UNIVERSITY OF GOTHENBURG
SCHOOL OF BUSINESS, ECONOMICS AND LAW

The Adverse Effects of Stricter Capital Regulation on the SME Bank Lending Channel

Palm Ballesta Rebecca: 920424
Poole Bonnier Fredrika: 920115

Master Thesis in Finance and Economics, 30 Credits
Graduate School
Supervisor: Elliot Viktor
Spring 2018

Abstract

The aim of this thesis is to investigate if stricter capital regulation creates negative shocks in the loan market and if these shocks adversely effect Small and Medium sized Enterprises (SME) access to external financing through the bank lending channel. This is tested through a Difference-in-Difference (DiD) model, where loan volume and interest rates of SMEs are compared to large firms in Europe from 2011 to 2016. The results indicate that there is a significant difference in both loan volume and price after 2014 when Basel III was implemented. Contrary to what was expected, the analysis show that SMEs seem better off after the implementation. The increase in lending and decrease in price towards SMEs relative to large firms indicating a healthier system. The mitigated effect of Basel III is assumed to be caused by factors such as the SME Supporting Factor.

Keywords: *SME, Bank Lending Channel, External Finance, Capital Regulation, Basel III, SME SF*

Contents

1 Introduction

Small and medium sized enterprises (SME) accounts for 99,8% of all firms in the EU-28 area. The importance of SMEs to the social well-being is well recognized, as these enterprises employ more people than all the largest firms do together. Increased difficulties for SMEs to access the funding they need to survive would have devastating consequences on the economy, given the their importance for the economy's well-being. Research on SMEs and their access to external financing is still relatively new and suffers from data problems. The mapping by Berger and Udell (1998) provides one of the more comprehensive overviews of the field, showing that bank loans serve as the main key channel for SME funding. More recent data from the Survey on the Access to Finance of Enterprises indicate that banks together with the use of trade credit, still serve as the two most prominent supply channels of finance to SMEs (ECB, 2017).

In the wake of the recent financial bank crisis and the European sovereign debt crisis, policy makers were concerned that the effects of the crisis would severely impact the bank lending towards SMEs. The implications were assumed to cause devastating effect for the economy as whole, given the vital presences of SMEs in the market and their reliance on the access to bank lending. In addition, stricter capital regulation was put in place because of the crisis, which could also amplify the negative effects of bank lending towards SMEs (Athanasoglou, Daniilidis, & Delis, 2014).

Previous academic literature have mainly focused on providing an understanding of the institutions and markets providing funding for SMEs (Berger & Udell, 2006; Mayer, 1994; Hernández-Cánovas & Martínez-Solano, 2010; Petersen & Rajan, 1994), but in the recent years the interest of understanding the negative impacts of capital regulation on SMEs access to bank credit has increased (Humblot, 2014; Izquierdo, Munoz, Rubio, & Ulloa, 2017; Koehn & Santomero, 1980; Bernanke & Lown, 1991; Elliot & Willesson, 2018) as well as SME experience of credit constraints (Casey & O'Toole, 2014; Mayordomo & Rodriguez-Moreno, 2017; Farinha & Félix, 2015; EBA, 2016). The long-run effects of the increased capital regulation in general are however debated. Some argue that the regulation will not spill over on the credit holders, but rather contribute to increased stability in the banking sector and have significant social benefits. On the other hand,

others claim that the increased capital requirements will have a negative effect on the economic activity (Miles, Marcheggiano, & Yang, 2011; Mehran & Thakor, 2011; Admati, DeMarzo, Hellwig, & Pfleiderer, 2014; Van Hoose, 2007; Peltzman, 1976).

The purpose of this thesis is therefore to further investigate if stricter capital regulation creates negative shocks in the loan market and if these adversely effect SMEs access to external financing through the bank lending channels. This thesis focuses on the supply side of bank lending by using both lending volumes and interest rates, the scope is delimited to the European market during 2011-2016. To address the purpose, two research questions are defined:

a) What are the effects of Basel III on bank loan volumes and interest rates in Europe?

b) How does these effects differ between SMEs and large firms?

This study extends previous work by moving beyond country-level evidence (Farinha & Félix, 2015; Izquierdo et al., 2017; Fidrmuc & Hainz, 2009; Humblot, 2014), allowing the model to control for different institutions and financing cultures. Following EBA (2016), Mayordomo and Rodriguez-Moreno (2017), Casey and O'Toole (2014), the research questions are examined by using a DiD model. However, this study estimates if Basel III causes adverse effects on lending towards SMEs, where loan volumes and interest rates of SMEs are compared to large firms during the implementation of Basel III. Whilst the prior reports rely on SAFE data to identify dependent variables and firm characteristics, this study utilize data from various data bases to include more variation and allows for smaller changes to be captured in the model. The approach has not been estimated in previous research and contributes to the existing literature with new insights about the impact of stricter capital requirement on SMEs access to finance and the effect of SME Supporting Factor.

This study finds evidence that the SMEs access to finance, in comparison to large firms, have improved to a greater extent after the introduction of Basel III. One plausible factor may be the SME support factor, which has facilitated lending towards SMEs. Con-

sequently, this study is the first, to the best of our knowledge, to identify an increase in access to finance for SMEs relative to large firms following the introduction of the SME supporting factor (SME SF).

The thesis is structured as followed: Section 2 provides background information about the importance of SMEs and the development of the Basel accords. Section 3 presents the theoretical framework and existing literature from which the results and analyses will be based on. Section 4 explains the model that is used to conduct the estimates, the variables included and how the data has been collected and handled. In section 5, the results are interpreted and the results are discussed in section 6 based on the theoretical framework. Section 7, presents our conclusion and provides suggestions for future research.

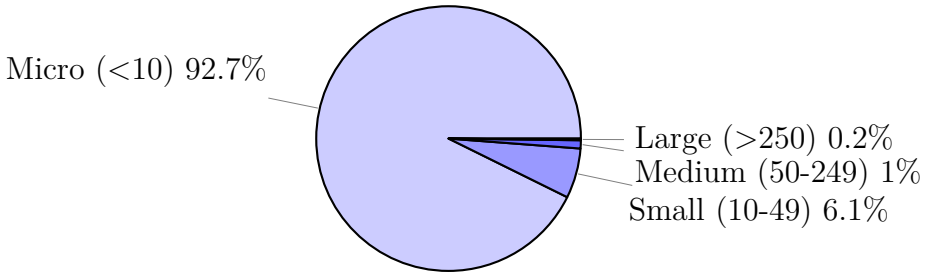
2 Background & Definition of Key Concepts

2.1 SME

Every enterprise needs to start somewhere; in most cases as a micro firm. Research shows that surviving firms then tend to grow, either organically or inorganically. A small fraction of these firms grow to become large firms and several studies points to the access to financing as an important feature for this to happen (Berger & Udell, 1998).

Following the majority of work on SMEs in Europe, we have utilized, the EU recommendation (2003/361/EC), stating that enterprises with less than 250 employees in combination with a turnover less than €50 million *or* a balance sheet smaller than €43 million are classified as SMEs. Figure 1 shows the division of European SMEs.

Figure 1: Division of Firms by size in Europe



*Numbers in parenthesis represents number of employees

As illustrated, SMEs represent 99,8% of all enterprises in the EU-28 area and employs 67% of the area's workforce, which makes SMEs*" ... the backbone of the European economy"* according to Muller et al. (2017). Furthermore, a positive link between the development of SMEs and economic growth, in terms of GDP per capita, have been witnessed (Beck, Demirguc-Kunt, & Levine, 2005).

As shown by figure 1, most companies remain small and constitutes the majority of all firms in the European market. Despite the importance of SMEs to our economy, information about them and their way of operations have been scarce throughout the history of economic theory. Berger and Udell (1998) recognize that the growing interest for SMEs and their financing began in the 1990's with the development of the flourishing innovative entrepreneurial sector, with companies such as Microsoft and Federal Express. As a result, regulators, policy makers and academics began to be more attentive to how the financial markets of small businesses were operating and how they were funded.

2.2 Capital regulation and Banking business

As credit providers, banks do in general play an important role in the economy as a special type of financial intermediaries, where they operate both as lenders with a monitoring role and provide liquidity to its customers (Rajan, 1996; Schmidt, Hackethal, & Tyrell, 1999). The implications of these two separate roles is described by Gjelsvik (2017, p. 39) who expresses it as: *"Note that banks are permanently facing the dilemma between a prudent management of their funds (on behalf of their investors and depositors) and their capacity to take risk"*. However, according to Izquierdo et al. (2017, p. 3) the global financial crisis resulted in *"... a regulatory tsunami in developed countries..."* as a consequence of

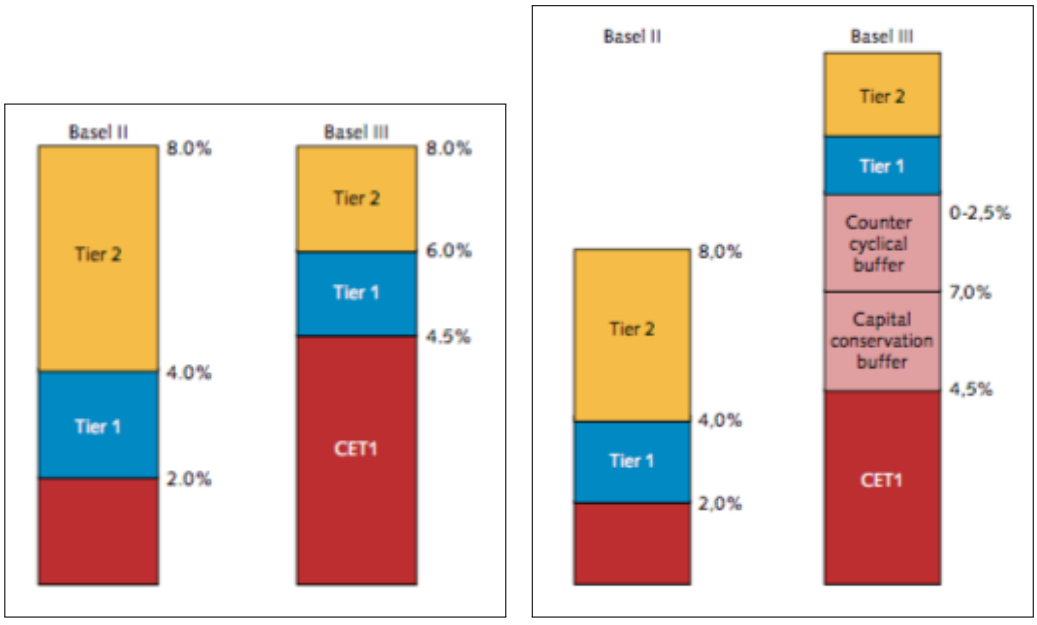
authorities' goal to reduce the probability of future financial crises as well as a way of managing the contraindicative roles of a bank. In Europe, increased capital regulation and its impact on bank lending channels is of particular interest since banks provide more than 70% of all debt in the market (Acharya, Eisert, Eufinger, & Hirsch, 2018)

Basel III is an extension of the old framework Basel II. However, at the time of the announcement of Basel III, policy makers were concerned that SMEs would be adversely effected by the increased in capital regulation. The issue being that Basel II introduced a new internal rating-based (IRB) approach where SMEs in general were considered to entail higher risks, causing higher ratings and thus higher capital recommendations than larger firms (Henneke & Truck, 2006). Therefore, special treatment was allowed on loans towards SMEs if the total exposure does not exceed €1 million between the parties where the SME credit could be treated the same way as for private individuals. Henneke and Truck (2006) continues by explaining that consideration was given to the benchmark risk-weights (BRW), which impacts the RWA and thus also the capital requirements, since there was a concern that credit conditions of SMEs might be effected negatively if banks were subjected to higher capital costs. Consequently, changes in the BRW function were made to reduce exposure for entities with a higher probability of default, such as SMEs, in the final version of Basel II.

Basel III is the most recent accord and is the regulation in use today, and several commentators have warned against the potential negative effects of this comprehensive framework (Schwerter, 2011; Blundell-Wignall & Atkinson, 2010). Basel III was announced in 2010 as a direct response to the financial crisis that started in 2007-2008, and was phased in until legally binding for all banks as of the 1st of January 2014 (Niemeyer, 2016). Figure 2 illustrates the difference in division and increase in the regulatory capital when comparing Basel II with Basel III. Figure 2b illustrates how the relative amounts of the different kind of capital are altered, where the Common Equity Tier 1 (CET1) has increased and Tier 1 as well as Tier 2 has decreased. Figure 2a shows both the new relative amounts of CET1 and Tier 1 and 2 capital as well as the additional capital buffers, Capital conservation (CCB) and Counter Cyclical (CCYB), introduced in Basel III. The CCB has a fixed relative amount of 2.5%, i.e. adding it to the previous total 8% of required capital

and making the new *minimum requirement* of Basel III 10.5%. In contrast, the CCYB is determined by the country in which the bank is operating in. The Basel framework allows the CCYB to vary between 0-2.5% and was added since one purpose of Basel III is to alleviate the pro-cyclicality of banks and increase the "capital cushion". This should protect depositors and deposit insurers from losses in the event of isolated or widespread bank failures. However, every country has the sovereign power to further increase the total capital regulation. Although it may seem that the regulation of capital increased substantially when Basel III was implemented, the BCSB in 2017 announced that even further additions will be made focusing on the calculations of the RWA rather than the leverage. The new additions are called Basel IV, and are to be phased in and expected to be fully implemented by 2022 (BCSB, 2017).

Figure 2: Difference between the capital requirements of Basel II and III



(a) Change in CET1 equity (b) Additional capital requirements

*Diagrams are borrowed from Niemeyer (2016)

The SME SF is embedded in Basel III to compensate for raised concern about the impact of capital regulation on SMEs. The SME SF was allowed by the Capital Requirements Regulation (CRR) with an intention to avoid *"... a reduction in the flow of new credit to SMEs"* according to Izquierdo et al. (2017, p. 18). The SME SF allows for a capital discount of 0.7619 to be made by the banks when lending to SMEs. The discount was

decided by dividing the capital requirements of 8% in Basel II, with the new requirement of 10,5% in Basel III (see fig. 2) which makes the calculation as follows:

$$\text{SME SF} \equiv \frac{\text{Capital requirement of Basel II (\%)}}{\text{Capital requirement of Basel III (\%)}} = \frac{8}{10.5} = 0.7619$$

The intent was to neutralize the effects of increased capital requirements towards SMEs and allow banks to keep the same level of SME lending as under the Basel II regulation (Izquierdo et al., 2017). The idea of the SME SF seems to be a continuation of the measures already taken in Basel II in order to facilitate lending toward SMEs. In order to be eligible to make the SME exposure reduced by the SME SF, the characteristics set by the European Commission are that the SME must have a turnover of less than €50 million and the total exposure towards the banking group cannot exceed €1,5 million (ECB, 2017).

3 Theoretical framework & Literature review

3.1 Information asymmetry

When looking at funding available through various markets, including the important debt market, Berger and Udell (1998) state that *"Because of its informational opacity, small business arguably is likely to bear a disproportionate share of the loss of funding that occurs when there is a market failure"*. The information opacity referenced is the theory of information asymmetry in the market. This occurs when the symmetric information assumption in the efficient market hypothesis fails to hold, information is asymmetric and prices are distorted and do not achieve optimality in the allocation of resources (Quy-Toan Do, 2004). Such asymmetry occurs when one agent in the market possesses more information than others about the relevant aspects of the trade being made. The insider, such as an entrepreneur or manager of an SME, has private information about the firm-/product/service for which an outsider cannot observe.

Consequently, asymmetric information causes problems such as adverse selection, moral hazard and agency costs. The outcome in the market could be a decrease in the lenders' incentive to provide loans, essentially creating negative externalities in the market and

making it inefficient (Tirole, 2006). Adverse selection arise before a loan is granted. An outsider cannot differ between good or bad borrowers, hence the outsider must either rely on the information received from the insider or increase monitoring fees and interest rates for all insiders to compensate for the increased default risk. However, given that bad borrowers are more likely to default on their loan they will be less affected by a higher interest rate relative to high-quality borrower, which means that higher interest rates tend to attract low-quality borrowers (Wollbrant, 2017). The problems of moral hazard arise after a loan is granted and funds are being managed by insiders. At this moment, only the insider has perfect information and gains full control of the funds. The outsider cannot observe the insider's carefulness in selecting projects, implementation of said investments, or efforts to act in the best interest of the firm (Tirole, 2006). The outsiders face an agency problem because of the probability of the borrower mismanaging the project and increasing their private benefit instead of maximizing the profit of the firm (Wollbrant, 2017).

When the problem of moral hazard is substantial, external equity finance, especially angel and venture capital may be particularly important. Before new ventures access significant amounts of external finance, they are often provided with angel financing and/or venture capital, indicating that the moral hazard problem is particularly substantial for these companies. When the need for external funding is high in relation to the insider's assets, including personal wealth at risk via pledges of personal collateral or guarantees, the risk of moral hazard increases (Berger & Udell, 1998). The choice of external equity or external debt is further affected by other arguments, for example, that external debt can be chosen to maintain the control within the company while external equity can be chosen to help share the risk with less risk-averse investors (Berger & Udell, 1998). Berger and Udell (1998) argue that the capital structure of small businesses is dependent on the management, which for small firms in most cases are the owners, implying that the agency problem does not exists but also introducing other factors impacting the decisions on capital structure, such as the risk-aversion and preference in the control-ownership trade-off in the firm when introducing capital from external parties.

In conclusion, the consequences of information asymmetry are many and have a great

impact on the operations and efficiency of the market. The Basel accords constitutes as a response to the existence of such negative externalities and market failures. In the following section we will discuss how information asymmetry impacts the bank lending channel towards SMEs in comparison to large corporations as well as how capital regulation is theorized to effects the loan market.

3.2 Small Business Finance

Since the late 90's, research on the importance and characteristics of SMEs has grown exponentially. As part of this growing interest, Berger and Udell (1998) adds to the literature by providing a complete picture of how the private equity and debt market work towards SMEs. By identify stages in the evolution of a firm and its need of additional/new funding, they contribute with new insights of development and the financial growth cycle of a firm (see A1 in appendix). As seen in figure A1, small and young firms are assumed to rely on the bank lending channel and trade credit early on in the growth cycle.

The financial growth cycle presented by Berger and Udell (1998) is similar to the pecking order hypothesis in the sense that it describes the financing preference of firms and that certain types of financing are preferred over others. Although, such a discussion is insignificant if considering the classic Modigliani-Miller theorem (Modigliani & Miller, 1958), which suggests that the cost of capital is unaffected by the choice of capital structure of a firm. However, the theorem assumes a competitive economy with no external forces affecting the outcome, making it less or not at all applicable in today's economy. The choice of external capital is therefore relevant, where the pecking order hypothesis claims that internal financing, e.g. retained earnings and initial equity, are preferred over external funds, such as debt and new issuance of equity. In addition, when the internal funds have been exhausted and there is a need for external funding, it is also hypothesized that debt funding is preferred over issuing new equity (Myers, 1984; Myers & Majluf, 1984). The core of the hypothesis consists of the idea that there is no information asymmetry when firms use internal finance or default free debt, a factor that is often associated with external finance (Tirole, 2006). Empirical research has shown that SMEs act in accordance with the pecking order hypothesis (Mateev, 2011; Zeidan, Galil, & Shapir, 2017; Watson, 2002). More specifically, Mateev (2011) shows that there is a negative correl-

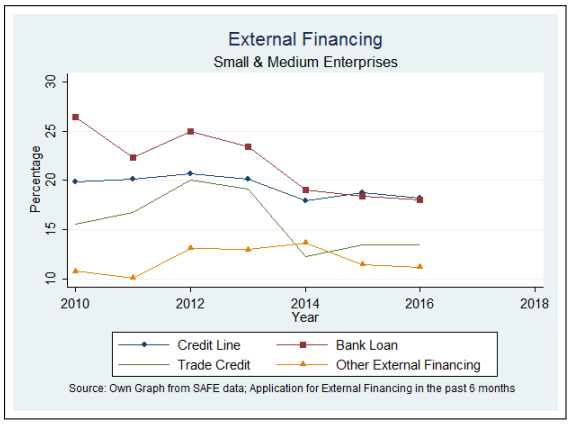
ation between the profitability and the leverage of the firms, i.e. when the profitability increases, the firm will deleverage and reinvest the profit rather than increasing their debt.

In contrast to the pecking order hypothesis, it has been shown that start-up firms move from internally generated funds to equity directly. The motive being that debt requires personal indebtedness which is not an as appealing alternative to entrepreneurs (Paul, Whittam, & Wyper, 2007). Paul et al. (2007) provide two reasons to these findings in terms of that entrepreneurs consider debt as a personal liability since it requires guarantees signed by the individual themselves and that entrepreneurs prefer having a well-chosen investor that can bring additional business skills and social capital (i.e. contacts and networks), which increases the growth possibilities of the firm. Brogi and Lagasio (2017) identifies an increased need to develop better channels for SMEs to gain access to equity financing instead of bank-lending. The authors identify that funds supplied by banks have shorter maturity than equity and that banks do supply credit to SMEs with a stable leverage.

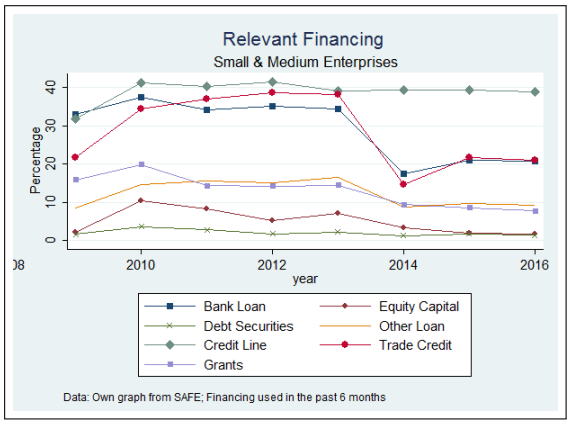
Contrary to Brogi and Lagasio (2017), the authors Berggren, Olofsson, and Silver (2000) presents a contraindicative theory and identifies an unwillingness among SME managers and owners to seek out new equity in order to grow. The authors argue that new equity results in lost control to another external party. The trade-off between ownership and control is dependent on the specific risk profile of the individual SME, leaving it difficult to facilitate channels between SMEs and private equity investors. However, there are new FinTech services on the uprising, that competes with the traditional bank lending platform by facilitating the connection between SMEs and financiers (Oricchio, Lugaresi, Crovetto, & Fontana, 2017).

Recent data provided by the Survey of Access to Finance in Europe (SAFE), allows for a comparison between the theory about the external financing of SMEs and how they actually operate. Figure 3a is based on this data and indicates that bank loans are the most preferred source to access external financing throughout the entire survey. Trade credit is the second most preferred channel to access financing for all years except 2014.

Figure 3: SME demand and usage



(a) SME demand of different types of external funding



(b) SME usage of different types of external funding

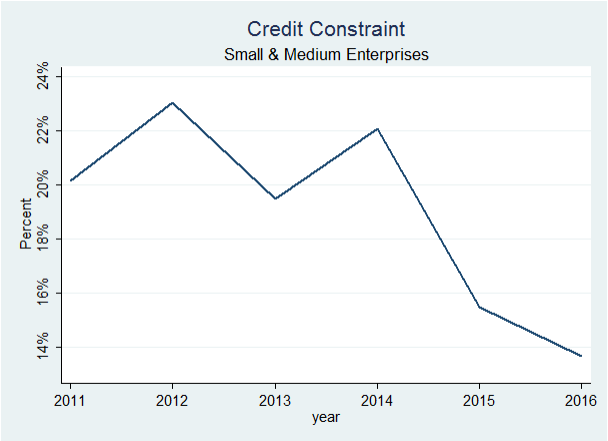
Figure 3b shows the source of finance among SMEs in the last 6 months, indicating the relevance of the various external capital. Comparing the graphs in figure 3 shows a distinct difference in the preferred financing and the actual financing used by SMEs. Figure 3a indicates that bank loans are the most preferred financing but figure 3b indicates that debt securities and trade credit is the most used. Lastly, figure 3a and 3b, reveals an apparent decrease in both demand and usage of all sorts of external finance, before and after implementation of Basel III in 2014.

The SAFE data indicates that lending from bank channels and trade credit are important sources of funding for SMEs in Europe. One of the specific characteristics of the loan market, is the existence of credit rationing, where Stiglitz and Weiss (1981) argue that even when the market is in equilibrium, credit rationing still exists in the loan market. The implications being that the laws of supply and demand are subject to a specific set of assumptions, where credit rationing is included. As SMEs are considered to be able to provide less information than large companies, they will also, in theory, be subject to more credit rationing than large firms. This is supported by Farinha and Félix (2015), that present evidence that credit rationing towards SMEs does exist. Also, the EBA (2016) report finds that approximately 16% of SMEs in Europe experience trouble to access funding via banks, whilst only 10% of the responding larger enterprises report the same issue. The report also concludes that the issues with finding available channels for financing grows larger for smaller firms, i.e. medium-sized companies experience less dif-

ficulties than small or micro sized firms.

Although it can be argued that credit rationing exists in the market even though it is in equilibrium, Mayordomo and Rodriguez-Moreno (2017) found that the SME SF alleviated some of the credit constraints of medium-sized firms in Europe. The reason for that the results only apply to medium sized firms is explained by the fact that medium sized firms are considered to be more safe than small and micro sized firms (Mayordomo & Rodriguez-Moreno, 2017). Figure. 4, which is based on the SAFE-data, supports this finding, and indicates a decrease of credit constrained SMEs in Europe from 2014, i.e. implementation of the SME SF.

Figure 4: Credit Constrained SMEs



3.3 Differences between SME and Large Enterprises

When describing SME credit availability, Berger and Udell (2006) argued that the conceptual framework by academics was oversimplified. The critique mostly referred to the classification of lending technologies being divided into two categories; (1) transactions based lending and (2) relationship-based lending. The former relies on quantitative data (hard data), whilst the latter use qualitative data (soft data). The simplification resulted in research investigating the theory of that larger financial institutions have a focus towards borrowers where hard data exists, i.e. more transparent entities, whilst smaller institutions rely on soft data making their business more relationship based and therefore directed towards smaller firms. It is this kind of relationship based lending which is theorized to be used largely towards more opaque borrowers (Hernández-Cánovas & Martínez-

Solano, 2010; Petersen & Rajan, 1994), implying that information can be extracted from building a relationship with the firm, where no hard data exists. As previously mentioned, the debt of an SME could be personally guaranteed by the entrepreneur, so that the financing of the firm is intertwined with the finances of the entrepreneur. This makes the firm an opaque borrower, since the external funds are dependent on assets not included in the balance sheets of the firm but on soft data such as personal creditworthiness and/or reputation of the firm (Berger & Udell, 1998).

Given that SMEs rely mostly on soft data, Berger and Udell (1998) find that they, in relation to larger firms, do not have the same access to public markets. Instead SME rely on private equity and debt markets. Such a dependence makes SMEs more vulnerable to changes in the market, if compared with large corporations who have access to more financing alternatives [1]. Furthermore, the EBA (2016) report suggests that the default risk of both large firms and SMEs are strongly correlated with a cyclical pattern, where default rates increases during downturns, although small enterprises are considered to be riskier than large firm throughout the whole cycle (EBA, 2016). Brogi and Lagasio (2017) argue that not even an aggressive expansionary monetary policy with negative interest rates lead to more credit being given to SMEs. As discussed, SMEs are in general more exposed to unpredicted trading and business cycles as well as trends in the economy or sectoral specific changes. Consequently, access to working capital, by bank overdrafts, has served as a go-to source in bad times (Acharya, Bharath, & Srinivasan, 2007; Fidrmuc & Hainz, 2009; Ford C, 2016).

Since the SMEs access to public markets are limited and therefore lacking in amount of hard data to correctly assess their credit, SMEs are in general considered opaque entities relative to larger firms (EBA, 2016). According to the report by EBA (2016), modeling the credit risk of SMEs are subject to various obstacles. One of them is that there is no information on the current market value of SMEs, due to the lack of a liquid market for SME loans. Portfolios containing bank SME loans, in general, includes large amounts of small loans, leaving it difficult to distinguish individual assessments of specific loans. This limitation of available information or reliance on more soft data, will amplify the effects

[1] Also shown in fig. 3b, where debt securities are shown to be the least used way of financing for firms included in the SAFE data.

of information asymmetry, i.e. issues with moral hazard and adverse selection, implying that they could face credit rationing to a greater extent than large firms.

3.4 Implications of Capital Regulation on Bank Lending

The previous sections list various factors and characteristics that separates SMEs from large firms as well as discuss their dependence of bank channels lending. We now turn towards findings from prior research of how the increased capital regulation impacts the lending of banks.

There are extensive ambiguity about pros and cons of bank regulation. According to Diamond and Dybvig (1983), the seminal paper is based on the market sorting itself out. On the other hand, Hellmann, Murdock, and Stiglitz (2000) argue that financial-market liberalization could be part of the reason why financial crises have occurred more often in recent history. Hellmann et al. (2000) suggests that, in theory, there is a straightforward connection between the degree of moral hazard problem and liberalization in the market. In comparison to the previous discussed moral hazard issue, problems in this setting refer to the management of banks and their prudence in selecting assets to invest in. The authors also claim that risk-taking by management ("gambling") has a positive correlation with competition in the banking sector.

Another explanation for tendencies and decisions to increase or to take excessive risks by management, is to consider it as signs of positional externalities (Hirsch, 1977), i.e. excess risk-taking by competitors may increase risk-taking by the individual bank. Such kind of actions does not result in a more efficient market. In an illustrative example, Hirsch (1977) points out that if everyone in a concert stand on their toes in order to get a better view, nobody would be relatively better off than before. Without imposing regulation, positional and negative externalities, such as a moral hazard problems, will increase the risk taking by bank management. It can also be arguing that it was these kind of externalities which created the highly levered bank entities of the recent financial crisis in 2007-2008 (Admati et al., 2014).

Although the subject of the existence of capital regulation can be debated, it is gener-

ally accepted among policy makers that the banking sector is subject to various market failures and negative externalities. As a result, there is regulation in place such as the Basel accords which aims to ensure financial stability (BCSB, 2010). However, there are still concerns about capital regulation and one of them is the theory of how increasing requirements might lead to higher funding costs for the banks. The increase might be passed on to the borrowers in terms of higher credit cost and/or a decreased loan volume and maturity. Lambertini and Mukherjee (2016) argue that interest rates will increase as a consequence of increased capital regulation. Furthermore, Diamond and Rajan (2000) claim that even though regulation brings financial stability, it also impacts banks' ability to create liquidity and their performance.

The above mentioned concerns are part of the *"negative NPV effect"*, where various other studies also contribute with different explanations of how increasing capital regulation impacts the NPV of investments negatively, i.e. making the opportunities unprofitable for the banks (Elliot & Willesson, 2018). All of the arguments supporting the NPV effect are connected to the natural pro-cyclicality of the banking sector, i.e. when the economy is good, more projects will be profitable since the NPV is higher and vice versa. The issue is that in a good economy this could result in increasing risk-taking by banks, i.e. issues with moral hazard grows larger. Therefore, given that the regulation in place is risk-based, this cyclicality is theorized to be amplified by capital requirements increasing the the negative NPV effects (Athanasoglou et al., 2014) .

Although Diamond and Rajan (2000) are critics of capital regulation and spokesmen of the negative NPV effect as mentioned earlier, they also recognize that it has a stabilizing effect on the financial market, i.e. capital regulation is not bad through and through. As explained by Hellmann et al. (2000), although the outcome of the regulation will not be Pareto efficient, it will force banks to internalize *"... the inefficiency of gambling."* by requiring them to keep more of their own capital at risk. Therefore, counterarguments to the negative NPV-effect also exist, where Mehran and Thakor (2011) argue that capital regulation will affect the systemic risk of the financial system, but will not spill-over as a regulatory cost to the bank owners or the provided credit. Admati et al. (2014) adds to this perspective by consistently going through existing fallacies about capital regula-

tion and concludes that the incentives behind every claim and statement is important to understand. The authors argue that policymakers should be aware about opinions that has a personal interest behind them and that the social benefits of capital regulation should be considered, rather than private costs or benefits that are to be made by specific institutions or people. Concurring with this idea is Miles et al. (2011) study on large British banks, which shows that higher capital requirements have a beneficial effect overall and conclude that a level of capital requirements even above that set by Basel III, would be desirable. Mehran and Thakor (2011) continues the arguments against the negative NPV effect, by theorizing that capital costs are calculated based on the capital asset pricing model. Increased cost in equity financing versus loans is then neutralized due to lower required capital risk premium. Increased capital regulation will thus affect the risk premium of loans and equity, whilst access to new investment opportunities may be financed by additional loans or equity.

There is still a continuous debate regarding the capital regulation, its social costs, benefits and theorized implications to the loan market. The pro-cyclicality of the banking sector and its connection to the negative NPV effect implies that an implementation of stricter capital regulation might impact the NPV of investment opportunities negatively. This leads us to the first hypothesis of this thesis, defined as followed:

Hypothesis I: Stricter capital requirements will have a shock in lending.

3.4.1 Impact of Capital Regulation on SME finance

As discussed in the previous sections, the issues and characteristics of SMEs access to external finance and credit differs from what can be expected by large firms. In addition, capital regulation is theorized to have an impact on bank lending overall, however this thesis also argues that it will have an adverse effect on lending towards SMEs. The negative NPV effect could partly explain the existence of the adverse decreases in lending between different segments. An alternative theoretical explanation is found in the *crowding out effect*. The crowding out effect differs from the negative NPV effect in the assumption that capital restrictions forces banks to turn down loans even if the investment would have been profitable, i.e. there is a strategic reasoning behind the decision that

does not solely depend on whether or not the investments generates a positive NPV. The theory suggests that increased capital regulation, bank capitalization and other economic conditions caused by the restrictions, will force banks to turn down loans as a matter of e.g. profitability or specialty knowledge in the specific sectors (Elliot & Willesson, 2018). In the context of the recent eurozone debt crisis, Crosignani (2017) provides evidence of weak banks having incentives to increase their holdings of domestic public debt at the cost of crowding-out private lending. Such a reduction in issued capital require SMEs to postpone investments or search for alternative investments (Elliot & Willesson, 2018).

Such consequences might result in increased difficulties for already credit constrained entities or individuals to access financing as these borrowers are deselected (Koehn & Santomero, 1980; Bernanke & Lown, 1991; Abdel-Baki & Shoukry, 2013). Humblot (2014) hypothesized that the implementation of Basel III specifically, would affect SMEs' access to bank credit negatively and argued that the smallest firms would be most negatively affected by the then new set of reforms and face the largest decrease in their loan volume. The author suggest that the cost of capital only impacts short term borrowings, indicating that a decrease in cost of capital due to an increase in equity volume can negatively affect short-term credits. This suggestion supports the idea that banks can re-balance their portfolios and reduce their least profitable exposures like SMEs' short-term credit.

To conclude, information asymmetry permeates throughout the entire economic environment causing SMEs access to finance to be more restricted than larger firms because of the opaque nature of the data they can provide. The impact of capital regulation on the end-users has been discussed and theories such as the negative NPV and crowding out effect will amplify the negative effects on lending to SMEs. A consequence that would be devastating since SMEs are heavily dependent on the bank lending channel.

The aim of this thesis is to examine how increased regulation will effect bank-lending towards SMEs. To test if increasing capital regulation does adversely impact opaque borrowers more negative, the hypothesis of this thesis is defined as followed:

Hypothesis II: The shock is asymmetric and impacts SMEs more severely than large firms.

4 Method

4.1 Model Specification

To test *Hypothesis I and II*, and investigate whether increasing capital regulations has adversely impacted lending amongst companies relative to size, two models have been defined. The reason will be explained in greater detail in the following sections. The two null-hypotheses are defined as followed:

1) H_0: Basel III has not adversely impacted lending volume towards SME and large enterprises.

...

2) H_0: Basel III has not adversely impacted financing costs towards SME and large enterprises.

where the corresponding models are estimated as followed:

$$\begin{aligned} \mathrm{IR}_{i,t} = \alpha + \beta_1 \mathrm{SME}_i + \beta_2 \mathrm{Post}_t + \beta_3 \mathrm{SME}_i * \mathrm{Post}_t + \beta_4 \mathrm{CapReg}_{i,t} + \beta_5 \mathrm{FirmChar}_{i,t} \\ + \beta_6 \mathrm{Macroeconomics}_{i,t} + \varepsilon_{i,t} \end{aligned} \tag{1}$$

$$\begin{aligned} log\mathrm{LVol}_{i,t} = \alpha + \beta_1 \mathrm{SME}_i + \beta_2 \mathrm{Post}_t + \beta_3 \mathrm{SME}_i * \mathrm{Post}_t + \beta_4 \mathrm{CapReg}_{i,t} + \beta_5 \mathrm{FirmChar}_{i,t} \\ + \beta_6 \mathrm{Macroeconomics}_{i,t} + \varepsilon_{i,t} \end{aligned} \tag{2}$$

where $IR_{i,t}$ and $LVol_{i,t}$ are the two dependent variables used as proxies, the former defined by aggregated average interest rates, sorted by country, on loans to firms with a maturity no longer than 5 years and the latter are aggregated loan volumes in a country per year where the firm operates. SME_i is a dummy variable that equals one when the firm is SME and zero otherwise, $Post_t$ is a dummy variable that is equal to one for all observation after 2014 and zero before, SME_i*$Post_t$ is an interaction variable of the two previously mentioned variables. Both models will be used to make a Difference in Difference estimation, where the interaction term SME_i*$Post_t$ will be the one of interest when analyzing the results.

The table 1 shows the factors included in $CapReg_{i,t}$, $FirmChar_{i,t}$ and $Macroeconomics_{i,t}$ variables. The variables will be further described in the following section.

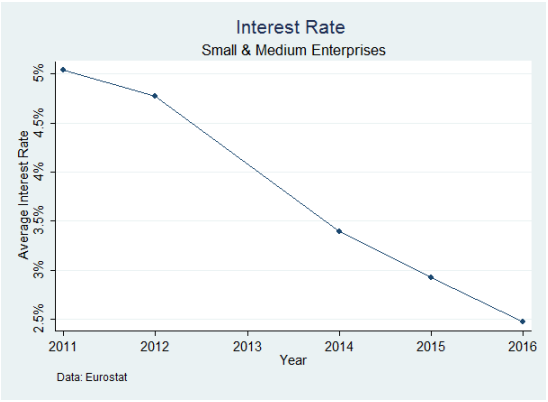
Table 1: Factors included as control variables

$\boldsymbol{CapReg_{i,t}}$	Common Equity Tier 1 *(log)* Tier 2 Capital *(log)* Average RWA *(log)*
$\boldsymbol{FirmChar_{i,t}}$	Shareholders' funds *(log)* Cash *(log)* Long-term Debt *(log)* Creditors *(log)* Change in Net income (%)
$\boldsymbol{Macroeconomics_{i,t}}$	GDP *(log)* Unemployment (%) Long-term Interest Rate (%)

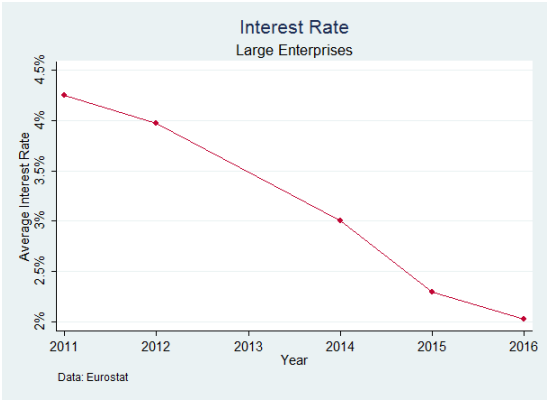
4.2 Data

In order to test *Hypothesis I and II*, two null hypotheses have been defined with two different dependent variables, interest rate and loan volume. The dependent variables were obtained from Eurostat. The data was obtained as monthly averages and converted into yearly averages for each country in the sample. Following ECB (2014), loans in the range €0.25-1 million have been used as a proxy for SME lending and loans above €1 million have been defined as a proxy for large firm lending. Due to limited access to data, the maturity of the dependent interest rate variable varies between the countries but does not exceed 5 years, i.e. the sample has short to medium maturity perspective. Figure 5 indicates the average interest rate during the sample period for SMEs and large companies, aggregated across all countries. The graph shows that the SMEs pay a higher price throughout the sample period, but also that the interest rates decreases rather steadily for both parties, and the pace of the decease is the same.

Figure 5: InterestRate



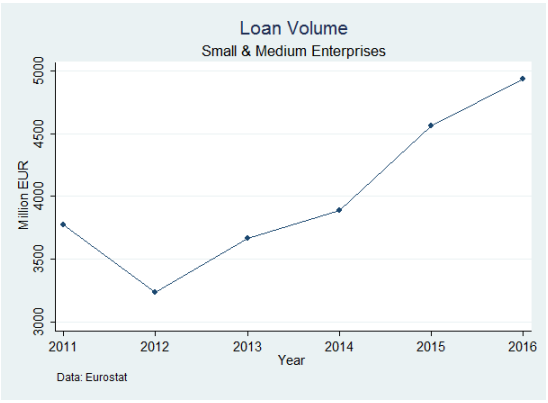
(a) Small and Medium Enterprises



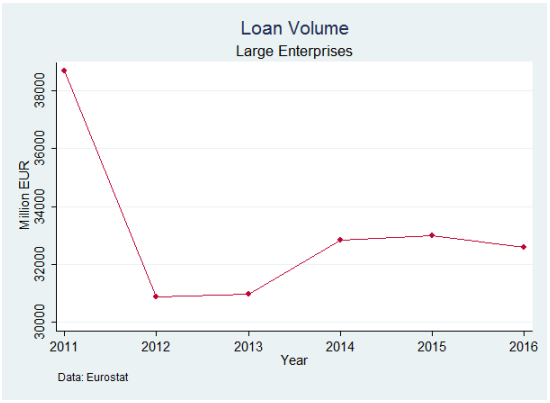
(b) Large Enterprises

Figure 6 shows how the dependent variables have developed over the time period. Figure 6a indicates that the loan volume to SME decreased from 2011 to 2012 and then steadily increased from 2012 to 2016. Figure 6b indicates that the loan volume to large enterprise decreased from 2011 to 2012, increased from 2013 to 2014 and then declined after 2014.

Figure 6: Loan Volume



(a) Small and Medium Enterprises

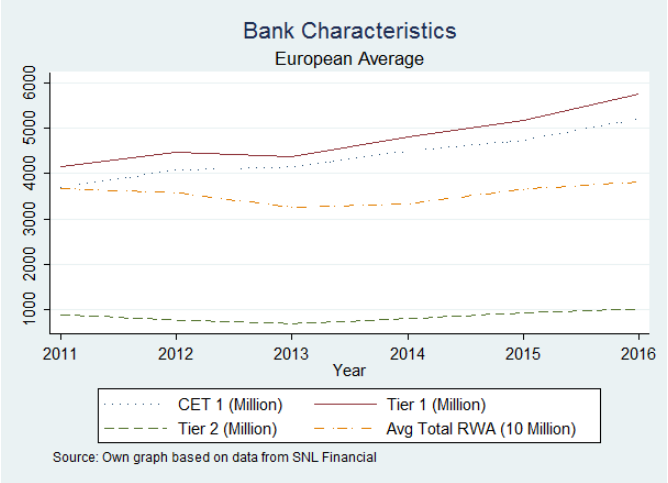


(b) Large Enterprises

Data on bank characteristics are retrieved from SNL Financial. Four different measures of the regulatory capital were used to capture the effect of Basel III: Tier 1 Common Capital, Tier 1 Ordinary Equity, Tier 2 Capital and average total RWA. The figures are EoY values from the balance sheets of the banks, from which a yearly average was calculated for every country based on the origin of the banks' operation. This average was later merged with the firm characteristics based on country and year, i.e. every firm from

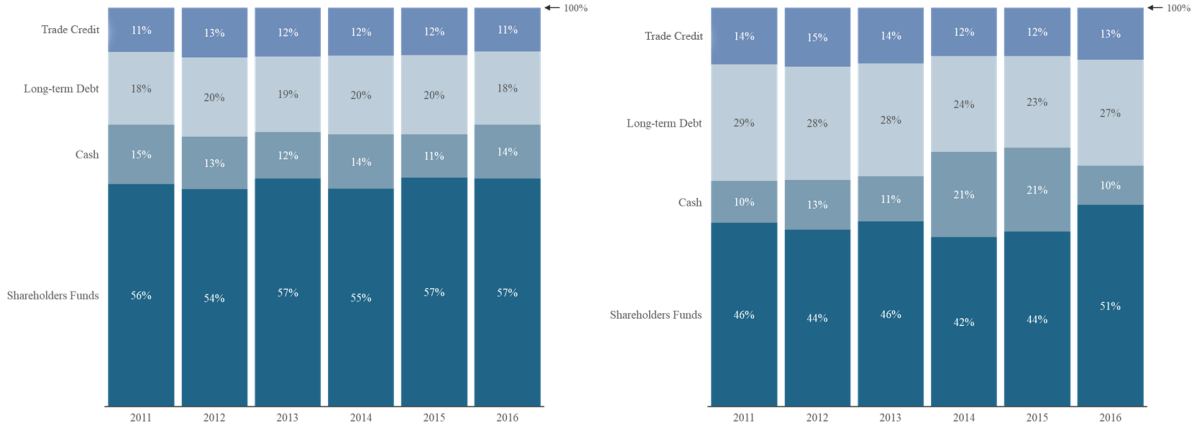
e.g. Germany in 2012 has the same value on the bank characteristic variables attached to them. Figure 7 indicates how the bank characteristic variables has developed over the period (means are aggregated without irrespective of country). Consistent with the Basel III requirement for more Tier 1 capital, the figure indicates that Tier 2 has remained relatively unchanged over the period while CET 1 and Tier 1 has increased from 2013. Average total RWA (in 10 000 000 units) has decreased from 2012 and increased in 2014.

Figure 7: Bank Characteristics



Information on firm characteristics are obtained using the Orbis database, the observations were randomly sampled by the database before the information were downloaded. The definition of SME follows the EU recommendation (2003/361/EC), where enterprises with less than 250 employers has been characterized as SMEs and enterprises with more than 250 employers has been characterized as large enterprises. The final dataset consists of 82 455 SMEs and 8 373 large firms, table 10 further presents the total number and observations in each category and per county. Figure 8 shows how the firm characteristics has developed over the sample time period for SMEs and large firms separately and independent of country, whilst figure 9 provides more detailed descriptive. Figure 8b shows an increasing trend in shareholders' funds during the period for large enterprises, long-term debt and creditors has remained relatively stable while loans and cash increased in 2013 and decreased in 2015. Figure 8a indicates that the long-term debt, loans, creditors and cash has remained relatively stable over the period while there is an increasing trend in the shareholders' funds.

Figure 8: Firm characteristics



(a) Small and Medium Enterprises (b) Large Enterprises

Data on macroeconomic variables were retrieved using Global Economic Monitor (GEM) to obtain GDP and OECD to obtain unemployment rates and long-term interest rates. The variables were obtained for each country in the dataset and merged with the dependent variables as well as firm and bank characteristics.

Figure 9: Variable statistics

(a) Small and Medium Enterprises

Small & Medium Enterprises
Pre-Treatment Period (year 2011-2013)

Variable	Obs	Mean	Std. Dev.	Min	Max
Stockholders' Equity	206662	5223045	1.48e+08	-1.55e+09	4.60e+10
Net Income	206662	295651.5	1.29e+07	-1.60e+09	2.13e+09
Number of Employees	206662	29.31728	41.36476	0	249
Cash	206662	1330415	8.39e+07	-3605647	2.57e+10
Long-Term Debt	206662	1823947	3.04e+07	-658752	7.01e+09
Creditors	206662	1121015	7150274	-1098458	1.34e+09
Interest	206662	3.82%	.0138115	2.02%	10.02%
Loan Volume	206662	4.14e+09	2.69e+09	2.09e+07	2.70e+10

Small & Medium Enterprises
Post-Treatment Period (year 2014-2016)

Variable	Obs	Mean	Std. Dev.	Min	Max
Stockholders' Equity	203709	5609558	1.28e+08	-7.30e+08	2.22e+10
Net Income	203709	285106.2	1.23e+07	-1.60e+09	1.91e+09
Number of Employees	203709	29.16326	41.38053	0	249
Cash	203709	1263460	6.28e+07	-6582000	1.81e+10
Long-Term Debt	203709	1911875	3.58e+07	-119552	7.01e+09
Creditors	203709	1148892	1.10e+07	-1098458	3.58e+09
Interest	203709	2.58%	.0088999	1.36%	5.86%
Loan Volume	4.43e+09	2.71e+09	2.42e+07	1.18e+10	4.43e+09

(b) Large Enterprises

Large Enterprises
Pre-Treatment Period (year 2011-2013)

Variable	Obs	Mean	Std. Dev.	Min	Max
Stockholders' Equity	9969	2.19e+08	1.82e+09	-2.16e+09	7.70e+10
Net Income	9969	1.74e+07	2.25e+08	-4.81e+09	1.06e+10
Number of Employees	9969	2227.832	13677.47	250	421391
Cash	9969	7.55e+07	2.22e+09	-3320705	2.15e+11
Long-Term Debt	9969	1.35e+08	1.36e+09	-1.82e+08	4.60e+10
Creditors	9969	6.75e+07	5.46e+08	-1959000	2.21e+10
Interest	9969	3.13%	.0165591	1.71%	08.93%
Loan Volume	9969	3.48e+10	3.49e+10	1.04e+08	1.53e+11

Large Enterprises
Post-Treatment Period (year 2014-2016)

Variable	Obs	Mean	Std. Dev.	Min	Max
Stockholders' Equity	9974	2.45e+08	2.11e+09	-1.20e+10	9.64e+10
Net Income	9974	1.78e+07	2.72e+08	-9.92e+09	1.23e+10
Number of Employees	9974	2212.784	13618.29	250	425594
Cash	9974	9.60e+07	3.16e+09	-3297149	2.26e+11
Long-Term Debt	9974	1.32e+08	1.30e+09	0	4.47e+10
Creditors	9974	6.70e+07	5.36e+08	-1959000	2.20e+10
Interest	9974	2.05%	.0099153	1.08%	5.96%
Loan Volume	9974	3.22e+10	3.37e+10	1.69e+08	1.32e+11

The thesis is delimited to European countries during 2011-2016, an extension of the time period was not possible due to lack of data on the dependent variables. Variables that were obtained in an absolute monetary figure were natural logged transformed (see table 1), to summarize changes in terms of a continuous compounding. By natural log transform the absolute monetary figures, we are able to capture small changes in the variables and directly interpret them as percentage changes.

The regressions are based on an unbalanced dataset as some values were randomly missing in the dataset and firms with less than three observations during the time period has been removed from dataset. A few large outliers, in terms of SMEs with inexplicable high values in the firm characteristics variables as well as large firms with inexplicable low values, were discovered in the sample. To keep them from skewing the analysis, they were removed from the sample.

Some countries are merged due to lack of data in the dependent variables (see figure 10). The implications being that firms operating in countries with lack of dependent variables were matched with another countries with similar macroeconomic factors, banks characteristics and economic conditions; in terms of GDP growth, estimated likeness in culture and geographic position. Figure 10 presents the number of observations for each country (or merger of countries) included in the dataset. The number of observations varies among the countries, but the distribution of the firms is similar to the real distribution of SMEs in the European countries (See A4 in appendix). For instance, Italy has a high number of SMEs, i.e. they should have the high number of observations in the sample.

Figure 10: Countries and number of observations

Country	*Nr of Firms Total*	*Nr of Obs Total*	*Nr of Firms SME*	*Nr of Obs SME*	*Nr of Firms Large Enterprises*	*Nr of Obs Large Enterprises*
Italy	24706	120213	24166	117569	543	2644
Sweden, Denmark, Finland & Norway	12874	15502	12633	14473	12250	13036
Spain	16980	79770	16597	77886	184	1884
France	8540	32540	8043	30535	506	2005
Estonia & Russian Federation	1181	3263	1036	2558	729	1289
Bulgaria & Romania	7960	10042	7815	9337	7508	8068
Portugal & Greece	6713	10199	6657	9918	5857	6080
Belgium & Luxembourg	5264	5322	5253	5268	5260	5303
Czech Republic	2738	10825	2514	9720	237	1105
Germany	2161	10193	1531	7120	631	3073
Slovak Republic	2003	4223	1917	3828	21	395
Latvia, Lithuania & Ukraine	851	1838	831	1742	738	450
Hungary	700	3118	577	2533	123	585
Slovenia	497	1484	477	1388	384	96
Netherlands	272	988	168	606	104	382
Poland	270	816	174	492	98	324
Ireland	255	1114	224	968	31	146
Austria	43	179	24	91	19	88
Cyprus	7	29	3	11	5	18
Total	***86326***	***369326***	***82455***	***351984***	***8373***	***17342***

4.3 Model Estimation

Research suggesting that SMEs access to bank loans is affected by both demand and supply constraints (Abor, Agbloyor, & Kuipo, 2014; Cressy & Olofsson, 1997). Abor et al. (2014) defines the supply constraints as factors such as informational asymmetries, higher transactional costs and inherent riskier nature of SMEs, i.e. factors that makes it harder for banks to supply loans. Demand constraints stems from factors such as inability of SMEs to produce pro-forma statements and/or persuasive business plans as well as the quality of the potential projects which qualifies for funding. Factors that SMEs themselves can control but that generally are hard to produce when seeking external financing. In order to make good inferences from the results, it is necessary to try to distinguish the demand from the supply factors and keep them separate. In practice, it is hard to do since it is difficult to delimit supply from demand. There are also many factors affecting both supply and demand, which increases the risk of omitted-variable bias.

The two main models that are estimated in this thesis have a supply side aspect in order to answer the question whether or not capital regulation has a disproportionate impact

on lending towards SMEs. To distinguish supply from demand, SMEs are separated from large enterprises to capture differences in the capital structure within the two groups and control for factors that cause informational asymmetry and supply constraints. In order to compare large firms with SMEs, the chosen methodology is a Difference in Difference (DiD) model, following the methodology in the report by EBA (2016). In the model, SMEs are treated as the treatment group and large companies as the control group. In the report, two justifications are provided of why large companies are suitable to be defined as the control group in comparison to SMEs. First off, the report mentions that the optimal control group would be SMEs not effected by new policy changes, but since the regulation was implemented in all EU countries, there are no SMEs that are not affected by it. This argument is combined with the second reason, which is the fact that there is no way of knowing how the financing of SMEs would have developed without the implementation of Basel III. Furthermore, also following the EBA (2016) report, 2014 is defined as the cut-off period from when the policy was implemented, i.e. all data from and including 2014 is treated as pre-treatment period.

SME_i is a dummy variable equal to 1 if the firm is a SME and zero otherwise. $Post_t$ is a dummy equal to 1 for the period after 2014 and $SME_i{*}Post_t$ is the DiD term of interest. Year 2013 has been dropped from the dataset to control for the phase in period, when banks could customize themselves to the new regulation. The obtained result should then provide a better inference of the actual difference of a new policy. If the DiD-model indicates that there is a significant difference between SME and large firm lending after the cutoff, year 2014, the null hypothesis is rejected and indicates that Basel III have an adversely effect on SME lending.

Even if other reports have used a DiD model to investigate SMEs access to external finance (EBA, 2016; Mayordomo & Rodriguez-Moreno, 2017; Casey & O'Toole, 2014), there are three distinct differences between them and this paper. The first is that all reports mostly rely on SAFE data to identify dependent variables and firm characteristics, whilst the model in this thesis does not. The SAFE data is mostly reported as dummy variables, by utilizing data from other databases, more variation is included and allows for smaller changes to be captured in the model. Furthermore, this thesis uses loan volumes

and interest rates as dependent, instead of credit constraint among SMEs as the three aforementioned reports. Lastly, this paper focuses on the increase of capital regulation and the hypothesized adverse effect on lending and not the effects of SME SF specifically.

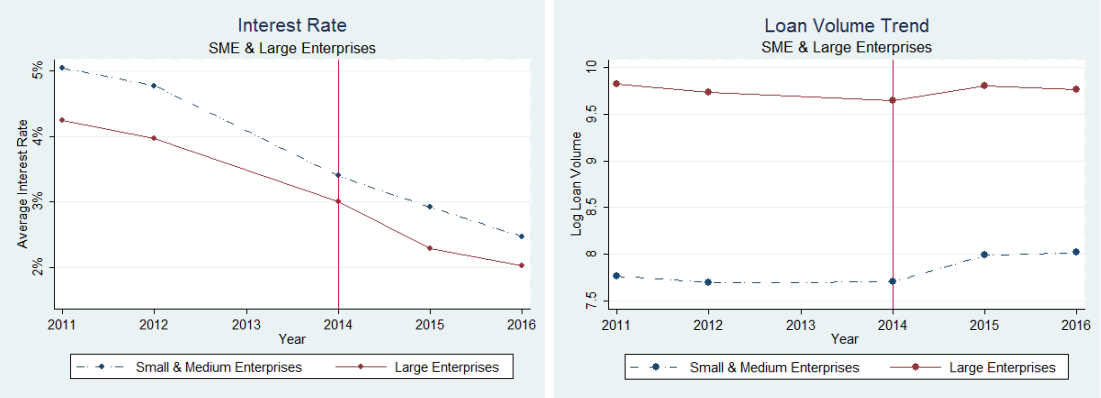
In order to have a proxy for the supply of financing through the bank lending channel, this thesis follows articles by Lambertini and Mukherjee (2016), Acharya et al. (2018), Khwaja and Mian (2008), where interest rate and loan volume have been used as dependent variables. Unlike this paper, the reports do not make a distinction between SMEs and large firms, but investigate the how shocks in the loan market (such as an increase in bank capital) impacts firms in general. Also, the articles do not use a DiD estimation, however this is due to the fact that a DiD estimation is a version of fixed effects regressions by using aggregate data (Angrist & Pischke, 2009) and the articles could to a great extent match their loans/interests with the banks and firms respectively, which is beyond the scope of this thesis[2]. Therefore, the DiD method is suitable and both dependent variables (interest rate and loan volumes) are aggregated at country-level in this thesis and using the ECB (2014) definition of what can be considered a proxy for a SME lending, i.e. the size of the loan, it can be applied to the defined model.

There is research emphasizing that availability of funds to SMEs are impacted by the structures in both the financial and lending institutions of a nation (Berger & Udell, 2006; Galli, Mascia, & Rossi, 2017; Beck, Demirguc-Kunt, & Maksimovic, 2004). As suggested by Beck et al. (2004), institutions impact the availability of financing provided to SMEs depending on the concentration of the financial market. Implying that, a more concentrated market decreases the availability of firm financing. The author also argues that this effect is smaller for larger sized firms with access to capital markets. Given that this thesis covers Europe, where institutions and financial markets varies across the different countries, this issue is dealt with by using a panel dataset. The panel dataset controls for time invariant and individual fixed effects such as the industry/country and unique risk preferences. This characteristics of the model is important, given that the sample of firms is from all over Europe and not a case study of a single (or a pair of) country (countries) (Farinha & Félix, 2015; Izquierdo et al., 2017; Fidrmuc & Hainz, 2009; Humblot, 2014).

[2]Banks nor firms are not very eager to provide or disclose such information and is hard to attain even for a seasoned academic researcher

To ensure internal validity of DiD-model, the treatment and control group have to experience similar trends in the pre-treatment period. The underlying assumption being that in absence of adverse effects, the trends for large and small firms would be similarly impacted by the new policy change. This is included in the assumptions in *Hypothesis I* of this thesis. Furthermore, figure 11 indicates that the parallel trend assumption is fulfilled and displays common trend in the pre-treatment period.

Figure 11: Parallel trends



(a) Interest rate (b) Loan Volume

In support of the use of the DiD model and responding to potential threats to the internal validity of the estimator the EBA (2016, p. 79) report states that *"... threats to the internal validity of the difference-in-differences estimator cannot come from either permanent differences in lending conditions between SMEs and large firms (e.g. SMEs are, on average, more credit constrained than large firms) or shared trends (as these are controlled for in the model). "*. Since this study uses the same method of defining and regressing small and large firms and control for shared trend (e.g. macroeconomic variables), the above argument can be applying to this thesis as well. In addition, since a DiD is a version of a fixed effects model, cluster standard errors are used to ensure the internal validity of the model. These standard errors control for potential heteroscedastic and correlation between the error terms over time between our countries (i.e. clusters). The clustered standard errors allow arbitrary correlation within a country and provides a consistent variance component estimation (VCE), even if there exists some serial correlation within the countries or/and the disturbances are not identically distributed over the

countries (Wooldridge, 2014; Arellano, 2003).

Bank, macroeconomic and firm characteristic variables are included in both models in this paper to control for shared trends (see table 1). Following Lambertini and Mukherjee (2016), bank characteristics was included to capture the implementation of stricter capital requirements. Unlike the aforementioned study, this paper utilizes logarithmic values of the absolute regulated capital instead of ratios. Following the EBA (2016) report, macroeconomic variables in terms of GDP and unemployment are included in the models to control for macroeconomic conditions that is assumed to be correlated with the loan volume and interest rates and demand conditions in the market. Hence the loan volume is assumed to decrease during a downturn and vice-versa. To control for the downward sloping trend in the dependent interest rate variable of model 1, a risk free long-term interest rate, i.e. a government bond with maturity of ten years, is included.

Firm characteristics in terms of change in net income, long-term debt, shareholder's equity, accounts payable and cash are included as control variables for the demand. The change in net income is included in the model to control for the volatility of the firm and therefore a measure of the uncertainty or level of risk associated with it, which impact the decision of a bank whether or not to grant loan applications. Other than the change in net income, the remainder of the control variables are balance sheet items, since the aim of the thesis is to investigate how financing of firms has been impacted by capital regulation. Long-term debt and shareholder's equity are included in the model to control for the firms' capital structure and leverage, where higher leverage could decrease their possibilities to be granted new loans and/or increase the interest rates to compensate for the higher level of risk. As discussed in the literature review, empirical research has shown that trade credit is an important source of funding for SMEs, i.e. a substitute for loan, and is therefore controlled for in the model. For large firms the credit variable controls the fact that there has been a recent credit crunch, i.e. even large firms could have had difficulties obtaining funding through bank lending channels. The only asset included in model is cash and, again, a reason for this is the credit crunch in order to control for decreased demand in loans. The intuition being that variation in the amount of liquid assets can be explained as taking precautionary measures when a firm wants to make sure they have

enough liquidity to finance future investments (Almeida, Campello, Cunha, & Weisbach, 2013). Given the credit crunch, the economic outlook may have been such that firms were vary about their possibility to obtain funding in the future, and therefore hoarded cash, making it an important source of financing or part of their corporate finance strategy.

5 Results

Results for six different specifications of the two baseline regressions are reported in figure 12. Specifications (1) and (2) uses the loan volume as dependent to capture the effect of Basel III on SMEs (1) and large firms (2) separately. Specification (3) and (4) instead uses interest rates as dependents for SMEs (3) and large enterprises (4). Specification (5) and (6) presents the DiD estimations, specification (5) uses the loan volume as dependent and specification (6) instead uses the interest rate as dependent. Specification (1) to (4) is used to capture differences in the capital structure within the two groups and control for factors that cause informational asymmetry and supply constraint. While specification (5) and (6) is the main regressions to capture if Basel III causes adverse effects on lending towards SMEs compared to large firms during the implementation of Basel III.

Figure 12: Hypothesis I and Difference in Difference

VARIABLES	(1) SME Loan Volume	(2) Large Firms Loan Volume	(3) SME Interest Rate	(4) Loan Volume Interest Rate	(5) DiD Loan Volume	(6) DiD Interest Rate
SME					-2.462***	0.00793***
					(0.209)	(0.00258)
Post					-0.0684***	-0.00951***
					(0.00761)	(0.000256)
Interaction					0.188***	-0.00364***
					(0.00787)	(0.000253)
CET1 (log)	0.324***	-0.413***	-0.0219***	-0.0110***	-0.0278**	0.000915***
	(0.0160)	(0.0178)	(0.000479)	(0.000692)	(0.0129)	(0.000308)
Tier2 (log)	0.289***	0.108***	0.00552***	0.00706***	0.289***	0.00578***
	(0.00369)	(0.0141)	(0.000177)	(0.000512)	(0.00522)	(0.000168)
Avg Total Risk-Weighted Assets (log)	-0.350***	0.205***	0.0164***	0.00828***	-0.167***	-0.0125***
	(0.00952)	(0.0381)	(0.000534)	(0.00141)	(0.0175)	(0.000563)
Shareholders' Funds (log)	0.0148***	0.00772	-0.00163***	-0.00114**	0.00848***	-0.000526***
	(0.00135)	(0.0127)	(7.14e-05)	(0.000482)	(0.00153)	(5.40e-05)
Cash (log)	0.000263	-0.00477	-1.20e-05	6.62e-05	0.000311	-1.57e-05
	(0.000372)	(0.00301)	(1.74e-05)	(8.75e-05)	(0.000388)	(1.28e-05)
Long Term Debt (log)	-0.000244	-0.00393	-4.63e-05*	-3.36e-05	-0.000252	-5.05e-05**
	(0.000558)	(0.00321)	(2.62e-05)	(0.000106)	(0.000580)	(2.04e-05)
Trade Credit (log)	0.00217***	0.000168	-1.43e-05	-0.000398	0.00234***	-5.43e-06
	(0.000649)	(0.00827)	(3.36e-05)	(0.000248)	(0.000692)	(2.70e-05)
% Change Net Income	4.78e-07*	7.65e-07**	-4.19e-08	2.17e-08*	1.51e-07	1.87e-08
	(2.79e-07)	(3.73e-07)	(2.93e-08)	(1.29e-08)	(1.46e-07)	(1.54e-08)
GDP (log)	-0.555***	0.627***	0.0471***	0.0214***	-0.0354	0.0282***
	(0.00889)	(0.0564)	(0.000847)	(0.00217)	(0.0346)	(0.000813)
Unemployment	-0.317***	2.976***	0.152***	0.149***	-1.316***	0.221***
	(0.0675)	(0.280)	(0.00222)	(0.0118)	(0.0883)	(0.00233)
Long Term Interest Rate (log)			0.0713***	0.0942***		0.00297**
			(0.00147)	(0.00791)		(0.00131)
Constant	32.32***	7.817***	-1.293***	-0.664***	23.99***	-0.603***
	(0.708)	(2.745)	(0.0437)	(0.106)	(0.768)	(0.0277)
F-Test	F(10,51735) =3146.00	F(10,2660) =574.19	F(11,51735) =27331.73	F(11,2660) =533.21	F(13,54381) =977.53	F(14,54381) =54059.89
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Observations	144,142	8,173	144,142	8,173	152,315	152,315
R-squared	0.316	0.394	0.673	0.494	0.264	0.787
Number of Firms	51,736	2,661	51,736	2,661	54,382	54,382
Country FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5.1 DiD Regression

The fifth column indicates that the average log loan volume for SMEs before 2014, the pretreatment period, was 2.462% less than the average log loan volume for large enterprises before 2014. The column also indicates that the average loan volume for SMEs after 2014 was 0.0684% more than the average loan volume for large enterprises before 2014. The interaction variable in column five indicates that there is a differential effect in loan volume after 2014 for SMEs and large enterprises, the effect positive and significant at a 0.01 significance level. Hence the interaction variable indicates that SME lending has increase by 0.188 percent more than large enterprises lending after 2014.

The sixth column indicates that the average interest rate for SMEs before 2014, the pretreatment period, was 0.00793 percent higher than the average interest rate of large enterprises before 2014. The column also indicates that the average interest rate for SMEs after 2014 was 0.00951 percent less than the average interest rate for large enterprises before 2014. The interaction variable in column six indicates that there is a differential effect in interest rate after 2014 for SMEs and large enterprises, the effect negative and significant at a 0.01 significance level. Hence the interaction variable indicates that SME interest rate has decrease by 0.00364 percent more than for large enterprises lending after 2014.

5.2 Bank Characteristics

Figure 12 indicates that all the bank characteristic variables have a significant effect on the financing for both large enterprises and SME.

The first column indicates that a 1 percent increase in the CET 1 and Tier 2 increases the SME loan volume by 0.324% and 0.289% respectively. A 1 percentage increase in the total average RWA decreases the SME loan volume by 0.350%. The second column indicates that a 1 percentage increase in CET 1 has a negative effect on the large enterprise loan volume of 0.413%. A 1 percentage increase in Tier 2 and total average RWA variable increases the loan volume for large enterprise by 0.108% and 0.205 respectively. The third column indicates that a 1 percentage increase in CET 1 decreases the interest rate for SMEs by 0.0219% and an increase in Tier 2 and total average total RWA increases

the SME interest rate by 0.00552% and 0.0163%. The forth column indicates that a 1 percentage increase in CET 1 decreases the interest rate for large enterprises by 0.011%. An increase in Tier 2 and total average RWA increases the interest rate for large enterprises by 0.00706% and 0.00828%.

5.3 Control Variables

The table also indicates that trade credit and shareholders equity has a 0.01 significant level positive effect on the loan volume for SME, while % change in net income has a 0.1 significant level effect on SME loan volume. Shareholders equity also has a 0.01 significant level negative effect on SME interest rate while trade credit has a 0.1 significant negative effect on SME interest rate. Change in net income has an 0.05 significant level positive effect on large loan volume. Shareholders funds and % change in net income has a significant effect on large interest rate on a 0.05 and 0.1 significant level. An increase in the macroeconomic control variables, GDP affects SME loan volume negatively and has an insignificant effect on the DiD loan volume regression, but affect the rest of the regressions positively, the effect is significant at a 0.01 significance level. A 1 percentage increase in the control variable unemployment has a negative effect on the DiD regression on loan volume and SME loan volume but a positive effect on the rest of the regressions, the effects are significant at a 0.01 significance level.

5.4 Robustness Tests

The estimated models are based on a panel dataset, where companies with less than 3 observations are excluded from the dataset. By excluding enterprises with insufficient information, the risk of survivorship bias increases due to endogenous factors. The missing values could be an indication that the companies has not survived, leaving a biased result since they are removed from the sample. It could also be argued that companies that disclose less are having issues with securing financing, excluding them from the dataset might result in a biased outcome. To control for missing values that might cause selection biases, the original regressions were estimated with missing values i.e. firms with 1 to 5 observations are included. By estimating the regressions with missing values, we are allowed to control for the firms that were excluded in the original regression and verify the correctness of the model. Figure A3 in appendix indicates that the results are verified

when all observations, including missing values and increased unbalanced panel data set, are used.

In the estimated models there are a clear cut-off, at 250 employees, between SME and large firms. This increases the risk of a misleading outcome since a firm with 250 employees is defined as large and a enterprise with 249 employees is defined as a SME. Hence, if visualizing all firms as part of a spectrum ranked from smallest to largest, and then drawing a line at what is defined an SME, the firms closest to the line at each side will be rather alike. To control for this, a model was estimated where medium-sized firms were dropped from the sample i.e. only micro and small firms were compared to large firms in the DiD. As previously, the EU recommendation (2003/361/EC) definition of micro, small and medium were followed, were enterprises with less than 10 employees are defined as micro, 10 to 50 employees are defined as small and enterprises with 50 to 250 are defined as medium. By dropping the firms closest to the cut-off, the results may show larger differences, which is why this is a good way of testing the robustness of our main models. In addition, the cut-off between the pre- and post-treatment was altered using 2015 as the first year of treatment instead of 2014. Instead of using year 2013 as a control for the phase-in period, year 2014 has been dropped from the sample to create further variation in the model. Figure A2 indicates the signs and significance of the coefficients in the DiD regressions remain unchanged as 2014 is used as phase-in period, medium sized enterprises are removed from the sample and year 2015 is used as the cutoff point.

In order to further test the robustness of the model, an alternative model was estimated from a separate data set. The model follows Casey and O'Toole (2014) and Mayordomo and Rodriguez-Moreno (2017), where these studies are based on information provided from the SAFE data. However, we combine the SAFE data with our Bank characteristics to test if the results are robust and in line with our results, thereby strengthening the validity of the result from the main DiD model. The model is defined as follows:

$$\mathrm{CC}_i = \alpha + \beta_1 \mathrm{CET1}_i + \beta_2 \mathrm{T2C}_i + \beta_3 \mathrm{RWA}_i + \beta_4 \mathrm{T}_i + \beta_5 \mathrm{GDP}_i + \beta_6 \mathrm{UE}_{i,t} + \varepsilon_{i,t}$$

where CC_i is a dummy variable that equals one when the firm is constrained and zero otherwise, $CET1_i$ is the Common Equity Tier 1 held by a bank, $T2C_i$ is the Tier 2 Capital

held by a bank, RWA_i is the average RWA during a year for the bank, T_i is a ranked variable that takes on the value 1 if the firm increased their turnover, 0 if it is at the same level and -1 if the turnover decreased. Lastly, the GDP_i and UE_i are the GDP and unemployment of the country in which the SME operates from. Given that the dependent variable, CC_i, is a dummy the model is estimated by using a logit regression, inference is made on the marginal effects and the sampling time period is 2011-2016.

This model using information from the SAFE data examines how regulatory bank capital impacts the experienced credit constraint among SMEs, i.e. given the theory of negative implications of tighter capital control, the supply of loans should decrease as regulation increases and therefore have a negative impact on the experienced credit constraints of SMEs. The results is presented in the appendix (see fig. A6) and indicate that during the sample time period, an increase in the regulatory bank capital decrease the probability of credit constraints among SMEs[3]. Consequently, the alternative model supports the results found in our DiD model and indicates that the SME access to finance has been facilitated as Basel III was introduced.

By creating variations in the method parameters, model specification and dataset, we are able to evaluate factors that potentially are causing variability in the obtained results. The different robustness tests verify the robustness of our regression, in terms of sign and significance, and indicates that both the access to finance and financing cost has facilitated after 2014.

6 Discussion

The Difference-in-Difference regressions implies that that there are statistically significant differences in both loan volume and funding cost between SME and large firms. Both null hypotheses defined in this paper are rejected, indicating that the increased capital regulations have caused adverse shocks in the loan market. In contrast to what was expected, the results imply that the loan volume has increased and funding costs decreased more for SMEs relative to large companies in the post-treatment period. This implies that

[3]The results for all variables included in the model are significant at a 0.01 significance level.

SMEs, after the implementation of Basel III are subject to less credit rationing by banks in comparison to large firms.

The results are partly explained by examining the sample data. Figure (6), shows an increase in loan volume towards SME after 2014, whilst the same figure depicts a diminishing trend towards large enterprises. The same obvious discrepancy is not distinguishable for the interest rate, but there is a clear downward trend for both SMEs and large corporations (see fig 11a). However, fig. 9, indicates that there is a substantial difference in the interest rate, indicating that both SMEs and large firms has experienced a lower average interest in post-treatment period. The figure also indicates that SMEs experienced a larger decrease than large enterprises and that the standard deviation, a rough measure of the associated level of risk, is the lowest in the post-treatment period for SMEs. Both figure (6b) and (9) underpins the results found in the DiD-regressions, that the access to bank lending both in terms of price and lending volumes, has been more advantageous for SMEs than large enterprises in the post-treatment period. These result contradicts the notion of SMEs having a disadvantage to obtain external financing due to existing information asymmetries and their perceived opaqueness (Berger & Udell, 1998).

Figure 4 shows a declining trend in credit constraint among SME after 2014, a result that is in line with the above discussion. From an asymmetric information perspective, the results indicate that the available information about SMEs has either increased or that there is less information required by the banks when granting loans. However, it could also be the simple reason that SMEs are more credit worthy in the post-treatment period due to better economic outlook in Europe. Indicating that even though credit rationing may exist in the market (Stiglitz & Weiss, 1981; Farinha & Félix, 2015), SMEs are not to a larger extent effected by it compared to large firms.

The brightened economic prospect causes higher expected returns on business investment for SMEs as well as large enterprises. In accordance with the negative NPV effect and its connection to the natural pro-cyclicality of the banking sector, the opposite is true when there are positive signals from the market, it will incentivize banks to increase their lending, since their customers' position and borrowing conditions becomes more attractive

(Elliot & Willesson, 2018). Indicating that the increased capital regulation has not spilled over as regulatory costs, as argued by Mehran and Thakor (2011), Admati et al. (2014) but could have amplified the positive economic prospects as suggested by Athanasoglou et al. (2014). Figure (8a) implies that long-term debt has decreased and the held cash reserve by large enterprises has increased in the year 2014 and 2015. The capital structure among large enterprises changed as the new regulatory framework was implemented, suggesting there was an increasing concern about future opportunities to access bank loans as suggested by Almeida et al. (2013). Increasing the reserve could be a response to the recent credit crunch and by increasing their liquid assets, large firms ensure that they will be able to fund future investments, regardless of capital regulation. Lastly, figure (8a) indicates that in 2016, future prospect has changed to a brighter outlook among large companies, as the accumulation of cash decreases.

The public market is an other channel for large enterprises to obtain financing, a channel that is not accessible for SMEs. As the economy has been more stable and the future prospects are positive, there might have been a period were large firms were returning to the markets instead of relying on bank lending. This may explain why the loan volumes has decreased for large firms after 2014, whilst increased for SMEs. A return to the capital markets would have resulted in a lowered demand for loans among large enterprises, causing the decrease in loan volume, as shown in figure (6b). The drop in demand for loans among large firms causing more room for SME lending, resulting in decreased credit constraint among SMEs.

The above discussion with the increased loan volume shown in figure (6a), suggest that the results could be linked to a reversal of the crowding out effect. Implying that during the financial crisis and the credit crunch, there has been some crowding out happening in the market, where large firms have been considered more profitable or strategically ”better” to supply with funds. The stabilization of the capital market has resulted in less demand for bank channel lending and forced banks to reverse back to lending to a broader customer base.

Although the loan volume and interest rates has become more advantageous for SMEs,

figure (8b) shows a contraindicative picture when looking at the capital structure of the SME sample. It illustrates that SME capital structure has remained relatively unchanged over the period despite the increase in loan volume. The variable used as a proxy for SME lending was defined by the size of the loan (ECB, 2014), i.e. loans under €1 million were classified as small business financing. The results might indicate that it is not lending to large firms per se that has decreased, but the amount of smaller sized loans have increased. This could explain why the capital structure of the SMEs are rather stable throughout the sample period, since the increase in loan volume is not going to the SME balance sheet but rather to larger firms taking on smaller loans. Such an explanation would be in line with the discussion about large firms returning to the capital markets, i.e. the need of larger amounts of capital via larger bank channel lending may have been substituted but there is still a demand for smaller amount of credit. Given that the SAFE data shows SMEs becoming less credit constrained throughout the sample period, the theories about the unwillingness of SMEs to use debt (Paul et al., 2007), due to requirements of personal guarantees/collateral, may be applicable to further explain why the capital structure of the SMEs has not changed as expected by the increased lending volume.

However, the most plausible factor for the result can be explained by the SME SF in the new regulatory framework. The objective of the SME SF was to neutralize the potential negative effects that Basel III would cause on the SME bank lending channel. In contrast to the EBA (2016) our study identifies an increase in access to finance for SMEs relative to large firms following the introduction of the SME SF. Our results indicate strong evidence that SME financing was facilitated in the aftermaths of the implementation of the new regulatory framework. Due to the great importance of SMEs to the well-being of the economy, we consider it essential that the right SMEs have access to the funding they need to survive and develop. SMEs are strongly dependent on bank loans, large companies, unlike the majority of SMEs, have access to the public market and are not as limited in financing alternatives. Therefore, we argue that the results indicate a healthier system that will benefit the well-being of the economy.

7 Conclusion

Basel III was introduced in response to the financial crisis with the objective to improve the banking sector's capacity to withstand shocks, strengthening supervision and reduce the probability of another financial crisis.

This thesis investigates if stricter capital regulation creates negative shocks in the loan market and if these adversely affect SMEs access to external financing through the bank lending channels. The increased capital regulation in Basel III, was expected to create adverse effects on the SME bank lending channel. The main reason for this expectation is the existence of information asymmetry and that SMEs does not, in general, have access to the public market and to a great extent rely on bank channel funding. The results indicate that there is a significant difference in both loan volume and price after 2014 when Basel III was implemented. Contrary to what was expected, our study find evidence that the supply of loans towards SMEs has increased after the implementation of Basel III. Furthermore, the sample data descriptive and presented SAFE data provides a good intuition about the results, indicating that credit constraints among SMEs has decreased, loan volume increased and financing cost decreased towards SMEs.

This thesis contributes to the policy debate on how bank capital regulation affects the real economy and provide useful insight to policymakers how the supply of loans is affected by increased capital regulation. Furthermore, the results can also provide evidence of the effectiveness of the SME SF, where this paper indicates that it has not only neutralized the potential negative effects of capital regulation, but facilitated bank lending to SMEs. Such results have not been found in any other previous report. The results found in this thesis, create an increased need for further research to evaluate how the SME SF affects SMEs of different sizes; micro, small and medium, to understand how the SME SF is applied and how it impacts SME lending. Consequently, given that SMEs represent 99,8% of all companies operating in the EU-28 area, we assume that the significant results found in this thesis should favor the well-being of the whole economy.

The method is based using proxies of SME loan volumes and interest rates, an interesting extension of the study is to perfectly match the given loans and interest with the respective

company and bank. Such an approach is beyond the scope of this thesis, but would have contributed to a more robust understanding of the relationship of capital requirements and the SME access to finance. Other suggestions for further research is to increase the time period of the study, to capture the effects during different economic cycles, and reassessing the analysis during the implementation of Basel IV.

References

Abdel-Baki, M. & Shoukry, M. (2013). Basel III, the Devil and Global Banking. *European Journal of Law and Economics*, *36*(1), 227–230. doi:10.1007/s10657-013-9401-4

Abor, J. Y., Agbloyor, E. K., & Kuipo, R. (2014). Bank finance and export activities of Small and Medium Enterprises. *Review of Development Finance*, *4*(2), 97–103. Special Issue: Developments in the Financial Services Sector in Africa. doi:https://doi.org/10.1016/j.rdf.2014.05.004

Acharya, V., Bharath, S. T., & Srinivasan, A. (2007, September). Does industry-wide distress affect defaulted firms? Evidence from creditor recoveries. *Journal of Financial Economics*, *85*(3), 787–821. doi:10.1016/j.jfineco.2006.05.011

Acharya, V., Eisert, T., Eufinger, C., & Hirsch, C. (2018). Real Effects of the Sovereign Debt Crisis in Europe: Evidence from Syndicated Loans. *The Review of Financial Studies*, hhy045. doi:10.1093/rfs/hhy045. eprint: /oup/backfile/content_public/journal/rfs/pap/10.1093_rfs_hhy045/3/hhy045.pdf

Admati, A. R., DeMarzo, P. M., Hellwig, M. F., & Pfleiderer, P. (2014). Fallacies and irrelevant facts in the discussion on capital regulation. In *Central Banking at a Crossroads: Europe and Beyond* (pp. 33–50). Anthem Press. Retrieved from http://www.jstor.org/stable/j.ctt1gxpd6m.6

Almeida, H., Campello, M., Cunha, I., & Weisbach, M. S. (2013, October). *Corporate Liquidity Management: A Conceptual Framework and Survey* (Working Paper No. 19502). National Bureau of Economic Research. doi:10.3386/w19502

Angrist, J. & Pischke, J.-S. (2009). *Mostly harmless econometrics : an empiricist's companion*. Princeton: Princeton University Press.

Arellano, M. (2003, June). *Panel data econometrics*. Advanced Texts in Econometrics. Oxford University Press.

Athanasoglou, P., Daniilidis, I., & Delis, M. D. (2014). Bank procyclicality and output: issues and policies. *Journal of Economics and Business*, *72*, 58–83. doi:https://doi.org/10.1016/j.jeconbus.2013.10.003

BCSB. (2010, December). Basel III: A global regulatory framework for more resilient banks and banking systems. Basel Committee on Banking Supervision. Retrieved from https://www.bis.org/publ/bcbs189.pdf

BCSB. (2017, December). Finalising Basel III - In brief. Basel Committee on Banking Supervision. Retrieved from https://www.bis.org/bcbs/publ/d424_inbrief.pdf

Beck, T., Demirguc-Kunt, A., & Levine, R. (2005, September). SMEs, Growth, and Poverty: Cross-Country Evidence. *Journal of Economic Growth*, *10*(3), 199–229.

Beck, T., Demirguc-Kunt, A., & Maksimovic, V. (2004, February). Bank competition and access to finance: international evidence. *36*, 627–48.

Berger, A. & Udell, G. (1998). The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle. *Journal of Banking and Finance*, *22*(6), 613–673.

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

Berggren, B., Olofsson, C., & Silver, L. (2000, November). Control Aversion and The Search for External Financing in Swedish SMEs. *Small Business Economics*, *15*(3), 233–242.

Bernanke, B. & Lown, C. S. (1991). The credit crunch. *Brookings Papers on Economic Activity*, *22*(2), 205–248. Retrieved from https://EconPapers.repec.org/RePEc:bin:bpeajo:v:22:y:1991:i:1991-2:p:205-248

Blundell-Wignall, A. & Atkinson, P. (2010, January). Thinking beyond Basel III: Necessary Solutions for Capital and Liquidity. *OECD Journal. Financial Market Trends*, (1), 9–33. Retrieved from http://search.proquest.com/docview/858091727/

Brogi, M. & Lagasio, V. (2017). SME Sources of Funding: More Capital or More Debt to Sustain Growth? An Empirical Analysis. In S. Rossi (Ed.), *Access to bank credit and sme financing* (pp. 173–199). Cham: Springer International Publishing. doi:10.1007/978-3-319-41363-1_7

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*(100), 173–193. Retrieved from https://EconPapers.repec.org/RePEc:eee:corfin:v:27:y:2014:i:c:p:173-193

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

Crosignani, M. (2017, September). *Why Are Banks Not Recapitalized During Crises?* (Working Paper No. 2017-084). National Bureau of Economic Research. doi:http://dx.doi.org/10.2139/ssrn.2432711

Diamond, D. W. & Dybvig, P. H. (1983, June). Bank Runs, Deposit Insurance, and Liquidity. *Journal of Political Economy*, *91*(3), 401–419.

Diamond, D. W. & Rajan, R. G. (2000, December). A Theory of Bank Capital. *Journal of Finance*, *55*(6), 2431–2465.

EBA. (2016, March). EBA report on SMEs and SME supporting factor. European Banking Authority. EBA/OP/2016/04.

ECB. (2014, July). *Monthly Bulletin*. European Central Bank. Retrieved from https://www.ecb.europa.eu/pub/pdf/mobu/mb201407en.pdf

ECB. (2017, May). Survey on the Access to Finance of Enterprises in the Euro area. Data summary on the survey reflecting the duration of October 2016 to March 2017. European Central Bank. Retrieved from https://www.ecb.europa.eu/pub/pdf/other/ecb.accesstofinancesmallmediumsizedenterprises201705.en.pdf?17da4ff2a730b7ababea4037e4ce8cae

Elliot, V. & Willesson, M. (2018, January). *Does bank regulation spill-over to firm financing? SME financing, bank monitoring and the efficiency of the bank lending channel*. Working Paper.

Farinha, L. & Félix, S. (2015, August). Credit rationing for Portuguese SMEs. *Finance Research Letters*, *14*, 167–177.

Fidrmuc, J. & Hainz, C. (2009). *Default Rates in the Loan Market for SMEs: Evidence from Slovakia* (ifo Working Paper Series No. 72). ifo Institute - Leibniz Institute for Economic Research at the University of Munich. Retrieved from https://EconPapers.repec.org/RePEc:ces:ifowps:_72

Ford C. (2016, January). Is Basel III responsible for holding back SME. Retrieved from http://www.bobsguide.com/guide/news/2016/Jan/8/is-basel-iii-responsible-for-holding-back-sme-growth/

Galli, E., Mascia, D. V., & Rossi, S. P. S. (2017). Legal-Institutional Environment, Social Capital and the Cost of Bank Financing for SMEs: Evidence from the Euro Area. In S. Rossi (Ed.), *Access to Bank Credit and SME Financing* (pp. 59–81). Cham: Springer International Publishing. doi:10.1007/978-3-319-41363-1_3

Gjelsvik, M. (2017, January). Economic Transformations of Regions: The Role of Banks. *Strategic Change*, *26*(1), 35–51.

Hellmann, T. F., Murdock, K. C., & Stiglitz, J. E. (2000). Liberalization, Moral Hazard in Banking, and Prudential Regulation: Are Capital Requirements Enough? *American Economic Review*, *90*(1), 147–165. Retrieved from http://search.ebscohost.com.ezproxy.ub.gu.se/login.aspx?direct=true&db=buh&AN=3021258&site=ehost-live

Henneke, J. & Truck, S. (2006). Asset Correlations and Capital Requirements for SME in the Revised Basel II Framework. *Banks and Bank Systems*, *1*(1).

Hernández-Cánovas, G. & Martínez-Solano, P. (2010, May). Relationship lending and SME financing in the continental European bank-based system. *Small Business Economics*, *34*(4), 465–482. doi:10.1007/s11187-008-9129-7

Hirsch, F. (1977). *Social limits to growth* (2 pr.). Cambridge, Mass.: Harvard U.P.

Humblot, T. (2014). *Basel III effects on SMEs' access to bank credit: An empirical assessment*. working paper or preprint. Retrieved from https://hal.archives-ouvertes.fr/hal-01096527

Izquierdo, J., Munoz, S., Rubio, A., & Ulloa, C. (2017, January). Impact of capital regulation on SMEs credit. Working Paper. BBVA.

Khwaja, A. I. & Mian, A. (2008, September). Tracing the Impact of Bank Liquidity Shocks: Evidence from an Emerging Market. *American Economic Review*, *98*(4), 1413–1442.

Koehn, M. & Santomero, A. M. (1980). Regulation of bank capital and portfolio risk. *Journal of Finance*, *35*(5), 1235–44. Retrieved from https://EconPapers.repec.org/RePEc:bla:jfinan:v:35:y:1980:i:5:p:1235-44

Lambertini, L. & Mukherjee, A. (2016). Is Bank Capital Regulation Costly for Firms? - Evidence from Syndicated Loan. Retrieved from https://cfi.epfl.ch/files/content/sites/cfi/files/shared/TEAM/Luisa/US_syndicate_2017.pdf

Mateev, M. (2011). How SME uniqueness affects capital structure evidence from Central and Eastern Europe panel data. *Quarterly journal of finance & accounting : QJFA*, *50*(1), 115–143.

Mayer, C. (1994, December). The assessment: money and banking: theory and evidence. (evidence of the importance of money for the economy). *Oxford Review of Economic Policy*, *10*(4).

Mayordomo, S. & Rodriguez-Moreno, M. (2017). Did the bank capital relief introduced by the Supporting Factor enhance SME lending? Banco de Espana. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2870002

Mehran, H. & Thakor, A. (2011). Bank Capital and Value in the Cross-Section. *Review of Financial Studies*, *24*(4), 1019–1067. Retrieved from https://EconPapers.repec.org/RePEc:oup:rfinst:v:24:y::i:4:p:1019-1067

Miles, D., Marcheggiano, G., & Yang, J. (2011, April). *Optimal Bank Capital*. CEPR Discussion paper 8333.

Modigliani, F. & Miller, M. (1958, January). Theory of Investment, The Cost of Capital, Corporation Finance and the Theory of Investment. *The American Economic Review*, *48*. Retrieved from http://search.proquest.com/docview/1289584756/

Muller, P., Julius, J., Herr, D., Koch, L., Peycheva, V., & McKiernan, S. (2017, November). Annual Report on European SMEs 2016/1017. Prepared for the European Commission, Contract number: EASME/COSME/2016/010.

Myers, S. C. (1984, July). The Capital Structure Puzzle. *Journal of Finance*, *39*(3), 575–592.

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

Niemeyer, J. (2016). Basel III - What and Why? Sveriges Riksbank. Retrieved from http://www.riksbank.se/Documents/Rapporter/POV/2016/2016_1/rap_pov_artikel_3_160317_eng.pdf

Oricchio, G., Lugaresi, S., Crovetto, A., & Fontana, S. (2017). Alternative Funding Options: E-platforms. In *SME Funding: The Role of Shadow Banking and Alternative Funding Options* (pp. 211–235). London: Palgrave Macmillan UK. doi:10.1057/978-1-137-58608-7_7

Paul, S., Whittam, G., & Wyper, J. (2007, February). The pecking order hypothesis: does it apply to start-up firms? *Journal of Small Business and Enterprise Development*, *14*(1), 8–21.

Peltzman, S. (1976). Toward a more general theory of regulation. *The Journal of Law and Economics*, *19*(2), 211–240. doi:10.1086/466865. eprint: https://doi.org/10.1086/466865

Petersen, M. A. & Rajan, R. G. (1994, March). The Benefits of Lending Relationships: Evidence from Small Business Data. *Journal of Finance*, *49*(1), 3–37.

Quy-Toan Do. (2004, October). Asymmetric Information. The World Bank. Retrieved from https://siteresources.worldbank.org/DEC/Resources/84797-1114437274304/Asymmetric_Info_Sep2003.pdf

Rajan, R. G. (1996). Why banks have a future: toward a new theory of commercial banking. *Journal of Applied Corporate Finance*, *9*(2), 114–128. doi:10.1111/j.1745-6622.1996.tb00119.x. eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1745-6622.1996.tb00119.x

Schmidt, R. H., Hackethal, A., & Tyrell, M. (1999). Disintermediation and the Role of Banks in Europe: An International Comparison. *Journal of Financial Intermediation*, *8*(1), 36–67. doi:https://doi.org/10.1006/jfin.1998.0256

Schwerter, S. (2011, November). Basel III's ability to mitigate systemic risk. *Journal of Financial Regulation and Compliance*, *19*(4), 337–354.

Stiglitz, J. & Weiss, A. (1981). Credit rationing in markets with imperfect information. *The American economic review*, *71*(3), 393–410.

Tirole, J. (2006). *The theory of corporate finance*. Princeton University Press.

Van Hoose, D. (2007). Theories of bank behavior under capital regulation. *Journal of Banking and Finance*, *31*(12), 3680–3697.

Watson, N., Robert & Wilson. (2002, April). Small and Medium Size Enterprise Financing: A Note on Some of the Empirical Implications of a Pecking Order. *Journal of Business Finance & Accounting*, *29*(3-4), 557–578.

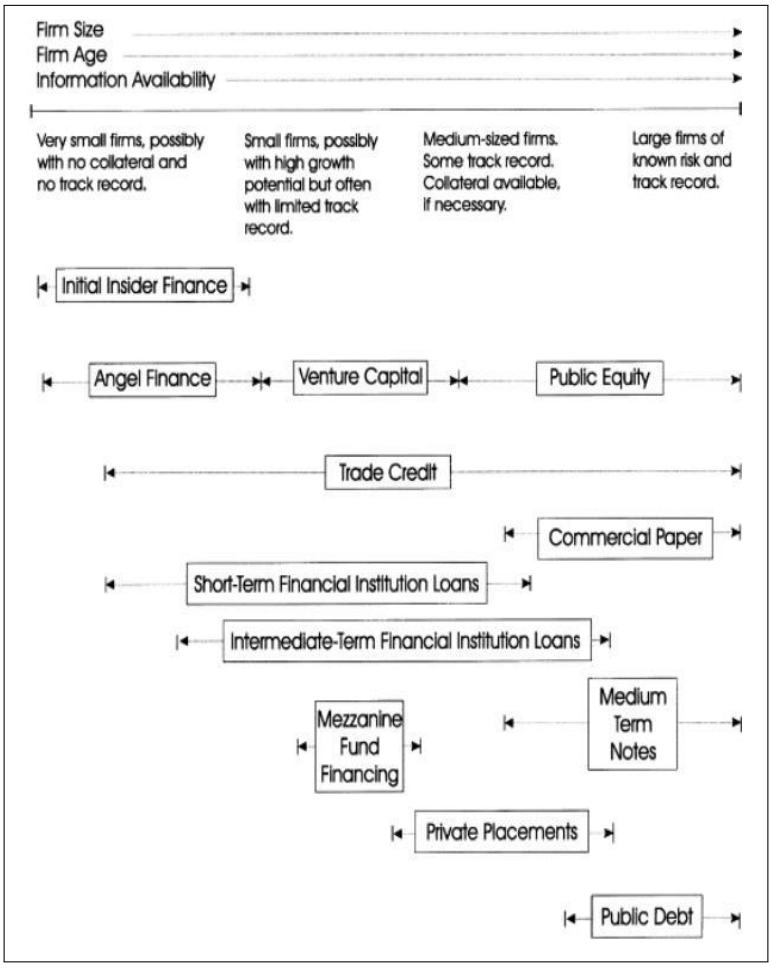
Wollbrant, C. E. (2017, March). Lecture notes in Advanced Microeconomics II. School of Business, Economics and Law at the University of Gothenburg.

Wooldridge, J. M. (2014). *Introduction to econometrics* (Europe, Middle East and Africa ed.). Andover: Cengage Learning.

Zeidan, R., Galil, K., & Shapir, O. M. (2017). Do ultimate owners follow the pecking order theory? *Quarterly Review of Economics and Finance*.

Appendix

A1



Financial growth cycle of firms as illustrated by Berger and Udell (1998)

A2

Robust, year 2014 dropped + 2015 as cutoff, only micro and small

VARIABLES	(1) SME Loan Volume	(2) Large Loan Volume	(3) SME Interest Rate	(4) Large Interest Rate	(5) DiD Loan Volume	(6) DiD Interest Rate
SME					-2.255***	0.00730**
					(0.170)	(0.00341)
Post					0.122***	-0.00994***
					(0.00430)	(0.000215)
Interaction					0.128***	-0.00514***
					(0.00442)	(0.000217)
CET1 (log)	0.00453	-0.127**	0.0130***	-0.0108***	0.233***	-0.0159***
	(0.00654)	(0.0640)	(0.000597)	(0.00307)	(0.0141)	(0.000390)
Tier 1 (log)	0.346***	0.0928	-0.0398***	-0.00602	-0.221***	0.0120***
	(0.00639)	(0.0733)	(0.000922)	(0.00432)	(0.0178)	(0.000596)
Tier 2 (log)	0.155***	0.139***	0.00402***	0.00656***	0.180***	0.00208***
	(0.00148)	(0.00714)	(9.99e-05)	(0.000390)	(0.00209)	(7.52e-05)
Avg Total Risk-Weighted Assets (log)	-0.193***	-0.178***	0.0222***	0.0107***	0.00499	-0.00502***
	(0.00290)	(0.0383)	(0.000289)	(0.00172)	(0.0153)	(0.000371)
Shareholders' Funds (log)	1.395	0.920	-0.189***	-0.0835**	-1.473	0.0462*
	(1.333)	(1.206)	(0.0658)	(0.0346)	(1.573)	(0.0279)
Cash (log)	0.00356	0.00351	-0.000174	3.90e-05	0.00826	-9.50e-05
	(0.00374)	(0.00914)	(0.000225)	(0.000304)	(0.00942)	(0.000205)
Long-Term Debt (log)	-0.0835	-0.162*	0.00540**	-0.00346	-0.236**	0.00196
	(0.0550)	(0.0849)	(0.00241)	(0.00232)	(0.113)	(0.00160)
Creditors (log)	-0.00291	-0.0211	0.00121*	-0.000338	-0.0183	0.000396
	(0.00645)	(0.0134)	(0.000729)	(0.000423)	(0.0147)	(0.000360)
% Change Net Income	2.18e-08	1.05e-06***	-1.63e-08**	1.47e-08	7.88e-07**	-2.31e-08***
	(5.97e-08)	(3.76e-07)	(7.08e-09)	(9.35e-09)	(3.59e-07)	(7.79e-09)
GDP (log)	-0.493***	0.795***	0.0626***	0.0195***	1.126***	-0.0113***
	(0.00652)	(0.0547)	(0.000779)	(0.00193)	(0.0337)	(0.00123)
Unemployment	-0.994***	2.529***	0.142***	0.191***	-0.00375	0.0622***
	(0.0194)	(0.189)	(0.00102)	(0.0111)	(0.0284)	(0.00108)
Lag Volume Loan (log)	0.680***	0.254***			0.597***	
	(0.00399)	(0.0129)			(0.00603)	
Long-Term Interest			0.0701***	0.111***		0.0594***
			(0.00145)	(0.00958)		(0.000797)
Constant	-19.39	-22.08	2.950*	1.656*	18.45	-0.724
	(33.54)	(32.03)	(1.665)	(0.907)	(42.48)	(0.716)
Observations	221,757	13,194	221,774	13,219	234,951	234,993
R-squared	0.739	0.610	0.742	0.483	0.700	0.821
Number of id	63,116	3,617	63,119	3,617	66,730	66,733
Country FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

A3

Robust, all missing values included

VARIABLES	(1) SME Loan Volume (log)	(2) Large Loan Volume (log)	(3) SME Interest Rate	(4) Large Interest Rate	(5) DID Loan Volume (log)	(6) DID Interest Rate
Tier 1 Common Capital (log)	0.259***	0.125***	-0.0177***	-0.0213***	0.00669	-0.00561***
	(13.75)	(4.90)	(-27.03)	(-26.97)	(0.59)	(-17.71)
Tier 1 Ordinary Equity (log)	0.0806***	-0.380***	-0.00319***	0.00965***	-0.0704***	0.00582***
	(9.35)	(-21.63)	(-8.52)	(13.51)	(-9.67)	(32.78)
Tier 2 Capital (log)	0.190***	0.123***	0.00582***	0.00602***	0.216***	0.00517***
	(81.40)	(9.85)	(31.04)	(11.53)	(47.10)	(30.59)
Avg Total Risk-Weighted Assets (log)	-0.263***	0.125*	0.0167***	0.00503***	0.108***	-0.0148***
	(-30.63)	(2.43)	(29.87)	(3.99)	(5.71)	(-27.78)
Shareholders' Funds (log)	0.0151***	0.00499	-0.00161***	-0.000900*	0.00242	-0.000498***
	(14.62)	(0.40)	(-22.26)	(-2.30)	(1.88)	(-9.98)
Cash (log)	0.000127	-0.00479	-0.0000129	0.0000823	0.0000365	-0.0000133
	(0.44)	(-1.69)	(-0.74)	(1.00)	(0.12)	(-1.06)
Long-Term Debt (log)	0.0000839	-0.00331	-0.0000466	-0.0000375	-0.0000557	-0.0000496*
	(0.18)	(-1.15)	(-1.78)	(-0.39)	(-0.11)	(-2.50)
Creditors (log)	0.00192***	-0.00281	-0.0000149	-0.000281	0.00174**	4.86e-08
	(3.64)	(-0.36)	(-0.45)	(-1.30)	(3.07)	(0.00)
% Change Net Income	-4.97e-08	0.00000135**	-4.16e-08	7.48e-09	0.00000120***	7.77e-09
	(-0.24)	(3.27)	(-1.48)	(0.80)	(4.00)	(0.58)
GDP (log)	-0.338***	0.676***	0.0492***	0.0167***	0.290***	0.0242***
	(-31.36)	(9.74)	(47.85)	(9.24)	(7.86)	(30.66)
Unemployment	0.567***	2.201***	0.143***	0.154***	-0.818***	0.240***
	(10.29)	(9.83)	(47.75)	(15.60)	(-10.62)	(98.33)
Lag Loan Volume (log)	0.562***	0.271***			0.648***	
	(99.18)	(10.64)			(77.17)	
Long-Term Interest Rate			0.0685***	0.111***		0.00465***
SME					-2.547***	0.00810**
					(-6.72)	(2.98)
Post					0.0791***	-0.00974***
					(11.40)	(-38.76)
Interaction					0.100***	-0.00411***
					(15.19)	(-16.90)
Constant	13.48***	-1.571	-1.385***	-0.429***	-3.582**	-0.409***
	(20.65)	(-0.50)	(-27.93)	(-4.93)	(-2.82)	(-16.34)
Observations	143,448	8,165	144,142	8,173	151,613	152,315
R-squared	0.555	0.482	0.739	0.519	0.551	0.800
Number of Firms	51,629	2,660	51,736	2,661	54,274	54,382
Firm FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

A4

Statistic representing the number of SME

TIME / GEO	2011	2012	2013	2014	2015
European Union (current com	20,448,910	20,717,621	21,000,000 (de)	21,736,481	21,800,000 (de)
Italy	:	3,628,547	3,581,269	3,530,507	3,497,783
France	2,417,698	2,731,649	2,870,186	3,045,323 (b)	2,765,282 (b)
Spain	2,285,379	2,252,804	2,229,190	2,253,596	2,337,621
Germany (until 1990 former t	:	1,802,281	1,802,561	2,087,347	1,985,471
United Kingdom	1,518,212	1,514,849	1,588,043	1,639,201	1,734,989
Poland	1,452,022	1,446,539	1,418,595	1,474,457	1,534,086
Netherlands	751,875	810,605	977,545	1,004,784	1,042,588
Czech Republic	963,753	967,067	949,260	956,420	961,287
Portugal	789,149	755,075	741,181	746,238	769,043
Greece	:	702,936	677,117	: (c)	764,471 (b)
Sweden	616,132	626,045	627,028	637,022	649,412
Belgium	517,769	533,350	533,487	561,279	569,950
Hungary	521,381	499,635	470,960	484,409	504,904
Slovakia	398,309	384,271	379,820	406,771	414,630
Romania	356,008	372,569	383,257	403,444	405,493
Bulgaria	281,793	285,346	287,045	292,852	298,559
Austria	265,584	268,640	277,970	280,716	280,850
Norway	249,704	255,951	258,657	262,366	267,922
Ireland	:	:	:	215,475	224,742
Finland	207,362	207,774	215,998	209,417	209,328
Denmark	:	190,761	188,682	189,669	187,367
Lithuania	114,721	128,608	139,657	160,770	172,527
Croatia	140,928	136,119	134,255	135,116	134,007
Slovenia	110,343	112,704	119,901	123,154	127,603
Latvia	70,398	82,943	87,887	91,083	100,216
Switzerland	:	:	97,146	99,671 (d)	95,796 (d)
Estonia	49,075	52,394	56,471	57,807	61,513
Luxembourg	25,382	25,415	26,870	27,406	27,841
Malta	25,977	25,126	23,512	24,369	24,123
Cyprus	: (c)	: (c)	43,896	: (c)	: (c)

Table A4: Number of SMEs 2011-2015. Source: Eurostat

A5

Bank Descriptives

Bank Deskriptives	Number of Banks
Germany	61
Sweden, Finland, Norway and Denmark	59
Switzerland	30
Ukraine, Estonia and Russia	30
Italy	21
Austria	18
Spain	16
Greece & Portugal	10
Netherlands	10
Luxembourg & Belgium	9
France	7
Czech Republic	6
Lithuania, Latvia, Slovakia & Ukraine	6
Poland	6
Bulgaria & Romania	5
Cyprus	4
Ireland	4
Bosnia & Herzegovina	3
Hungary	3
Total	**308**

A6 a and b

Credit Constraint Regression

```
Iteration 0:   log pseudolikelihood = -15500.509
Iteration 1:   log pseudolikelihood =  -14874.76
Iteration 2:   log pseudolikelihood = -14855.379
Iteration 3:   log pseudolikelihood = -14855.368
Iteration 4:   log pseudolikelihood = -14855.368

Logistic regression                             Number of obs     =     32,411
                                                Wald chi2(6)      =    1288.41
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -14855.368               Pseudo R2         =     0.0416

------------------------------------------------------------------------------
             |               Robust
CreditConstraint |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Tier1CommonCapitalCET1 |  -.3984961   .0592743    -6.72   0.000    -.5146715   -.2823206
Tier2Capital000 |   .1968238   .0368553     5.34   0.000     .1245886    .269059
AvgTotalRiskweightedAssets |   .2373452   .0744525     3.19   0.001     .0914209    .3832695
GDPcurrentUSmillionsseasa |  -.1875969   .0220886    -8.49   0.000    -.2308898   -.1443039
Unemployment |   5.383709   .2693648    19.99   0.000     4.855763    5.911654
TurnoverIncreased |  -.3215084   .0179094   -17.95   0.000    -.3566102   -.2864067
       _cons |   2.078979   .5214611     3.99   0.000     1.056934    3.101024
------------------------------------------------------------------------------
```

```
Expression   : Pr(CreditConstraint), predict()
dy/dx w.r.t. : Tier1CommonCapitalCET1 Tier2Capital000 AvgTotalRiskweightedAssets GDPcurrentUSmillionsseasa Unemployment TurnoverIncreased

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Tier1CommonCapitalCET1 |  -.0574363   .0085306    -6.73   0.000    -.074156   -.0407166
Tier2Capital000 |   .0283687   .0053165     5.34   0.000     .0179486    .0387889
AvgTotalRiskweightedAssets |   .0342092   .0107227     3.19   0.001      .013193    .0552254
GDPcurrentUSmillionsseasa |  -.0270388   .0031818    -8.50   0.000    -.033275   -.0208027
Unemployment |   .7759683   .0384064    20.20   0.000     .7006931    .8512435
TurnoverIncreased |  -.0463399   .0025553   -18.14   0.000    -.0513481   -.0413317
------------------------------------------------------------------------------
```