_Trade	D_SubDebt	D_Informal	D_Equity	D_Internal	D_External
Common Law countries								
Ireland	0.64	0.73	0.84	0.11	0.56	0.57	0.54	0.90
Israel	0.41	0.76	0.83	0.13	0.43	0.22	0.71	0.91
United Kingdom	0.36	0.68	0.72	0.08	0.43	0.19	0.71	0.81
Mean	0.47	0.72	0.80	0.11	0.47	0.33	0.65	0.80
standard deviation	0.12	0.03	0.06	0.02	0.06	0.17	0.08	0.05
max − min	0.28	0.08	0.13	0.06	0.13	0.37	0.17	0.11
French-Roman countries								
Albania	0.58	0.63	0.41	0.38	0.61	0.43	0.61	0.67
Belgium	0.48	0.59	0.42	0.14	0.33	0.16	0.44	0.72
Cyprus	0.33	0.65	0.56	0.05	0.14	0.05	0.48	0.76
France	0.40	0.54	0.31	0.03	0.19	0.12	0.47	0.67
Greece	0.42	0.39	0.66	0.09	0.21	0.20	0.54	0.72
Italy	0.48	0.71	0.64	0.05	0.26	0.19	0.52	0.80
Lithuania	0.44	0.56	0.56	0.13	0.45	0.45	0.56	0.74
Luxembourg	0.37	0.55	0.23	0.01	0.17	0.15	0.46	0.65
Malta	0.40	0.76	0.59	0.06	0.27	0.13	0.63	0.94
Netherlands	0.42	0.73	0.59	0.32	0.47	0.13	0.55	0.68
Portugal	0.40	0.64	0.52	0.07	0.28	0.09	0.32	0.71
Romania	0.37	0.62	0.50	0.07	0.42	0.11	0.57	0.70
Spain	0.46	0.58	0.58	0.12	0.34	0.13	0.53	0.73
Turkey	0.74	0.43	0.68	0.26	0.44	0.35	0.40	0.79
Mean	0.45	0.60	0.52	0.13	0.33	0.19	0.50	0.66
standard deviation	0.10	0.10	0.13	0.11	0.13	0.12	0.08	0.09
max − min	0.41	0.37	0.45	0.37	0.46	0.40	0.31	0.36

Figure 4.1 presents the development of the use of the different forms of finance over time for the SAFE survey (EC/ECB Survey on the access to finance for enterprises). The first remarkable observation is the big increase in the access to external finance from 2009 to 2010/2011. In 2010, the world economy recovered from the financial crisis which explains this increase in the use of external finance because lenders are not tightening their money anymore and because firms are experiencing growth again which results in an increased demand for external finance in order to fund the new growth opportunities. The second remarkable observation is the big drop in almost all sources of finance in 2014. This result comes as a surprise, because the consequences of the sovereign debt crisis reached their peak in 2012 and 2013 (as most countries experienced a drop in GDP in those years). A possible explanation is that there has been a delayed effect of the sovereign debt crisis. Tables A3a-c report the basic descriptive statistics of the country level variables.

Figure 4.1: Development of the access to external finance over time
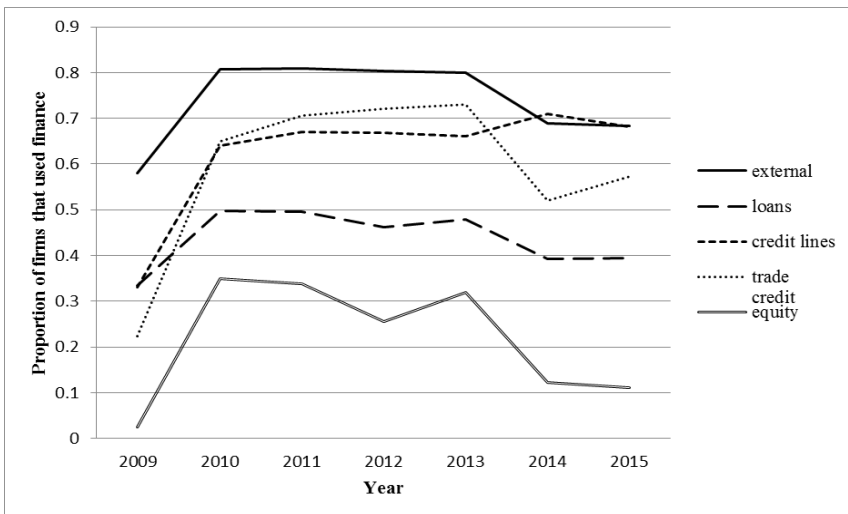
4.4 Results

4.4.1 Cross-sectional variation in the access to external finance

The baseline analysis covers how the use of a particular form of finance depends on country characteristics. The results are reported in Table 4.4 (EC/ECB Survey on the access to finance for enterprises). In this and all the following tables the mean parameters (Odds-Ratios and z-statistics) of the 100 regressions are reported.

Five out of the seven variables for banking sector development have a significant and positive effect on the probability of acquiring external finance. SMEs have more access to external finance in countries with a big and competitive banking sector, with a strong focus on long debt maturity and where there is a lot of coverage by high quality credit registries. A one standard deviation[28] increase in bank size increases the probability of having access to finance with 3.7%. A one standard deviation increase in competition increases this probability with 11.6%. For maturity, credit registry coverage and credit registry quality these effects are 5.0%, 3.1% and 7.0% respectively. For the two most significant variables; competition and quality of credit registries this would imply that SMEs in Germany are 30.1% more likely to have access to external finance than SMEs in Spain, based on the difference in competition in the German and Spanish banking sector (2.6 times the standard deviation). For the quality of credit registries the difference between Germany and Spain equals exactly one standard deviation. These results are most of the times supporting the hypothesis 1.1 indicating the SMEs benefit from developed banking sectors in general.

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[28] See table A3

Firms located in countries with a liquid and low volatility stock market and where firms get publicly listed more frequently have easier access to external finance, while a big market cap actually reduces the likelihood of attracting external finance. An explanation for this is that liquid stock markets with a low risk profile are signals of stable economies with low information asymmetry, having a positive effect on the willingness of lenders to extend credit. This relationship only seems to hold in bank-based economies, but not in market-based economies (economies with a higher market cap). A one standard deviation increase in the number of IPO's, stock liquidity and risk increases the probability of attracting external finance with 7.1%, 8.1% and -14.9% respectively. For the most significant variable, risk, a difference of one standard deviation is equal to the difference between the Netherlands and Greece. Three out of four variables are support for hypothesis 2.2, indicating that SMEs benefit from developed stock markets in general.

Creditor protection rights have a positive and significant influence on the probability of attracting external finance. A one standard deviation increase in the quality of the creditor protection rights increases the probability of attracting external finance with 7.4%. This implies that German SMEs have a 14.8% higher probability to attract external finance than Italian SMEs, since the difference is two standard deviations. This is plausible because creditors are more willing to provide finance when their rights to claim back the money are stronger protected, which is in line with hypothesis 1.3. However, the remaining variables are not in accordance with hypothesis 1.3.

Table 4.4: Cross-country variation

This table reports the mean parameters of 100 probit regression where the source of finance is regressed on several country characteristics. The reported coefficients for every variable are Odds-Ratios with the coinciding z-statistics in parentheses. The control variables are sales, profitability, GDP per capita and a group of industry dummies. Only firms that report that the investment needs have not affected their need for external finance negatively are included in the subsamples. ***, **, * indicate a significance level of 1%, 5% and 10% respectively, with standard errors that are clustered at the country level

	D_Ext	D_Loans	D_CreditLine	D_Trade	D_Subdebt	D_Informal	D_Equity
BSIZE	1.001	0.999	1.000	1.004	0.996	0.999	1.003
	(3.13) ***	(-2.56) ***	(0.31)	(7.50) ***	(-2.14) **	(-0.96)	(3.14) ***
BRANCH	0.999	0.999	0.998	0.993	0.998	0.999	0.991
	(-1.06)	(-1.57)	(-1.92) *	(-7.55) ***	(-0.93)	(-0.90)	(-6.04) ***
HI	1.844	0.963	1.367	1.944	1.101	1.125	1.615
	(6.76) ***	(-0.40)	(3.03) ***	(5.77) ***	(0.21)	(1.15)	(2.66) ***
MATURITY	1.031	1.031	1.057	1.072	1.011	0.980	0.902
	(3.46) ***	(3.26) ***	(5.76) ***	(6.63) ***	(0.38)	(-1.50)	(-5.91) ***
BANKZ	0.998	1.009	1.002	0.983	0.986	1.004	1.023
	(-0.87)	(3.62) ***	(0.63)	(-5.71) ***	(-1.81) *	(1.06)	(4.83) ***
CR_COVERAGE	1.001	1.001	1.002	1.001	1.004	1.006	1.003
	(2.54) ***	(2.73) ***	(3.68) ***	(2.72) ***	(-3.05) ***	(8.23) ***	(3.74) ***
CR_QUALITY	1.068	0.977	1.061	1.137	0.979	0.910	0.908
	(4.27) ***	(-1.39)	(3.43) ***	(6.47) ***	(-0.45)	(-3.81) ***	(-3.22) ***

Table 4.4 (cont'd)

	D_Ext	D_Loans	D_CreditLine	D_Trade	D_Subdebt	D_Informal	D_Equity
NR_IPO	1.003	1.002	1.006	1.006	1.009	1.007	1.007
	(4.13) ***	(3.29) ***	(8.23) ***	(7.68) ***	(3.71) ***	(6.89) ***	(5.64) ***
MARKETCAP	0.923	1.024	0.814	0.782	0.867	0.891	0.821
	(-5.56) ***	(1.57)	(-12.74) ***	(-14.74) ***	(-2.86) ***	(-4.61) ***	(-7.47) ***
LIQUIDITY	1.032	1.019	1.023	1.084	1.095	1.062	1.043
	(5.47) ***	(3.07) ***	(3.52) ***	(10.36) ***	(4.68) ***	(6.27) ***	(3.63) ***
RISK	0.843	0.881	0.713	0.573	0.442	0.547	0.447
	(-7.96) ***	(-5.49) ***	(-14.47) ***	(-20.31) ***	(-10.44) ***	(-15.89) ***	(-16.48) ***
RULE_LAW	0.990	1.000	0.986	0.974	1.006	1.003	0.974
	(-5.51) ***	(0.19)	(-7.00) ***	(-11.98) ***	(0.84)	(0.78)	(-0.97)
DISCLOSURE	1.003	0.960	1.000	0.987	0.855	0.904	1.078
	(0.47)	(-5.58) ***	(0.00)	(-1.53)	(-7.22) ***	(-8.89) ***	(4.46) ***
PROTECT	1.036	0.979	1.040	1.097	1.087	1.124	1.217
	(-4.95) ***	(-2.67) ***	(4.85) ***	(9.89) ***	(3.14) ***	(9.05) ***	(6.95) ***
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R Square	4.50%	3.70%	4.50%	12.20%	15.10%	9.20%	11.50%
N	19,885	15,429	14,544	12,390	4,584	7,932	7,324

4.4.2 Cross sectional-variation in the access to bank finance relative to alternative sources

Five out of seven banking variables (size and scope being the two exceptions) have a positive effect on the likelihood of attracting either bank loans or lines of credit (or both). This indicates that banking sector development has a positive effect on the access to bank finance. However, as opposed to former literature (e.g. Berger et al., 1995; Peek and Rosengren, 1998), size and scope do not seem to be important for the access to bank finance for SMEs. Much more important is the institutional and strategic context of the banking sectors (e.g. bank risk, competition and the coverage by high quality credit registries). The only form of finance that has similar z-statistics to bank loans and/or lines of credit is trade credit, indicating that SMEs in countries with a developed banking sector also have easier access to trade credit. The results are by and large support for hypothesis 1.1´.

The results for the variables on stock market development on the individual forms of external finance are highly comparable to the results for external finance in general. This means that all types of finance providers are more willing to provide funding in a stable stock market, meaning that there are no differences between bank finance and alternative forms of finance. Therefore, there is no support for hypothesis 1.2´. The results also show no empirical evidence for hypothesis 1.3´.

4.4.3 Access to finance during the crisis

The results with the interaction effects between the country variables and the crisis dummy (dummy equal to 1 in 2009 and 0 otherwise) are presented in Table 4.5 (EC/ECB Survey on the access to finance for enterprises). As expected, the access to external finance was significantly lower during the financial crisis; the probability of having access to external finance is 65.3% lower during the 2009 financial crisis.

For the access to external finance in general there is little to no evidence that banking sector development helps to get access to finance in general during a crisis. However, substantial differences between the different forms of external finance exist. These differences are especially large for bank finance versus non-bank finance. For the two forms of bank finance (bank loans and lines of credit), at least one of them is positively influenced by all variables related to banking sector development (except CR_COVERAGE). On the contrary, most of the alternative forms of bank finance (except trade credit) are barely influenced by banking sector development. The findings indicate that the access to bank finance (relative to non-bank finance) during a crisis for SMEs is better in countries with a more developed banking sector. This is because developed banking sectors are generally better in withstanding negative shocks to the economy and therefore are better in extending credit during a crisis relative to less developed banking sectors. Referring back to the insignificant result for external finance in general, this indicates that firms who cannot access bank credit during a crisis do have problems in attracting alternative forms of finance. Overall, the results support hypothesis 2.1 for bank finance.

Table 4.5: Cross-country and time variation

This table reports the mean parameters of 100 probit regression where the source of finance is regressed on several country characteristics, a crisis dummy and the interaction terms between the country variables and the crisis dummy. The reported coefficients for every variable are Odds-Ratios with the coinciding z-statistics in parentheses. The control variables are sales, profitability and a group of industry dummies. Only firms that report that the investment needs have not affected their need for external finance negatively are included in the subsamples.***,**,* indicate a significance level of 1%, 5% and 10% respectively, with standard errors that are clustered at the country level.

	D_Ext	D_Loans	D_CreditLine	D_Trade	D_Subdebt	D_Informal	D_Equity
D_CRISIS	0.347	0.484	0.020	0.089	0.053	0.052	0.281
	(-1.83) *	(-1.24)	(-6.03) ***	(-3.17) ***	(-1.85) *	(-3.41) ***	(-1.02)
BSIZE*D_CRISIS	1.002	1.003	1.003	0.999	1.000	0.996	0.996
	(1.65) *	(2.01) **	(2.32) **	(-0.36)	(0.03)	(-1.79) *	(-0.71)
BRANCH*D_CRISIS	1.001	1.004	0.999	1.014	1.007	1.006	1.016
	(0.33)	(1.91) *	(-0.59)	(5.07) ***	(1.10)	(1.86) *	(2.25) **
HI*D_CRISIS	1.689	2.180	3.005	2.339	15.381	2.866	12.574
	(1.39)	(2.03) **	(2.86) ***	(1.71) *	(1.80) *	(1.77) *	(1.51)
MATURITY*D_CRISIS	1.011	0.955	1.113	1.024	1.040	1.017	0.766
	(0.37)	(-1.48)	(3.35) ***	(0.61)	(0.43)	(0.37)	(-2.24) **
BANKZ*D_CRISIS	1.000	1.011	1.008	0.958	0.984	0.991	0.976
	(0.07)	(1.73) *	(1.13)	(-4.91) ***	(-0.74)	(-0.90)	(-1.10)
CR_COVERAGE*D_CRISIS	1.001	1.002	0.997	0.995	0.993	0.997	1.002
	(0.68)	(1.52)	(-2.44) ***	(-2.86) ***	(-1.91) *	(-1.41)	(0.49)
CR_QUALITY*D_CRISIS	0.912	0.858	1.112	1.027	0.933	0.980	0.747
	(-2.16) **	(-3.41) ***	(2.19) ***	(0.46)	(-0.53)	(-0.33)	(-2.10) **

Table 4.5 (cont'd)

	D_Ext	D_Loans	D_CreditLine	D_Trade	D_Subdebt	D_Informal	D_Equity
NR_IPO*D_CRISIS	1.014	1.007	1.013	1.017	0.987	0.999	0.987
	(3.32) ***	(1.56)	(3.14) ***	(3.53) ***	(-1.04)	(-0.15)	(-0.93)
MARKETCAP*D_CRISIS	1.110	1.152	1.102	1.001	0.973	0.965	0.799
	(1.56)	(2.02) ***	(1.37)	(0.01)	(-0.22)	(-0.38)	(-0.97)
LIQUIDITY*D_CRISIS	0.958	0.971	0.912	0.976	1.011	1.013	1.188
	(-2.73) ***	(-1.81) *	(-5.33) ***	(-1.08)	(0.20)	(0.54)	(2.42) ***
RISK*D_CRISIS	1.265	1.132	1.673	1.172	1.004	1.200	0.636
	(2.22) **	(1.13)	(4.64) ***	(1.17)	0.07	(1.13)	(-1.85) *
RULE_LAW*D_CRISIS	1.004	0.999	1.010	1.014	1.015	1.017	1.021
	(0.81)	(-0.12)	(2.01) **	(2.51) ***	(1.50)	(2.71) ***	(1.36)
DISCLOSURE*D_CRISIS	0.982	0.957	1.093	1.003	1.028	1.057	1.016
	(-0.86)	(-1.96)	(3.98) ***	(0.11)	(0.46)	(1.73) *	(0.21)
PROTECT*D_CRISIS	0.962	1.029	0.883	0.894	0.994	0.936	1.085
	(-1.74) *	(1.19)	(-5.17) ***	(-3.81) ***	(-0.15)	(-1.91) *	(0.90)
Country Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R Square	6.00%	4.50%	8.60%	19.20%	26.20%	16.60%	19.50%
N	19,885	15,429	14,544	12,390	4,584	7,932	7,324

An additional noteworthy result is that SMEs located in countries with a higher Z-score for banks are less likely to attract trade credit during a crisis, while they are more likely to attract bank loans. This supports the redistribution view of trade credit by Garcia-Appendini and Montoriol-Garriga (2013).

For stock market development there is the counterintuitive result that SMEs located in highly liquid stock markets have less access to external finance during a crisis, while SMEs located in highly risky stock markets have more access to external finance during a crisis. However, this result is largely explained by a substitution relationship between equity and lines of credit. As expected, it appears that SMEs located in countries with a highly liquid (highly risky) stock market are more (less) likely to issue equity during a crisis. However, counter-effects for lines of credit offset this. The results seem to indicate that SMEs rely more on equity when the stock market conditions are relatively favourable during a crisis and rely more on lines of credit when the stock market conditions are relatively unfavourable during a crisis. A strong legal framework does not seem to help SMEs in attracting external finance during a crisis. The exception that does support the hypothesis 2.3 is that a strong rule of law and a high disclosure score helps SMEs to attract more lines of credit and informal finance during the crisis. This means that banks and informal lenders are still willing to provide credit in these uncertain times when there is a strong government and when they have access to a lot of information due to the high disclosure requirement. However, having strong creditor protection rights reduces the likelihood of attracting external finance (both in general and for several individual forms of finance) during a crisis. In Table 4.4, *PROTECT* has a

positive effect on the access to finance. This finding indicates that creditor protection rights in Europe help SMEs to increase their access to external finance during economic booms, but these protection rights do not work optimally during a recession.

These results only hold for the 2009 financial crisis. The effects of the country characteristics on the access to finance during the 2012-13 sovereign debt crisis do not report any meaningful results and are therefore not reported in this paper.

4.4.4 Cross-sectional variation in debt substitution

As mentioned in section 4.3, substitution is measured by a dummy that indicates that the firm was able to attract a particular form of finance if it was unable to attract bank finance. This means that the substitution indicator (SI) equals 1 (0) if the firm has (no) access to trade credit, informal finance or equity conditional on having no access to bank credit (e.g. bank loans or lines of credit). In the analyses conducted in this and the following subsections, the substitution indicators are conducted for negative shocks to bank loans and lines of credit separately. In the regression analyses that investigate substitution for bank loans (lines of credit) the variable D_Creditlines (D_Loans) is included as a control variable. Table 4.6a (4.6b) reports the mean values of the substitution indicators for bank loans (lines of credit) per country (EC/ECB Survey on the access to finance for enterprises).

Table 4.6a: Summary Statistics Substitution Indicator – Bank Loans

This table presents the average percentage of firms that do not have access to bank loans, but that are able to attract either trade credit, informal finance or equity instead during the period 2009-2015 within every country. The countries are classified on their legal origin, which is based on La-Porta et al. (1997) and Djankov et al. (2007). In the table, the cross-country mean for every legal origin is presented, together with the standard deviation and the variation width.

	SI_Trade	SI_Informal	SI_Equity
Nordic countries			
Denmark	0.35	0.17	0.22
Finland	0.71	0.21	0.12
Iceland	0.48	0.19	0.09
Norway	0.23	0.13	0.13
Sweden	0.30	0.16	0.22
Mean	0.41	0.17	0.16
standard deviation	0.19	0.03	0.06
max – min	0.48	0.08	0.13
Germanic countries			
Austria	0.44	0.24	0.16
Bulgaria	0.24	0.17	0.07
Croatia	0.09	0.08	0.05
Czech Republic	0.20	0.17	0.03
Estonia	0.41	0.23	0.08
Germany	0.28	0.23	0.19
Hungary	0.10	0.15	0.00
Latvia	0.16	0.33	0.28
Macedonia	0.51	0.27	0.10
Montenegro	0.43	0.36	0.00
Poland	0.48	0.15	0.07
Serbia	0.60	0.35	0.00
Slovakia	0.27	0.19	0.22
Slovenia	0.08	0.13	0.07
Switzerland	0.33	0.38	0.22
Mean	0.31	0.23	0.11
standard deviation	0.17	0.09	0.09
max – min	0.52	0.30	0.28

Table 4.6a (cont'd)

	SI_Trade	SI_Informal	SI_Equity
Common Law countries			
Ireland	0.77	0.31	0.14
Israel	0.66	0.40	0.53
United Kingdom	0.57	0.24	0.08
Mean	0.67	0.32	0.25
standard deviation	0.10	0.08	0.24
max – min	0.20	0.16	0.45
French-Roman countries			
Albania	0.13	0.00	0.23
Belgium	0.24	0.20	0.12
Cyprus	0.47	0.03	0.05
France	0.23	0.13	0.09
Greece	0.55	0.17	0.12
Italy	0.51	0.14	0.11
Lithuania	0.38	0.41	0.41
Luxembourg	0.08	0.09	0.08
Malta	0.61	0.24	0.12
Netherlands	0.40	0.29	0.07
Portugal	0.35	0.15	0.06
Romania	0.32	0.24	0.05
Spain	0.41	0.23	0.08
Turkey	0.25	0.19	0.29
Mean	0.35	0.18	0.13
standard deviation	0.16	0.10	0.10
max – min	0.53	0.41	0.36

Table 4.6b: Summary Statistics Substitution Indicator – Credit Lines

This table presents the average percentage of firms that do not have access to lines of credit, but that are able to attract either trade credit, informal finance or equity instead during the period 2009-2015 within every country. The countries are classified on their legal origin, which is based on La-Porta et al. (1997) and Djankov et al. (2007). In the table, the cross-country mean for every legal origin is presented, together with the standard deviation and the variation width.

	SI_Trade	SI_Informal	SI_Equity
Nordic countries			
Denmark	0.29	0.11	0.15
Finland	0.61	0.18	0.08
Iceland	0.35	0.18	0.06
Norway	0.14	0.13	0.09
Sweden	0.22	0.15	0.25
Mean	0.32	0.15	0.13
standard deviation	0.18	0.03	0.08
max – min	0.47	0.07	0.19
Germanic countries			
Austria	0.35	0.18	0.15
Bulgaria	0.22	0.18	0.05
Croatia	0.09	0.01	0.03
Czech Republic	0.19	0.13	0.03
Estonia	0.12	0.08	0.01
Germany	0.21	0.21	0.16
Hungary	0.10	0.16	0.01
Latvia	0.15	0.34	0.22
Macedonia	0.72	0.50	0.00
Montenegro	0.24	0.25	0.11
Poland	0.45	0.14	0.04
Serbia	0.83	0.40	0.50
Slovakia	0.27	0.15	0.18
Slovenia	0.07	0.08	0.05
Switzerland	0.50	0.67	0.00
Mean	0.30	0.23	0.10
standard deviation	0.23	0.18	0.13
max – min	0.76	0.66	0.50

Table 4.6b (cont'd)

	SI_Trade	SI_Informal	SI_Equity
Common Law countries			
Ireland	0.77	0.29	0.15
Israel	0.56	0.31	0.56
United Kingdom	0.57	0.19	0.06
Mean	0.63	0.26	0.26
standard deviation	0.12	0.06	0.27
max – min	0.21	0.12	0.50
French-Roman countries			
Albania	0.17	0.00	0.14
Belgium	0.22	0.18	0.09
Cyprus	0.34	0.04	0.06
France	0.19	0.09	0.08
Greece	0.43	0.07	0.08
Italy	0.40	0.11	0.07
Lithuania	0.46	0.42	0.44
Luxembourg	0.11	0.10	0.12
Malta	0.80	0.33	0.13
Netherlands	0.28	0.22	0.05
Portugal	0.31	0.12	0.04
Romania	0.27	0.21	0.04
Spain	0.35	0.17	0.06
Turkey	0.56	0.18	0.27
Mean	0.35	0.16	0.12
standard deviation	0.18	0.11	0.11
max – min	0.69	0.42	0.40

From Table 4.6 it appears that trade credit is the most likely alternative when banks cut their lending, because the average substitution indicator for trade credit is much higher than for informal finance and equity. In most countries, at least 30% of the firms are able to substitute a loss in bank credit (regardless of bank loans or lines of credit) for trade credit, while 30% is rarely reached for the other two alternatives. This result is not surprising because the number of research papers on substitution between bank debt and trade credit (for SMEs) is much higher than the research papers on substitution between bank debt and informal finance/equity. The substitution indicator for trade credit also has a much higher standard deviation across countries, indicating that the likelihood of attracting trade credit after a negative shock to bank credit differs a lot across countries. Table 4.7a (4.7b) indicates which country variables explain the variation in the likelihood of substitution for bank loans (lines of credit) (EC/ECB Survey on the access to finance for enterprises).

Both tables indicate that substituting bank credit for trade credit is more likely in countries with developed banking sectors. Substituting a loss in bank loan availability is more likely in countries with big and competitive banking sectors where loans have a high maturity and where the credit registries are of high quality. These findings indicate that developed banking sectors also promote the use of supplier lending. A possible explanation is that providers of trade credit have the opportunity to fall back on their own banks (via factoring) when their clients default. These opportunities are not available for informal finance or equity finance, resulting in an insignificant or significantly negative relationship for those variables. Most of the results support the hypothesis 3.1.

Table 4.7a: Cross country variation in substitution for bank loans

This table reports the mean parameters of 100 probit regression where the dummy that indicates if the firm was able to substitute bank loans for alternative forms of finance is regressed on several country characteristics. The reported coefficients for every variable are Odds-Ratios with the coinciding z-statistics in parentheses. The control variables are sales, profitability, GDP per capita, a dummy indicating the use of lines of credit and a group of industry dummies. Only firms that report that the investment needs have not affected their need for external finance negatively are included in the subsamples.***,**,* indicate a significance level of 1%, 5% and 10% respectively, with standard errors that are clustered at the country level.

	SI_Trade	SI_Informal	SI_Equity
BSIZE	1.002	0.996	1.001
	(2.45) ***	(-2.89) ***	(0.65)
BRANCH	0.996	1.003	0.993
	(-1.38)	(1.37)	(-2.58) ***
HI	2.387	0.934	1.384
	(4.40) ***	(-0.28)	(0.97)
MATURITY	1.068	0.983	0.904
	(3.76) ***	(-0.75)	(-3.32) ***
BANKZ	0.977	0.998	1.031
	(-4.47) ***	(-0.26)	(3.58) ***
CR_COVERAGE	1.000	1.004	1.005
	(0.41)	(3.16) ***	(3.72) ***
CR_QUALITY	1.271	1.029	0.853
	(6.93) ***	(0.66)	(-3.07) ***
NR_IPO	1.006	1.005	1.007
	(4.35) ***	(2.51) ***	(2.88) ***
MARKETCAP	0.730	0.945	0.778
	(-10.59) ***	(-1.28)	(-5.10) ***
LIQUIDITY	1.096	1.047	1.059
	(6.85) ***	(2.89) ***	(2.87) ***
RISK	0.621	0.686	0.463
	(-10.82) ***	(-6.58) ***	(-9.05) ***

Table 4.7a (cont'd)

	SI_Trade	SI_Informal	SI_Equity
RULE_LAW	0.975	1.010	0.979
	(-6.87) ***	(1.83) *	(-2.79) ***
DISCLOSURE	1.012	0.936	1.002
	(0.85)	(-3.48) ***	(0.09)
PROTECT	1.109	1.101	1.072
	(6.44) ***	(4.49) **	(2.27) **
Country Variables	Yes	Yes	Yes
Control Variables	Yes	Yes	Yes
Pseudo R Square	17.90%	9.50%	14.50%
N	5,024	3,038	3,384

Table 4.7b: Cross country variation in substitution for lines of credit

This table reports the mean parameters of 100 probit regression where the dummy that indicates if the firms was able to substitute lines of credit for alternative forms of finance is regressed on several country characteristics. The reported coefficients for every variable are Odds-Ratios with the coinciding z-statistics in parentheses. The control variables are sales, profitability, GDP per capita, a dummy indicating the use of bank credit and a group of industry dummies. Only firms that report that the investment needs have not affected their need for external finance negatively are included in the subsamples.***,**,* indicate a significance level of 1%, 5% and 10% respectively, with standard errors that are clustered at the country level.

	SI_Trade	SI_Informal	SI_Equity
BSIZE	1.002	0.995	1.003
	(2.15) **	(-2.81) ***	(1.34)
BRANCH	0.996	1.006	0.994
	(-2.34) **	(2.47) ***	(-2.07) ***
HI	1.873	1.431	2.651
	(2.74) ***	(0.99)	(2.46) ***
MATURITY	1.064	0.980	0.870
	(3.13) ***	(-0.78)	(-4.08) ***
BANKZ	0.975	1.004	1.041
	(-4.41) ***	(0.56)	(4.32) ***

Table 4.7b (cont'd)

	SI_Trade	SI_Informal	SI_Equity
CR_COVERAGE	1.000	1.005	1.007
	(0.09)	(4.25) ***	(5.18) ***
CR_QUALITY	1.208	1.004	0.758
	(5.20) ***	(0.08)	(-5.18) ***
NR_IPO	1.007	1.007	1.012
	(4.19) ***	(2.88) ***	(4.49) ***
MARKETCAP	0.785	0.931	0.782
	(-7.35) ***	(-1.44)	(-4.50) ***
LIQUIDITY	1.081	1.050	1.071
	(5.19) ***	(2.69) ***	(2.93) ***
RISK	0.581	0.706	0.420
	(-10.46) ***	(-5.27) ***	(-8.47) ***
RULE_LAW	0.975	1.018	0.983
	(-5.91) ***	(2.65) ***	(-2.19) **
DISCLOSURE	1.005	0.942	0.969
	(0.33)	(-2.70) ***	(-1.12)
PROTECT	1.108	1.133	1.107
	(5.65) ***	(5.13) ***	(2.90) ***
Country Variables	Yes	Yes	Yes
Control Variables	Yes	Yes	Yes
Pseudo R Square	15.60%	8.30%	17.20%
N	4,028	3,346	3,039

Another important finding is that the median Z-score of banks reduces the likelihood of substituting a loss in bank credit for trade credit. The most likely explanation is that SMEs who are unable to attract bank credit located in countries with a high creditworthy banking sector are SMEs that

are underperforming and therefore should not get credit. Moreover, these firms are the ones who are forced to fund themselves with internal equity, which explains the positive Odds-Ratio for *BANKZ* on *SI_Equity.*

Another interesting finding in the effect of credit registries. The coverage of credit registries increases the likelihood of substituting bank credit for informal finance or equity (but not for trade credit). Assuming that trade credit has lower costs of capital than informal finance and internal equity, it seems to indicate that the coverage of credit registries increases the likelihood of attracting finance with higher costs of capital. However, if the credit registries are of high quality, SMEs are more likely to substitute bank credit for trade credit (and less likely for informal finance or equity). Concluding, credit registries help SMEs to attract other sources of finance when banks cut their lending and the higher the quality of those agencies the lower the costs of capital of the funding they can acquire.

The effects of the stock market variables are similar as to earlier analyses, indicating that SMEs located in countries with a liquid and low-risk stock market have easier access to alternative forms of finance when banks cut their lending. This finding indicates that stable stock markets do not only reduce information asymmetries between banks and customers but also between other types of lenders. This indicates that if an SME cannot get bank credit because the bank is forced to cut its lending, the SME should be able to access alternative sources of finance if it is located in a stable stock market. The results are support for the hypothesis 3.2.

For legal development, it appears that (as found in previous results in this paper) SMEs have easier access to alternative sources of finance after a

negative shock to bank credit when the rights of creditors are better protected.

4.4.5 Robustness

As mentioned earlier, a very important contributor for the importance of bank credit (relative to alternative forms of finance) is the relationship that the firm has with its bank. The SAFE survey offers the opportunity to investigate the effect of banking relationships with the question *"Do you feel comfortable to talk about financing with banks and obtain the desired results"* (EC/ECB Survey on the access to finance for enterprises). Unfortunately, this question is only asked once every two years (once a year since 2013), resulting in a big loss of data. Table 4.8 shows the results of the baseline regressions when the answer to this question (yes or no) is included in the regression as a control variable (EC/ECB Survey on the access to finance for enterprises).

For expositional reasons, only the results for external finance in general, bank credit and lines of credit are presented. The results are highly comparable to Table 4.4, indicating that the findings hold when controlling for banking relationships. One interesting difference though is that the significance of the coverage by credit registries vanishes when controlling for relationship lending. This indicates that when SMEs have a strong relationship with their bank, credit registries are no longer necessary in order to get funding because the bank itself can obtain the required information.

Table 4.8: Cross-country variation – controlling for bank relationships

This table reports the mean parameters of 100 probit regression where the source of finance is regressed on several country characteristics. The reported coefficients for every variable are Odds-Ratios with the coinciding z-statistics in parentheses. The control variables are sales, profitability, GDP per capita, a dummy for a strong bank-relation group of industry dummies. Only firms that report that the investment needs have not affected their need for external finance negatively are included in the subsamples.***,**,* indicate a significance level of 1%, 5% and 10% respectively,with standard errors that are clustered at the country level.

	D_Ext		D_Loans		D_CreditLine	
BSIZE	1.002		1.000		1.000	
	(3.16)	***	(-0.65)		(-0.21)	
BRANCH	0.998		0.997		1.000	
	(-1.66)	*	(-2.41)		(-0.25)	
HI	1.752		1.002		1.423	
	(5.14)	***	(0.00)		(2.89)	***
MATURITY	1.030		1.030		1.069	
	(2.52)	***	(2.39)	***	(5.15)	***
BANKZ	1.006		1.012		1.005	
	(1.66)	*	(3.44)	***	(1.32)	
CR_COVERAGE	1.000		1.000		0.999	
	(0.13)		(0.05)		(-0.92)	
CR_QUALITY	1.055		0.972		1.106	
	(2.90)	***	(-1.43)		(4.88)	***
NR_IPO	1.005		1.003		1.007	
	(5.97)	***	(3.47)	***	(8.31)	***
MARKETCAP	0.896		0.975		0.824	
	(-6.24)	***	(-1.43)		(-10.16)	***
LIQUIDITY	1.030		1.030		1.015	
	(4.08)	***	(3.80)	***	(1.81)	*
RISK	0.857		0.886		0.758	
	(-6.08)	***	(-4.52)	***	(-10.21)	***
RULE_LAW	0.992		0.999		0.984	
	(-3.02)	***	(-0.44)		(-5.15)	***
DISCLOSURE	1.018		0.980		0.995	
	(1.90)	*	(-2.01)	**	(-0.50)	
PROTECT	1.021		0.956		1.044	
	(2.34)	***	(-4.53)	***	(4.30)	***
Control Variables	Yes		Yes		Yes	
Pseudo R Square	5.1%		5.1%		5.2%	
N	11,388		8,653		8,341	

In the baseline analysis it is not possible to include country fixed effects because some country variables (for example, creditor protection rights and the disclosure requirements) exhibit low variation over time. Table 4.9 reports the results when country fixed effects are added to (and the variables that vary insufficiently over time excluded from) the regression models (EC/ECB Survey on the access to finance for enterprises).

The effects of the variables related to banking sector development and stock market development are similar to the baseline regression in Table 4.4 in most cases. The majority of the variables related to banking sector development still have a positive effect on the access to external finance in general when controlling for country fixed effects. The same applies for bank credit specifically because either bank loans or lines of credit (or both) are positively affected by most banking sector variables. Two noteworthy changes are that banking competition and the quality of credit registries now has a significantly negative effect on the access to finance. For stock market development, it appears that the number of IPO's and the inverse risk level remain significantly positive.

Table 4.9: Cross-country variation – country fixed effects

This table reports the mean parameters of 100 probit regression where the source of finance is regressed on several country characteristics. The reported coefficients for every variable are Odds-Ratios with the coinciding z-statistics in parentheses. The control variables are sales, profitability, GDP per capita, and a group of industry and country dummies. Only firms that report that the investment needs have not affected their need for external finance negatively are included in the subsamples.***,**,* indicate a significance level of 1%, 5% and 10% respectively, with standard errors that are clustered at the country level.

	D_Ext		D_Loans		D_CreditLine	
BSIZE	1.011		1.006		1.016	
	(6.71)	***	(3.44)	***	(9.27)	***
BRANCH	0.997		1.005		0.960	
	(-0.87)		(1.11)		(-9.17)	***
HI	0.576		0.370		0.261	
	(-1.72)	*	(-2.80)	***	(-3.31)	***
MATURITY	1.036		1.033		1.071	
	(3.03)	***	(2.68)	***	(5.52)	***
BANKZ	1.021		1.014		1.006	
	(3.37)	***	(2.19)	**	(0.85)	
CR_COVERAGE	1.005		1.003		1.010	
	(5.39)	***	(3.25)	***	(8.84)	***
CR_QUALITY	0.473		0.843		0.776	
	(-7.30)	***	(-1.60)		(-1.97)	**
NR_IPO	1.007		1.005		1.012	
	(7.31)	***	(5.23)	***	(11.99)	***
MARKETCAP	0.707		0.878		1.085	
	(-5.99)	***	(-2.14)		(1..21)	
LIQUIDITY	0.966		1.031		1.008	
	(0.97)		(0.78)		(0.20)	
RISK	0.774		0.802		0.832	
	(-7.88)	***	(-6.31)	***	(-5.10)	***
Control Variables	Yes		Yes		Yes	
Pseudo R Square	6.6%		4.8%		7.5%	
N	19,885		15,429		14,544	

As addressed earlier, I disentangle supply-driven rationales from demand-driven rationales by ensuring that all firms in the sample have demand for external finance. In the baseline analysis, this is done by excluding firms from the sample where the current fixed investments, working capital investments and investments in corporate restructurings are affecting the demand for external finance in a negative way for *all three* types of investments. In other words, the firm is included if at least one of the three types of investments is not affected in a negative way. However, the source of finance is also dependent on the nature of the investments (e.g. trade credit is highly dependent on working capital investments but not on corporate restructurings). For this reason, the baseline regression is repeated conditional on every type of investment separately (while controlling for the other two). The results are reported in Table 4.10 (EC/ECB Survey on the access to finance for enterprises). The results remain highly similar for investments in working capital and fixed assets. For investments in corporate restructuring, the results are much weaker (i.e. less significant variables). This is not unsurprising because corporate restructurings are very rare for SME's, compared to investments in fixed assets and working capital.

Table 4.10: Cross-country variation – investment maturity

This table reports the average parameters of 100 probit regressions where the source of finance is regressed on several country characteristics. The reported coefficients for every variable are Odds-Ratios with the coinciding z-statistics in parentheses. The control variables are sales, profitability, GDP per capita, dummies for investment needs and industry dummies. Only firms who report that their investments in working capital (panel A), fixed assets (panel B) or corporate restructuring (panel C) have not affected their need for external finance negatively are included in the subsamples.***,**,* indicate a significance level of 1%, 5% and 10% respectively, with standard errors that are clustered at the firm level.

Panel A: Investments in Working Capital

	D_Ext	D_Loans	D_CreditLine	D_Trade	D_Subdebt	D_Informal	D_Equity
BSIZE	1.001	0.999	1.000	1.001	0.993	0.995	0.999
	(0.92)	(-1.37)	(-0.21)	(2.37) ***	(-3.41) ***	(-4.69) ***	(-0.49)
BRANCH	1.002	1.002	0.999	1.001	1.007	1.006	0.997
	(1.54)	(1.33)	(-0.90)	(0.95)	(1.95) **	(3.51) ***	(-1.36)
HI	1.980	1.190	1.590	3.521	3.972	1.879	2.341
	(4.85) ***	(1.11)	(3.04) ***	(7.12) ***	(2.40) ***	(2.42) ***	(2.64) ***
MATURITY	1.025	1.021	1.054	1.042	0.983	0.973	0.948
	(1.97) **	(1.66) *	(4.08) ***	(2.95) ***	(-0.47)	(-1.39)	(-2.07) **
BANKZ	0.993	1.006	1.006	0.971	0.985	0.994	1.021
	(-2.27) **	(1.80) *	(1.64)	(-7.62) ***	(-1.50)	(-1.11)	(3.18) ***
CR_COVERAGE	1.002	1.002	1.004	1.001	1.003	1.006	1.004
	(3.28) ***	(2.93) ***	(6.27) ***	(1.14)	(1.59)	(6.03) ***	(3.72) ***
CR_QUALITY	1.067	0.960	1.029	1.279	1.115	1.052	1.006
	(2.55) ***	(-1.50)	(1.09)	(7.88) ***	(1.33)	(1.19)	(0.12)

Table 4.10 Panel A (cont'd)

	D_Ext	D_Loans	D_CreditLine	D_Trade	D_Subdebt	D_Informal	D_Equity
NR_IPO	1.002	1.001	1.007	1.001	1.008	1.006	1.012
	(1.46)	(1.10)	(6.02) ***	(1.50)	(1.82) *	(2.86) ***	(5.70) ***
MARKETCAP	0.914	1.068	0.826	0.735	0.805	0.820	0.720
	(-3.73) ***	(2.59) ***	(-7.42) ***	(-11.31) ***	(-2.34) **	(-4.32) ***	(-5.91) ***
LIQUIDITY	1.038	1.013	1.034	1.096	1.147	1.083	1.057
	(4.57) ***	(1.60)	(3.85) ***	(8.95) ***	(5.13) ***	(6.16) ***	(3.29) ***
RISK	0.787	0.847	0.658	0.524	0.399	0.524	0.545
	(-7.70) ***	(-4.01) ***	(-12.59) ***	(-16.87) ***	(-7.46) ***	(-11.07) ***	(-8.08) ***
RULE_LAW	0.989	1.001	0.991	0.975	1.021	1.013	0.970
	(-4.33) ***	(0.37)	(-3.22) ***	(-8.86) ***	(2.17) **	(3.00) ***	(-5.72) ***
DISCLOSURE	0.994	0.942	1.000	0.988	0.842	0.913	0.954
	(-0.69)	(-6.18) ***	(-0.40)	(-1.12)	(-5.60) ***	(-5.99) ***	(-2.36) ***
PROTECT	1.046	0.993	1.030	1.107	1.125	1.118	1.072
	(4.31) ***	(-0.55)	(2.67) ***	(8.04) ***	(3.40) ***	(6.47) ***	(2.67) ***
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R Square	5.60%	3.60%	6.20%	13.40%	17.80%	9.70%	14.80%
N	11,209	9,309	8,787	7,551	3,348	5,136	4,336

Panel B: Investments in Fixed Assets

	D_Ext	D_Loans	D_CreditLine	D_Trade	D_Subdebt	D_Informal	D_Equity
BSIZE	1.000	0.999	1.000	1.001	0.994	0.994	1.000
	(0.63)	(-1.45)	(0.12)	(1.43)	(-2.93) ***	(-5.05) ***	(0.21)
BRANCH	1.003	1.002	1.000	1.003	1.006	1.006	0.998
	(2.63) ***	(1.27)	(-0.19)	(1.83) *	(1.60)	(3.19) ***	(-0.96)
HI	2.438	1.285	1.973	3.918	3.857	1.652	4.393
	(6.01) ***	(1.56)	(4.16) ***	(7.19) ***	(2.39) ***	(1.82) *	(4.34) ***
MATURITY	1.029	1.028	1.058	1.042	0.979	0.981	0.947
	(2.18) **	(2.04) **	(4.03) ***	(2.65) ***	(-0.56)	(-0.93)	(-1.99) **
BANKZ	0.992	1.006	1.005	0.969	0.984	0.996	1.025
	(-2.30) **	(1.82) *	(1.36)	(-7.35) ***	(-1.56)	(-0.74)	(3.49) ***
CR_COVERAGE	1.002	1.002	1.004	1.001	1.004	1.006	1.005
	(2.50) ***	(3.06) ***	(5.74) ***	(1.35)	(2.05) **	(6.17) ***	(-4.00) ***
CR_QUALITY	1.081	0.942	1.047	1.273	1.102	1.043	0.973
	(3.02) ***	(-2.17) **	(1.65) *	(7.31) ***	(1.22)	(0.97)	(-0.52)

Table 4.10 Panel B (cont'd)

	D_Ext	D_Loans	D_CreditLine	D_Trade	D_Subdebt	D_Informal	D_Equity
NR_IPO	1.000	1.003	1.007	1.001	1.006	1.006	1.012
	(0.02)	(2.84) ***	(5.95) ***	(1.01)	(1.29)	(2.59) ***	(5.08) ***
MARKETCAP	0.923	1.081	0.820	0.740	0.769	0.837	0.718
	(-2.87) ***	(2.93) ***	(-7.09) ***	(-10.12) ***	(-2.89) ***	(-3.75) ***	(-5.65) ***
LIQUIDITY	1.028	1.013	1.018	1.093	1.134	1.075	1.061
	(3.28) ***	(1.51)	(1.92) *	(8.08) ***	(4.76) ***	(5.37) ***	(3.38) ***
RISK	0.811	0.847	0.680	0.528	0.409	0.515	0.533
	(-6.39) ***	(-4.80) ***	(-10.83) ***	(-15.22) ***	(-7.24) ***	(-10.84) ***	(-7.97) ***
RULE_LAW	0.993	1.001	0.993	0.978	1.011	1.017	0.971
	(-2.48) ***	(0.40)	(-2.31) **	(-6.91) ***	(1.25)	(3.71) ***	(-5.17) ***
DISCLOSURE	0.998	0.939	1.012	0.986	0.862	0.910	0.961
	(-0.21)	(-6.11) ***	(1.13)	(-1.23)	(-4.96) ***	(-5.88) ***	(-1.84) *
PROTECT	1.039	1.003	1.016	1.123	1.124	1.110	1.085
	(3.39) ***	(0.24)	(1.30)	(8.35) ***	(3.30) ***	(5.79) ***	(3.01) ***
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R Square	5.70%	4.20%	5.80%	12.70%	16.20%	10.40%	14.90%
N	9,996	8,527	7,925	6,618	3,258	4,833	9,996

Panel C: Investments in Corporate Restructuring

	D_Ext	D_Loans	D_CreditLine	D_Trade	D_Subdebt	D_Informal	D_Equity
BSIZE	0.998	0.999	0.998	0.996	0.977	0.993	0.999
	(-1.84) *	(-0.76)	(-1.71) *	(-2.72) ***	(-4.40) ***	(-4.22) ***	(-0.56)
BRANCH	1.005	1.000	1.005	1.011	1.014	1.012	0.995
	(2.10) **	(0.22)	(2.24) **	(4.09) ***	(1.98) **	(3.91) ***	(-1.27)
HI	2.069	1.549	3.424	3.839	1.154	2.401	0.716
	(2.52) ***	(1.44)	(4.01) ***	(3.84) ***	(0.22)	(2.09) **	(-0.64)
MATURITY	1.042	1.036	1.027	1.025	1.010	1.009	0.976
	(1.64)	(1.42)	(1.03)	(0.88)	(0.10)	(0.25)	(-0.54)
BANKZ	0.988	1.013	1.002	0.942	0.985	0.992	1.014
	(-1.83) *	(1.97) **	(0.35)	(-7.30) ***	(-0.77)	(-0.84)	(1.21)
CR_COVERAGE	1.002	1.003	1.005	1.000	1.006	1.007	1.005
	(1.45)	(2.02) **	(3.88) ***	(-0.27)	(1.71) *	(3.99) ***	(2.30) **
CR_QUALITY	1.072	0.871	1.035	1.447	1.307	0.989	1.024
	(1.21)	(-2.36) ***	(0.57)	(5.45) ***	(1.36)	(-0.16)	(0.19)

Table 4.10 Panel C (cont'd)

	D_Ext	D_Loans	D_CreditLine	D_Trade	D_Subdebt	D_Informal	D_Equity
NR_IPO	1.002	1.005	1.007	0.998	1.004	1.007	1.021
	(0.61)	(1.78)	(2.28) **	(-0.65)	(0.54)	(1.83) *	(-4.16) ***
MARKETCAP	0.907	1.068	0.833	0.630	0.941	1.016	0.629
	(-2.03) **	(1.31)	(-3.64) ***	(-8.44) ***	(-0.46)	(0.22)	(-3.81) ***
LIQUIDITY	1.050	1.033	1.046	1.139	1.298	1.083	1.032
	(3.20) ***	(2.08) **	(2.79) ***	(6.69) ***	(4.58) ***	(3.92) ***	(1.12)
RISK	0.732	0.906	0.657	0.448	0.265	0.585	0.476
	(-4.58) ***	(-1.44)	(-5.82) ***	(-9.71) ***	(-5.80) ***	(-5.81) ***	(-4.67) ***
RULE_LAW	0.996	0.998	0.999	0.982	1.050	1.026	0.963
	(-0.78)	(-0.49)	(-0.27)	(-3.22) ***	(2.52) ***	(3.42) ***	(-3.63) ***
DISCLOSURE	0.968	0.913	0.978	0.975	0.763	0.864	0.948
	(-1.87) *	(-5.07) ***	(-1.26)	(-1.27)	(-4.66) ***	(-6.03) ***	(-1.42)
PROTECT	1.083	1.023	1.059	1.175	1.133	1.146	1.058
	(3.98) ***	(1.13)	(2.70) ***	(6.57) ***	(2.11) **	(5.08) ***	(1.17)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R Square	7.70%	5.80%	5.80%	15.50%	18.50%	8.20%	18.50%
N	3,255	2,844	2,780	2,521	1,492	2,146	1,647

The goal of this paper is to find out which country characteristics related to banking sector development, stock market development and the legal framework affect the access to finance for SMEs. It is interesting to know how much the variation across countries improves the explanatory power of a model that only considers firm characteristics. Table 4.11 reports two Pseudo R^2's; the R^2 of a stripped model with only firm characteristics and the R^2 of a complete model with all types of country characteristics (EC/ECB Survey on the access to finance for enterprises). Next to this, the change in the R^2 of the different types of country characteristics are reported in order to see which kind of country characteristics improve the explanatory power of the regression models the most. These incremental values for the Pseudo R^2's are relative to the stripped model.

Table 4.11: Pseudo R^2 disentanglement

This table reports the average Pseudo R^2's of 100 probit regressions where the sources of finance are regressed on firm characteristics only and on firm characteristics plus all country characteristics. In addition, the incremental average Pseudo R^2's of the following four (groups of) country variables are reported; GDP per capita, banking sector development, stock market development and legal development. These incremental R^2's are the changes to the R^2 of the model with the firm characteristics only.

	Total Psuedo R Squares						
	D_Ext	D_Loans	D_CreditLine	D_Trade	D_Subdebt	D_Informal	D_Equity
Stripped (Firm Variables Only)	2.51%	2.19%	1.37%	3.28%	3.78%	1.89%	1.90%
Total	4.53%	3.66%	4.48%	12.17%	15.12%	9.16%	11.51%
	Incremental Psuedo R Squares						
GDP per Capita	0.18%	0.19%	0.13%	0.12%	0.40%	0.28%	0.14%
Banking Sector Variables	1.41%	0.98%	1.43%	4.89%	4.60%	2.97%	3.73%
Stock Market Variables	0.99%	0.17%	1.96%	4.50%	6.04%	4.44%	6.64%
Legal Framework Variables	0.31%	0.72%	0.07%	0.72%	1.09%	0.48%	0.31%
Total Increment	**2.02%**	**1.47%**	**3.11%**	**8.89%**	**11.34%**	**7.27%**	**9.61%**

It appears that country variation is highly important in explaining the access to finance for SME's. In the model for external finance in general, the Pseudo R^2 almost doubles when all country characteristics are added to the model. For bank finance, the Pseudo R^2 increases roughly 1.5 times for bank loans and it triples for lines of credit. For the alternative forms of finance the explanatory power increases with a factor 4 or higher. The abilities of SMEs to attract finance are quite volatile over time because especially banking sector and stock market development (i.e. time-variant country characteristics) increase the explanatory power of the models, while the increase in explanatory power is quite limited for legal development (i.e. time-invariant country characteristics). Surprisingly, stock market development seems to be even more important than banking sector development in explaining the access to finance for SMEs, because the explanatory power of stock market development is stronger in all specifications, except bank loans (taking into account that stock market development is estimated by four variables and banking sector development by seven). Stable stock markets indicate optimism about the future state of the economy, which is highly important because lenders are more willing to provide finance to risky and opaque firms (i.e. SMEs) if they foresee bright market conditions and have better information. However, stable stock markets are not helpful during times of crisis, as shown in Table 4.5.

4.5 Conclusion

This study investigates how several determinants of the banking sector development, stock market development and the legal framework at the national level affect the access to finance for SMEs.

The most interesting findings regarding banking sector development

are as following. First, almost all variables that approximate for banking sector development result in better access to bank finance during crisis periods, while banking sector development does not help to acquire alternative forms of finance during a crisis. This means that firms who cannot access bank credit during the crisis in a developed banking sector are likely to have troubles in acquiring external finance. Second, of all the proxies that estimate banking sector development, competition and bank loan maturity seem to be to most important ones. Bank loan maturity and banking sector competition are the only two proxies that have a consistently positive effect on the access to finance in general, the access to bank finance in particular (both during crisis and non-crisis periods) and on the ability to substitute bank credit for trade credit. Third, the results on the effects of credit registries on the access to finance are mixed. Both a strong coverage by and a good quality of credit registries increases the likelihood to attract external finance in general and bank credit specifically. However, strong coverage decreases the likelihood that firms can attract bank finance during times of crisis, while strong quality increases the likelihood of attracting bank finance. This implies that credit registries only improve the access to bank finance for SMEs during a crisis when they are of exceptional quality. In addition, strong coverage increases the likelihood that SMEs can substitute a loss in bank credit availability with informal finance or equity, but not with trade credit (which has generally lower costs of capital). Paradoxically, high quality of credit registries increases the likelihood of substituting bank credit with trade credit, but not with informal finance or equity. This means that better coverage by credit registries improves the likelihood of attracting alternative forms of finance

when banks cut their lending and the higher the quality of those credit registries the lower the costs of capital of the source of finance they can attract.

Regarding stock market development it appears that the occurrence of IPO's, liquidity and the inverse risk have a positive effect on the likelihood of acquiring any form of external finance. Therefore, it also is not surprising that these three factors positively contribute to the likelihood of substituting bank credit for any other form of finance.

During a crisis, firms in liquid stock market with a low risk level prefer to fund themselves with equity instead of debt, while firms fall back on bank debt in stock markets that are less liquid and have a higher risk level.

The evidence on legal development is rather weak. Only creditor protection rights seem to have the desired effect. SMEs located in countries with strong creditor protection rights have a higher likelihood of attracting external finance in general and bank finance specifically. Also, alternative lenders are more willing to step in when banks cut their lending when the creditor protection rights are strong. However, creditor protection rights do not seems to work optimal during times of crisis, because the likelihood of attracting any form of external finance during a crisis is actually lower in countries with stronger creditor protection rights.

These findings are important to take into account for policy implications regarding SME finance. Important examples are the rules set by the European Central Bank (ECB). This paper helps the ECB to better estimate how policy changes will affect the access to finance for SMEs in Europe and whether different countries are impacted by policy changes in different ways. It is also relevant for (future changes in) the Basel Accords,

since capital requirement probably effect SMEs in different ways than large firms and because the dependency on banks differs across countries.

4.6 Appendices

Table A1: List of Hypotheses

Panel A: Access to finance in general
Research Question 1a: Does banking sector development improve the access to finance for SMEs?
H1.1a Size of the banking sector has a positive effect on the access to external finance for SMEs
H1.1b Scope of the banking sector has a positive effect on the access to external finance for SMEs
H1.1c Competition of the banking sector has a positive effect on the access to external finance for SMEs
H1.1d Loan maturity has a positive effect on the access to external finance for SMEs
H1.1e Creditworthiness of the banking sector has a positive effect on the access to external finance for SMEs
H1.1f Coverage by credit registries has a positive effect on the access to external finance for SMEs
H1.1g Quality of credit registries has a positive effect on the access to external finance for SMEs
H1.1a' Size of the banking sector has a stronger effect on bank finance than on alternative forms of finance for SMEs
H1.1b' Scope of the banking sector has a stronger effect on bank finance than on alternative forms of finance for SMEs
H1.1c' Competition of the banking sector has a stronger effect on bank finance than on alternative forms of finance for SMEs
H1.1d' Loan maturity has a stronger effect on bank finance than on alternative forms of finance for SMEs
H1.1e' Creditworthiness of the banking sector has a stronger effect on bank finance than on alternative forms of finance for SMEs
H1.1f' Coverage by credit registries has a stronger effect on bank finance than on alternative forms of finance for SMEs
H1.1g' Quality of credit registries has a stronger effect on bank finance than on alternative forms of finance for SMEs
Research Question 1b: Does stock market development improve the access to finance for SMEs?
H1.2a Total market cap has a positive effect on the access to external finance for SMEs
H1.2b Number of IPO's has a positive effect on the access to external finance for SMEs
H1.2c Liquidity has a positive effect on the access to external finance for SMEs
H1.2d Risk has a negative effect on the access to external finance for SMEs
H1.2a' Total market cap has a stronger effect on bank finance than on alternative forms of finance for SMEs
H1.2b' Number of IPO's has a stronger effect on bank finance than on alternative forms of finance for SMEs
H1.2c' Liquidity has a stronger effect on bank finance than on alternative forms of finance for SMEs
H1.2d' Risk has a stronger effect on bank finance than on alternative forms of finance for SMEs

Panel A: Access to finance in general (cont'd)

Research Question 1c: Does legal development improve the access to finance for SMEs?

H1.3a	Rule of law has a positive effect on the access to external finance for SMEs
H1.3b	Strong disclosure requirements have a positive effect on the access to external finance for SMEs
H1.3c	Strong creditor protection rights have a positive effect on the access to external finance for SMEs
H1.3a'	Rule of law has a stronger effect on bank finance than on alternative forms of finance for SMEs
H1.3b'	Strong disclosure requirements have a stronger effect on bank finance than on alternative forms of finance for SMEs
H1.3c'	Strong creditor protection rights have a stronger effect on bank finance than on alternative forms of finance for SMEs

Panel B: Access to finance during crisis

Research Question 2a: Does banking sector development helps to attract external finance during times of crisis?

H2.1a	SMEs in banking sectors with a bigger size have easier access to external finance during a crisis, relative to SMEs in banking sectors with a smaller size
H2.1b	SMEs in banking sectors with a bigger scope have easier access to external finance during a crisis, relative to SMEs in banking sectors with a smaller scope
H2.1c	SMEs in strongly competitive banking sectors have easier access to external finance during a crisis, relative to SMEs in banking sectors with a weakly competitive banking sector
H2.1d	SMEs is banking sectors that extend debt with longer maturity have easier access to external finace during a crisis, relative to SMEs in banking sectors that extend debt with shorter maturity
H2.1e	SMEs in high creditworthy banking sectors have easier access to external finance during a crisis, relative to SMEs in banking sectors with a low creditworthy banking sector
H2.1f	SMEs in areas with strong coverage by credit registries have easier access to external finance during a crisis, relative to SMEs in areas with weak coverage by credit registries
H2.1g	SMEs in areas with high quality credit registries have easier access to external finance during a crisis, relative to SMEs in areas with low quality credit registries

Research Question 2b: Does stock market development helps to attract external finance during times of crisis?

H2.2a	SMEs in large stock markets have easier access to external finance during a crisis, relative to SMEs in small stock markets
H2.2b	SMEs in stock market with frequent IPOs have easier access to external finance during a crisis, relative to SMEs in stock market with infrequent IPOs
H2.2c	SMEs in liquid stock markets have easier access to external finance during a crisis, relative to SMEs in illiquid stock markets
H2.2d	SMEs in stock markets with a high risk have poorer access to external finance during a crisis, relative to SMEs in stock markets with a low risk

Research Question 2c: Does legal development helps to attract external finance during times of crisis?

H2.3a	SMEs in areas with a strong rule of law have easier access to external finance during a crisis, relative to SMEs in areas with a weak rule of law.
H2.3b	SMEs in areas with strong disclosure requirements have easier access to external finance during a crisis, relative to SMEs in areas with weak disclosure requirements
H2.3c	SMEs in areas with strong creditor protection rights have easier access to external finance during a crisis, relative to SMEs in areas with weak creditor protection rights

Panel C: Substitution

Research Question 3a: Does banking sector development helps to substitute bank credit for alternative sources of finance?

H3.1a SMEs in banking sectors with a bigger size are more likely to substitute a negative shock to bank credit with alternative sources of finance

H3.1b SMEs in banking sectors with a bigger scope are more likely to substitute a negative shock to bank credit with alternative sources of finance

H3.1c SMEs in strongly competitive banking sectors are more likely to substitute a negative shock to bank credit with alternative sources of finance

H3.1d SMEs is banking sectors that extend debt with longer maturity are more likely to substitute a negative shock to bank credit with alternative sources of finance

H3.1e SMEs in high creditworthy banking sectors are more likely to substitute a negative shock to bank credit with alternative sources of finance

H3.1f SMEs in areas with strong coverage by credit registries are more likely to substitute a negative shock to bank credit with alternative sources of finance

H3.1g SMEs in areas with high quality credit registries are more likely to substitute a negative shock to bank credit with alternative sources of finance

Research Question 3b: Does stock market development helps to substitute bank credit for alternative sources of finance?

H3.2a SMEs in large stock markets are more likely to substitute a negative shock to bank credit with alternative sources of finance

H3.2b SMEs in stock market with frequent IPOs are more likely to substitute a negative shock to bank credit with alternative sources of finance

H3.2c SMEs in liquid stock markets are more likely to substitute a negative shock to bank credit with alternative sources of finance

H3.2d SMEs in stock markets with a high risk are less likely to substitute a negative shock to bank credit with alternative sources of finance

Research Question 3b: Does legal development helps to substitute bank credit for alternative sources of finance?

H3.3a SMEs in areas with a strong rule of law are more likely to substitute a negative shock to bank credit with alternative sources of finance

H3.3b SMEs in areas with strong disclosure requirements are more likely to substitute a negative shock to bank credit with alternative sources of finance

H3.3c SMEs in areas with strong creditor protection rights are more likely to substitute a negative shock to bank credit with alternative sources of finance

Table A2: Cross-country sample size

Table A2 reports the sample size across countries from both data sources. The numbers reported for the SAFE survey are *firm-years* because the SAFE survey does not have a time-series element (i.e. every time a survey is conducted the participating firms are different from the previous survey). The raw number represents the actual number of observations in the SAFE survey for every country, while the adjusted number represents the number of firms that is included in the regressions (the number of observations per country is capped at 1,000, 1,500 or 2,000 depending on the size of the country). The weight represents the relative weight of the adjusted number to the total number of observations.

Country	raw	Adjusted	Weight
Albania	294	294	0.9%
Austria	5,508	1,000	3.0%
Belgium	5,619	1,000	3.0%
Bulgaria	2,024	1,000	3.0%
Croatia	822	822	2.4%
Cyprus	480	480	1.4%
Czech Republic	1,921	1,000	3.0%
Denmark	1,990	1,000	3.0%
Estonia	473	473	1.4%
Finland	5,032	1,000	3.0%
France	12,990	2,000	5.9%
Germany	12,856	2,000	5.9%
Greece	5,693	1,000	3.0%
Hungary	2,016	1,000	3.0%
Iceland	503	503	1.5%
Ireland	5,062	1,000	3.0%
Israel	190	190	0.6%
Italy	13,347	2,000	5.9%
Latvia	833	833	2.5%
Lithuania	900	900	2.7%
Luxembourg	467	467	1.4%
Macedonia	291	291	0.9%
Malta	475	475	1.4%
Montenegro	395	395	1.2%
Netherlands	6,412	1,500	4.4%
Norway	456	450	1.3%
Poland	4,652	1,000	3.0%
Portugal	5,771	1,000	3.0%
Romania	2,033	1,000	3.0%
Serbia	190	190	0.6%
Slovakia	902	902	2.7%
Slovenia	640	640	1.9%
Spain	12,869	2,000	5.9%
Sweden	1,983	1,000	3.0%
Switzerland	100	100	0.3%
Turkey	856	856	2.5%
United Kingdom	4,472	2,000	5.9%
Total	**121,517**	**33,761**	**100%**

Table A3a: Descriptive Statistics for Country Characeristics (Banking Sector)

This table presents the mean values of the proxies for banking sector development over the period 2009-2015 within every country. The variables are winsorized at the level of 1 and 99%. The countries are classified on their legal origin, which is based on La-Porta et al. (1997) and Djankov et al. (2007). In the table, the cross-country mean for every legal origin is presented, together with the standard deviation and the variation width.

	BSIZE	BRANCH	HI	MATURITY	BANKZ	CR_COVERAGE	CR_QUALITY
Nordic countries							
Denmark	175	33	0.42	4.8	9.8	8	6
Finland	92	14	0.87	4.4	7.6	19	6
Iceland	124	48	0.52	4.1	-0.8	100	7
Norway	85	11	0.08	5.2	6.6	100	6
Sweden	129	22	0.43	4.6	7.8	100	5
Mean	121	25.6	0.46	4.6	6.2	65.4	6
standard deviation	35.8	15.1	0.28	0.4	4.1	47.5	0.7
max – min	90	37	0.79	1.2	10.7	92	2
Germanic countries							
Austria	94	15	0.72	5.3	21.7	52	7
Bulgaria	63	63	0.62	7.9	1.6	58	5
Croatia	68	34	0.4	5.8	5.5	97	6
Czech Republic	50	24	0.66	5.2	4.5	87	7
Estonia	78	15	0.55	4.4	8.6	31	7
Germany	85	15	0.8	4.5	16.5	100	8
Hungary	49	16	0.61	5	5.1	58	5
Latvia	59	24	0.46	9.6	2.7	73	6
Macedonia	47	24	0.4	0	4.7	100	7
Montenegro	53	42	0.06	4.6	5.9	26	5
Poland	52	33	0.61	5.7	8	82	8
Serbia	46	37	0.76	5.2	11.7	100	7
Slovakia	50	27	0.81	5.2	14.7	66	6
Slovenia	64	34	0.72	5.6	4.2	88	5
Switzerland	161	50	0.67	4.5	11.1	27	6
Mean	67.9	30.2	0.59	5.2	8.4	69.7	6.3
standard deviation	29.6	13.9	0.2	2	5.7	26.9	1
max – min	115	48	0.75	9.6	20.1	74	3

Table A3a (cont'd)

	BSIZE	BRANCH	HI	MATURITY	BANKZ	CR_COVERAGE	CR_QUALITY
Common Law countries							
Ireland	106	25	0.71	5.9	5.7	100	7
Israel	68	20	0.42	3.9	23.3	99	7
United Kingdom	152	25	0.59	5.2	8.9	100	8
Mean	108.7	23.3	0.57	5	12.6	99.7	7.3
standard deviation	42.1	2.9	0.15	1	9.4	0.6	0.6
max - min	84	5	0.29	2	17.6	1	1
French-Roman countries							
Albania	41	23	0.49	0	3.5	19	6
Belgium	57	42	0.74	5	11.2	84	5
Cyprus	175	47	0.91	5.9	4	20	5
France	96	40	0.69	5.1	10.4	41	6
Greece	114	35	0.83	5.6	1.6	78	7
Italy	91	64	0.75	6	10.6	100	7
Lithuania	44	30	0.9	3.5	3.8	100	8
Luxembourg	95	84	0.68	4.8	23.3	8	5
Malta	117	40	0	7.2	16.4	8	5
Netherlands	116	19	0.76	4.8	8.1	83	7
Portugal	145	60	0.76	6.7	11.2	100	7
Romania	41	32	0.86	7.1	3.8	58	7
Spain	152	83	0.44	6.2	13.7	64	7
Turkey	68	19	0.71	9.4	6.2	85	6
Mean	96.6	44.1	0.68	5.5	9.1	60.6	6.3
standard deviation	43	21.4	0.24	2.1	6	35	1
max - min	134	65	0.91	9.4	21.7	92	3
Overall Sample							
Mean	100.2	39.1	0.69	5.5	10.3	77.2	6.7
Median	94.9	33	0.71	5.1	10.1	82.5	7
Standard Deviation	36.8	22.8	0.14	1.6	5.9	30.8	1

Table A3b: Descriptive Statistics for Country Characeristics
(Stock Market)

This table presents the mean values of the proxies for stock market development over the period 2009-2015 within every country. The variables are winsorized at the level of 1 and 99%. The countries are classified on their legal origin, which is based on La-Porta et al. (1997) and Djankov et al. (2007). In the table, the cross-country mean for every legal origin is presented, together with the standard deviation and the variation width.

	NR_IPO	LN_MARKETCAP	LIQUIDITY	RISK
Nordic countries				
Denmark	5	6.7	12.6	0.64
Finland	4	6.2	14.0	0.82
Iceland	0	1.6	n/a[29]	0.65
Norway	12	5.3	14.5	1.19
Sweden	18	5.8	14.6	0.76
Mean	7.8	5.1	11.1	0.81
standard deviation	7.2	2.0	6.3	0.22
max - min	18	5.1	14.6	0.55
Germanic countries				
Austria	4	6.8	11.9	0.69
Bulgaria	2	5.8	n/a[29]	0.93
Croatia	1	2.8	6.9	1.52
Czech Republic	2	2.4	10.1	2.01
Estonia	0	5.1	9.7	1.04
Germany	24	6.7	11.1	0.75
Hungary	1	1.0	11.5	6.69
Latvia	2	5.0	n/a[29]	1.43
Macedonia	0	3.3	n/a[29]	0.91
Montenegro	0	9.2	n/a[29]	0.45
Poland	31	3.5	13.5	1.50
Serbia	0	6.2	n/a[29]	1.04
Slovakia	1	4.6	3.8	0.56
Slovenia	0	5.1	7.0	0.73
Switzerland	6	6.4	14.2	0.72
Mean	4.9	4.9	6.6	1.40
standard deviation	9.4	2.1	5.5	1.52
max - min	31	8.2	14.2	6.24

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[29] The regressions also have been conducted without the variable *LIQUIDITY* in order to be able to include these countries into the analyses. The results remain similar and therefore the results are not reported.

Table A3b (cont'd)	NR_IPO	LN_MARKETCAP	LIQUIDITY	RISK
Common Law countries				
Ireland	7	7.6	14.0	0.54
Israel	9	4.1	15.0	1.05
United Kingdom	104	8.6	17.0	0.42
Mean	40.0	6.8	15.3	0.67
standard deviation	55.4	2.4	1.5	0.33
max - min	97	4.5	3.0	0.63
French-Roman countries				
Albania	0	0.0	0.0	0.00
Belgium	5	6.9	12.8	0.52
Cyprus	2	3.6	10.8	2.13
France	29	7.6	15.1	0.61
Greece	3	6.1	13.6	1.56
Italy	17	7.4	16.8	0.77
Lithuania	1	4.6	9.4	0.74
Luxembourg	5	6.4	6.8	0.53
Malta	0	4.5	7.8	0.52
Netherlands	9	6.9	14.8	0.64
Portugal	1	4.9	15.0	1.04
Romania	2	5.7	13.6	1.03
Spain	19	6.0	15.6	0.97
Turkey	31	12.8	15.9	0.59
Mean	8.9	6.0	12.0	0.83
standard deviation	10.8	2.8	4.6	0.52
max - min	31	12.8	16.8	2.13
Overall Sample				
Mean	16.9	6.4	13.8	0.94
Median	9.0	6.6	14.4	0.75
Standard Deviation	23.6	1.6	2.5	0.95

Table A3c: Descriptive Statistics for Country Characeristics (Legal)

This table presents the mean values of the proxies for legal development over the period 2009-2015 within every country. The variables are winsorized at the level of 1 and 99%. The countries are classified on their legal origin, which is based on La-Porta et al. (1997) and Djankov et al. (2007). In the table, the cross-country mean for every legal origin is presented, together with the standard deviation and the variation width.

	RULE_LAW	DISCLOSURE	PROTECT
Nordic countries			
Denmark	99	7	8
Finland	100	6	7
Iceland	92	7	5
Norway	99	7	5
Sweden	99	8	6
Mean	97.8	7.0	6.2
standard deviation	3.3	0.7	1.3
max - min	8.0	2.0	3.0
Germanic countries			
Austria	97	5	5
Bulgaria	53	10	9
Croatia	64	3	5
Czech Republic	83	2	6
Estonia	86	8	7
Germany	92	5	6
Hungary	70	2	8
Latvia	75	5	9
Macedonia	52	7	6
Montenegro	58	5	12
Poland	75	7	7
Serbia	45	4	5
Slovakia	68	3	7
Slovenia	81	4	3
Switzerland	94	0	6
Mean	72.9	4.7	6.7
standard deviation	16.2	2.6	2.2
max - min	52	10.0	9.0

Table A3c (cont'd)	RULE_LAW	DISCLOSURE	PROTECT
Common Law countries			
Ireland	94	10	7
Israel	80	7	6
United Kingdom	93	10	7
Mean	89.0	9.0	6.7
standard deviation	7.8	1.7	0.6
max - min	14	3.0	1.0
French-Roman countries			
Albania	38	8	8
Belgium	89	8	4
Cyprus	83	7	7
France	89	9	4
Greece	66	5	3
Italy	64	7	2
Lithuania	76	7	6
Luxembourg	96	6	3
Malta	87	3	2
Netherlands	97	3	3
Portugal	83	6	2
Romania	60	9	10
Spain	83	5	5
Turkey	58	9	3
Mean	76.4	6.6	4.4
standard deviation	16.9	2.0	2.5
max - min	59	6	8
Overall Sample			
Mean	83.1	6.4	5.0
Median	88.4	6.0	5.0
Standard Deviation	13.1	2.2	2.1

Chapter 5
Conclusion

The chapters included in this dissertation try to deepen our understanding on the drivers of the access to and the use of finance for firms, with a strong emphasis on SMEs. In addition, it addresses the heterogeneity in the ways that firms can fund themselves. Therefore, after reading this dissertation the reader should better understand why different firms are funded in different ways. This dissertation considers the following topics, each covered in a different chapter; (a) which types of assets are the most useful sources of collateral in order to attract leverage; (b) whether the use of credit from banks and the use of credit from suppliers are moving in the same or in the opposite direction and what drives the interplay between them; (c) which frictions at the country level are the most important drivers of the access to (several sources of) finance and how the effects of these frictions differ during economic booms and recessions.

The first study is about the collateral channel, where the relationship between the asset structure and corporate leverage is investigated. This study confirms that property, plant and equipment is the best source of collateral for long-term debt, while accounts receivables is the best source of collateral for short-term debt. The usefulness of these assets to be used as collateral decreased during the financial crisis, but only for firms who are bank-dependent (i.e. financially constrained).

The second study is about the interplay between bank credit and trade credit, with a strong emphasis on the condition that bank credit decreases.

Under this condition, substitution relationships where firms can compensate the loss in bank credit with additional trade credit and complementary relationships where firms are also facing declines in trade credit are almost equally likely to occur. However, the first is much more likely to occur during economic booms, while the latter is much more likely to occur during economic recessions. Next to this, only firms of good credit quality are able to compensate a loss in bank credit with trade credit.

The last study is about the drivers of the access to finance at the country level. The study finds that firms who are located in countries with the following characteristics have the most access to external finance; highly competitive banking sectors, long debt maturity, high quality credit registries, high stock market liquidity, low stock market volatility and strong creditor protection rights. However, attracting external finance during a crisis is more difficult. Firms located in countries with highly developed banking sectors still do have more access to bank finance during a crisis relative to countries with underdeveloped banking sectors, but firms who are bank rationed in those countries also have difficulties in attracting alternative sources of finance.

Nederlandse Samenvatting

(summary in Dutch)

De hoofdstukken in deze dissertatie trachten onze kennis te verdiepen omtrent de determinanten van de toegang tot en het gebruik van financiering van bedrijven, waarbij een sterke nadruk wordt gelegd op de financiering van het MKB. Tevens belicht het de diversiteit in de manieren waarop bedrijven zich kunnen financieren. Na het lezen van deze dissertatie behoort de lezer beter te begrijpen waarom verschillende ondernemingen zich op verschillende manieren financieren. Deze dissertatie behandelt de volgende onderwerpen, die elk in een apart hoofdstuk aan bod komen; (a) welke vormen van activa het meest bruikbaar zijn als onderpand met het oog op het aantrekken van vreemd vermogen; (b) of het gebruik van bank krediet en leverancierskrediet in dezelfde of in tegengestelde richtingen lopen en welke factoren ten grondslag liggen aan het samenspel tussen deze twee financieringsvormen; (c) welke fricties op landsniveau de sterkste invloed hebben op de toegang tot (diverse vormen van) financiering en hoe de invloed van deze fricties verschillen ten tijde van hoog- en laagconjunctuur.

Het eerste onderzoek gaat over het gebruik van onderpand, waar de relatie tussen de activastructuur en de passivastructuur onderzocht wordt. Dit onderzoek bevestigt dat vaste activa het best bruikbare onderpand is voor langlopende leningen, terwijl debiteuren (een vorm van vlottende activa) het best bruikbare onderpand is voor kortlopende leningen. De bruikbaarheid van deze activa als onderpand is gedurende de financiële crisis echter aanzienlijk gedaald, maar alleen voor bedrijven die bank-

afhankelijk zijn (m.a.w. slechts beperkte toegang hebben tot financieringsvormen).

Het tweede onderzoek gaat over het samenspel tussen bank krediet en leverancierskrediet, waarbij een sterke nadruk wordt gelegd op de situatie waarin bedrijven minder bank krediet kunnen verkrijgen. Onder deze restrictie blijkt dat een substitutierelatie waarbij bedrijven het verlies in toegang tot bank krediet kunnen compenseren met extra leverancierskrediet en een complementaire relatie waarbij bedrijven ook minder toegang krijgen tot leverancierskrediet bijna even waarschijnlijk zijn om voor te komen. Echter, komt deze eerste situatie veel vaker voor tijdens hoogconjunctuur, terwijl de tweede situatie veel vaker voorkomt tijdens laagconjunctuur. Daarnaast zijn enkel bedrijven met een goede kredietwaardigheid in staat om het verlies in toegang tot bank krediet te kunnen compenseren met leverancierskrediet.

Het laatste onderzoek gaat over de factoren die de toegang tot financiering op landsniveau beïnvloeden. Het onderzoek geeft aan dat bedrijven die zich bevinden in landen met de volgende karakteristieken de meeste toegang hebben tot externe financiering; een competitieve bancaire sector, veel verstrekking van langlopende leningen, hoge kwaliteit van kredietregistratiebureaus, hoge liquiditeit op de aandelenmarkt, lage volatiliteit op de aandelenmarkt en sterke wetgeving omtrent bescherming van kredietverstrekkers. Echter, het aantrekken van externe financiering gedurende een crisis blijft lastig. Bedrijven die gelokaliseerd zijn in landen met een sterk ontwikkelde bancaire sector zijn nog in staat om bankleningen te verkrijgen tijdens een crisis, in vergelijking met landen in onderontwikkelde bancaire sectoren, bedrijven die echter al beperkte

toegang hebben tot bancaire leningen hebben in deze landen net zoveel moeilijkheden om alternatieve financiering aan te trekken.

References

Agarwal, V., Taffler, R. (2007). Twenty-five years of the Taffler Z-score model: Does it really have predictive ability? Accounting and Business Research, 37(4), 285-300.

Albuquerque, R., Ramadorai, T., Watugala, S. (2015). Trade Credit and Cross-Country Predictable Firm Returns. Journal of Financial Economics, 115(3), 592-613.

Almeida, H., Campello, M., Weisbach, M. (2004). The Cash Flow Sensitivity of Cash. Journal of Finance, 59(4), 1777-1804.

Altman, E. (1968). Financial Rations, Discriminant Analysis and the Prediction of Corporate Bankruptcy. Journal of Finance, 23(4), 589-609.

Atanasova, C. (2007). Access to Institutional Finance and the Use of Trade Credit. Financial Managemment, 36(1), 49-67.

Ayyagari, M., Beck, T., Demirgüç-Kunt, A. (2007). Small and Medium Enterprises Across the Globe. Small Business Economics, 29(4), 415-434.

Ayyagari, M., Demirgüç-Kunt, A., Maksimovic, V. (2010). Formal versus Informal Finance: Evidence from China. Review of Financial Studies, 23(8), 3048-3097.

Bancel, F., Mittoo, U. (2004). Cross-country determinants of capital structure choice: a survey of European firms. Financial Management, 33(4), 103-132.

Baker, M., Wurgler, J. (2002). Market Timing and Capital Structure. Journal of Finance, 57(1), 1-32

Basel Committee on Banking Supervision, 2006. Basel II: International Convergence of Capital Measurement and Capital Standards: A Revised Framework. June 2006.

Basel Committee on Banking Supervision, 2011. Basel III: A global regulatory framework for more resilient banks and banking systems. Revised version, June 2011.

Bates, T., Kahle, M., Stulz, R. (2009). Why Do U.S. Firms Hold So Much More Cash than They Used To? Journal of Finance, 64(5), 1985-2021.

Beck, T., Demirgüç-Kunt, A. (2006). Small and medium-size enterprises: Access to finance as growth constraint. Journal of Banking and Finance, 30(11), 2931-2943

Beck, T., Demirgüç-Kunt, A., Levine, R. (2005). SMEs, Growth and Poverty: Cross-Country Evidence. Journal of Economic Gowth, 10(3), 199-229

Beck, T., Demirgüç-Kunt, A., Maksimovic, V. (2004). Bank Competition and Access to Finance: International Evidence. Journal of Money, Credit and Banking, 36(3), 627-648.

Beck, T., Demirgüç-Kunt, A., Maskimovic, V. (2008). Financing patterns around the world: are small firms different? Journal of Financial Economics, 89(3), 467-487.

Beck, T., Demirgüç-Kunt, A., Martinez Peria, M. (2007). Reaching out: access to and use of banking services across countries. Journal of Financial Economics, 85(1), 234-266.

Beck, T., Demirgüç-Kunt, A., Martinez Peria, M. (2008). Banking services for everyone? Barriers to bank access around the world. World Bank Economic Review, 22(3), 397-430.

Beck, T., Kysucky, V., Norden, L. (2015). Credit information sharing and financing constraints. Working Paper Series.

Beck, T., Levine, R., Loayza, V. (2000). Finance and the Sources of Growth. Journal of Financial Economics, 58(1-2), 261-300.

Becker, B., Ivashina, V. (2014). Cyclicality of Credit Supply: Firm Level Evidence,. Journal of Monetary Economics, 62(1), 76-93.

Behr, P., Foos, D., Norden, L. (2017). Cyclicality of SME lending and government involvement in banks, Journal of Banking and Finance, 77(1), 64-77 .

Behr, P., Norden, L., Noth, F. (2013). Financial constraints of private firms and bank lending behaviour, Journal of Banking and Finance, 37(9), 3472-3485.

Benmelech, E., Bergman, N. (2011). Bankruptcy and the Collateral Channel. Journal of Finance, 66(2), 337-378.

Berger, A., Black, L. (2006). Bank size, lending technologies, and small business finance. Journal of Banking and Finance, 35(3), 724-735

Berger, A., Frame, S., Ioannidou, V. (2011). Tests of Ex Ante Versus Ex Post Theories of Collateral Using Private and Public Information. Journal of Financial Economics, 100(1), 85-97.

Berger, A., Kashyap, A., Scalise, J. (1995). The transformation of the U.S. banking industry: what a long, strange trip it's been, Brookings Papers on Economic Activity, 2(1), 55-218.

Berger, A., Miller, N., Petersen, M., Rajan, R., Stein, J. (2005). Does function follow organizational form? Evidence from the lending practices of large and small banks. Journal of Financial Economics, 76(2), 237-269.

Berger, A., Udell, G. (1995). Relationship lending and lines of credit in small firm finance. Journal of Business, 68(3), 351-381.

Berger, A., Udell, G. (2002). Small Business Credit Availability and Relationship Lending: The Importance of Bank Organisational Structure. Economic Journal, 112(477), F32-F53.

Berger, A., Udell, G. (2006). A more complete conceptual framework for SME finance. Journal of Banking and Finance, 30(11), 2945-2966.

Bernanke, B., Gertler, M. (1995). Inside the Black Box: The Credit Channel of Monetary Policy Transmission. Journal of Economic Perspectives, 9(4), 27-48.

Bertay, A., Demirgüç-Kunt, A., Huizinga, H. (2015). Bank ownership and credit over the business cycle: is lending by state banks less procyclical? Journal of Banking and Finance, 50(1), 326-339.

Bharath, S., Dahiya, S., Saunders, A., Srinivasan, A. (2011). Lending Relationships and Loan Contract Terms. Review of Financial Studies, 24(4), 1141-1203.

Biais, B., Gollier, C. (1997). Trade Credit and Credit Rationing. Review of Financial Studies, 10(4), 903-937.

Boissay, F., Gropp, R. (2013). Payment Defaults and Interfirm Liquidity Provision. Review of Finance, 17(6), 1853-1894.

Bolton, P., Freixas, X., Gambacorta, L., Mistrulli, P. (2016). Relationship and transaction lending in a crisis. Review of Financial Studies, 29(10), 2643-2676.

Boot, A., Thakor, A., Udell, G. (1991). Secured lending and default risk: equilibrium analysis, policy implications and empirical results. Economic Journal, 101(406), 458-472.

Booth, L., Aivazian, V., Demirgüç-Kunt, A., Maskimovic, V. 2001. Capital structure in developing countries. Journal of Finance, 56(1), 87-130.

Boyd, J., Graham, S. (1986). Risk, regulation, and bank holding company expansion into nonbanking. Quarterly Review-Federal Reserve Bank of Minneapolis, 10(1), 2-17.

Boyd, J., Graham, S., Hewitt, R. (1993). Bank holding company mergers with nonbank financial firms: effects on the risk of failure. Journal of Banking and Finance, 17(1), 43-63.

Bradley, M., Jarrell, G., Kim, E. (1984) On the Existence of an Optimal Capital Structure: Theory and Evidence. Journal of Finance, 39(3), 857-878.

Breza, E., Liberman, A. (2017). Financial Contracting and Organizational Form: Evidence from the Regulation of Trade Credit. Journal of Finance, 72(1), 291-324.

Byoun, S. (2008). How and Why Do Firms Adjust Their Capital Structure toward Targets. Journal of Finance, 63(6), 3069-3096.

Calabrese, R., Zenga, M. (2008). Measuring Loan Recovery Rate: Methodology and Empirical Evidence. Statistica & Applicazioni, 6(2), 193-214.

Calabrese, R., Zenga, M. (2010). Bank loan recovery rates: Measuring and nonparametric density estimation. Journal of Banking and Finance, 34(5), 903-911.

Campello, M., Giambona, E. (2013). Real Assets and Capital Structure. Journal of Financial and Quantitative Analysis, 48(5), 1333-1370.

Campello, M., Giambona, E., Graham, J., Harvey, C. (2012). Access to Liquidity and Corporate Investment in Europe during the Financial Crisis, Review of Finance, 16(1), 323-346.

Campello, M., Graham, J., Harvey, C. (2010). The real effects of financial constraints: Evidence from a financial crisis. Journal of Financial Economics, 97(3), 470-487.

Campello, M., Hackbarth, D. (2012). The Firm-Level Credit Multiplier. Journal of Financial Intermediation, 21(3), 446-472.

Carbo-Valverde, S., Rodriguez-Fernandez, F., Udell, G. (2016). Trade Credit, the Financial Crisis, and SME Access to Finance. Journal of Money, Credit and Banking, 48(1), 113-143.

Carbo-Valverde, S., Rodriguez-Fernandez, F., Udell, G. (2009). Bank market power and SME financing constraints. Review of Finance, 13(2), 309-340.

Casey, E., O'Toole, C. (2014). Bank lending constraints, trade credit and alternative financing during the financial crisis: Evidence from European SMEs. Journal of Corporate Finance, 27(1), 173-193.

Cressy, R., Olofsson, C. (1997). European SME Financing: An Overview. Small Business Economics, 9(2), 87-96

Chan, Y., Thakor, A. (1987). Collateral and Competitive Equilibria with Moral Hazard and Private Information, Journal of Finance, 42(2), 345-363.

Chaney, T., Sraer, D., Thesmar, D. (2012). The Collateral Channel: How Real Estate Shocks Affect Corporate Investment. American Economic Review, 102(6), 2381-2409.

Chava, S., Purnanandam, A. (2011). The Effects of Banking Crisis on Bank-Dependent Borrowers. Journal of Financial Economics, 99(1), 116-135.

Chung, K. (1993). Asset Characteristics and Corporate Debt Policy: An Empirical Test. Journal of Business Finance & Accounting, 20(1), 83-98.

Cowling, M., Liu, W., Ledger, A. (2012). Small business financing in the UK before and during the current financial crisis. International Small Business Journal, 30(7), 778-800.

Cumming, D., Johan, S., Li, D. (2011). Exchange trading rules and stock market liquidity. Journal of Financial Economics, 99(3), 651-671.

Cuñat, V. (2007). Trade Credit: Suppliers as Debt Collectors and Insurance Providers. Review of Financial Studies, 20(2), 491-527.

Davydenko, S., Franks, J. (2008). Do Bankruptcy Codes Matter? A Study of Defaults in France, Germany, and the U.K. Journal of Finance, 63(2), 565-608.

De Jong, A., Kabir, R., Nguyen, T. (2008). Capital structure around the world: the roles of firm- and country-specific determinants. Journal of Banking and Finance, 32(9), 1954-168.

Demirgüç-Kunt, A., Levine, R. (1996). Stock market development and financial intermediaries: stylized facts. World Bank Economic Review, 10(2), 291-321.

Demirgüç-Kunt, A., Maksimovic, V. (1996). Stock market development and financing choices of firms. World Bank Economic Review, 10(2), 341-369.

Demirgüç-Kunt, A., Maksimovic, V. (1998). Law, finance and firm growth. Journal of Finance, 53(6), 2107-2137.

Demirgüç-Kunt, A., Maksimovic, V. (1999). Institutions, financial markets and firm debt maturity. Journal of Financial Economics, 54(3), 295-336.

Demirgüç-Kunt, A., Maksimovic, V. (2002). Funding Growth in Bank Based and Market Based Financial Systems: Evidence from the Firm-Level Data. Journal of Financial Economics, 65(3), 337-363.

Denis, D., Mihov, V. (2003). The choice among bank debt, non-bank private debt, and public debt: evidence from new corporate borrowings. Journal of Financial Economics, 70(1), 3-28.

Denis, D., Sibilkov, V. (2010). Financial Constraints, Investment, and the Value of Cash Holdings. Review of Financial Studies, 23(1), 247-269.

Desai, M., Fritz Foley, C., Hiner Jr., J. (2004). A Multinational Perspective on Capital Structure Choice and International Capital Market. Journal of Finance, 59(6), 2451-2481.

Deutsche Bundesbank (2012). The importance of trade credit for corporate financing in Germany – evidence from financial statement statistics. Monthly Report October 2012, 51-63.

Devereux, M., Smith, G. (1994). International risk sharing and economic growth. International Economic Review, 35(3), 535-550.

Diamond, D. (1991). Debt maturity structure and liquidity risk. Quarterly Journal of Economics, 106(3), 709-737.

Djankov, S., McLiesh, C., Shleifer, A. (2007). Private credit in 129 countries. Journal of Financial Economics, 84(2), 299-329.

Donaldson, C. (1961). Corporate Debt Capacity. Harvard University

Duchin, R., Ozbas, O., Sensoy, B. (2010). Costly external finance, corporate investment, and the subprime mortgage credit crisis. Journal of Financial Economics, 97(3), 418-435.

EC/ECB Survey on the access to finance for enterprises. (2016).

Emery, G. (1987). An Optimal Financial Response to Variable Demand. Journal of Financial and Quantitative Analysis, 22(2), 209-225.

Engel, D., Stiebale, J. (2014). Private equity, investment and financial constraints: firm-level evidence for France and the United Kingdom. Small Business Economics, 43(1), 197-212

European Commission. (2005). The new SME definition. User guide and model declaration.

Eurostat. (2016). http://ec.europa.eu/eurostat/web/national-accounts/data/database

Fabbri, D., Menichini, A. (2010). Trade Credit, Collateral Liquidation, and Borrowing Constraints. Journal of Financial Economics, 96(3), 413-432.

Fama E., French, K. (2001). Disappearing Dividends: Changing Firms Characteristics or Lower Propensity to Pay? Journal of Financial Economics, 60(1), 3-43.

Fan, J., Titman, S., Twite, G. (2012). An international comparison of capital structure and debt maturity choices. Journal of Financial and Quantitative Analysis, 47(1), 23-56.

Farre-Mensa, J., Ljungqvist, A. (2016). Do Measures of Financial Constraints Measure Financial Constraints? Review of Financial Studies, 29(2), 271-308.

Faulkender, M., Petersen, M. (2006). Does the Source of Capital Affect Capital Structure? Review of Financial Studies, 19(1), 45-79.

Fazzari, S., Hubbard, G., Petersen, B. (1988). Financing Constraints and Corporate Investment, Brookings Papers on Economic Activity, 1988(1), 141-195.

Ferrando, A., Popov, A., Udell, G. (2015) Sovereign stress, unconventional monetary policy, and SME access to finance. European Central Bank - Working Paper Series

Fisman, R., Love, I. (2003). Trade Credit, Financial Intermediary Development and Industry Growth. Journal of Finance, 58(1), 353-73.

Frank, M., Goyal, V. (2009). Capital Structure Decisions: Which Factors Are Reliably Important? Financial Management, 38(1), 1-37.

Garcia-Appendini, E., Montoriol-Garriga, J. (2013). Firms as liquidity providers: Evidence from the 2007-2008 financial crisis. Journal of Financial Economics, 109(1), 272-291.

Gertler, D., Gilchrist, S. (1994). Monetary Policy, business cycles and the behavior of small manufacturing firms. Quarterly Journal of Economics, 109(2), 309-340.

Giannetti, M. (2003). Do better institutions mitigate agency problems? Evidence from corporate finance choices. Journal of Financial and Quantitative Analysis, 38(1), 185-212.

Giannetti, M., Burkart, M., Ellingsen, T. (2011). What You Sell Is What You Lend? Explaining Trade Credit Contracts. Review of Financial Studies, 24(4), 1261-1298.

Granger, C. (1969). Investigating Causal Relations by Econometric Models and Cross-Spectral Methods. Econometrica, 37(3), 424-438.

Greene, W. (2008). Econometric Analysis. Prentice Hall, Upper Saddle River, New Jersey.

Grunert, J., Weber, M. (2009). Recovery Rates of Commercial Lending: Empirical Evidence for German Companies. Journal of Banking and Finance, 33(3), 505-513.

Hadlock, C., Pierce, J. (2010). New Evidence on Measuring Financial Constraints: Moving Beyond the KZ Index. Review of Financial Studies, 23(5), 1909-1940.

Hannan, T., Hanweck, G. (1988). Bank insolvency risk and the market for large certificates of deposit. Journal of Money, Credit and Banking, 20(2), 203-211.

Hall, T. (2012). The Collateral Channel: Evidence on Leverage and Asset Tangibility. Journal of Corporate Finance, 18(3), 570-583.

Haselmann, R., Pistor, K., Vig, V. (2010). How Law affects Lending. Review of Financial Studies, 23(2), 549-580.

Herrmann, D., Saudagaran, S., Thomas, W. (2006). The Quality of Fair Value Measures for Property, Plant and Equipment. Accounting Forum, 30(1), 43-59.

Houston, J., Lin, C., Ma, Y. (2010). Creditor rights, information sharing, and bank risk taking. Journal of Financial Economics, 96(3), 485-512.

Illueca, M., Norden, L., Udell, G. (2014). Liberalization and Risk Taking: Evidence from Government-controlled Banks. Review of Finance, 18(4), 1217-1257.

Ivashina, V., Scharfstein, D. (2010). Bank Lending During the Financial Crisis of 2008. Journal of Financial Economics, 97(3), 319-338.

Jacobson, T., Von Schedvin, E. (2015). Trade Credit and the Propagation of Corporate Failure: An Empirical Analysis. Econometrica, 83(4), 1315-1371.

Jorion, P., Zhang, G. (2009). Credit contagion from counterparty risk. Journal of Finance, 64(5), 2053-2087.

Kale, J., Shahrur, H. (2007). Corporate Capital Structure and the Characteristics of Suppliers and Customers. Journal of Financial Economics, 83(2), 321-365.

Kahle, K., Walkling, R. (1996). The Impact of Industry Classifications on Financial Research. Journal of Financial and Quantitative Analysis, 31(3), 309-335

Kaplan, S., Zingales, L. (1997). Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints? Quarterly Journal of Economics, 112(1), 169-215.

Kashyap, A., Lamont, O., Stein, J., 1994. Credit Conditions and the Cyclical Behavior of Inventories. Quarterly Journal of Economics, 109(3), 565-92.

Kestens, K., Van Cauwenberge, P., Van Der Bauwhede, H. (2012). Trade credit and company performance during the 2008 financial crisis. Accounting and Finance, 52(4), 1125-1151.

Khieu, H., Mullineaux, D., Yi, H. (2012). The determinants of bank loan recovery rates. Journal of Banking and Finance, 36(4), 923-933.

King, G., Levine, R. (1993). Finance and Growth: Schumpeter Might Be Right. Quarterly Journal of Economics, 108(3), 717-737.

Kisgen, D. (2006). Credit Ratings and Capital Structure. Journal of Finance, 61(3), 1035-1072.

Kisgen, D. (2009). Do Firms Target Credit Ratings or Leverage Levels? Journal of Financial and Quantitative Analysis, 44(6), 1323-1344.

Kraus, A., Litzenberger, R. (1973). A state-preference model of optimal financial leverage. Journal of Finance, 28(4), 911–922.

Kysucky, V., Norden, L. (2016). The benefits of relationship lending in a cross-country context: a meta-analysis. Management Science, 62(1), 90-110.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R. (1997). Legal Determinants of External Finance. Journal of Finance, 52(3), 1131-1150.

Lamont, O., Polk, C., Saá-Requejo, J. (2001). Financial Constraints and Stock Returns. Review of Financial Studies, 14(2), 529-554.

Leary, M. (2009). Bank Loan Supply, Lender Choice, and Corporate Capital Structure. Journal of Finance, 64(3), 1143-1185.

Levine, R. (1997). Financial development and economic growth. Journal of Economic Literature, 35(2), 688-726.

Levine, R., Zervos, S. (1998). Stock markets, banks and economic growth. American Economic Review, 88(3), 537-558.

Love, I., Preve, L., Sarria-Allende, V. (2007). Trade credit and bank credit: Evidence from recent financial crises. Journal of Financial Economics, 83(2), 453-469.

Mason, C., Harrison, R. (1997). Business Angel Networks and the Development of the Informal Venture Capital Market in the U.K.: Is There Still a Role for the Public Sector, Small Business Economics, 9(2), 111-123

Mian, S., Smith, C. (1992). Accounts Receivable Management Policy: Theory and Evidence. Journal of Finance, 47(1), 169-200.

Modigliani, F., Miller, M. (1958). The cost of capital, corporate finance and the theory of investment. American Economic Review, 48(3), 261–297.

Modigliani, F., Miller, M. (1958). Corporate income taxes and the cost of capital: A correction. American Economic Review, 53(3), 433–443.

Morris, J. (1976). On corporate debt maturity strategies. Journal of Finance, 31(1), 29-37.

Murfin, J., Njoroge, K. (2014). The Implicit Costs of Trade Credit Borrowing by Large Firms. Review of Financial Studies, 28(1), 112-145.

Myers, S. (1984). The capital structure puzzle. Journal of Finance, 39(3), 575-592.

Myers, S., Majluf, N. (1984). Corporate financing and investment decisions when firms have information that investors do not have. Journal of Financial Economics, 13(2), 187-221.

Ng, C., Smith, J., Smith, R. (1999). Evidence on the determinants of credit terms used in interfirm trade. Journal of Finance, 54(3), 1109-1129.

Nilsen, J. (2002). Trade Credit and the Bank Lending Channel. Journal of Money, Credit and Banking, 34(1), 226-253.

Norden, L., Van Kampen, S. (2013). Corporate Leverage and the Collateral Channel. Journal of Banking and Finance, 37(12), 5062-5072.

Norden, L., Van Kampen, S., Illueca, M. (2017). Substitution effects in private debt: evidence from SMEs. Working Paper Series.

Peek, J., Rosengren, E. (1998). Bank consolidation and small business lending: it's not just bank size that matters. Journal of Banking and Finance, 22(6-8), 799-819.

Petersen, M.., Rajan, R. (1994). The Benefits of Lending Relationships: Evidence from Small Business Data. Journal of Finance, 49(1), 3-37.

Petersen, M., Rajan, R. (1997). Trade Credit: Theories and Evidence. Review of Financial Studies, 10(3), 661-691.

Poutziouris, P. (2001). The Views of Family Companies on Venture Capital: Empirical Evidence from the UK Small to Medium-Size Enterprising Economy, 14(3), 277-291

Puri, M., Rocholl, J., Steffen, S. (2011). Global Retail Lending in the Aftermath of the US Financial Crisis: Distinguishing between Supply and Demand Effects. Journal of Financial Economics, 100(3), 556-578.

Rajan, R., Winton, A. (1995). Covenants and collateral as incentives to monitor. Journal of Finance, 50(4), 1113-1146.

Rajan, R., Zingales, L. (1995). What do we know about capital structure? Some evidence from international data. Journal of Finance, 50(5), 1421-1460.

Rajan, R., Zingales, L. (1998). Financial Dependence and Growth. American Economic Review ,88(3), 559-586.

Smith, J. (1987). Trade Credit and Informational Asymmetry. Journal of Finance 42(4), 863-871.

Smolarski, J., Kut, C. (2009). The impact of venture capital financing on SME performance and internationalization. International Entrepreneurship and Management Journal, 7(1), 39-55

Stiglitz, J., Weiss, A. (1981). Credit rationing in markets with imperfect information. American Economic Review, 71(3), 393-410.

Strahan, P., Weston, J. 1996. Small business lending and bank consolidation: is there cause for concern? Current Issues in Economics and Finance 2, 2(3), 1-6.

Tuzel, S. (2010). Corporate Real Estate Holdings and the Cross-Section of Stock Returns. Review of the Financial Studies, 23(6), 2268-2302.

Udell, G. (2004). Asset Based Finance – Proven Disciplines for Prudent Lending. The Commercial Finance Association, 2004.

Uesugi, I., Yamashiro, G. (2008). The Relationship between Trade Credit and Loans: Evidence from Small Businesses in Japan. International Journal of Business, 13(2), 141-163.

Verbeek, M. (2012). A Guide to Modern Econometrics. John Wiley and Sons, Chichester.

Wang, T., Thornhill, S. (2010). R&D Investment and Financing Choices: A Comprehensive Perspective. Research Policy, 39(9), 1148-1159.

Whited, T., Wu, G. (2006). Financial Constraints Risk. Review of Financial Studies, 19(2), 531-559.

Worldbank (2016)
http://databank.worldbank.org/data/reports.aspx?source=global-financial-development

Worldbank (2016)
http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators

Worldbank (2016)
http://databank.worldbank.org/data/reports.aspx?source=doing-business

Yang, X. (2011). The Role of Trade Credit in the Recent Subprime Financial Crisis. Journal of Economics and Business, 63(5), 517-529.

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Stefan van Kampen was born on January 6th 1989 in Dirksland in the Netherlands. He owns a BSc in Business Administration and a MSc in Finance & Investments, both obtained from the Rotterdam School of Management. He started his career as a data librarian and became a lecturer at the Rotterdam School of Management shortly afterwards in 2013. During his job as a lecturer, he also worked on this dissertation. His teaching activities were mainly based on Empirical Corporate Finance, Banking and Statistics. Since September 1st 2017 he works as Senior Financial Policy Advisor at the Ministry of Interior Affairs and Kingdom Relationship of the Netherlands in The Hague.

Author Portfolio

<ins>Publications</ins>

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Corporate Finance Seminal, by Lars Norden

Applied Econometrics, by Marno Verbeek

<ins>Attended Conferences</ins>

1st Benelux Banking Research Day in Amsterdam, Netherlands, 2014

21st Meeting of the German Finance Association in Karlsruhe, Germany, 2014

13th Corporate Finance Day in Ghent, Belgium, 2015

<ins>Teaching</ins>

Research Methods in Finance, MScFI-programme (2013-2017)

Research Clinics in Finance, MiM-programme (2013-2017)

Corporate Finance, MiM-programme (2016)

Investments, MScFI-programme (2016)

Thesis supervision, MScFI, BScBA, and MiM-programme

<ins>Certificates</ins>

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Professor of the Year Award in MScFI, 2016

The ERIM PhD Series

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This dissertation discusses the access to finance of mostly financially constrained firms on several dimensions. The first study investigates the relationship between corporate leverage and the asset structure. It appears that non-current assets are more important sources of collateral than current assets. The collateral channel is more pronounced for bank-dependent firms, but it weakened the most for these firms during the crisis. The second study investigates whether SMEs receive more trade credit after they experienced a negative shock to bank credit. This ability to substitute depends in a positive way on the credit quality of the firms and the stage of the economy. Moderately financially constrained firms are most likely to substitute. The third study investigates how several variables related to banking sector development, stock market development and legal development affect the access to SME finance. The main finding is that SME's have better access to finance if they are located in countries with a competitive banking sector, with a strong preference for long debt maturity, with high quality credit registries, with liquid and low-volatile stock markets and with strong creditor protection rights.

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