COSTS AND BENEFITS OF INCREASED REGULATION

Empirical evidence on effects of Basel III capital ratios on Scandinavian banks

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Abstract

Ever since the financial crisis, there have been calls for increased regulation of the banking industry. The Basel Accord took immediate action and introduced the third version of their Basel framework shortly after the crisis hit, increasing demands on bank capital and liquidity. The banking industry responded with a report claiming that the costs of the Basel III regulation would be high. This as banks would face increased cost of capital due to them being required to hold more expensive capital, as opposed to cheaper debt. This increase in the cost of capital would end up on the lenders bill as banks increase their lending spreads, eventually resulting in a reduction of economywide lending growth, a mechanism that later has been supported by several studies. While the theoretical impact of regulation has been widely discussed, little work has been done on an empirical level. There is thus a need for empirical evidence on what happens to banks following increased regulatory standards.

Given this background, the study aims to answer the following question:

“What effects have the increased capital ratios of Basel III had on Swedish, Danish and Finnish banks’ lending growth, cost of capital and default risk?”

Through a quantitative study using paired T-tests as well as regression analysis, the study finds that increased capital ratios does indeed lead to lower lending growth. The extent to which is however smaller than anticipated by most other studies. Increased capital ratios were also shown to have a positive effect on banks in that it reduced their cost of capital. This shows that there are two counteracting forces on banks cost of capital following increases in capital ratios. One where cost of capital increases due to increased cost of financing, and one where cost of capital decreases as bank risk and investor expectations are lowered. The study also finds empirical evidence that the Basel risk-weighted capital ratios does not help reduce bank risk. Instead, banks reduce their risk by increasing their total capital to assets ratio. This implies that the Basel capital ratios only work through a secondary effect of banks increasing their capital to assets ratio following a regulatory tightening.

The main contributions of the study are showing that regulators need to be mindful when implementing new regulation, as there are negative effects on economies lending growth. Additionally, the fact that lower bank risk results in lower cost of capital is a fact that has been mostly ignored by scholars in the field, something this study may be able to change. Lastly, the inability of the risk-based capital ratios to reduce bank risk is significant in that it puts into question whether the Basel Accord are able to produce a reliable framework for minimizing risk in the banking industry.
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1. Introduction

The purpose of this chapter is to introduce the main topic of the study, its background and why it is a relevant research subject. This will lead to the research question that the study intends to answer. Additionally, the study’s purpose, contributions and limitations will also be presented.

1.1 Problem background

Plenty of academic attention has been devoted to discerning the main causes behind the financial crisis of 2007-2008, to the point where academics now agree. Perverse lending and risk operations by banks, driven by the advent of securitization and the originate and distribute model led to unsustainable household credit growth and an asset price bubble in the housing market which caused the crisis (Brunnermeier, 2009, p. 77). Through the international holdings of toxic assets by, in particular banks, but also other institutions, a crisis which could theoretically have been mostly confined to the American economy, spread rapidly throughout the world. (Brunnermeier, 2009, p. 81).

Significant financial turmoil followed in the wake of the crisis and has been referred to as the worst financial disruption since the great depression (Adebambo et al., 2015). Even to this day, the effects of the crisis are felt in many parts of the world, as evident by low or even negative interest rates. Arguably, the turmoil subsequent to the crisis was in large parts responsible for the sovereign debt crisis that appeared in the Eurozone during 2010-2011 (Blundell-Wignall & Atkinson, 2010, p. 2). Both institutions as well as individuals were taken by surprise by the crisis, as the banking industry is one, if not the most regulated sector in the world (Adesina & Mwamba, 2016, p. 319).

Following the crisis, regulatory bodies acted quickly in response to a general outcry for improved stability in the banking sector (Blundell-Wignall & Atkinson, 2010, p. 2). One of these institutions is the Basel Committee for Banking Supervision (BCBS), the main international regulatory body of the banking industry. Originally founded in 1974, in response to turmoil in the currency and banking markets, the Basel Committee aims to regulate banking risk in order to ensure a stable financial system (Bank For International Settlements, 2016). Its first step towards this goal was to introduce the first ever international framework for the banking industry, in which banks were required to have a capital to risk-weighted assets ratio of 8%. This first set of regulation is referred to as Basel I (Bank For International Settlements, 2016).

As the banking industry evolved, the regulatory standards were forced to follow. In 1999, Basel II was introduced to replace the previous Basel I. Basel II built on the capital requirements of Basel I, but added two additional complementary pillars to the framework. These new pillars were a supervisory review of institutions capital adequacy and internal assessment procedures, as well as a requirement of disclosure to strengthen overall market discipline (Bank For International Settlements, 2016). Numerous updates of the Basel II framework were implemented until 2006, all of which were based on the three pillars (Bank For International Settlements, 2016).

During the same month as the financial crisis erupted, the Basel Committee proposed increased risk management and supervision of the banking industry in their Basel III framework. Basel III enhanced and strengthened the three pillars established in Basel II,
but also extended the framework with several innovations. Examples of these innovations included a capital conservation buffer, a countercyclical capital buffer, a leverage ratio, increased liquidity requirements and additional requirements for systemically important banks (Bank For International Settlements, 2016). In late 2010, the Committee settled on the new stricter rules to be implemented during the following ten-year period (Bank For International Settlements, 2016). Just as Basel II, Basel III has been under constant evolution for the past ten years. In fact, the full Basel III framework was considered complete as late as December 2017 (Ingves, 2018). In addition to the above demands, the newest additions also restrict the use of internal calculation models for risk-weighted assets and homogenized this procedure for the banking industry overall, as Basel Committee Chairman, and Governor of the Swedish Central Bank, Stefan Ingves noted in a speech in January 2018. This as a response to much of the criticism directed at the Basel framework (Ingves, 2018).

Basel III did, as noted, meet criticism from the banking industry. After the Basel III framework was introduced in 2010, the Institute of International Finance (IIF), a body consisting of high standing members of the banking industry, released a report calculating and presenting the potentially severe negative macroeconomic effects of the regulation (IIF, 2010). The underlying logic of the report was that higher capital and liquidity demands required banks to raise more capital, increasing their cost of capital. The increase in the cost of capital would end up on the lenders bills via increased lending rates, decreasing supply of credit and even reducing employment and GDP (IIF, 2010).

As a response, the Basel Committee released their own report calculating the macroeconomic impact of increased regulation (BCBS, 2010). For the sake of argument, the committee accepted the mechanism argued by the IIF and based their calculations on the premise that this was how it all worked. They did however note that these calculations would always be an upper bound on the costs of regulation, as they fully disregarded the fact that as banks become safer, investors will expect a lower return on their investments, which will reduce the cost of capital, rather than increase it. Expectedly, the Basel Committee found the macroeconomic costs to be significantly smaller than the ones reported by the IIF, noting that while there are costs, these should be small enough to not impact the economies in any significant way (BCBS, 2010).

The 2017 additions to the Basel III framework met criticism as well, in particular from the Scandinavian countries. In an article in Bloomberg, the head of the Swedish Bankers’ Association, as well as the Danish banking lobby opposed the new Basel standards, claiming they would have severe negative effects on the Swedish and Danish economies (Levring, 2017). By not taking the low default history of Scandinavian banks into account, the new regulations are expected to hit them harder by forcing them to have further increased capital, in relation to others (Levring, 2017). Countries which have comparatively high exposure to mortgage credit, such as the Scandinavian countries, will be the ones most affected by the recent Basel additions according to a KPMG report (Nicolaus, 2017).

Similar to the BCBS report, Blundell-Wignall & Atkinson (2010, p. 20-21), while acknowledging the costs of regulation, criticized the results of the IIF report, claiming them to be “highly exaggerated”. They claim that raising the capital required to comply with the Basel III standards would be far less disruptive than suggested in the IIF report, given that the effect on lending spreads, opposed to what was argued by the IIF, would be small. (Blundell-Wignall & Atkinson, 2010, p. 20-21).
It should be noted that the Basel Committee holds no supranational authority. Rather, it designs broad supervisory guidelines that may be implemented by national authorities. As such, they have no legal standing to implement the new regulation, a job that falls entirely on the national regulatory authorities (Wahlström, 2009, p. 54). Furthermore, the Basel standards are global minimum standards (Ingves, 2018). This means that nations are free to impose stricter regulations and shorten the time frame of implementation. The European Union decided to implement Basel III via regulation and directives in 2014. The EU legislation, often referred to as the Capital Requirements Directive IV (CRD IV), went beyond the minimum requirements proposed by the Basel Committee and encouraged national authorities to apply even stricter rules in some cases (Thedéen & Lindblad, 2017).

The freedom to implement stricter regulation have been particularly embraced by the Swedish authorities. Swedish regulators have a widespread reputation as the toughest in Europe, a stance which was among the motivations of Scandinavia’s biggest and most important bank Nordea to move their headquarters from Stockholm to Helsinki (Milne, 2017). The move takes Nordea out of reach from the Swedish regulators and into the hands of the European Banking Union, of which Finland is a member. Björn Wahlroos, Nordea chairman noted “We see the move as an important strategic step in positioning Nordea on a par with its European peers. The level playing field and predictable regulatory environment offered by the banking union are, we believe, in the best interest of Nordea’s customers, shareholders and employees” (Milne, 2017).

The potential effects of increased banking regulation is a topic of current interest, especially in the Scandinavian countries. The most recent update of the Basel III framework has been the subject of debate as to its potential effects on the Scandinavian economies (Levring, 2017). In addition, the Nordea case has made it clear that the regulatory standards matter for banks in respect to their strategic decisions and operations. While it is clear that the Basel regulatory framework has a significant impact on the banking industry, as well as being a topic of relevance to industry and individual alike, due to the long-term implementation of Basel III, empirical work on the effects of the regulation is scarce. Given that there exist multiple different theoretical views as to the impact of increased regulation, there is a need for academia to continue doing research on the subject to arrive at what the actual relationship is.

Due to the early adoption of the Basel III rules in Scandinavian countries, it should be possible to conduct an early examination on its effect on the banking industry so far. Note however that as Norway is not a member of the European Union, they are yet to fully employ the new regulation. Norwegian banks are thus excluded from the study.

1.2 Problematization

In its role as the primary regulatory body for the international banking industry, the Basel framework has throughout its time been met with criticism. Even though many supported the idea of Basel I and applauded having a global benchmark for banking regulation, there were severe problems with it (Balthazar, 2006, p. 32). One such issue was that due to its relative simplicity, in combination with financial innovation, banks were able to arbitrage between their required need for capital and the amount forced by regulation. Through securitization practices, banks could offload assets with high risk, transform them, and take them back as assets with lower amounts of risk. This allowed banks to increase their
amount of total assets while lowering their required capital ratios, thus increasing risk in the banking industry (Balthazar, 2006, p. 32).

While Basel II put an end to the regulatory arbitrage, it came with its own set of problems. If Basel I was perceived as simplistic and straight-forward, Basel II on the other hand was perceived as overly complex (Pakravan, 2014, p. 211). Basel II allowed for approved banks to use their own internal models for calculating risk-weighted assets, which in the end would cause high variability in reported risk-weighted assets between otherwise very similar banks, indicating issues with the measure (Le Leslé & Avramova, 2012, p. 13). Additionally, further financial innovation would allow banks to adopt techniques to minimize their total risk-weighted assets, and thus their required capital, all the while maintaining or increasing their overall risk-level (Pakravan, 2014, p. 212).

The introduction of the Basel III framework also met heavy criticism from the banking industry, claiming its effect on the macroeconomy would be severe (IIF, 2010). The IIF claims that through the channel of increased cost of capital, the supply of credit in the economies would fall, causing deflationary pressures, falls in GDP and increased unemployment (IIF, 2010). As the Basel Committee finished their Basel III framework during the end of 2017, the new additions also met opposition from the industry. Scandinavian banks were particularly outspoken about the regulation hitting them unnecessarily hard and the possible effects this would have on the Scandinavian real economies (Levring, 2017).

The IIF standpoint have received mixed academic support. Some reports found the claims of the IIF to be exaggerated, and estimated the potential effects to be small (Blundell-Wignall & Atkinson, 2010, p. 20-21). Other work has found increased capital requirements to decrease loan growth of banks during the first few years, for it to have fully recovered by the three-year mark (Bridges, et al., 2014, p. 23). Later work has also provided some support for the IIF claims. Roulet (2017, p. 20) for instance, finds that capital ratios have a significant and negative impact on bank lending growth, and claims that implementing capital and liquidity ratios to all banks irrespective of their attributes could have counterproductive results.

Another issue is that while the Basel Accord has been internationally recognized as the most important regulatory framework for the banking industry, recent research has found that it does not achieve what it is supposed to achieve. Bitar et al. (2018, p. 236) finds that the risk based capital ratios used in all Basel regulation does not reduce banks default risk, whereas non-risk based ratios does. This is a problem for the Basel Committee, as they have relied on the risk-based capital ratios as one of their main sources of regulation since the inception of the framework. Showing that these measures does not perform as they are intended to could reduce the industry’s as well as society’s confidence in the committees’ ability to provide a regulatory framework that works to reduce risk in the banking sector as efficiently as possible.

The actual effects of increased regulations are therefore still unclear, both regarding their costs and their benefits. This is problematic for banks as well as regulators, as they cannot tell how new regulation will affect them, making it difficult for them to adapt in the optimal way. Furthermore, this will increase the uncertainty of the industry, which is less than ideal. As can be seen in the Nordea case, unpredictability of regulation, both current and future, has an impact on banks strategic decisions. As such, not knowing the effects of regulation is problematic, a fact this study can help to alleviate.
1.3 Research question

The central question this study aims to answer is:

- What effects have the increased capital ratios of Basel III had on Swedish, Danish and Finnish banks’ lending growth, cost of capital and default risk?

1.4 Purpose

The purpose of the study is to determine some of the major costs and benefits of the implemented Basel III framework on a sample of Swedish, Danish and Finnish banks. Macroeconomic costs of increased regulation are argued to come from decreased lending growth, resulting in lower GDP, whereas the costs for individual banks are represented by an increase in their overall cost of capital. The study thus aims to show both the costs to the overall economy, as well as to the individual institutions, in addition to the benefits achieved by lower default risk.

1.5 Research gap

While some attention has been devoted to the theoretical costs of the latest regulation, no studies have shown the actual outcomes on an empirical level. The banking industry believes that increased regulation will have negative effects on GDP through the channel of increased cost of capital leading to lower lending growth, constraining the economy (IIF, 2010). The academic work on regulatory effects on lending growth has so far provided inconclusive answers, and few make the explicit connection to cost of capital. There thus exists an opportunity to extend the knowledge in the field of regulatory effects on the industry, as well as provide evidence towards whether the cost of capital channel as well as the risk reduction channel is observable in practice.

The study also extends earlier theories on the connection between regulation and lending growth to a new region. This is important since the Scandinavian economies are among the strongest in Europe, as evident by high sovereign rating scores. If future regulation is to hit the Scandinavian economies harder than others, it would likely cause extra pressure on their real economies. There is thus a current need to extend the analysis to the Scandinavian region and fill the academic void that exists there.

1.6 Theoretical and practical contribution

The main theoretical contribution of this paper lies partly in adding additional data to a currently contentious subject. Some studies argue that the costs of increased regulation would be small (Blundell-Wignall & Atkinson, 2010), others that they would be significant but short-lived (Bridges, et al., 2014), and others still that they would be significant and detrimental to the economy (IIF, 2010); (Angelini, et al., 2015). Additional data is required to arrive at a consensus, something this paper hopefully can contribute towards. Additionally, no research on the subject have been performed on the
Scandinavian region. As the Scandinavian economies continues to grow stronger, their relative importance is likely to increase. Given this fact, focused studies on the Scandinavian region should be receiving increased interest.

The practical contributions of the paper are focused either on the regulators or on the industry getting regulated. By providing information on how the regulation has impacted banks, it should help the regulators provide optimal regulations from a cost/benefit perspective. While regulators surely are aware of the theoretical costs of increased regulation, and tries to optimize it, little evidence have been provided on empirical effects. As for the banking industry, knowing the effects of regulation is surely an important piece of information. As noted earlier, uncertainty about future regulation was one of the reason prompting a move by banking giants Nordea, indicating that it is a subject of high importance.

Lastly, recent studies have found the risk-based capital ratios of the Basel accord to be ineffective in reducing bank default risk. Given the structure of the study, this will be examined further in the Scandinavian region. Should the study find further support against the risk-based ratios, potential practical implications could be substantial.

1.7 Delimitations

As noted, the study will be focused on the Scandinavian region. For the purpose of the study, Scandinavia is assumed to feature Sweden, Denmark and Finland, as those countries have implemented the CRD IV package into legislation. Scandinavia is a region of high current interest, providing motivation for the choice. As the study will be conducted on the sample as a whole, rather than on the individual institutions, a homogenous banking industry in the countries is also necessary. Note here that homogeneity refers to the overall banking culture, rather than specific institutions. While the nuances of the individual banks will differ in the sample used, the overall banking culture in these countries is mostly similar. Furthermore, due to time limitations, scope restrictions are necessary. Nevertheless, the choice of region should be able to provide interesting results.

While the aim of the study is to illuminate actual costs and benefits of regulatory changes in the banking industry, no attempt to analyze the costs and benefits against each other will be made. Whether the benefits of regulation outweigh the costs is a big discussion that should be treated in an individual paper. As such, no focus will be directed towards that question in this study.

The time frame used is also limited. Data from a number of years before and after the Basel III framework was put into effect will be used. The benefit of going very far back in time to collect data should be minimal. The timespan adopted in the study should be sufficient for its intended purposes.
2. Background on the Basel Accord

The purpose of this chapter is to give the reader an introduction to the purpose, fundamentals and evolution of the Basel regulation. Additionally, shortcomings of each version of the Basel Accord will be discussed.

As regulation lies as a centerpiece of this study, it is important to provide a thorough background on the main regulatory institution of the banking industry. Arguably, the most important regulatory body for the banking industry is the Basel Committee and their Basel Accords. The following sections will cover how the Basel Accords have changed over time, and provide knowledge on current regulatory requirements. The current regulatory requirements will be important throughout the study. Knowledge about them and how we ended up where we are is thus essential.

2.1 Basel I

While the Basel Committee was founded in 1974 in response to disturbances on the international currency and banking markets (Bank For International Settlements, 2016), the first Basel Accord was released in 1988. The Basel Capital Accord, or Basel I, came into existence in the aftermath of a debt crisis in Latin America. The crisis revealed the fact that capital ratios of many banks were deteriorating in a time where international risk was increasing, putting the banking system in danger (Bank For International Settlements, 2016). As the name suggests, the Capital Accord focused solely on credit risk and left other risks to be handled by national regulators (Balthazar, 2006, p. 17). The Basel Committee identified two main objectives of Basel I (Balthazar, 2006, p. 17), namely:

- To strengthen the soundness and stability of the international banking system.
- To diminish existing sources of competitive inequality among international banks.

In order to achieve these goals, Basel I imposed two specific requirements. A capital adequacy ratio, and a risk-asset ratio.

2.1.1 Capital adequacy ratio

The capital adequacy ratio was put into place to ensure that banks had enough capital to cover eventual losses. In the case of adverse events where banks suffer losses, capital is the first line of defense. If the bank has enough capital to absorb the losses, no harm will be done to the overall economy. If there isn’t enough capital to cover the losses however, it could spell trouble (Bank For International Settlements, 2016).

The total capital adequacy ratio for Basel I was set at 8% of risk-weighted assets. It should however be noted that the Committee recognized that not all capital was of equal value. Two different classes of capital were introduced, with liquidity as the main divider between them, and certain restrictions imposed upon them (Balthazar, 2006, p. 17). The highest quality capital was called Tier 1. Tier 1 capital was highly liquid and consisted
only of common equity or disclosed reserves. Tier 2 capital on the other hand consisted of undisclosed reserves, hybrid instruments and subordinated debt (Balthazar, 2006, p. 17). Tier 1 capital thus either was money, or could be turned into money immediately and without any risk of value loss, whereas Tier 2 capital was riskier, both in terms of liquidity and value loss.

For Basel I, Tier 1 capital had to be at minimum 4% of risk-weighted assets, whereas the restriction for Tier 2 capital was that it could not exceed the amount of Tier 1 capital. From the total capital, certain deductions could be made in particular circumstances, where balance sheet items such as goodwill and investments in unconsolidated subsidiaries were allowed to be fully deducted from the risk-weighted assets (Balthazar, 2006, p. 18).

### 2.1.2 Risk-weighted assets

To determine what assets and how much of the assets the capital needed to cover, the Committee introduced a concept that was one of the main innovations of Basel I, namely risk-weighted assets. The idea behind it was that different assets was perceived as more or less risky, a fact they wanted to consider. The required risk coverage would vary from asset to asset, depending on the assets perceived risk, where riskiness was usually determined by the liquidity of the instrument, existence of collateral or who the counterparty was (Balthazar, 2006, p. 18). Calculating the required coverage of different ratios by their respective risk-weight is a practice that has lived on even until today.

The risk-weights of assets was divided into four different groups. The most secure and liquid group required 0% coverage and contained items such as cash and claims on OECD central governments. The second group required 20% coverage and contained items such as claims on OECD banks and multilateral development banks as well as claims on public sector entities of OECD countries. The third group required 50% coverage and included only mortgage loans, with the last group requiring 100% coverage included all other claims (Balthazar, 2006, p. 18).

To illustrate how risk-weighted assets work, consider the following example. A bank has 200,000 dollars in assets. 100,000 dollars are in mortgage loans, 50,000 dollars are in cash and 50,000 dollars are claims on a local business. Total risk-weighted assets of the bank are then calculated by:

\[
\begin{align*}
\text{Mortgage loan assets (100.000) } \times \text{ Mortgage loan weight (50 \%)} &= 100.000 \times 0.5 = 50.000 \text{ dollars} \\
\text{Cash assets (50.000) } \times \text{ Cash weight (0 \%)} &= 50.000 \times 0 = 0 \text{ dollars} \\
\text{Corporate loan assets (50.000) } \times \text{ Corporate loan weight (100 \%)} &= 50.000 \times 1 = 50.000 \text{ dollars}
\end{align*}
\]

Total risk-weighted assets of the bank are thus 50,000 + 50,000 = 100,000 dollars. The total amount of capital required for this bank is then:

\[
\begin{align*}
\text{Total risk – weighted assets (100.000) } \times \text{ Required capital ratio (8 \%)} &= 100.000 \times 0.08 = 8000 \text{ dollars}
\end{align*}
\]
2.1.3 Critique of Basel I

While Basel I worked in some areas, for instance as providing a global benchmark for banking regulation, it faced issues in others (Balthazar, 2006, p. 32). The amount of capital that was required by regulation rarely lined up with the capital banks felt they required to support their activities, usually called economic capital. This discrepancy between regulatory capital and economic capital became one of the main drivers of financial innovation during that time (Jackson, et al., 1999, p. 3).

One of these innovations was securitization. Securitization, shortly put, is a technique where illiquid assets (usually loans) is transferred or sold to an independent company called a Special Purpose Vehicle (SPV) to be transformed into liquid securities (Balthazar, 2006, p. 34). Through the process of securitization, banks were able to essentially arbitrage between the regulatory capital and economic capital (Jackson, et al., 1999, p. 3). By engaging in activities that consumed more economic than regulatory capital, such as offloading loans with 100 % risk rate, and getting back assets with lower than 100 % risk rate, banks increased their risk relative to the minimum capital, which was a problem (Balthazar, 2006, p. 34). The advent of securitization also undermined Basel I in that it exposed banks to increasing amounts of market risk, something Basel I was not prepared to handle (Balthazar, 2006, p. 35). As the world would later find out, these securitization practices would cause enormous financial disruptions throughout the world during the latest financial crisis.

2.2 Basel II

As the economic environment changed, regulation was forced to do the same. The first consultative paper for Basel II was issued in 1999 and the final proposal was published in 2004. Through six years of consultation with the banking sector, Basel II aimed to achieve three goals (Balthazar, 2006, p. 40), these were:

- To increase the quality and the stability of the international banking system.
- To create and maintain a level playing field for internationally active banks.
- To promote the adoption of more stringent practices in the risk management field.

In order to achieve these goals, Basel II introduced a structure based on three pillars. The three pillars were designed to support the overarching objective of improved financial stability and better risk management practices (Balthazar, 2006, p. 44). Pillar one was based on Basel I and referred to minimum capital requirements. The second pillar aimed to increase risk management practices beyond credit risk by forcing banks to think about things such as reputation risk, strategic risk and interest rate risk, whereas the third pillar concerned market discipline and prompted mandatory disclosures of banks internal risk management practices (Balthazar, 2006, p. 46).

2.2.1 Pillar 1 – Minimum capital requirement

Contrary to Basel I, Basel II extended the capital ratio beyond credit risk to also include
market and operational risk. The capital ratio remained at 8% of total risk weighed assets and Tier 2 capital could not exceed the amount of Tier 1 capital, just as in Basel I (BCBS 2004, p. 12). In addition to including market and operational risk, Basel II also changed the way risk-weighted assets were calculated. Banks were now given the choice between two methods of calculating their credit risk. These were the standardized approach and the internal ratings-based approach (BCBS, 2004, p. 15). The standardized approach remained the same as in Basel I, where different assets were given different risk weights, and overall required coverage was calculated that way. The risk-weights given to assets in Basel II were revised from Basel I, but the method stayed the same (BCBS, 2004, p. 15).

The second approach was the internal ratings-based approach, or IRB approach, where banks were allowed to use their own internal models for calculating risk, given they had received approval from their national supervisors (BCBS, 2004, p. 13). The IRB approach was introduced for the trading book in a revision of Basel I in 1996 (Balthazar, 2006, p. 29), and subsequently found its way into the banking book as of Basel II.

In order to try and combat the increase in securitization that evolved as Basel I was introduced, a securitization framework was adopted. The framework defined what procedures would be classed as securitization and how the risk embedded in those operations would be covered (BCBS, 2004, p. 113). In essence, the securitization framework stated that banks have to hold capital to cover all their securitization dealings (BCBS, 2004, p. 113), essentially putting an end to the regulatory arbitrage that emerged in Basel I.

The last addition in pillar one was a revision on trading book regulation. While some changes took place in the 1996 revision of Basel I (Balthazar, 2006, p. 23), Basel II revised what activities would be included in the regulation of the trading book, to combat recent financial innovation (BCBS, 2004, p. 150). Besides a revision of outdated definitions, the biggest part of the changes to the trading book were how to value the market risk. Marking to market, reporting asset values after their current market value, emerged as the preferred method of measuring market risk in the trading book in Basel II, and has remained so until today (BCBS, 2004, p. 151).

2.2.2 Pillar 2 – Supervisory review process

While a majority of the effort of Basel II was directed at the first pillar, to the extent where more than half the report introducing Basel II focused on pillar one, the Basel Committee did not believe that it encouraged improved risk practices for banks. The supervisory review process was directed at achieving just that (BCBS, 2004, p. 158). The second pillar states that “Supervisors are expected to evaluate how well banks are assessing their capital needs relative to their risks and to intervene, where appropriate. This interaction is intended to foster an active dialogue between banks and supervisors such that when deficiencies are identified, prompt and decisive action can be taken to reduce risk or restore capital.” (BCBS, 2004, p. 158). Furthermore, the committee outlined four key principles of the supervisory review in order to make sure supervision was carried out mostly the same way in all countries (BCBS, 2004). The four key principles were:
• Banks should have a process for assessing their overall capital adequacy in relation to their risk profile and a strategy for maintaining their capital levels.
• Supervisors should review and evaluate banks’ internal capital adequacy assessments and strategies, as well as their ability to monitor and ensure their compliance with regulatory capital ratios. Supervisors should take appropriate action if they are not satisfied with the result of this process.
• Supervisors should expect banks to operate above the minimum regulatory capital ratios and should have the ability to require banks to hold capital in excess of the minimum.
• Supervisors should seek to intervene at an early stage to prevent capital from falling below the minimum levels required to support the risk characteristics of a particular bank and should require rapid remedial action if capital is not maintained or restored.

The above quote and principles highlight one of the most important additions of the supervisory review, namely the fact that it gives national supervisors the authority to take necessary action against banks that are not fulfilling the requirements outlined in pillar one.

2.2.3 Pillar 3 – Market discipline

In addition to capital requirements and extensive regulatory supervision, Basel II introduced demands on risk practice disclosure in its third pillar. The main purpose of pillar three was to complement the capital requirements and supervisory review in pillar one and two and encourage improved market discipline by requiring that certain information be disclosed in yearly reports (BCBS, 2004, p. 175). The disclosure served the purpose of informing market participants of important information such as the scope of application, capital, risk exposures, risk assessment processes, and the overall capital adequacy of the institution (BCBS, 2004, p. 175). The focus of the third pillar is thus on what information should be provided in these reports in order to ensure that the reporting standards are roughly the same all over the world.

2.2.4 Critique of Basel II

While Basel II were a more comprehensive and complex framework than Basel I, it also suffered from limitations. One such issue was indeed its increased complexity. Pakravan (2014, p. 211) argues that the flaws in Basel partly stems from the fact that risk-weight calculations are based on historical data, where the nature and length of the data used differs widely between different variables. This resulted in the fact that no major bank in the U.S managed to get their internal models approved by the authorities, despite investing heavily to do so (Pakravan, 2014, p. 211). The high complexity also caused banks to try and game the system. Like the regulatory arbitrage that emerged in the aftermath of Basel I, the period after Basel II saw banks adopt techniques with the purpose of minimizing risk-weighted capital (Pakravan, 2014, p. 212). The most fruitful methods to achieve this involved manipulating the risk-weights of assets, using derivatives to
lower risk-weights and focusing their overall exposure in lower-risk assets (Pakravan, 2014, p. 212).

This argument was later supported by a Bank for International Settlements paper which found a high variability in the reported risk-weighted assets both within and across countries. Banks with similar levels and structures of assets showed a wide variation in their reported risk weighted assets (Le Leslé & Avramova, 2012, p. 13). This indicates that banks were able to manage their risk calculations to achieve a level of required risk-weighted capital that suited them.

### 2.3 Basel III

While Basel III was under development before the financial crisis of 2008 erupted, the changes made were largely a response to the causes of the crisis (Walter, 2010). Basel III focused on macroprudential regulation in order to minimize systemic risk in the banking industry and reduce the likelihood that a situation similar to the crisis would occur again (Walter, 2010). Basel III builds on the foundation of the three pillars introduced in Basel II but focuses on improving both the quality and quantity of held capital and aims to improve risk coverage (BCBS, 2011). The major new additions to the Basel III framework were:

- Raising the quality of the capital base
- Strengthening the risk coverage of institutions
- Introduction of a capital conservation buffer
- Introduction of a countercyclical buffer
- Introduction of a leverage ratio
- More stringent regulation for systemically important institutions
- Improved liquidity standards

#### 2.3.1 Raising the quality of the capital base

The foundation of raising the quality of the capital base was the realization that the banking system went into the crisis with insufficient levels of high quality capital. Furthermore, the crisis revealed an inconsistency in the definition of capital across different jurisdictions, making it hard for market participants to assess and compare the quality of capital across different institutions (BCBS, 2011, p. 12). Basel III introduced an updated definition of what Tier 1 and Tier 2 capital was, as well as added an additional layer of Tier 1 capital. As of Basel III, Tier 1 capital were divided into Common Equity Tier 1 (CET1) and additional Tier 1 capital (BCBS, 2011, p. 12).

CET1 capital consists of common shares issued by the bank, stock surpluses, retained earnings, accumulated comprehensive income and other disclosed reserves and some regulatory adjustments (BCBS, 2011, p. 13). The increase in quality of capital mainly refers to this change, where CET1 capital is perceived as capital of the highest quality.

Basel III also changed the required composition of held capital. While the required overall risk-weighted capital remained at 8%, 4.5% had to be CET1 capital and a total of 6% had to be Tier 1 capital. While the quantity of overall capital stayed the same, the quantity of quality capital was increased (BCBS, 2011, p. 12).
Basel III also took a stern approach to some securitization practices. Acknowledged as a major contributor to systemic risk during the crisis, the risk-weights of certain securitization exposures increased from its Basel I and II level of 50% to 1250% in Basel III (BCBS, 2011, p. 27). This risk-weight also included investments into specific commercial entities, likely as an attempt to stop the establishment of multiple SPVs, as was seen during the crisis.

### 2.3.2 Strengthening the risk coverage

Strengthening the risk coverage means that additional forms of risk is included in the Basel III framework. While Basel I focused only on credit risk and Basel II included market and operational risk as well, Basel III adds counterparty credit risk into the mix. The crisis revealed failures to capture major on- and off-balance sheet risks and some exposures related to derivatives. The inclusion of counterparty credit risk is aimed to correct those errors (BCBS, 2011, p. 29-30). An additional effect of this regulatory change was to reduce the procyclicality within the industry. By increasing the capital buffers of derivative, repo and securities transactions between banks, the ambition was to dampen the procyclical effects of interbank transactions (BCBS, 2011, p. 3).

Further limitations were also set on transactions involving derivatives, as it was recognized as a source of systemic risk during the crisis. Before and during the crisis, derivative instruments were generally traded over the counter (OTC). OTC trading involves a direct trade between the involved parties, exposing both parties to increased credit risk as well as counterparty credit risk. Basel III includes incentives for banks to shy away from OTC trading, and move those transactions into central clearing parties (CCPs) instead (BCBS, 2011, p. 3-4). CCPs help reduce risk in the system by taking away the credit risk involved in the derivatives trading from the banks by transferring it to the CCP instead. The incentive to use CCPs was done by severely reducing the risk-weights of assets dealt through CCPs, with the ultimate goal to fully eliminate OTC trading in favor of CCPs (BCBS, 2011, p. 4).

### 2.3.3 The capital conservation buffer

The capital conservation buffer is another measure intended to dampen the procyclical effects that were observed within the banking industry. The idea behind the capital conservation buffer was that banks are required to build up a buffer of extra capital in good times, in order to be able to draw upon them when they are inevitably hit with bad times (BCBS, 2011, p. 5). The Basel III buffer was set at 2.5% of CET1 capital and is placed on top of the minimum capital requirements. Banks are thus required to hold this buffer in addition to the 8% regulatory capital. Furthermore, banks who fail to achieve the minimum level of the capital conservation buffer will have their ability to pay out dividends, share buybacks or bonus payments restricted until the proper buffer level has been achieved (BCBS, 2011, p. 56). The purpose of this was to stymie high bonus payments or dividend plans of banks who were deemed not to satisfy the Basel III risk procedures.
2.3.4 The countercyclical buffer

The countercyclical buffer was another innovation to capitalize on the lessons learned from the crisis. The crisis showed that losses in the banking sector can be significant when a financial downturn is preceded by a period of excess credit growth. Due to the interconnectedness of banks, these losses can destabilize the whole banking sector and trigger a vicious cycle where problems in the financial sector contributes to a downturn in the real economy. These issues then feed back to the banking sector, creating even more problems (BCBS, 2011, p. 57).

The purpose of the countercyclical buffer was to ensure that the capital requirements imposed on the banking industry take into account the current macro-financial environment in which the banks operate. As the financial climate will vary from country to country, the countercyclical buffer was to be deployed by national jurisdictions. When the responsible national authority finds that the current financial system is experiencing excess credit growth, they can decide to impose the countercyclical buffer at a level between zero and 2.5% (BCBS, 2011, p. 57-58). The level of the buffer is up to the discretion of the responsible authority, however, the decision should be based on their judgement as to the extent of the buildup of system-wide risk in the economy (BCBS, 2011, p. 58).

The countercyclical buffer is in practice an extension to the capital conservation buffer, in times when national authorities deems it necessary. When the countercyclical buffer is zero, banks will face restrictions on distribution of dividends, bonus payments or share buybacks if their CET1 level is below the minimum of 7% (4.5% from regulatory capital requirements plus 2.5% from the capital conservation buffer). If the authorities would however decide that a countercyclical buffer of 2.5% is necessary, the same restrictions would apply to banks who do not achieve the then required CET1 level of 9.5% (Basel Committee on Banking Supervision, 2011, p. 60).

2.3.5 The leverage ratio

Further evidence on the strong impact of the financial crisis on Basel III was the introduction of the leverage ratio. One of the underlying causes of the crisis was the buildup of excessive leverage in the banking sector. Banks managed to heavily increase their leverage while still showing strong risk based capital ratios, thus eluding regulatory attention (BCBS, 2011, p. 61). Due to the high leverage in essentially the entire banking sector, a positive feedback loop between losses, declines in bank capital and contraction of credit was created at the height of the crisis. As the crisis developed, banks were required to deleverage their positions in a manner which significantly depreciated asset prices, causing heavy losses. The losses induced further deleveraging, leading to further increased losses and the deleterious feedback loop ensued, destabilizing the entire system (BCBS, 2011, p. 61).

In order to combat the excessive buildup of leverage, Basel III introduced a requirement on banks to achieve a certain leverage ratio. The purpose of the leverage ratio is stated as to “constrain the build-up of leverage in the banking sector, helping avoid destabilising deleveraging processes which can damage the broader financial system and the economy; and reinforce the risk-based requirements with a simple non-risk based “backstop” measure.” (BCBS, 2011, p. 61). A leverage ratio of 3% was to be tested during the period
January 1, 2013 to January 1, 2017. The calculation of the leverage ratio was to be based on banks balance sheets. However, as off-balance sheet items were shown to provide large amounts of leverage during the crisis, the majority of these items were to be included with a value of 100 % (BCBS, 2011, p. 62-63).

2.3.6 Additional requirements for systemically important banks

As evident from the crisis, allowing very big banks to fall is a recipe for disaster. The fall of Lehman Brothers sent ripples through the entire financial system, and is seen as one of the major catalysts setting off the crisis (Brunnermeier, 2009, p. 89). The Lehman Brothers episode surely gave credibility to the too-big-to-fail hypothesis, claiming that large banks that are systemically important will never be allowed to fall as the effects on the economy would be too severe (BCBS, 2013a, p. 3). This increases the issues of moral hazard for large institutions, where there will be incentives to take on excessive risk in the pursuit of profitability as they could never fail (BCBS, 2013a, p. 3).

In order to combat the negative externalities created by global systemically important banks (G-SIBs) and the moral hazard issues, Basel III introduced a requirement for these banks to be able to absorb large additional losses with their own capital (BCBS, 2013a, p. 2-3). How much additional losses the banks were required to absorb depends on their cross-jurisdictional activity, size, interconnectedness and substitutability and complexity of capital (BCBS, 2013a, p. 11). The amount required at the introduction of Basel III shifted between 1 to 2.5 % of total risk-weighted assets. However, if the Basel Committee finds that a bank with the highest level off loss absorption requirements would increase their systemic risk, they are able to increase the required absorption levels by one percentage point. This is done to minimize the moral hazard issues for large institutions (BCBS, 2013a, p. 12).

2.3.7 Improved liquidity standards

Arguably, the most significant changes introduced in Basel III were regulatory additions to improve liquidity standards. As with most other changes, the idea draws upon the lessons learned during the crisis. During the early stages of the crisis many banks faced difficulties with their liquidity, despite having adequate capital levels. The fast reversal of market conditions evaporated the liquidity of many bank assets, causing severe stress to the banking system and necessitated central bank action to support both markets and individual institutions (BCBS, 2013b, p. 1). In order to ensure that banks have enough liquidity to resist severe losses, Basel III introduced two liquidity measures for banks to adhere to, namely the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR).

The purpose of the LCR is to ensure short-term resilience of the liquidity risk profile of banks. By making sure that banks possess an adequate amount of high-quality liquid assets that exceed their needs for a 30-calendar day liquidity stress scenario, the LCR aims to minimize possible adverse effects from a liquidity crunch (BCBS, 2013b, p. 1). The framework also supplies a definition of high-quality liquid assets as those who can be converted into cash easily and immediately, with little to no loss in value (BCBS, 2013b, p. 7). Outside of situations where the bank can be perceived as being under stress, the stock of high-quality liquid assets is required to be at minimum 100 % of total net
cash outflows over the next 30 days during a liquidity stress period BCBS, 2013b, p. 7). The LCR thus ensures that banks are able to secure short-term funding for their cash outflows.

While the LCR is focused on short-term funding, the NSFR aims to make sure banks have sufficient amounts of long-term funding. The NSFR is defined as the amount of available stable funding relative to the required amount of stable funding. Available stable funding in this context is defined as the portion of capital and liabilities that the bank expects to be reliable over a period of one year (BCBS, 2014, p. 2). The required amount of stable funding is based on the liquidity risk profile of the institution. Calculating the required amount of stable funding is done with the help of a required stable funding (RSF) factor, which gives different weights to different assets depending on their respective liquidity (BCBS, 2014, p. 6-7). In essence, the RSF factor works in the same way as the risk-weighted asset calculations that were introduced in Basel I.

In addition to the ratios, the improved liquidity standards also introduced monitoring tools for supervisors to adhere to. By standardizing what measures supervisors are to consider in the application of the Basel framework, potential discrepancies between countries could be minimized (BCBS, 2013b, p. 40). The metrics that are part of the monitoring tools, and thus should be the attention of national supervisors include:

- Contractual maturity mismatch.
- Concentration of funding.
- Available unencumbered assets.
- LCR by significant currency.
- Market-related monitoring tools.

It should however be noted that the monitoring tools are the minimum amount of information national supervisors should consider when they decide institutions liquidity risk exposure and they are free to use additional information at their own discretion (BCBS, 2013b, p. 40).

### 2.3.8 Critique of Basel III

Like Basel I and II, Basel III did not go unscathed in the academic world. While some additions received degrees of praise, such as the attempt to dampen pro-cyclicality and the updated definition of capital, several issues were identified (Blundell-Wignall & Atkinson, 2010, p. 13). Blundell-Wignall & Atkinson (2010, p. 13) argue that the liquidity management framework is unnecessary. While many crises present themselves as liquidity crises at the end, the authors do not believe that liquidity is the source of the problem. The liquidity framework thus adds increased complexity and eliminates management discretion without adding any real value (Blundell-Wignall & Atkinson, 2010, p. 13). This sentiment was echoed by Pakravan (2014, p. 215) who claimed that the fundamental flaw with Basel II was its unnecessarily high complexity, causing it to contribute to systemic risk rather than to decrease it. He further states that Basel III only increased the level of complexity of the regulation. Adding increased complexity to a system that does not work due to its complexity, and expecting it to solve its inherent issues would equate to “doing the same thing over and over again and expecting different results”, Einstein’s classic definition of insanity (Pakravan, 2014, p. 215).
Blundell-Wignall & Atkinson (2010, p.14) further argues that the fundamental issues with the Basel accord are rooted in the original design of the framework and thus neither introduced by Basel III, nor addressed by it. They also list three fundamental issues with the Basel framework.

First, the conceptual underpinnings of the framework are poor. The capital charges have been designed in a way to make them simple to calculate and easy to compare. Ultimately, the conditions under which the underlying assumptions makes sense are far-fetched (Blundell-Wignall & Atkinson, 2010, p. 14). Secondly, the framework is biased against diversification. As diversification benefits are not present in the calculations of risk-weighted capital, this encourages institutions to concentrate their asset allocation to those assets with low risk-weights, such as sovereign debt, claims on OECD banks and residential real estate (Blundell-Wignall & Atkinson, 2010, p. 14). As it would turn out, these asset classes were later at the center of the financial crisis of 2008 and the European sovereign debt crisis of 2011. Lastly, they claim that it demands too little equity and permits too much leverage. They claim that the new addition of the leverage ratio, while correct in theory, will likely have a small real-world effect due to the leverage ratio being too low. The authors anticipate that low capital levels will still remain and pose threats to systemic stability (Blundell-Wignall & Atkinson, 2010, p. 14.)

2.4 Basel 3.5

In December 2017, the Basel Committee finalized their revisions and completed the Basel III framework. Even today, the revisions made are in reference to issues that became evident during the crisis. The latest revision provides some major changes to the Basel III framework, mainly in the way risk-weighted assets are calculated. This in an effort to reduce the variability of risk-weighted assets to ensure the continued reliability of the RWA measure (BCBS, 2017, p. 1). During the crisis, market participants lost faith in the reported risk-weighted assets, which created problems in the financial system (BCBS, 2017, p. 1).

Banks can still choose between the standardized and the IRB approach. The standardized approach has however been revised in order to give updated risk-weights to different assets to more accurately reflected their perceived risk level (BCBS, 2017, p. 4). As with Basel II, banks with supervisory approval are still allowed to use the IRB approach to calculate their risk-weighted assets (BCBS, 2017, p. 53), however, as this was one of the major sources of RWA variability, Basel 3.5 introduced a floor for risk-weighted assets based on the standardized approach. As of Basel 3.5, risk-weighted assets can never be below 72.5 % of the value achieved by using the standardized approach (BCBS, 2017, p. 137). The maximized benefit from using the IRB approach is thus capped at 72.5 % of the standardized approach, which should reduce RWA variability.

In addition to the changes in RWA calculation, Basel 3.5 also solidifies the leverage ratio as suggested in Basel III to 3%. G-SIBs are also required to hold a leverage ratio buffer, which will work in tandem with the LCR. The leverage ratio buffer will be set at 50 % of the LCR. A G-SIB that is required to hold a LCR of 2 % will thus also need to hold a leverage ratio buffer of 1 % (BCBS, 2017, p. 141).
2.5 Critique of Basel 3.5

As Basel 3.5 was released in December 2017, little academic attention has been devoted to discerning its effects. The banking industry did however react negatively to the announcement, where Scandinavian banks in particular argued that the changes would hit them hard (Levring, 2017). Basel 3.5 introduces even more complexity into the framework, meaning the critique made towards Basel III’s complexity remains relevant for Basel 3.5. Basel 3.5 does increase the leverage ratio required for large institutions, addressing some of the issues detailed by Blundell-Wignall & Atkinson (2010, p. 14). It is however doubtful whether an increase of the leverage ratio by roughly one percentage point would be sufficient to fully address the issues present in the Basel framework.
3. Theoretical Methodology

The purpose of this chapter is to present the theoretical methodology used in the study. This includes researcher preconceptions, research philosophy, research approach and research methodology. The choices made in these matters contributes to forming the study into its final form.

3.1 Preconceptions

An important part of academic research is the endeavor to remain objective. However, an individuals’ previous knowledge and conceptions could influence their objectivity without them realizing it. The baggage that we carry with us influences our every-day thoughts and actions, and does so in a very natural way, in that we might not even recognize its effect (Quinlan, 2011, p.12). In the strive for objectivity, it is therefore essential to realize how our previous experiences might influence our thinking, and recognize when this occurs. The most effective way of doing so is to carefully examine your motivations and make sure the basis on which you make your decisions are sound and comes from an objective place, rather than one which is affected by previous knowledge and experiences (Quinlan, 2011, p.12). Knowledge of these factors is an important step in making sure the study remains objective. Therefore, the likelihood of this study being significantly affected by preconceptions should be low.

3.2 Researcher background and topic choice

Knowing the background of a study’s authors might help the reader maintain a critical perspective for the rest of the thesis. This study is done as part of a two-year master’s program in Finance at Umeå University, Sweden. The author has no practical experiences or connections to the banking industry but developed an increased interest of the banking industry during courses studied at the master level. The foundation of the knowledge held by the author comes from a masters course studied at the University of Groningen called International Banking and Finance, which detailed the varying roles played by banks in the past, present and what it is likely to be in the future. One area of focus was how specific adverse events shaped the direction of the banking industry, one such event is arguably the latest financial crisis. This fact spurred the interest in examining how the banking industry has handled the latest requirements proposed by the Basel Accord as the regulation is tightly connected to the financial crisis. As the researcher has no connections to the banking industry through previous experiences, the risk of biases impacting the results of the study should be small.

3.3 Research philosophy

Throughout time there has been extensive debate in the academic world as to what should be considered research and what should not. While some argue that numerical exercises built on data collection and testing is what constitutes proper research, others emphasize the insights provided by softer values. In the end, where the researcher stands in this
debate usually boils down to their research philosophy (Long et al., 2000, p. 190). The research philosophy is usually determined by three overarching principles; ontology, referring to assumptions about the nature of social reality, epistemology, referring to what should be perceived as knowledge, and methodology, referring to how to best achieve the goal of answering the research question (Long et al., 2000, p. 190). In addition, some researchers also focus on axiology, the role of values, as an important part of the research philosophy. Understanding the researchers views on these topics is important in understanding and framing the results and analysis presented in the study. This chapter will thus include a short discussion on these matters.

3.3.1 Ontological standpoint

Long et al. (2000, p. 190) defines ontology as the “assumptions held about the nature of social reality”. The ontological standpoint falls into two categories, those who believe that the reality can be objectively analyzed as it is external to each individual, or those who believe that reality is an individual construct, and thus subjective. The main characteristics of these viewpoints have conveniently given them their name, objectivism and subjectivism. Due to their significant differences, subscribers of each viewpoint have often been in conflict with one another. Subjectivists claim that understanding science in any form can never really be objective, and any attempt to do so is folly. On the other hand, objectivists believe that subjectivism is based on fundamentally self-defeating ideas (Chipangura et al., 2016, p. 264). In many cases, the ideas about reality follows from the method with which the research is done, or vice versa. Objectivists usually employ a quantitative method whereas subjectivists favor qualitative data.

This study will be performed using quantitative data. From that usually follows the belief that reality can be objectively observed and studied. The data collected will thus be assumed to have an objective meaning, with a cause and effect that is separate from individual ideas and reflections. The basis for this lies in the purpose of the study. The goal is to find an empirical quantifiable relationship between regulatory requirements and its respective costs and benefits. To be able to do so and to be able to employ some level of generalizability, an objectivistic view will be required. This viewpoint will also color the analysis that is performed later in the study, and should be taken into consideration by the reader.

3.3.2 Epistemological standpoint

Epistemology is usually defined as “what is the basis of knowledge and how can it be transmitted”. One’s epistemological views are usually connected to the ontological ones. As with ontology, the views on knowledge can either be objective and equally accessible to all, or subjective and dependent on individual experiences (Long et al., 2000, p. 190). While some refer to these as objectivism and subjectivism for epistemology as well, it is also common to refer to the objective viewpoint as positivism, and the subjective side as interpretivism. Much like with ontology, epistemological views usually follows a certain research design, or vice versa. Positivists usually aim to study “that which is”, things that can be accurately measured with quantitative and numerical data. Interpretivists on the other hand focuses on “that which is becoming”, a field that is harder to study with
numerical data, but instead relies on a qualitative design and softer values (Raadschelders, 2011, p. 918).

As previously mentioned, this study will focus on numerical data and employ a more objectivistic viewpoint. Given that the purpose of the study is to study how certain factors interact, rather than why they interact, the positivist viewpoint is the more rational choice. The positivist view assumes that the data collected will be objective and unbiased, which given that they are collected from annual reports should not be far from the truth.

### 3.3.3 Axiological standpoint

While ontology and epistemology focus on the nature of reality and knowledge, axiology has a connection to more ethical considerations. Axiology engages in questions of value or worth, such as what values have driven these actions, and what purposes are actually worthy of research. While epistemology tells us what can and cannot be captured and used as evidence in our research, axiology tells us whether or not the research in and of itself is worthy of pursuing (Ortega, 2005, p. 317). It is possible that a researchers’ values about a subject can, if not accounted for, bias the results of a study. It is thus important to ensure that the practical methodology is designed in such a way that any and all potential biases are minimized (Saunders et al., 2012, p. 137-138). It should however be understood that a researchers’ values about a subject is likely a significant part in the process of subject choice. Given the knowledge of the potential axiological issues that can arise, any effects thereof should be minimized.

### 3.4 Research approach

A studies research approach can usually be divided into two categories, deduction or induction. The deductive approach focuses on logical coherence. That is, from a set of general premises, a more specific conclusion is drawn with the precondition that the conclusion must be analytically traceable to the original premises (Ketokivi & Mantere, 2010, p. 315). Inductive reasoning on the other hand runs in the opposite direction. The conclusions drawn through an inductive approach are not theoretical extensions of the original premises, but rather an amplification of the overall knowledge base (Ketokivi & Mantere, 2010, p. 315). A common way of separating the two philosophies is by presenting deduction as the common means of proving or enhancing existing theory through the use of statistical tests and hypotheses, whereas induction is claimed to be used in the “creation” of new theory, that has yet to see the light of day (Ghauri, & Grønhaug, 2010, p. 15-16).

As the purpose of this study is to provide additional empirical data based on an already existing theoretical base. The information provided in the theoretical base will thus be tested in a new context using a number of hypothesis and statistical methods. While some generalization will be done over the sample of the study, no new theory will be created. Given these facts, the deductive approach will be used throughout the study. As the study will employ a deductive approach, it is important to ensure that there is a clear connection between the conclusions drawn and the underlying premises that were presented.
3.5 Research method

As have been noted earlier, there is a close connection between the epistemological decisions and the research method. An objectivistic ontology and positivistic epistemology are closely connected to quantitative studies, whereas subjectivism and interpretivism have strong links to qualitative studies. In most cases, the research method employed depends on the question the research aims to answer. In a simplified way, qualitative research aims to answer the question “how?” and “why?”, whereas quantitative research focuses on the questions “how often?” or “how many?” (Malina et al., 2011, p. 6).

Quantitative and qualitative studies can also be separated by the way which they try to persuade the reader of their results. While quantitative studies try to prove their worth by deemphasizing individual judgement and drawing logical conclusions based on established premises, qualitative research convinces through rich descriptions and comparisons across different cases. Due to this, quantitative research is usually generalizable to populations, whereas qualitative research tries to generalize to theory (Malina et al., 2011, p. 6).

The method employed in this study will be the quantitative one. As the goal is to find statistically significant connections between regulatory changes and their costs and benefits, a quantitative study is the reasonable choice. The quantitative method will help to ensure that the results presented are value free and based on a sound theoretical framework. Generalization will be made to the sample presented rather than the overarching theory, in accordance with the studies purpose. Overall, these epistemological and methodological choices are best suited to be able to present a reliable answer to the research question of the study.

3.6 Time perspective

Researchers can employ different time-horizons in their studies, usually determining what they want to show (Cooper & Schindler, 2014, p. 128). The two most common approaches are cross-sectional studies, where the focus is to examine a specific phenomenon at a specific time, and longitudinal studies, which generally focuses on longer time-frames and tracks developments over time (Cooper & Schindler, 2014, p. 128). The employed time perspective can also influence the way in which data is collected. Where cross-sectional studies might prefer survey data, longitudinal studies prefer strictly quantitative data such can be found in various databases.

This study will employ a longitudinal perspective as it aims to determine changes in variables over time, with a specific cutoff point. While there are comparative elements in the study, the comparisons are done over time, rather than over cases. The longitudinal approach is important to be able to see what effects the increased regulation has had on the banks in the sample. As such, the longitudinal approach is the reasonable choice, given the purpose of the study.
3.7 Critical analysis of sources

In a study like this, critically analyzing the sources used is important. Particularly so since a number of institutional reports have been used in the theoretical framework. It is important to understand that most, if not all, of these institutions have their own agenda or benefit in some way from a particular set of results. It is likely that this will, knowingly or not, bias the results of these studies. One clear example of this is the report on regulatory impacts from the IIF and Basel Committee. The IIF consists of leading professionals from within the commercial banking industry. They would as such benefit from minimizing the amount of regulatory pressure, so they can keep maximizing profits without diverting focus to regulatory requirements. Given these incentives, it seems logical that their study would exaggerate the negative consequences of the regulation, to make the case for more leniency in the industry.

On the other side of the coin, the Basel Committee consists of the heads of countries central banks. Their ambition is to ensure that no banks will need to be bailed out, as the associated costs, to the society, economy and the nation, will be very high. While finding the optimal amount of regulation might be on their agenda, it would be reasonable to assume that the Basel Committee would rather over-do the regulatory requirements than to be overly lenient, given that the associated costs are not clearly excessive. Due to this incentive structure, it seems likely that their reports might instead underestimate the costs of regulation.

The presence of these reports in this study is motivated by the fact that they hold a high degree of relevance as the subjects detailed and the models used provide a solid foundation. The institutions releasing these reports are also well known and of high stature. This should reduce the risk of their results being completely unreliable. In addition, a careful analysis has been done in order to make sure that the methods used do not suffer from so clear biases that they are fully irrelevant. The directions presented in the reports are overall similar, in that they all show that increased regulation does come with increased costs to either the economies or the banking industry, however the magnitude of these costs varies from the different reports.

Another measure taken to make sure that the theoretical foundation used in this paper remains sound is the inclusion of reports from all different sides. Whenever a source from within the banking industry has been used, to the extent possible, a corresponding source from the regulatory perspective is included to add balance. Furthermore, several academically written papers are included in the theoretical foundation. While it is not possible to be completely certain that the articles presented in academic journals are free from bias, they have all gone through a process of peer-review. It is therefore assumed that any major bias presented in these articles would have been dealt with and removed during this review process. Overall, it is reasonable to assume that the academic work is mostly neutral. Given the measures taken, the notion that the theoretical foundation is flawed due to excess bias can be disregarded.

As for the academic articles themselves, the focus has been to include the most relevant work in the field. As a general rule, new publishes builds on the most prominent earlier contributions and are therefore assumed to be of high quality. In addition, a conscious objective of using primary sources have been maintained throughout the review process, in order to minimize the risk of misunderstanding or misinterpretation. There are cases where this has not been possible, however the sources used in the original works steady
have been of high regard and used in several other academic works. There should thus be little risk of misinterpretation of facts throughout this study.

Some of the works cited do have several years on them since they were published. Given the rapid expansion and change in the financial environment, the relevance of these studies can be questioned. In these cases, an effort has been made to ensure that the referenced sources are still prominent in recent academic work, which has been the case throughout. While newer work usually changes certain aspects, the core theory and the building blocks of which has remained the same, making the original theory relevant to this day, despite its old age.

The overall assessment is that the academic sources used are of high quality and are reliable. The more dubious sources from different institutions have all been complemented by views from an opposing side, as well as from neutral academic work. The overall quality of the work used in this chapter should therefore be high.
4. Theoretical frame of reference

The purpose of this chapter is to introduce the main theoretical underpinnings of the field of study. The theoretical framework presented will lie as the foundation for the rest of the study and is the basis for the hypothesis formed in this chapter. The chapter is concluded with a critical analysis of the sources used.

This chapter will present the main academic works in the fields of regulation, cost of capital, lending growth and default risk as well as a combination thereof. The purpose is to provide a sound framework to be used to form hypotheses and function as the foundation for the later analysis. While not all theories will be fully applied in the study, understanding the theories used requires knowledge of earlier work in the field. The section will thus feature both a background on the most prominent work in the different fields, as well as literature directly related to the current study.

4.1 Regulation

It should be noted from the get-go that regulation involves a number of different actions, all with the purpose of increasing the security of the sector being regulated. For the banking industry, as have been explained in the previous chapter, regulation has mainly focused on imposing different forms of ratio requirements on the industry. Thus, when talking about regulation and its effects, one is essentially talking about the effects of imposing these ratios. The following section will thus present the main academic work on the corresponding effects of implementing these regulatory measures. Since the purpose of this study is to determine the effects of recent banking regulation, understanding why regulation is important and the recent theories regarding its effect is relevant.

Since the crisis of 2008, and the increased regulatory attention that inevitably followed, scholars have tried to determine the effects of increasing regulation. Aiyar et al. (2015, p. 957), claims that capital requirements are necessary for three main reasons. First, failure of banks will have high social costs, such as contractions of credit supply and failures of payment systems, matters which are generally not considered by bank managers. Secondly, safety nets protecting bank creditors incentivizes risk-taking and leads to shareholders encouraging bank managers to take on excessive risk in the pursuit of increased profits with the potential of causing negative externalities on the economies. Lastly, agency problems between bank managers and shareholders can cause increased risk-taking behavior if managers can obtain private benefits from maintaining a situation of high default risk through, for instance, and most commonly, remuneration practices (Aiyar et al., 2015, p. 957).

While necessary to ensure systemic stability, regulation in general, and capital requirements in particular, do come with costs attached. The main costs of minimum equity ratios are either carried within the financial system such as inefficient bank operations and decreased wealth of bank shareholders, or carried by the nonfinancial sector such as reductions in lending (Aiyar et al., 2015, p. 958). Instead of raising equity to comply with target ratios, banks can choose to reduce lending which could have adverse effects on economic growth (Aiyar et al., 2015, p. 960). Furthermore, the authors
argue that a prudent bank will target an optimal level of debt to assets that is focused on debt rather than equity. As capital requirements forces banks to skew the distribution towards more equity, it is reasonable to believe that regulation that forces banks away from their optimal ratio will negatively affect bank performance (Aiyar et al., 2015, p. 959-960).

While the last argument makes sense theoretically, it has found limited support empirically. Berger & Bouwman (2013) performed a study on U.S banks from 1984 to 2010 and find that increasing capital increases the market share of small banks at all times, and for medium and large banks during banking crises. For small banks, the mechanism for this result is due to the fact that these banks are mainly focused on relationship lending. For these banks to create value, long-term relationships between customers and the banks are essential. Relationship borrowers would thus be on the lookout for high-capital banks to conduct their business, as they require a lengthy relationship which is ensured by the banks high capital levels. Higher capital levels for small banks will thus lead to increased market share, as they attract more long-term borrowers, an effect which is viable both during normal times as well as during crises. (Berger & Bouwman, 2013, p. 162). Furthermore, the authors argue that improved access to noncore funding is a driver of market share. Higher capital requirements improve all banks access to noncore funding which then increases their market share. This mechanism exists for all banks, regardless of size (Berger & Bouwman, 2013, p. 168-169).

Berger & Bouwman (2013) further explore the connection between a banks’ capital and their ability to survive during crisis. Their results show that higher capital improves the probability of smaller banks surviving during normal times, market crisis and banking crisis. For medium and large banks, capital only helps increase the probability of surviving a banking crisis. Overall, capital can be shown to help banks survive through rough times (Berger & Bouwman, 2013, p. 155). These results have logical economic interpretations. Capital is, as is also argued by the Basel Committee, the first line of defense against losses. As smaller banks are more frequently exposed to negative shocks, and have limited access to the financial markets, capital is helpful at all times. For medium and large banks on the other hand, their access to the financial markets can help mitigate losses from smaller shocks, and only in larger banking crises does extra capital help increase probability of survival (Berger & Bouwman, 2013, p. 155-160).

Additional work has however found opposing evidence. Tchana Tchana (2014) performed a study on the Indonesian banking industry over the years 1980-2003, trying to find how certain factors affected probability and duration of banking instability. The study shows that given the existence of deposit insurance, introducing or strengthening reserve requirements had a positive association with banking instability, but also tended to reduce crisis duration. Capital adequacy requirements, as the ones introduced by the Basel Committee was shown to reduce both the probability and duration of banking crisis (Tchana Tchana, 2014, p. 62-63). As the Basel Committee introduced both increased reserve requirements and capital adequacy ratios, the result on financial stability of the Basel regulation would according to Tchana Tchana’s work remain uncertain.

4.2 Lending growth
4.2.1 Theoretical foundation

For a long period, the financial system was perceived as irrelevant for economic growth. From the early 80’s to the mid 90’s, at the height of development of New Keynesian thinking, the connection between the financial system and economic growth seemed forgotten (Levine, 1997, p. 688). Before that however, some major economists attributed an important role of banks in growing the economy. One of the first and most famous was Austrian economist Joseph Schumpeter. Schumpeter (1912, referenced in Levine, 1997, p. 688) argues that banks trigger technological development by identifying and funding entrepreneurial activity with good chances of introducing innovative products and production processes to the market. These new products and processes increases the productivity of the economy, which leads to faster economic growth. This was later echoed by John Hicks (1969, referenced in Levine, 1997, p. 688) who claimed that the banking industry played a critical role in igniting industrialization in England by funding investments in what Hicks called “immense works”.

In the mid 90’s, attention was once again directed at the connection between the financial system and economic growth. Academics during this time found that financial market development was a critical part of the overall growth process. In addition, evidence was presented that the level of financial development was a significant predictor of economic growth, capital accumulation and technological change, much like Schumpeter argued in the beginning of the twentieth century (Levine, 1997, p. 703).

Today, most would agree that lending growth is an important macroeconomic factor that needs to be monitored. The major criticism towards the Basel Accord from the banking industry was the potentially significant negative consequences on the real economies that would follow in its wake. The mechanism through which this would happen was argued to be increased spreads and reduced lending growth, leading to stagnating economies (IIF, 2010). The academics that opposed this view also acknowledged the important role of lending growth. The criticism was based on exaggerated estimates of the effects on lending growth, rather than to the fact that lending growth was macroeconomically insignificant (Blundell-Wignall & Atkinson, 2010, p. 20-21).

4.2.2 Determinants of lending growth

As with the cost of capital, finding theoretical support for the factors driving lending growth is important to be able to perform a reliable analysis. Overall, studies on lending growth and its determinants have been done on an aggregated, economywide level (Mazibas & Tuna, 2017; Hoffmann, et al., 2014; Sarath & Pham, 2015). The theoretical foundation for individual institutions lending growth is thus slim. Elkedag & Wu (2011, p. 11-13) finds that business cycle is a determinant of lending growth. A booming economy is characterized by increased credit growth, while a stagnating economy usually suffers from heavily reduced lending. Intuitively, interest rates should have a significant impact on lending growth. Low interest rates imply that lending is cheap, which will spur lending, whereas high interest rates will reduce it (Elkedag & Wu, 2011, p. 11-13). The authors further find that credit growth is usually linked with deteriorating bank balance sheet soundness (Elkedag & Wu, 2011, p. 14-15). Following this, equity to debt levels should be significant in determining lending growth.
4.3 Cost of capital

4.3.1 Theoretical foundation

Theories regarding firms’ cost of capital has been regarded as the starting point of modern corporate finance and is inextricably linked to theories on optimal capital structure (Krstevska et al., 2017, p. 278). Theories on capital structure is relevant to this study as regulatory requirements forces banks to hold a minimum level of equity in relation to debt. This level is likely not consistent with the institutions optimal capital structure, and would thus increase its overall cost of capital. Understanding the foundations of capital structure theories is therefore important in being able to analyze the consequences of regulatory requirements.

In the world of business, the theory of capital structure irrelevance, or the “Modigliani & Miller theorem” (M&M theorem), is as close to a religious text as you could come. Any study focusing on the cost of capital would be remiss not to include it. As the name suggests, Modigliani & Miller (1958) finds that given certain assumptions on the bond and stock markets, the average cost of capital of any firm is wholly independent of its capital structure. It should be noted that the theorem is a theoretical exercise and its applicability to the real world has been widely discussed since its inception. As with most theoretical models, the assumptions on which it was built has been the main point of contention. The M&M theorem assumes perfect markets, perfect information, no taxes, no transaction costs and no bankruptcy costs. While almost everyone agrees that the theorem holds given the assumptions outlined, most also find that the situation described does not exist in the real world (Krstevska et al., 2017, p. 281-282).

Building on the M&M theorem, but relaxing the assumptions of no taxes and no bankruptcy costs, Kraus & Litzenberger (1973) developed what they called the trade-off theory. The authors argue that since debt gives tax benefits, whereas equity does not, firms will prefer debt financing over equity financing. However, increasing debt also increases probability of bankruptcy, which is followed by bankruptcy costs. The optimal capital structure is then achieved by maximizing the trade-off between the tax benefits of debt financing and the increasing bankruptcy costs that follow along with it. As the M&M theorem does not allow for bankruptcy costs, it is assumed to miss an important part of the puzzle as to finding the optimal capital structure (Kraus & Litzenberger, 1973).

Further building on the M&M theorem, Stewart C. Myers (1984) presented another popular theory on firms’ capital structure, namely that of the pecking order. Myers (1984, p. 581) argue that firms settle on their capital structure based on a pecking order of financing. If there are internal funds available to finance operations or investments, those will always be used first, as it is the cheapest form of finance. Would external finance be required, firms will choose the safest securities first. This means they will start with low-risk borrowing, such as debt and bonds before moving to equity. External equity is at the bottom of the pecking order, and thus seen as the last resort financing, due to it being the most expensive (Myers, 1984, p. 581). The foundation of this argument is that of asymmetric information. Should external finance be needed, managers will invariably have more information on the investments made or the use of the funds than other actors. Thus, by issuing equity, managers will be exposed to the whim of the markets. Due to the
lack of information on the side of the investors, it is likely that the share price of the issued equity will be below its actual value, making the financing inefficient. This situation can be fully avoided by using internal means, or severely mitigated by the use of debt (Myers, 1984, p. 583-584).

The above theories are to this day the core of the optimal capital structure field. While the M&M theorem has been mostly discarded due to its strong assumptions, academics have tried to find out which of the trade-off theory or the pecking order theory can be observed in empirical work. In a study of over 3000 firms over the period 1971-1989, Fama & French (2002) aims to investigate just that. Overall, the authors find significant support for both theories, while still acknowledging that there exist weaknesses in both. They were not able to conclusively prove one theory over the other, but find them both to be relevant in explaining firms’ capital structures (Fama & French, 2002). While the theories might seem old or even antiquated, its continued relevance in present day academia motivates their presence and is therefore considered as a solid foundation for the rest of this study.

4.3.2 Determinants and calculation of the cost of capital

As the aim of this study is to determine how increased capital ratios effect banks cost of capital, it is important to understand what determines the cost of capital and how you calculate it. This is not as easy as it might sound. The reason for this can be understood from its definition. One way of defining firms cost of capital is as the interest rate used to discount cash flows in calculations determining the value added of investments (Miller, 2009, p. 129). From this definition, it is clear that the cost of capital is different for each individual firm, as is its determinants. A model that is fully applicable to all firms is thus not achievable, as it will differ from company to company. Some intuitive assumptions can however be made as to factors that should have an impact on firms cost of capital.

The previously mentioned IIF report claimed that banks cost of capital should have risen post regulation due to the increased demands of equity financing, which is perceived to be more expensive than debt financing (IIF, 2010). If this is true, the equity to debt ratio should have a positive effect on cost of capital. Another factor that is likely to influence the cost of capital is the size of the institution. Berger & Bouwman (2013, p. 155-160) argues that larger institutions have better access to the capital markets, which should reduce the cost of capital as the supply of available capital increases. Macroeconomic factors are also likely to affect cost of capital. The current interest rate environment will have an impact on the cost of capital, as when interest rates are high, required rate of return rises. Additionally, business cycle is also likely to have an effect. A booming economy is usually signified by easy access to capital and funding, leading to lower costs of capital whereas a poor economic climate will conversely increase cost of capital.

As for its calculation, the cost of capital is in essence the cost of funding. As companies can receive funding from either equity or debt, the cost of capital is then composed of these two measures. The most common way of calculating the cost of capital is the Weighted Average Cost of Capital (WACC) model. The WACC uses the required rate of return on equity and the required rate of return on debt, together with the firms’ weights of debt and equity to calculate an average cost of capital (Miller, 2009, p. 129). Given how well established the use of the WACC is in both theory and practice, it will serve as the determinant of firms cost of capital for this study.
4.4 Default risk

4.4.1 Theoretical foundation

As was shown during the crisis, allowing big banks to fall can have severe detrimental consequences for the economy. The regulatory response was to try and ensure bank stability by reducing the default risk of the industry as a whole. It is argued that bank defaults are a consequence of excessive risk taking by banks. When the economy runs into trouble, banks do not hold enough safe and liquid assets to ensure its survival (Schenck & Thornton Jr, 2016, p. 173-174). The theoretical foundation for bank risk taking usually boils down to moral hazard and agency issues.

The concept of moral hazard was introduced in the field of health economics in the late 1960s. In particular, the moral hazard theory was construed as a counter-argument to academics advocating the welfare benefits of health insurance (Nyman, et al., 2018, p. 168). Instead of being a force of good, making people feel at ease that they would be taken care of in case of adverse events, the existence of insurance introduced inefficiencies and was argued to encourage risky behavior, to the extent that it was welfare-reducing (Nyman et al., 2018, p. 168). The agency theory on the other hand was articulated by Eugene Fama (1980), claiming that the separation of incentives from different firm agents and their shareholders causes them to act in their own self-interest, to the detriment of the firm.

Translated to the banking industry, moral hazard appears when institutions or individuals are freed from the consequences of their actions, or have the belief that they will be freed, should things go against them (Ngalawa, et al., 2016, p. 324). Moral hazard has been primarily discussed in the context of deposit insurance and bailout programs. Deposit insurance is an important part of the financial safety net in large parts of the world and means that the national central bank insures all customer deposits of a bank. Even if the bank would fail, the customer deposits would still be paid out. The idea of deposit insurance is that it fully prevents bank runs, which otherwise is one of the main concerns for banks (Ngalawa, et al., 2016, p. 324). As stated, it does however promote issues of moral hazard. Managers and shareholder alike know that even if the bank would fail, no direct harm would come to their depositors. This encourages banks to pursue high-risk-high-reward business strategies, to maximize potential shareholder wealth, which in turn would increase risk of default.

One extension of the moral hazard issues, apparent in the post crisis era is the too-big-to-fail hypothesis. The too-big-to-fail (TBTF) doctrine states that very large banks are too important for the financial system, that allowing them to fall is not a viable option. In a situation of distress, governments would intervene and support these banks to ensure their survival (Kazandzhieva-Yordanova, 2017, p. 16-17). A consequence of this is that the banks have incentives to expose themselves to increasing amounts of risk, in search for higher returns. A bank that knows with certainty that it would not be allowed to fail has free reign to engage in any activities they see fit and can disregard factors such as immorality, default risk and liquidity constraints (Kazandzhieva-Yordanova, 2017, p. 27).

Agency problems in banking usually manifest in a tendency of managers to have complete discretion in the everyday decision making, while their own personal interests have not lined up with those of either the shareholders or the society as a whole (Bebchuck & Fried, 2003). The most common way to for the institutions to handle the issues presented
by agency theory is through an optimal compensation structure. By structuring the compensation package in a way that aligns the managers' goals to those of the shareholders, agency problems are perceived to be minimized (Bebchuck & Fried, 2003, p. 72). It would however appear evident in the period during and after the crisis that many institutions had failed in their endeavors. Many compensation structures had promoted excessive short-termism, leading to high risk-taking in the short run to maximize gains (Bayless, 2009, p. 795). As have been previously noted, the Basel Committee have since then introduced restrictions on compensation for institutions that do not achieve required regulatory ratios, in an effort to minimize agency problems.

4.4.2 Determinants and calculation of default risk

A common indicator of default risk used in academia is the Z-score. While there are several different Z-scores, the one used in this study was introduced in the early 1950s by A.D Roy and measures an institution's distance from insolvency (Laeven & Levine, 2009, p. 262). The Z-score formula uses the return on assets, the capital assets ratio and the standard deviation of return on assets to calculate how many standard deviations a bank has to fall in order for the bank to become insolvent. An insolvent bank has losses that are greater than equity, which means that given no government bailout, the bank would default (Laeven & Levine, 2009, p. 262). Given its prevalence in academic work since its inception, the Z-score will be used to measure default risk in this study.

4.5 Regulation and lending growth

Most would agree that the implicit cost of increased regulation moves through the mechanism of increased cost of capital, leading to increased lending spreads, lower supply of loans and slower lending growth, which would have harmful effects on the overall economy. It is thus relevant to discuss the theoretical linkages between regulation and lending growth, to understand how these factors interact.

Most research done on the subject (Aiyar, et al., 2012; Aiyar, et al., 2015; IIF 2010; BCBS 2010; Bridges, et al., 2014; De Nicoló 2015) seem to confirm the idea that increased capital ratios do lead to a fall in lending growth. However, the extent to which differs widely and is of significance. While large reductions in lending growth would have negative implications on the economy, smaller changes should not be a source of worry.

The analysis of the IIF contained figures on how regulatory changes would affect lending growth in the U.S, Euro Area and Japan. For the Euro Area, the biggest banking sector in the world, they estimate regulatory changes to decrease lending growth by over 5% at the introduction of the regulation, to slowly regain momentum from there but remain negative from 2011 – 2020. This reduction in lending growth would by 2020 have cost the Euro Area 853 billion dollars in reduced GDP (IIF, 2010, p. 85).

A similar analysis was performed by Aiyar et al. (2012) on UK banks. The authors argued that the UK was particularly suitable for such studies, due to national regulatory standards introduced in the 90s’ that forced different banks to hold different amounts of capital. The authors observed how changes in these regulatory requirements had an impact on the lending of the individual institutions while checking for changes in loan demand and
cyclical variations. They find that a 100 basis point increase in the capital ratio does on average lead to a cumulative fall in the lending growth by 6.5 – 7.2 percentage points (Aiyar, et al., 2012, p. 18-19). This figure is higher than the one estimated by the IIF, and would thus have a significant impact on the real economy.

The Basel Committee also included effects on lending growth in their report. In contrast to the IIF however, the Committee claims that the regulatory effects on lending growth should be dampened by the transitory manner of implementation. This means that they are allowing banks a period of several years to adjust to the new regulation, which should reduce the cost for banks to acquire additional capital. In addition, the Basel Committee claims that both the cost and quantity of credit should recover fast, reversing the impact on the real economy fast enough for it to not have a significant impact. The Basel Committee presents figures showing that a one percentage point increase in the capital requirements, given an adjustment time of two years, should reduce lending by between 0.7 – 3.6 % (BCBS, 2010).

It should be noted however that all the above research presents estimates of future values, based on a similar theoretical foundation. It should not be taken for granted that their results hold in empirical work. While little research has been done on the actual empirical effects on lending growth from the Basel III framework, previous Basel Accords have however produced some insights.

Brinkmann & Horovitz (1995) connects the U.S credit crunch of early 1990s’ to the implementation of Basel I. Their study found significant differences in behavior between banks that had surpluses exceeding the regulatory requirements compared to banks that did not. Banks with larger surpluses as the requirements set in grew at a faster rate compared to those who had to amass resources to comply with the new regulation. Furthermore, banks who already had enough capital to comply used their new capital to grow their loans at twice the rate compared to banks who did not. This points towards the fact that the slow growth in loans during the period was exacerbated by the imposition of new regulatory requirements for the banking industry (Brinkmann & Horovitz, 1995, p. 859-860).

A Bank of England report by Bridges et al. (2014) using data on UK banks from 1990 – 2011 aims to empirically show the connection between lending growth and capital requirements. The authors split their lending data into household secured lending, household unsecured lending, Commercial Real Estate (CRE) lending and non-CRE corporate lending (Bridges et al., 2014, p. 17-19). Using a low confidence level of 68 %, they find significant reductions in all lending segments. Household unsecured loans face the smallest reduction with an annual 0.68 percentage point decrease, followed by secured household loans with an annual reduction of 0.94 percentage points. Corporate loans show an annual reduction of 3.86 percentage points and CRE loans fall by 8.07 percentage points annually (Bridges et al., 2014, p 19).

One of the more recent studies was carried out by De Nicolò (2015). The aim of the study was to build on much of the literature mentioned in this section, and improve their models to reach an understanding to what extent regulation affects lending growth. Using data on about 1400 publicly traded banks in 43 countries over the period 1982-2013 the study finds that an increase in capital ratio from 10 to 11 % would result in a short-term reduction in lending of 4 % and a long-term reduction in lending of 0.4 to 1.8 % (De Nicolò, 2015, p. 16-17).
There have however been studies showing that a decrease in the capital ratio could lead to reductions in the growth of lending. Peek & Rosengren (1997) performed a natural experiment in the aftermath of the 1980s’ Asian equity crisis. The aim was to analyze the effects of capital shocks on lending of Japanese banks that have branches located in the U.S. The study finds that a 1 percentage point decline in the parent banks’ capital ratio lead to a decline of their U.S branch banks total loans by 6 % (Peek & Rosengren, 1997, p. 495-496). This channel of transmission is important to keep in mind. While regulation is certainly associated with costs, the aim of reducing the probability of large financial disruption that would force banks to reduce their capital ratio and subsequent lending growth does come with a number of benefits.

4.6 Regulation and cost of capital

As the purpose of this study is to determine changes in cost of capital, lending growth and default risk since the inception of new stricter regulation, it is important to outline the connection that exists in current theory between these factors. As has been discussed earlier, a report by the IIF claimed that the new regulation would force banks to increase their equity. As equity is perceived to be costlier than debt, this would drive up banks average cost of capital (IIF, 2010). The IIF report is built on aggregated models of the banking system in different areas. The models have a common structure but tries to include the differences in how the banking system has evolved in different areas of the world. They report that one of the main drawbacks of their model was the inability to include the effects of the leverage ratio, due to lack of aggregated data. However, they claim that this would only bias the cost estimates downwards (IIF, 2010, p. 3-4).

The models in the report find that the Euro area will be hit the hardest by the increased regulation. Through the mechanism of increased cost of capital leading to higher lending spreads and a reduction in lending, GDP growth would fall by 0.9 % over the period 2011-2015, and by 0.5 % over the period 2011-2020 in the Euro area. In absolute terms, this represent a GDP loss of 920 billion dollars in the 2011-2015 period, and a loss of 1109 billion dollars over the period 2011-2020. This further represents a fall of real GDP by 4.68 and 4.83 % over the respective periods (IIF, 2010, p. 6).

As the IIF consists of leaders from within the industry, it seems reasonable that they tend to walk on the side of negativity. This has been echoed in following academic work. Blundell-Wignall & Atkinson (2010) performed a study on the major banks in both the U.S and the EU to determine the effects of Basel III. While they acknowledge the fact that increasing the amount of equity relative to debt will increase banks cost of capital, their study show that the estimates posed by the IIF are exaggerated (Blundell-Wignall & Atkinson, 2010, p. 20). They further show to what level, depending on the excess cost of equity relative to debt and the equity ratio required, lending spreads have to increase to recoup the costs related to increasing their cost of capital. A required equity ratio of 10 %, that is higher than current requirements, would need an increase in lending spreads of between 50 to 100 basis points, given that the excess cost of equity relative to debt lies somewhere between 5 and 10 % (Blundell-Wignall & Atkinson, 2010, p. 22). In a macroeconomic sense, it is doubtful that this would have any major negative effects on the overall economy, as was estimated by the IIF.

In addition to the IIF report, the Basel Committee produced their own report on the impact of stronger capital and liquidity requirements. The Basel Committee also assumes
increasing required equity and leverage ratios will affect banks cost of capital. Their study of economic costs follows that of the IIF, in that the major impact on the economy would follow from increased lending spreads, which is a direct consequence of increased cost of capital (BCBS, 2010, p. 21).

To perform their analysis, the Basel Committee aggregated data on 6660 banks in 13 different countries over the period 1993 to 2007 to produce a theoretical representative bank for each of the different countries. The resulting balance sheet and cost data for the representative banks are assumed to be long-run steady state averages that would correctly reflect each country’s general institutional environment and regulatory framework (BCBS, 2010, p. 21).

The Basel report finds the average cost of equity across all studied countries to be 14.8% and steady state lending spreads of 100 and 200 basis points for short- and long-term debt respectively (BCBS, 2010, p. 22). Their analysis show that a one percentage point increase in the capital ratio would require an increase in lending spreads of 11 to 25 basis points to fully cover the increased cost of capital (BCBS, 2010, p. 23).

It should however be noted that they claim this figure to be an upper bound, as some of the assumptions made are overly restrictive. For instance, they claim that in reality there is an argument to be made that overall cost of capital would decrease in response to more stringent regulation. The higher capital ratios would decrease bank leverage, making the bank safer. As the bank is now objectively less risky, the required return of investors should fall, leading to a reduction in the cost of capital (BCBS, 2010, p. 22).

This theory, based on the M&M theorem, was empirically tested by Kayshap et al. (2010, p. 16) with positive results. While the methodology used was simple, they find that for U.S public banks during the period 1976 – 2008, an increase in equity ratio leads to a decrease in bank risk perfectly in line with the M&M theorem. This would mean that higher equity ratios decrease the required return of investors, and thus reducing the cost of capital, ceteris paribus.

As discussed earlier, while the M&M theorem is powerful in theory, and some parts of it can be observed in reality, there are still issues with it. Elliot (2009, p. 4) analyzes the cost of capital effects of increased regulation and finds that the M&M theorem is not applicable to U.S banks due to the existence of deposit guarantees, the too-big-to-fail doctrine, and the presence of tax benefits that does not exist in the world of Modigliani & Miller. The study further examines different ways banks can adjust their behavior to make up for the increased cost of stricter regulation. By either adjusting the loan rate, the return on equity, return on debt, credit spreads, administrative costs and other costly benefits, banks can make sure the adjustment does not have a negative impact on the overall economy (Elliot, 2009, p. 8-9). Aiming to adjust one of these factors would however not be advisable, as the adjustments would have to be relatively big. Instead, smaller adjustments to most or all variables would generate the smallest externalities on the economy (Elliot, 2009, p. 8-9).

As can be seen, there exists no consensus on how regulation influence banks cost of capital. While most institutions have assumed that banks costs of capital increases following increased capital ratios for the sake of argument, there are arguments to be made that it might in fact decrease. Even so, the extent to which cost of capital is affected by increased regulation varies depending on what instance has released the report.
4.7 Regulation and default risk

The most significant benefit of regulation is that it, if implemented properly, reduces fragility in the economic system and thus minimizes the risk of negative externalities spreading through the economies in times of stress (Rizwan et al., 2018, p. 38). The costs outlined in previous sections should ideally be weighed up by enough benefits to make it worthwhile. Given the substantial costs associated with systemwide financial distress, if regulation succeeds in preventing systemic risk, it would in the minds of most likely be worth it. It is however not clear whether current financial regulation succeeds in minimizing default risk on the institutional level or systemic risk on the global level. This section aims to provide relevant knowledge on the linkages between regulation and default risk.

Given the wide berth of the term default risk, it is important to realize that many different types of regulation do have an impact on the default risk of banks. Following the crisis, three main components was identified as the most important to minimize individual bank risk and reduce overall systemic risk. These three components were strengthening banks capital framework and improving their liquidity, successfully dealing with moral hazard and too-big-to-fail issues and making overall markets more robust (Llewelyn et al., 2017, p. 232).

Basel III implemented different types of regulation to tackle these issues. Strengthening banks capital and liquidity situations has been done by the strengthening or introduction of ratios. By forcing banks to have enough capital and liquidity to absorb significant losses, systemic risk should be substantially reduced (Llewelyn et al., 2017, p. 232). The moral hazard and too-big-to-fail issues have been dealt with by the introduction of increased demands on globally and domestically important banks capital and liquidity. Furthermore, Basel III allowed national authorities to restrict bonuses and dividends for institutions that do not comply with the regulatory requirements. As such, there should be little incentive for managers to seek high risk strategies that jeopardizes their ability to comply with regulation, as their potential pay-off would be restricted (Llewelyn et al., 2017, p. 233-234). Finally, increasing the robustness of the markets is done by aiming to eliminate OTC trading, and instead moving these transactions to a CCP which, if run prudently, should eliminate credit and counterparty credit risk (Llewelyn et al., 2017, p. 234).

While the measures of the Basel Accord do sound reasonable in theory, it is relevant to find out how it has performed in practice. Rizwan et al. (2018, p. 38) set out to test the impact of financial regulation in reducing financial fragility of banks in a setting consisting of both commercial banks and Islamic banks. Their methodology focuses on nine different measures of regulation and their effects on individual banks probability-of-default. The study finds that for the countries studied, capital requirements have a significant and negative impact on probability-of-default. For most banks, a one unit increase in the capital ratio leads to a reduction of the probability-of-default by 2.2 % (Rizwan et al., 2018, p. 56). This should hardly be surprising as capital ratios has been the focus of the Basel Accord since it’s very inception in the early 1980’s. The study further finds that the degree of independence of supervisory authorities and regulation aiming to restrict the amount of permissible banking activities also successfully reduces probability of default. A one unit increase of these factors would reduce the probability-of-default by 8.7 % and 2.2 % respectively (Rizwan et al., 2018, p. 57).
However not all regulatory measures have the intended effect. Rizwan et al. (2018, p. 57-58) finds that degree of supervisory power and a variable they call the “private monitoring index” have positive impacts on banks probability of default. In terms of supervisory power, it is argued that supervisors with too much power could have a tendency to favor some institutions over others, attract donations and attention from lobbyists as well as extract bribes and commit to other integrity issues. As for private monitoring the argument is that an over-reliance on private monitoring would decrease the amount of risk-management practices implemented by banks of their own will. This is particularly observable in developing countries who suffer from poorly developed capital markets, accounting standards as well as having inconsistent legal systems (Rizwan et al., 2018, p. 57-58).

It should be noted that the different regulatory measures do not affect every bank in the same way. While some types of regulation might diminish probability-of-default for larger banks, it could increase the probability-of-default for smaller institutions, or vice versa. For instance, supervisory independence does not have a significant effect on less stable banks, with a higher original level of probability-of-default (Rizwan et al., 2018, p. 57). In addition, the effects of regulation vary widely between commercial banks and Islamic banks, however those effects are considered to be outside the scope of this study.

The fact that banking regulation has a heterogenous effect on different institutions is echoed by Laeven & Levine (2009). Their study aims to determine the impact of regulatory changes on bank risk depending on different ownership structures. Using a sample of 279 banks across 48 countries over the period 1996-2001 they find that the effects of regulation varies significantly depending on the ownership structure of the bank (Laeven & Levine, 2009). Banks with more powerful owners tend to take more risks compared to banks who have more owners with less power, thus increasing their risk of default (Laeven & Levine, 2009, p. 273).

However, not all academic work finds that current regulatory measures are effective in reducing default risk. A recent study by Bitar et al. (2018, p. 234), using a sample of 1992 banks from 39 OECD countries find that the risk-weighted capital ratios are insignificant in determining bank risk. When the model instead used a regular equity to assets ratio, a significant and negative relationship between capital ratios and bank risk was observed. This shows that the risk-weighted asset model employed by the Basel Committee is inferior to standard equity to asset ratios in improving banking stability. This result is echoed by an earlier study by Altunbas et al. (2007, p. 58) who finds that, among others, bank equity to asset ratio has a significant and negative effect on bank risk.

Given the above findings, it is arguable whether the one-size-fits-all type of regulation imposed by the Basel Committee is truly working to reduce bank risk in all cases. While there is some flexibility in the latest versions of the Basel Accord, such as differing levels of the countercyclical buffer being imposed by national authorities and the additional requirements imposed on both domestic and systemically important banks, these areas do not seem to be where most of the variation in effect takes place. With that said however, implementing regulation tailored after each individual banks characteristics is likely to be impossible.

4.8 Hypothesis

Following the purpose of this study and based on the theoretical framework presented
above, a number of hypothesis connecting the increased regulatory standards to potential costs and benefits of the regulation will be carried out. The following hypothesis will be tested:

**Hypothesis one.**

\( H_0: \) Regulatory measures, as indicated by increased capital requirements, has no effect on banks’ lending growth.

With the alternative hypothesis:

\( H_A: \) Regulatory measures, as indicated by increased capital requirements, has a significant effect on banks’ lending growth.

**Hypothesis 2.**

\( H_0: \) Regulatory measures, as indicated by increased capital requirements, has no effect on banks’ cost of capital.

With the alternative hypothesis:

\( H_A: \) Regulatory measures, as indicated by increased capital requirements, has a significant effect on banks’ cost of capital.

**Hypothesis three.**

\( H_0: \) Regulatory measures, as indicated by increased capital requirements, has no effect on banks’ default risk.

With the alternative hypothesis:

\( H_A: \) Regulatory measures, as indicated by increased capital requirements, has a significant effect on banks’ default risk.
5. Practical Methodology

The purpose of this chapter is to present the practical methodology used throughout the study. This includes how data has been collected and processed, what statistical tests are being done and how to make sure that the results presented are reliable.

5.1 Data collection

The data used in this study consists of information gathered from banks annual and risk reports. To ensure the reliability of the study, the aim was to include as many banks as possible. However, in order to perform the study, a number of criteria was imposed on the banks to be able to be selected. The target population were Scandinavian banks with similar regulatory requirements. Because of this, the banks were required to be of Swedish, Danish or Finnish origin. These countries fully introduced the Basel III framework into legislation in the form of the CRD IV package in 2014. While some differences persist in the regulatory requirements between large and small banks in the different countries, the overall regulation is the same, which should ensure comparability between the selected banks.

Furthermore, the selected banks were required to have banking as their main activity. The banking market, particularly in Sweden, consists of a number of companies that have extended their operations into banking from other industries. Examples are ICA banken, who have their main operations in selling groceries, Norwegian Bank, who mainly operate in aviation and Länsförsäkringar Bank having their main operations in insurance. Including these banks would be problematic as the information posted in the annual reports cannot be clearly distinguished between the different segments. While some of the indicators used, such as lending are unaffected, most others are not. Total assets and liabilities will for instance be affected by having their main operations in another industry, making them unsuitable for selection in this study.

Another condition was that the selected banks needed to be public companies, traded on a stock exchange. The purpose of the study contains determining cost of capital effects of increased regulation. To be able to do this, the banks cost of equity and debt need to be estimated, as the information is not readily available. The methods used to obtain these estimates will be further discussed later, but requires information on the companies’ beta value and stock price, resulting in the requirement of the banks being public.

As the sample used is not one of chance, but could be argued to be either one based on specific selection criteria, or of convenience, this puts into question the generalizability of the results presented. However, the population consists of almost all the major players of the banking industry in the countries. The exception is the Finnish banking industry which consists of many private financial co-operations, which would not have been able to be part of the study in any case. A completely random population that would have satisfied the criteria to be able to perform the study would have been mostly similar to the one used. Given the completeness of the population used, the reliability and validity of the study should not be adversely affected to any significant degree.

The end result is a sample of 20 banks from the three different countries, where five banks are Swedish, two are Finnish and 13 are from Denmark. A list of all banks in the study can be found in Appendix 1. In total, 38 different indicators were collected or calculated.
based on the data from the banks annual and risk reports. Consolidated data over the entire banking group have been used throughout, to ensure that no information is calculated twice. Given that the study aims to estimate changes based on increased regulation, the time frame was decided to include a few years before the regulatory changes and a few years after. The final decision ended up including the years 2010-2017. Going back further than 2010 would be problematic as it takes us right into the crisis period, where many banks suffered heavy losses. While banks still felt the effects of the crisis in 2010, it can be argued that the large adjustments by government institutions had at that point already taken place. The 2010-2017 period is largely homogenous in its overall business environment and should thus enable comparability over the periods. The sample consists of 160 observations of 38 variables which altogether means that more than 6000 data points were manually collected and calculated. Through this relatively vast collection, there is the possibility of errors being made. Great care has been taken to make sure that no errors have been made in the collection and handling of the data. Any potential errors made should be small enough to not impact the result of the study in a significant way.

5.2 Tests

A significant part of any quantitative study is performing correct and relevant statistical tests. These tests ensure that any observed variation hold significance and are not only due to randomness in the sample. In order to fulfill the purpose of the study, two types of tests will be carried out to establish the significance of regulation on the factors outlined in the research question. The first test to be conducted is a paired T-test and the other a regression analysis.

5.2.1 T-tests

The general idea with a T-test is to determine whether a sample has a specific hypothesized mean value. A paired T-test is useful for comparing effects on a variable from a specific event as it can compare values from a pair of observations of the same variable, such as before and after an event, and find whether the change is statistically significant (Frost, 2016).

In more mathematical terms, the T-value is achieved by the following formula:

\[ T = \frac{\bar{x} - \mu}{s/\sqrt{n}} \]

Where:

\( \bar{x} \) represents the sample mean.
\( \mu \) the hypothesized mean value.
\( s \) is the standard deviation of the sample.
\( n \) is the number of observations.

The measurement of the T-test usually goes by the name signal-to-noise ratio, which describes how the formula works. The numerator is referred to as the signal, that is the size of the effect. The larger the discrepancy between the sample mean and the hypothesized mean, the stronger the signal. The denominator in turn is known as the noise. The noise factor is determined by the variability of the mean, where a larger
variability means more noise, as it is less precise and has more random error. As can be seen from the formula, the T-value is simply the ratio of the signal to noise, and indicates in standard errors how large the differences are. Large signals and low levels of noise gives large T-values, which indicates that the difference observed between the sample estimate and the hypothesized value is of significance, rather than just observed due to random error (Frost, 2016).

Depending on the amount of observations, and the significance level used, the T-value achieved may or may not be significant. The statistical software used will calculate the p-value inferred from the T-test. The p-value tells the probability of observing a difference from the hypothesized value that is at least as large as the one that can be observed in the data (Frost, 2016).

If a p-value is below the chosen significance level, the differences are said to hold statistical significance, if it is not, no significant differences can be proven from the sample used (Frost, 2016). This study will highlight statistical differences that have a significance level of 10, 5 or 1 %. The significance level also describes the probability of obtaining a Type 1 error, that is rejecting a null hypothesis that is in fact true. Given this fact, a significance on the 1 % level is the most certain to be absent of errors, and the 10 % level the least certain. P-values above 10 % are assumed to hold too high probability of errors as to be of significance at all.

The paired T-test is particularly useful for this study as it contains a comparison of two distinct event windows, that is before and after the introduction of the most recent regulation. If the introduction of the regulation has significantly affected the behavior of banks, we would expect to see large T-values from our tests and p-values below the given significance level.

5.2.2 Regression analysis

In addition to the T-tests, a regression analysis will be performed for the variables outlined in the research question. While the T-tests examines whether the differences in a variable between periods are statistically significant, it says nothing about the mechanics behind the potential changes. A regression analysis attempts to explain changes in a chosen dependent variable from changes in a number of chosen independent variables simultaneously. The regression model further shows the strength of the relationship between the dependent and the independent variables (Saunders et al., 2012, p. 523).

In order for the results of the regression model to be reliable, a number of assumptions must be fulfilled and checked for. The first assumption is that the parameters of the model must be linear. The parameters are the coefficients generated by the regression model, usually denominated by \( \beta \). The linearity of the coefficients allows for the execution of a linear regression and is thus imperative (Woolridge, 2013, p. 83). The second assumption is that the values of the variables need to be independent, that is, there cannot exist any correlation between them (Woolridge, 2013, p. 84). Third, there cannot exist multicollinearity in the model. Variables are allowed to correlate to some extent, there can however not exist perfect collinearity between any of the independent variables (Woolridge, 2013, p. 84). The degree to which collinearity is allowed varies between different research. This study will employ a cutoff value of 60 %, that is, as long as the collinearity does not exceed \( \pm 0.6 \), there should not be a risk of issues with multicollinearity, as stated by Pearson (2010, p. 291). The fourth assumption is that the
expected value of the errors need to be zero for all values of the independent variable, making sure that autocorrelation does not cause bias within the model (Woolridge, 2013, p. 87). The fifth and final assumption states that the error term is assumed to be normally distributed, with zero mean and constant variance. This ensures that the residuals are homoscedastic, whereas the opposite would mean heteroscedasticity which has a tendency to overestimate the strength of the relationships presented in the model (Woolridge, 2013, p. 87).

The manner in which these assumptions are checked and corrected for tend to differ between research. A common way to determine the relationship between the dependent and independent variables is by what can be referred to as “eyeball econometrics”, that is by visually analyzing scatterplots. This analysis can with some degree of certainty determine the linearity of the variables as well as check for heteroskedasticity. A common issue with time-series data is the presence of autocorrelation, that is that errors of the model are correlated. Testing for multicollinearity is a straight-forward process by using a collinearity matrix, where, as stated, values below ± 0.6 are allowed.

Given that all assumptions are satisfied, a general regression model takes the form of:

\[ y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots + \beta_p x_{ip} + \epsilon_i \]

Where:

- \( y_i \) is the dependent variable.
- \( \beta_0 \) is the mean of the dependent variable when the value of the independent variables is equal to zero.
- \( \beta_p \) represents the slope of the independent variables. The slope coefficient determines the level of change in the dependent variable as the specific independent variable increases by one unit.
- \( x_i \) are the independent variables.
- \( \epsilon_i \) represents the errors.

The number of independent variables in the regression model largely depends on the size of the sample. While an overall consensus does not exist as to the number observations required for each independent variable, there are some distinct opinions. Some statisticians argue that 10 observations for each independent variable in your regression model is sufficient, others claim that 15 observations per independent variable is needed for reliable results while others argue for 50 observations plus eight times the number of independent variables used (Pearson, 2010, p. 288). Whatever the case, the number of observations in this study should allow the regression model to include at least ten different independent variables, without losing reliability in the results.

**5.3 Regression models and variable description**

For the results of a regression analysis to be reliable, it is important to have a sound theoretical basis for the inclusion of independent variables, as well as their assumed effects. This section will outline the starting point of regression models used, the theoretical basis of the variables, their theorized effect as well as how they were estimated. It should be noted that three different regressions will be carried out, one where lending growth is the dependent variable, one for cost of capital and one for default risk.
5.3.1 Regression one – Lending growth

The first regression model will in its original state take the following form:

\[ \ln\text{Grwth}_i = \beta_0 + \beta_1 BCycle + \beta_2 \text{IntRate} + \beta_3 \text{Soundness} + \beta_4 \text{CptlRatio} + \beta_5 DSIB + \beta_6 CoC + \epsilon_i \]

Where:

- \( \epsilon_i \) is the error term.

\( \ln\text{Grwth} \) is the dependent variable lending growth. The theoretical foundation, as have been outlined in the theory chapter, stems from academic articles claiming that one of the major effects of increased regulation is a fall in lending growth, which in turn will have detrimental effects on the overall economy (Aiyar et al., 2012; IIF, 2010; BCBS, 2010; Brinkmann & Horowitz, 1995; Bridges et al., 2014; De Nicolò, 2015). The regression model fills the purpose of examining the existence of lending growth effects from increased regulation, while simultaneously checking for macro and micro factors.

BCycle is an estimator for business cycle effects, as estimated by the growth rate in GDP. A booming economy will have large increases in GDP growth, whereas slumping economies will experience the reverse. Business cycle effects were found by Elkedag & Wu (2011) to have a significant impact on lending growth, where large values of GDP growth will lead to increases of lending growth. The expected relationship between the variables is thus positive.

IntRate is the short time interest rates. The intuition being that low interest rates will encourage more lending, and vice versa. The relation between the variables is therefore expected to be negative, as increases in interest rate should lead to reductions in lending growth. As few studies have been made on the determinants of lending growth, there is no existing empirical foundation, however the intuition is an established economic relationship between the two variables.

Soundness, is a measure of bank balance sheet soundness, as estimated by the equity to debt ratio. Elkedag and Wu (2011) found that credit growth is related to deteriorating bank balance sheet soundness, that is, a reduction in equity with respect to debt. The expected relationship is thus negative, where increased balance sheet soundness should reduce lending growth.

CptlRatio is the calculated capital ratio. The capital ratio is calculated by dividing total risk-weighted assets with total equity. This is a slight simplification on the requirements of the regulatory capital, which separates different types of capital. However, the risk reports on all banks did not allow for calculation of the different capital types. The total capital ratio does however follow the same direction as the more explicit versions of the capital ratio, and should thus function as a good estimator of regulatory capital changes. According to most academic research as well as institutional reports, increases in capital ratio will reduce lending growth (Aiyar et al., 2012; IIF, 2010; BCBS, 2010; Brinkmann & Horowitz, 1995; Bridges et al., 2014; De Nicolò, 2015). The sign is therefore assumed to be negative.

DSIB (Domestic Systemically Important Bank) is a dummy variable for large banks that takes the value 1 for large institutions and 0 for the others. The dummy variable is assumed to be necessary as the banking industry in Sweden and Denmark consists of few very large players. Due to the market shares of these banks, they should theoretically hold
a significant advantage over the other banks, which the dummy variable is expected to pick up on.

CoC is the calculated cost of capital. The theoretical foundation comes from the mechanism presented in the IIF report, stating that increased regulation leads to reduced lending growth, through increases in bank cost of capital. The expected sign is therefore negative, as increases in cost of capital should lead to reduced lending growth. The estimation of the cost of capital is problematic, as there are numerous ways of doing so. As stated earlier, the cost of capital consists of the cost of equity and the cost of debt, both of which must be estimated as they are not explicitly stated by the different banks. The estimation of cost of equity have been done using two different models.

The most common way of estimating cost of equity is through the Capital Asset Pricing Model (CAPM). The CAPM formula is the following:

\[ r_E = r_f + \beta_a (r_m - r_f) \]

Where:
- \( r_E \) is the cost of equity.
- \( r_f \) is the risk-free rate.
- \( \beta_a \) is the beta of the company.
- \( r_m \) is the expected market return.

CAPM thus states that the cost of equity is equal to the risk-free rate plus the firms’ beta value times the market risk premium. The information required to carry out the calculation have been collected through external sources, which will be discussed later.

Another way of calculating the cost of equity is through the dividend capitalization model (DCM). The DCM formula is the following:

\[ r_E = \left( \frac{D}{P} \right) + g \]

Where:
- \( r_E \) is the cost of equity.
- \( D \) is the dividend paid out next period.
- \( P \) is the current stock price of the firm.
- \( g \) is the growth rate of dividends.

DCM thus requires the firms to pay out dividends, which has not always been the case for the banks in the sample. The advantage of the DCM is that the information can be collected from the respective companies’ annual reports, meaning that the risk of misinformation should be small.

Cost of debt is more straightforward to calculate, as it simply is the amount of interest a firm pays on their interest-bearing liabilities. The cost of debt has thus been calculated by dividing interest expense by interest bearing liabilities, both figures can be found in the annual reports.

To finally end up with a cost of capital, the Weighted Average Cost of Capital model (WACC) have been used. The WACC model looks like the following:

\[ WACC = \frac{E}{V} * r_E + \frac{D}{V} * r_D \]
Where:

\[
\frac{E}{V} \text{ is ratio of equity to total assets.}
\]

\[
\frac{r_E}{V} \text{ is the cost of equity.}
\]

\[
\frac{D}{V} \text{ is the ratio of debt to total assets.}
\]

\[
\frac{r_D}{V} \text{ is the cost of debt.}
\]

The WACC model thus takes into account the amount of equity and debt and averages their respective costs to end up with a total cost of capital. As several methods of calculating cost of equity have been used, three different cost of equity variables are tested in this study. The first bases cost of equity solely on the CAPM model, the second solely on the DCM model and the third averages the result of both models to get a cost of equity. The model providing the most significant results will subsequently be the one presented in the study.

5.3.2 Regression two – Cost of capital

The second regression model will in its original state take the following form:

\[
CoC_i = \beta_0 + \beta_1 \text{Size} + \beta_2 \text{Soundness} + \beta_3 \text{CptlRatio} + \beta_4 \text{IntRate} + \beta_5 \text{BCycle} + \beta_6 \text{DSIB} + \epsilon_i
\]

Where:

CoC is the dependent variable Cost of Capital. The theoretical foundation is that increased regulatory pressure will increase banks cost of capital, as previously stated. The main purpose of the regression model is to determine whether there are observable cost of capital effects from increased regulatory requirements, while checking for both macro and micro factors. All three estimators of cost of capital will be tested, that is where cost of equity is calculated by the DCM, CAPM and the average of both, but only the variable providing the best results will be presented.

Size is an indicator of bank size, as estimated by the natural logarithm of total assets. Given the large variation in total assets and due to the existence of a few large banks, it was necessary to take the logarithm of total assets, to avoid large outliers. The theoretical foundation for size effects are from Berger & Bouwman (2013), who argue that larger institutions have better access to capital markets, meaning their cost of capital should be lower. The relationship between cost of capital and size should therefore be negative.

Soundness is the equity to debt ratio. IIF (2010) reports that as debt is considerably cheaper than equity, a larger amount of equity compared to debt will increase the overall cost of capital. Modigliani & Miller (1958) on the other hand in their famous theorem claims that capital structure is fully irrelevant for firms cost of capital, given a number of assumptions. Given the extremity of the M&M assumptions, the relationship between soundness and cost of capital is assumed to be positive.

CptlRatio is the estimator for regulatory capital. Most theory states that increases in regulatory capital requirements also increases banks cost of capital (Aiyar et al., 2012; IIF, 2010; BCBS, 2010; Brinkmann & Horowitz, 1995; Bridges et al., 2014; De Nicolò, 2015). The assumed relationship is therefore assumed to be positive. It should however
be noted that the BCBS (2010) and Kayshap et al. (2010) finds the capital ratio to possibly be negatively related to cost of capital, due to reductions in banks’ risk levels.

IntRate is the variable for short-term interest rates. The intuition behind the inclusion of this variable is that as the interest rates increase, investors will demand higher returns on their investments. This should increase both the cost of debt and equity, and thus have a significant positive impact on cost of capital.

BCycle is business cycle effects, estimated by GDP growth. The intuition is that a flourishing economy is usually signified by easy access to credit, whereas a stagnating economy experiences the reverse scenario. Easy access to credit should reduce overall cost of capital, and a positive relation between the variables is therefore assumed.

DSIB is a dummy variable which takes the value 1 for very large banks, and 0 for others. As stated earlier, this variable is assumed to capture competitive advantages achieved by very large institutions due to their large market share.

**5.3.3 Regression three – Default risk**

The third regression will in its original state take the following form:

\[ Z_{score} = \beta_0 + \beta_1 \text{Size} + \beta_2 \text{CptlRatio} + \beta_3 \text{Bcycle} + \beta_4 \text{Soundness} + \beta_5 \text{DSIB} + \epsilon_i \]

Where:

Zscore is the dependent variable and the estimator for default risk as used in this study as well as others, such as Laeven & Levine (2009). The regression aims to determine whether increased regulatory ratios have been successful in reducing bank risk, while checking for macro and micro factors. The calculation of the Z-score is done from the following formula:

\[ Z \text{ – score} = \frac{(\text{ROA} + \text{CAR})}{\sigma(\text{ROA})} \]

Where:

ROA is return on assets.
CAR is the capital to assets ratio.
\( \sigma(\text{ROA}) \) is the standard deviation of ROA. The standard deviation in this study will be calculated from the ROA of the past three years.

As stated earlier, the Z-score measures how many standard deviations ROA must fall for the bank to become insolvent. Thus, the higher the Z-score, the less risk a bank has of defaulting.

Size is an indicator of bank size. The intuition behind the inclusion of the variable being that larger institutions have larger incentives to promote risky behavior, as they are more likely to be bailed out by governments, were they ever to fall on hard times. Given the too-big-to-fail hypothesis, larger institutions should be riskier than others. We would therefore expect the relationship between the variables to be negative.

CptlRatio is the ratio between total risk-weighted assets and equity, the estimator of regulatory requirements. The idea behind increased regulatory requirements is to reduce
the probability of bank default. The relationship between the variables is therefore assumed to be positive.

Bcycle is business cycle effects. The intuition being that macroeconomic factors influence the default risk of banks. One of the main macroeconomic factors is the business cycle, as captured by GDP growth. The direction of the relationship is somewhat unclear. On the one hand, good times can be assumed to reduce the likelihood of bank default. On the other hand, good times can make banks increase their risk, which would have the opposite effect.

Soundness is captured by the equity to debt ratio. More equity in relation to debt would increase the amount of losses a bank can withstand without falling into default. The relationship between the variables is thus perceived to be positive.

DSIB is the dummy variable, taking the value one for large banks and zero for the others. As with size, if the TBTF hypothesis is correct, very large banks have incentives to increase their risk, which should be captured by the dummy.

### 5.3.4 Regression assumptions

This section will discuss how the assumptions necessary for a regression analysis have been checked and accounted for. The first test checks the multicollinearity condition between all the variables used in the different regressions, which is done by a simple correlation matrix. The matrix is presented in Table 1 below.

<table>
<thead>
<tr>
<th></th>
<th>Soundness</th>
<th>Size</th>
<th>Interest Rates</th>
<th>Lending Growth</th>
<th>Cost of Capital</th>
<th>Business Cycle</th>
<th>Capital Ratio</th>
<th>Z-Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>-0.634***</td>
<td>(0.000)</td>
<td>-0.037</td>
<td>(0.194)</td>
<td>-0.003</td>
<td>(0.720)</td>
<td>0.006</td>
<td>(0.011)</td>
</tr>
<tr>
<td>Interest Rates</td>
<td>-0.103</td>
<td>(0.529)</td>
<td>0.201***</td>
<td>(0.971)</td>
<td>0.029</td>
<td>(0.716)</td>
<td>0.016</td>
<td>(0.949)</td>
</tr>
<tr>
<td>Lending Growth</td>
<td>-0.029</td>
<td>(0.000)</td>
<td>0.286***</td>
<td>(0.000)</td>
<td>0.050</td>
<td>(0.000)</td>
<td>0.039</td>
<td>(0.016)</td>
</tr>
<tr>
<td>Cost of Capital</td>
<td>0.050</td>
<td>(0.000)</td>
<td>-0.258***</td>
<td>(0.000)</td>
<td>-0.066</td>
<td>(0.000)</td>
<td>0.007</td>
<td>(0.000)</td>
</tr>
<tr>
<td>Business Cycle</td>
<td>0.196***</td>
<td>(0.012)</td>
<td>0.139*</td>
<td>(0.001)</td>
<td>0.098</td>
<td>(0.392)</td>
<td>0.016</td>
<td>(0.962)</td>
</tr>
<tr>
<td>Capital Ratio</td>
<td>-0.035</td>
<td>(0.000)</td>
<td>0.126</td>
<td>(0.985)</td>
<td>0.050</td>
<td>(0.462)</td>
<td>0.059</td>
<td>(0.970)</td>
</tr>
<tr>
<td>Z-score</td>
<td>-0.469***</td>
<td>(0.000)</td>
<td>0.862***</td>
<td>(0.000)</td>
<td>-0.059</td>
<td>(0.985)</td>
<td>0.146*</td>
<td>(0.000)</td>
</tr>
<tr>
<td>DSIB</td>
<td>0.047</td>
<td>(0.000)</td>
<td>0.015</td>
<td>(0.000)</td>
<td>0.015</td>
<td>(0.000)</td>
<td>0.047</td>
<td>(0.000)</td>
</tr>
</tbody>
</table>

* Indicates significance at the 10% level
** Indicates significance at the 5% level
*** Indicates significance at the 1% level

p-values shown in parenthesis

As can be seen, there are some potential issues with multicollinearity present. As stated earlier, collinearity coefficients below ±0.6 should not pose any problems, however there are some variables in the regressions that exceed those levels. In particular, Soundness and Size have a correlation coefficient of -0.634, slightly above the given break-point. The variables Size and DSIB also suffer from correlation with a coefficient of 0.862. The fact that Size and DSIB has high correlation makes sense as they in essence measure the same phenomenon, given that the systemically important banks are by nature also the
largest banks. Following the results of the correlation matrix and given that they explain the same thing, Size and DSIB should not be simultaneously used in the same regression. As for Soundness and Size, a further check of multicollinearity, in the form of a VIF-test will be performed in the models where they are simultaneously included. VIF stands for Variance Inflation Factor and is a statistical test of the severity of multicollinearity. As correlation values does not indicate whether multicollinearity issues will be present in the model, a VIF test can tell how severe the multicollinearity is, and thus how likely they are to cause problems in the model (Saunders, et al., 2012, p. 524). Due to this result, the regression models including both size and DSIB will be altered to only include one of the variables. Disregarding these instances, the models should fulfill the no multicollinearity condition.

To check for the linearity condition, a visual analysis of scatterplots showing residuals against predictor variables have been conducted. To ensure linearity, the residuals should be equally spread out above and below the zero line. As can be seen from the below figures, this seems to be the case for all models. A single scatterplot for each model will be presented here for brevity, for a more thorough presentation, see Appendix 2.

Figure 1. Scatterplot of residuals vs predictors – Model one
To check for potential heteroskedasticity, a visual analysis has been performed of scatterplots showing residuals against fitted values. Homoscedasticity assumes constant variance of errors. This should be seen in the figures as a constant spread of the plotted residuals, in contrast to a fanning out pattern which is common with heteroskedastic data. The figures below show that the variance is rather constant for model one, however a few outliers cause a fan pattern where the residuals are larger for larger values, which could be a cause for concern. A potential solution to this issue is to exclude the outliers from the sample. However, such action cause other issues, such as trying to fit the sample to the model, rather than the model to the sample. The figure for the second model show that there should be no issues of heteroskedasticity in it whereas the figure for the third model show tendencies for patterns, with a convergence toward the middle. As the visual analysis could not provide conclusive answers as to the homoscedasticity of the models,
a statistical test called the Cook-Weisberg test was conducted on each of the three models. The Cook-Weisberg tests the null hypothesis of constant variance of errors, meaning that as long as the resulting p-values are above a chosen significance level, the models can be assumed to be homoscedastic.

The Cook-Weisberg test of the first model gave a p-value of 0.065, meaning that the null hypothesis could not be rejected given a 5% significance level, and there should therefore be no issues of heteroskedasticity in it. Testing on the second model gave a p-value of 0.084, whereas the test on the third model gave a p-value of 0.053. Given these results, there should not be any issues of heteroskedasticity in either of the models.

Figure 4. Scatterplot of residuals vs. fits – Model one.

Figure 5. Scatterplot of residuals vs. fits – Model two.
Tests have also been conducted on the assumption of normality of the residuals. The tests show that for all three models, the errors are not normally distributed. While OLS estimates are still unbiased following non-normality, one way of overcoming potential issues is to have a large enough sample. It has been shown that samples over 15 observations still produce reliable results, even through a non-normally distributed sample (The Minitab Blog, 2014). As this study contains 160 observations, there should be no significant impact on the results.

5.4 Model criticism

While the obvious ambition has been to achieve the best possible models, there are identifiable issues that warrant discussion. Most of these issues relate to the calculation of the cost of capital. First and foremost, to calculate the cost of equity using the CAPM model, information on risk-free interest rates, risk premiums and stock betas have to be collected. It is important that these figures are trustworthy, as they are the foundation of the calculation. It would be possible to calculate these values by yourself, however the process is rather time-consuming and complex. In order to save time, the information on risk premia and risk-free rates for each of the three countries have been collected from an external website (market-risk-premia.com). Before using the collected data, a thorough analysis of the methodology used to arrive at the values have been conducted. The methods employed have academic backing, and have been carried out in the correct way. Furthermore, the calculations are done by well-educated academics, all holding Ph.D.’s in finance. Additionally, the figures have all been calculated in the same way for each country. Even if miscalculations have been done, they should affect all countries equally. There should thus be little worry that incorrect data have affected the results of the study.

The data regarding each company’s beta have also been collected from an external website (infrontanalytics.com). The company provides professional data services and analytics. As with the risk-premia, the models employed are all based on academic work and are correctly done. The information provided is therefore assumed to be valid. As with the interest rates, all beta values have been collected from the same source. Any
potential bias in the estimates should therefore be equal for each company. Overall, the data provided by both sources are perceived to be of high quality and should pose little risk of significantly affecting the results.

A more prominent issue lies with the models used for calculation of the cost of equity. The current macroeconomic situation in the Nordic countries, especially in terms of interest rates, are unprecedented in history. As the CAPM model relies heavily on interest rates, the current interest environment of historically low, or even negative, interest rates may cause issues with the accuracy of the estimates provided by the model. It is possible that these factors cause the estimates from the CAPM model to be underestimated.

A similar issue is present with the DCM model, as it relies on continuous dividends being paid by the companies. There have been cases where the banks in the sample have either paid no dividends at all during the period, or only during a few years. When no dividends have been paid, the DCM model does not function at all, and the results from the CAPM model have been employed in its stead. The companies that only paid dividends for a few years is equally problematic. As the DCM model includes the growth rate of dividends, this variable can have a high variation when only a few dividends are paid, or are paid sporadically. This effect might cause the cost of equity estimates from the DCM model to be both over- or underestimated, depending on the growth rate of dividends. However, all models employing the cost of capital variable showed the best fit with the estimates of the CAPM, rather than the DCM or the average of the two. The problems with the DCM should thus not have any effect on the result of the study.

It should be noted that the same methodology has been employed for all companies included in the study for all periods and all variables. Even if the estimates were to be unreliable, it does not invalidate the results of the study. While certain amounts of care should be taken when determining absolute levels of cost of capital effects, the over-time comparison should remain fully valid. This means that the research question can still be appropriately answered, even if the cost of capital measures were to be found unreliable.
6. Results

The purpose of this chapter is to present the main findings of the study. This includes descriptive data on the main variables of the study, results on the performed statistical tests as well as how they relate to the proposed hypothesis.

6.1 Descriptive data

Table 2 below presents a summary of descriptive data for the variables used in the regressions, where size is presented in its non-logarithmic form. The table provides some interesting information. The mean annual growth in lending over the years 2010-2017 is slightly above 2.5%. The presence of outliers is clear as the third quartile of lending growth is roughly 6.6 per cent, whereas the maximum value is above 95%. This is due to a case where banks merged and thus saw a large increase in their lending amount. The statistics also show the impact of the low interest rate environment. The mean interest rate is 0.4%, contributing to a low cost of capital mean of 1.13%. The highest observed interest rate and cost of capital is 1.6% and 3.3% respectively, with the lowest -0.690 and 0.058 for the variables.

The Z-score data show evidence of a sound banking industry with overall high values. The mean values show that on average banks can endure a fall of ROA by 66 standard deviations before defaulting. The discrepancy between the most stable banks and the most unstable is however quite large, showing a Z-score of 241.46 as the maximum and – 1.19 as the minimum. The capital ratio further proves the solidity of the Nordic banks, with a mean of almost 19% of equity over risk-weighted assets, which is above the regulatory requirements. The overall stability of the banking sector is thus high in the Nordic area.

The soundness measure is given from equity over debt. Given that banks operate mainly through the issuance of debt, it makes sense for the variable to report relatively low values. A reported mean of nearly 9% means that banks generally have about ten times more debt than equity. The size measure shows the large variability in bank size in the sample. The figures in the table are expressed in million SEK. As can be seen, the largest banking institution has assets valued at over 6 trillion SEK, whereas the mean value is about 860 billion. The business cycle and interest rates are not bank specific, but rather country specific. The lowest GDP growth was experienced by Finland in 2010, and the highest by Sweden in 2011, however that was mainly driven by a significant fall in 2010.

As the purpose of the study is to highlight possible changes due to regulation, it is interesting to see how these factors have changed over time. Table 3 and 4 below show descriptive data on the variables in 2010 as well as 2017. The data shows an increase in lending growth from 2010 to 2017 by roughly 1.5 percentage points. Banks also seem to experience lower cost of capital in 2017 compared to 2010, where average cost of capital...
in 2010 was 1.47 %, the same figure in 2017 was 0.67 %. A contributing factor to this is the interest rate which had a mean of 1.02 % in 2010, compared to -0.4 % in 2017. This shows that the full extent of central bank reactions of the crisis could not be felt in 2010.

Banks have also become safer compared to 2010. Granted, the 2010 data is gathered in the immediate aftermath of the worst financial crisis since the great depression but even so the Z-score values are high. Even just after the crisis, the average bank could suffer a fall in ROA by 56 standard deviations before they would default. There is also an observable increase in capital ratio from 2010 to 2017. The average bank in 2010 had a capital ratio of almost 14.5 %, whereas the same figure in 2017 was 21.7 %. The overall soundness ratio has also increased from 2010. The average bank in 2010 had 8.23 % equity to assets, whereas the average bank in 2017 had 10.22 %. This makes sense as regulatory requirements have continuously forced banks to increase the amount of equity held. Banks have seemingly also become bigger since 2010, where the average bank have increased their assets by more than 100 billion SEK. Naturally, the business cycle measure increased from 2010 to 2017, which hardly can be surprising given that the effects of the financial crisis were surely still felt in 2010. GDP growth have increased with roughly 0.8 percentage points since 2010.

Overall, it seems like the banking industry have gone through significant changes from 2010 compared to 2017, where the industry today seems overall better off. It is however possible that the 2010 sample is influenced by the adverse effects of the financial crisis to a larger extent than the 2017 one, which should be taken into consideration.

### Table 3. Descriptive statistics of variables 2010

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>SE</th>
<th>Mean</th>
<th>StdDev</th>
<th>Minimum</th>
<th>Q1</th>
<th>Median</th>
<th>Q3</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lending Growth</td>
<td>20</td>
<td>0.011</td>
<td>0.022</td>
<td>0.100</td>
<td>-0.202</td>
<td>-0.039</td>
<td>0.021</td>
<td>0.073</td>
<td>0.236</td>
<td></td>
</tr>
<tr>
<td>Cost of Capital</td>
<td>20</td>
<td>0.015</td>
<td>0.001</td>
<td>0.005</td>
<td>0.002</td>
<td>0.011</td>
<td>0.015</td>
<td>0.018</td>
<td>0.024</td>
<td></td>
</tr>
<tr>
<td>Z-Score</td>
<td>20</td>
<td>0.144</td>
<td>0.015</td>
<td>0.085</td>
<td>0.063</td>
<td>0.096</td>
<td>0.133</td>
<td>0.181</td>
<td>0.316</td>
<td></td>
</tr>
<tr>
<td>Capital Ratio</td>
<td>20</td>
<td>0.082</td>
<td>0.012</td>
<td>0.053</td>
<td>0.021</td>
<td>0.045</td>
<td>0.069</td>
<td>0.112</td>
<td>0.236</td>
<td></td>
</tr>
<tr>
<td>Soundness</td>
<td>20</td>
<td>762600</td>
<td>317598</td>
<td>1420343</td>
<td>1407</td>
<td>8869</td>
<td>44196</td>
<td>1354266</td>
<td>5213901</td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>20</td>
<td>0.023</td>
<td>0.006</td>
<td>0.028</td>
<td>-0.030</td>
<td>-0.005</td>
<td>0.043</td>
<td>0.043</td>
<td>0.043</td>
<td></td>
</tr>
<tr>
<td>Business Cycle</td>
<td>20</td>
<td>0.010</td>
<td>0.001</td>
<td>0.003</td>
<td>0.005</td>
<td>0.006</td>
<td>0.013</td>
<td>0.013</td>
<td>0.013</td>
<td></td>
</tr>
</tbody>
</table>

### Table 4. Descriptive statistics of variables 2017

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>SE</th>
<th>Mean</th>
<th>StdDev</th>
<th>Minimum</th>
<th>Q1</th>
<th>Median</th>
<th>Q3</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lending Growth</td>
<td>20</td>
<td>0.025</td>
<td>0.018</td>
<td>0.081</td>
<td>-0.165</td>
<td>-0.042</td>
<td>0.050</td>
<td>0.076</td>
<td>0.163</td>
<td></td>
</tr>
<tr>
<td>Cost of Capital</td>
<td>20</td>
<td>0.007</td>
<td>0.001</td>
<td>0.005</td>
<td>0.001</td>
<td>0.003</td>
<td>0.006</td>
<td>0.008</td>
<td>0.026</td>
<td></td>
</tr>
<tr>
<td>Z-Score</td>
<td>20</td>
<td>0.147</td>
<td>0.138</td>
<td>0.617</td>
<td>0.232</td>
<td>42.0</td>
<td>74.4</td>
<td>165.5</td>
<td>211.0</td>
<td></td>
</tr>
<tr>
<td>Capital Ratio</td>
<td>20</td>
<td>0.217</td>
<td>0.013</td>
<td>0.059</td>
<td>0.114</td>
<td>0.170</td>
<td>0.214</td>
<td>0.250</td>
<td>0.333</td>
<td></td>
</tr>
<tr>
<td>Soundness</td>
<td>20</td>
<td>0.102</td>
<td>0.012</td>
<td>0.055</td>
<td>0.012</td>
<td>0.060</td>
<td>0.086</td>
<td>0.149</td>
<td>0.206</td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>20</td>
<td>899769</td>
<td>357187</td>
<td>1597391</td>
<td>2893</td>
<td>17388</td>
<td>68469</td>
<td>1808837</td>
<td>5712360</td>
<td></td>
</tr>
<tr>
<td>Business Cycle</td>
<td>20</td>
<td>0.031</td>
<td>0.001</td>
<td>0.005</td>
<td>0.025</td>
<td>0.029</td>
<td>0.031</td>
<td>0.031</td>
<td>0.042</td>
<td></td>
</tr>
<tr>
<td>Interest Rates</td>
<td>20</td>
<td>-0.004</td>
<td>0.000</td>
<td>0.002</td>
<td>0.007</td>
<td>-0.006</td>
<td>-0.003</td>
<td>-0.003</td>
<td>-0.003</td>
<td></td>
</tr>
</tbody>
</table>

### 6.2 T-tests

To be able to determine whether there are significant differences in the variables between the periods, paired T-test have been conducted. The tests have been set up to compare the data from before and after Basel III were introduced into legislation in 2014. The paired
T-tests show whether differences between the periods are significant, as well as the direction of the change. It does however not say anything about the cause of the change, meaning that to be able to answer the research question, the T-tests need to be complemented by a regression analysis, which will be presented later.

Table 5 below show the results of the T-test for lending growth. As can be seen, the average lending growth before 2014 was about zero, whereas the years after show a growth of slightly above 5%. This gives a T-value of -2.57, corresponding to a p-value of 0.012 and is thus significant at the 5% level. This proves a statistically significant increase in lending growth in the years after the regulation was introduced, which is contrary to the theoretical foundation.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std.Dev</th>
<th>SE Mean</th>
<th>95% CI</th>
<th>T-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before LndGrowth</td>
<td>80</td>
<td>0.000</td>
<td>0.104</td>
<td>0.112</td>
<td>-0.093; -0.012</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After LndGrowth</td>
<td>80</td>
<td>0.052</td>
<td>0.177</td>
<td>0.020</td>
<td></td>
<td>2.570**</td>
<td></td>
</tr>
<tr>
<td>Difference</td>
<td>80</td>
<td>-0.052</td>
<td>0.183</td>
<td>0.020</td>
<td></td>
<td></td>
<td>0.012</td>
</tr>
</tbody>
</table>

**Indicates significance at the 5% level**

Table 6 below show the results of the T-test for cost of capital. The average cost of capital before 2014 was about 1.5%, whereas the same figure after 2014 was 0.82%, a difference of 0.636 percentage points. This gives a T-value of 11.85, corresponding to a p-value of 0.000 and significance at the 1% level. This shows that there has been a statistically significant decrease in banks cost of capital in the years after the 2014 regulation, which like the case for lending growth is opposite of the theoretical foundation.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std.Dev</th>
<th>SE Mean</th>
<th>95% CI</th>
<th>T-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before CoC</td>
<td>80</td>
<td>0.015</td>
<td>0.006</td>
<td>0.001</td>
<td>0.005; 0.007</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After CoC</td>
<td>80</td>
<td>0.008</td>
<td>0.006</td>
<td>0.001</td>
<td>11.850***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference</td>
<td>80</td>
<td>0.006</td>
<td>0.005</td>
<td>0.001</td>
<td></td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>

***Indicates significance at the 1% level

Table 7 below show the results of the T-test for Z-score, the estimate for bank default probability. The table shows that the mean Z-score before the 2014 regulation was 53.38, whereas the same figure after 2014 was 79.43, a difference of 26.06. This means that banks can withstand an additional 26 standard deviation fall in ROA in the period after 2014, compared to before. This gives a T-value of 11.85, corresponding to a p-value of 0.000 and significance at the 1% level. Given the results, there are statistically significant evidence that banks have less risk of default in the period after 2014, compared to the period before, which is in line with the theoretical foundation.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std.Dev</th>
<th>SE Mean</th>
<th>95% CI</th>
<th>T-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before Z-Score</td>
<td>80</td>
<td>53.4</td>
<td>42.9</td>
<td>4.8</td>
<td>-40.2; -11.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After Z-Score</td>
<td>80</td>
<td>79.4</td>
<td>57.7</td>
<td>6.5</td>
<td>-3.66***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference</td>
<td>80</td>
<td>-26.1</td>
<td>63.7</td>
<td>7.1</td>
<td></td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>

***Indicates significance at the 1% level
Table 8 below show the results of the T-tests for capital ratio. As the table shows, the average capital ratio before the 2014 regulation was roughly 16.7%, whereas it in the period after is 21%, indicating a difference of 4.4 percentage points. This gives a T-value of -5.64, corresponding to a p-value of 0.000 and significance on the 1% level. There is thus statistically significant evidence that banks have increased their capital ratio in the period after the 2014 regulation, compared to the period before it, which is in accordance with the existing theoretical foundation.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>St.Dev</th>
<th>SE Mean</th>
<th>95 % CI</th>
<th>T-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before CptlRatio</td>
<td>80</td>
<td>0.167</td>
<td>0.081</td>
<td>0.009</td>
<td>-0.029; 0.009</td>
<td>-5.64***</td>
<td>0.000</td>
</tr>
<tr>
<td>After CptlRatio</td>
<td>80</td>
<td>0.211</td>
<td>0.098</td>
<td>0.011</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference</td>
<td>80</td>
<td>-0.044</td>
<td>0.070</td>
<td>0.008</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

***Indicates significance at the 1 % level

In summary, all the conducted tests show statistical significance, meaning that there have been significant changes in bank behavior since the inception of the regulation. However, two of the four tests show results that are contrary to the established theoretical foundation. As stated however, the T-tests does not show what factors drive the results. To be able to later analyze these results, further testing needs to be done. These tests will take the form of regression analysis, which will be able to show how different factors affect the dependent variables. Following the results of the regression analysis, a more extensive discussion will be able to be conducted later in the study.

6.3 Results of regressions

6.3.1 Regression model one

As stated in the practical methodology, the first regression model, based on the theoretical framework initially looked like:

\[
\text{LnGrowth}_i = \beta_0 + \beta_1 BCycle + \beta_2 \text{IntRate} + \beta_3 \text{Soundness} + \beta_4 \text{CptlRatio} + \beta_5 \text{DSIB} + \beta_6 \text{CoC} + \epsilon_i
\]

The result of the regression is presented in Table 9 below. Two out of the six variables show significance, one at the 1% level and one at 10%. The cost of capital is significant at 1% and the relationship is negative. This is in line with what would be expected following the theoretical framework. The capital ratio is significant at the 10% level with a negative relationship, in line with expectations. Both the constant and the overall model are significant at the 1% level, which shows that the model achieves what it is supposed to. The R-squared, that is the degree to which the model can explain the variability in the dependent variable, is 15.06%. However, the adjusted R-squared is a more suitable measure for models that include more than one variable, this figure is 11.73%.
There are however several variables that did not have any explanatory power. In order to increase the accuracy of the model, the soundness and Domestic Systemically Important Banks (DSIB) variables were excluded from the regression due to low significance. The result of the adjusted model is presented in Table 10 below. Following this adjustment, the explanatory power of the model improved from 11.73 % to 12.22 %. The cost of capital is still significant at 1 %, with a coefficient of -10.19. This means that a one unit increase of the cost of capital would decrease the lending growth by 10.19 units, ceteris paribus. The capital ratio is significant at the 10 % level with a coefficient of -0.236, meaning a one unit increase in the capital ratio would decrease lending growth by 0.236 units, ceteris paribus. The constant, or the intercept, is 0.195, which indicates that when the coefficients of the other variables in the model is equal to zero, lending growth is 0.195.

While neither the business cycle nor the interest rate are significant in the model, the p-values are not large enough to warrant their exclusion from the model. Additionally, removing them from the model would cause the adjusted R-square to drop, thus reducing the explanatory power of the overall model.

<table>
<thead>
<tr>
<th>Business Cycle</th>
<th>-0.831</th>
<th>0.047</th>
<th>0.273</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest Rates</td>
<td>2.71</td>
<td>2.08</td>
<td>0.194</td>
</tr>
<tr>
<td>Soundness</td>
<td>-0.075</td>
<td>0.248</td>
<td>0.763</td>
</tr>
<tr>
<td>Capital Ratio</td>
<td>-0.231</td>
<td>0.132</td>
<td>0.083*</td>
</tr>
<tr>
<td>DSIB=1</td>
<td>0.020</td>
<td>0.026</td>
<td>0.454</td>
</tr>
<tr>
<td>Cost of Capital</td>
<td>-10.21</td>
<td>2.15</td>
<td>0.000***</td>
</tr>
<tr>
<td>Constant</td>
<td>0.193</td>
<td>0.047</td>
<td>0.000***</td>
</tr>
<tr>
<td>Observations</td>
<td>150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regression F-Value</td>
<td>4.52</td>
<td>0.000***</td>
<td></td>
</tr>
<tr>
<td>R-Squared</td>
<td>15.06%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adj. R-Squared</td>
<td>11.73%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*** Indicates significance at the 1 % level
* Indicates significance at the 10 % level
After the changes in the regression model, the final model resulted in the following regression equation:

\[ \text{Lending Growth}_i = 0.195 - 0.851 \text{Business Cycle} + 2.76 \text{Interest Rates} - 0.236 \text{Capital Ratio} - 10.19 \text{Cost of Capital} \]

### 6.3.2 Regression model two

As stated in the practical methodology, the second regression model, based on the theoretical framework, initially looked like:

\[
\text{CoC}_i = \beta_0 + \beta_1 \text{Size} + \beta_2 \text{Soundness} + \beta_3 \text{CpctlRatio} + \beta_4 \text{IntRate} + \beta_5 \text{BCycle} + \beta_6 \text{DSIB} + \epsilon_i
\]

The result of the initial regression is presented in Table 11 below. As can be seen, two out of the original six variables show statistical significance at the 1% level. The capital ratio is significant and show a negative relationship with the cost of capital, which is in line with the BCBS argument of reduced bank risk leading to lower expected returns and lower cost of capital, but contrary to other academic work such as IIF (2010), Aiyar et al. (2012), Aiyar et al. (2015), Bridges et al. (2014) and De Nicolò (2015). The short-term interest rates are also significant at the 1% level and show a positive relationship. The constant as well as the overall model are both significant at the 1% level, and the adjusted R-squared is 33.34%, meaning that the model can explain roughly one third of the variability in the dependent variable.
However, this model also contains variables with low explanatory power. Additionally, the variables size and Domestic Systemically Important Banks (DSIB) were found to have high correlation, with a VIF-value of above 200, and should thus not be used simultaneously in a model. Removing either one of them caused the significance of the other to decrease heavily, resulting in both being removed from the model. Additionally, to check for interactions between the dependent variables, lending growth was introduced to the model and increased both the R-squared and was significant. The final regression model is shown in Table 12 below.

### Table 11. Result of regression model 2.1

<table>
<thead>
<tr>
<th>Model: 2.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of variables: 6</td>
</tr>
<tr>
<td>Dependent variable: Cost of Capital</td>
</tr>
<tr>
<td>Coefficient</td>
</tr>
<tr>
<td>Size</td>
</tr>
<tr>
<td>Soundness</td>
</tr>
<tr>
<td>Capital Ratio</td>
</tr>
<tr>
<td>Interest Rates</td>
</tr>
<tr>
<td>Business Cycle</td>
</tr>
<tr>
<td>DSIB=1</td>
</tr>
<tr>
<td>Constant</td>
</tr>
<tr>
<td>Observations</td>
</tr>
<tr>
<td>Regression F-Value</td>
</tr>
<tr>
<td>R-Squared</td>
</tr>
<tr>
<td>Adj. R-Squared</td>
</tr>
</tbody>
</table>

*** Indicates significance at the 1% level

### Table 12. Result of regression model 2.2

<table>
<thead>
<tr>
<th>Model: 2.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of variables: 3</td>
</tr>
<tr>
<td>Dependent variable: Cost of Capital</td>
</tr>
<tr>
<td>Coefficient</td>
</tr>
<tr>
<td>Interest Rates</td>
</tr>
<tr>
<td>Capital Ratio</td>
</tr>
<tr>
<td>Lending Growth</td>
</tr>
<tr>
<td>Constant</td>
</tr>
<tr>
<td>Observations</td>
</tr>
<tr>
<td>Regression F-Value</td>
</tr>
<tr>
<td>R-Squared</td>
</tr>
<tr>
<td>Adj. R-Squared</td>
</tr>
</tbody>
</table>

*** Indicates significance at the 1% level

All variables remaining in the model are significant at the 1% level, as well as the constant and the overall model. The coefficient of the interest rate is 0.456, indicating that a one unit increase in the short term interest rate would increase cost of capital by 0.456 ceteris paribus, which is according to expectations. The coefficient of the capital ratio is -0.018, meaning that a one unit increase in the capital ratio would decrease the cost of
capital by 0.018 ceteris paribus, which is contrary to most academic work on the subject. Lending growth had a coefficient of -0.012 indicating that a one unit increase in lending growth would decrease cost of capital by 0.012 units. The constant has a value of 0.013, indicating that when the other variables are equal to zero, cost of capital is 0.013. The explanatory power of the final model is 42.35%.

Following the adjustments to the original model, the final model on cost of capital resulted in the following regression equation.

\[
\text{Cost of Capital}_i = 0.013 - 0.018\text{Capital Ratio} + 0.456\text{Interest Rates} - 0.012\text{Lending Growth}
\]

### 6.3.3 Regression model three

As stated in the practical methodology, the third regression model, based on the theoretical framework, initially looked like:

\[
Z_{score} = \beta_0 + \beta_1 \text{Size} + \beta_2 \text{CptlRatio} + \beta_3 \text{Bcycle} + \beta_4 \text{Soundness} + \beta_5 \text{DSIB} + \epsilon_i
\]

The result of the initial regression is presented in Table 13 below. As can be seen, two out of the five variables are significant, and both at the 10 % level. Size is significant and has a positive relationship with Z-score, as would be expected according to theory. It is however likely that some of the effect that should be captured by the size measured is instead captured by the Domestic Systemically Important Banks (DSIB) variable, given that they explain the same thing. The soundness measure is also significant and has a positive relationship. The overall model is significant at the 1 % level, but the constant remains insignificant. The adjusted R-squared of the model is 15.93%.

<table>
<thead>
<tr>
<th>Table 13. Result of regression model 3.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model: 3.1</td>
</tr>
<tr>
<td>Number of variables: 5</td>
</tr>
<tr>
<td>Dependent variable: Z-Score</td>
</tr>
<tr>
<td>Coefficient</td>
</tr>
<tr>
<td>Size</td>
</tr>
<tr>
<td>Capital Ratio</td>
</tr>
<tr>
<td>Business Cycle</td>
</tr>
<tr>
<td>Soundness</td>
</tr>
<tr>
<td>DSIB=1</td>
</tr>
<tr>
<td>Constant</td>
</tr>
<tr>
<td>Observations</td>
</tr>
<tr>
<td>Regression F-Value</td>
</tr>
<tr>
<td>R-Squared</td>
</tr>
<tr>
<td>Adj. R-Squared</td>
</tr>
</tbody>
</table>

*** Indicates significance at the 1 % level
* Indicates significance at the 10 % level

Removing the variables business cycle and Domestic Systemically Important Banks (DSIB) caused the size measure to increase its significance, but had detrimental effects on the significance of the capital ratio, which decreased heavily. As the capital ratio is the
most important variable in the study, it should not be excluded. However, to test the findings of Bitar et al. (2018), the risk-based capital ratio variable was replaced with one that fills the same purpose, namely the Capital to Assets Ratio (CAR). This ratio does not use risk-weighted assets but instead uses total assets in the ratio calculations. Additionally, cost of capital was introduced to the model to check for interactions. The Capital to Assets Ratio (CAR) and the soundness variable suffered from heavy correlation with VIF values above 100, as well as making soundness insignificant, which resulted in the removal of soundness from the model. The final regression model is shown in Table 14 below.

<table>
<thead>
<tr>
<th>Model: 3.2</th>
<th>Number of variables: 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent variable: Z-Score</td>
<td></td>
</tr>
<tr>
<td>Coefficient</td>
<td>SE</td>
</tr>
<tr>
<td>Size</td>
<td>10.0</td>
</tr>
<tr>
<td>Cost of Capital</td>
<td>-1748.0</td>
</tr>
<tr>
<td>Capital to Assets Ratio</td>
<td>265.0</td>
</tr>
<tr>
<td>Constant</td>
<td>-46.9</td>
</tr>
<tr>
<td>Observations</td>
<td>160</td>
</tr>
<tr>
<td>Regression F-Value</td>
<td>14.33</td>
</tr>
<tr>
<td>R-Squared</td>
<td>21.61%</td>
</tr>
<tr>
<td>Adj. R-squared</td>
<td>20.10%</td>
</tr>
</tbody>
</table>

*** Indicates significance at the 1% level

As the table shows, the significance of size increased drastically with the exclusion of the Domestic Systemically Important Banks (DSIB) variable, where it is now significant at the 1% level with a coefficient of 10. This means that a one unit increase in size increases the Z-score by 10 units, ceteris paribus. The new variable cost of capital is significant at the 1% level, with a coefficient of 1748. The interpretation being that a one unit increase in cost of capital decreases Z-score by 1748 units ceteris paribus. The Capital to Assets Ratio is also significant and positive at the 1% level, with a coefficient of 265, meaning that a one unit increase of the capital to assets ratio improves Z-score by 265. The overall model is still significant at the 1% level, whereas the constant remains insignificant. The explanatory power increased after the changes to 20.10%, meaning that the model can explain just above one fifth of the variability in the dependent variable.

Following the adjustments to the original model, the final model on Z-score resulted in the following regression equation:

\[
Z_{score} = -46.9 + 10\text{Size} - 1748\text{Cost of Capital} + 265\text{Capital to Assets Ratio}
\]

6.4 Summary of testing and relation to hypothesis

6.4.1 Hypothesis one

The null hypothesis of hypothesis one read “Regulatory measures, as indicated by increased capital requirements, has no effect on banks’ lending growth.”
The T-test for hypothesis one showed that there are statistically significant differences in banks lending growth between ‘before’ and ‘after’ the 2014 regulation, proving that for unspecified reasons lending growth have increased in the period after the regulation. The regression models paint a clearer picture. The analysis showed that capital ratio had a significant and negative impact on lending growth, while checking for both micro and macro factors.

Given the results of the performed tests and a 90 % significance level, the null hypothesis can be rejected. The significance level is above the most common measure in business research, where 95 % is the common standard. Increasing the significance level to 90 % means that there is a one in ten chance that a Type 1 error has been committed. However, this increase is assumed to be mostly offset given the sound theoretical basis of the relationship between capital ratios and lending growth. Overall, the results provided from the tests allows for a reliable answer to the research question posed regarding banks lending growth.

6.4.2 Hypothesis two

The null hypothesis of hypothesis two read “Regulatory measures, as indicated by increased capital requirements, has no effect on banks’ cost of capital”.

The T-test for hypothesis showed that there are statistically significant differences in banks cost of capital between the periods before and after the introduction of regulation in 2014. The T-test shows that for unspecified reasons, cost of capital has decreased in the period after 2014, compared to the period before. The regression analysis showed that a banks’ capital ratio has a significant impact on their cost of capital, however contrary to much of the theoretical foundation, the relationship is negative. Increasing capital ratios thus seems to lead to a lower cost of capital for banks.

Given the results of the tests performed, the null hypothesis can be rejected at a significance level of 99 %. The overall conclusion is that the tests performed gives a reliable answer to the research question posed.

6.4.3 Hypothesis three

The null hypothesis of hypothesis three reads “Regulatory measures, as indicated by increased capital requirements, has no effect on banks’ default risk”.

The T-test for hypothesis three showed that there are statistically significant differences in banks default risk between the period before- and after 2014, where default risk has decreased in the period after the introduction of the 2014 regulation. The conducted regression analysis show that a risk-weighted measure of banks capital ratio does not have a direct significant impact on banks default risk, and was not included in the final regression model. However, a standard measure of total capital to total assets (CAR) showed a significant and positive relationship.

Given the performed test there is sufficient evidence to reject the null hypothesis. While the risk-weighted measure of capital ratio failed to show significance, a version using total assets rather than risk-weighted assets was significant in the model. The regression could thus prove that increases in capital ratio was a significant driver of these results. In
addition, bank size and their cost of capital were significant in determining bank default risk. The conducted tests allow for a reliable answer to the research question posed.

6.5 Complementary tests

To be able to perform a thorough analysis, additional T-tests were performed to determine how the regulation has changed certain aspects of banks’ balance sheets. One interesting aspect is whether banks have increased their amount of equity in the period after the regulation, as it speaks to how banks have acted to comply with the new regulation. As shown in Table 15 below, there is a significant increase in the amount of equity held by banks in the 2014-2017 period, compared to the 2010-2013 period with a mean difference of 10539 million SEK.

<table>
<thead>
<tr>
<th>Table 15. Paired T-test - Equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>Before Equity</td>
</tr>
<tr>
<td>After Equity</td>
</tr>
<tr>
<td>Difference</td>
</tr>
</tbody>
</table>

*** Indicates significance at the 1% level

It is however possible that the increases in equity is also followed by an increase in risk-weighted assets, which would not indicate that banks are safer, but merely have grown larger. To test for this, a paired T-test on total RWA was conducted and is presented in Table 16 below. As the table shows, there is no significant increase in the amount of risk-weighted assets reported by banks after the regulatory tightening. A small increase of 3600 million SEK is noted in the 2014-2017 period, which is not enough for statistical significance. We can thus say that while bank equity has increased following the regulation, reported risk-weighted assets have stayed the same.

<table>
<thead>
<tr>
<th>Table 16. Paired T-test - RWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>Before RWA</td>
</tr>
<tr>
<td>After RWA</td>
</tr>
<tr>
<td>Difference</td>
</tr>
</tbody>
</table>

A summary of all the conducted tests, their results and their eventual connection to the formulated hypothesis is provided in Table 17 below.
<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Description (H0)</th>
<th>H0 rejected or not</th>
<th>Performed tests</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypothesis 1</td>
<td>Regulatory measures, as indicated by increased capital requirements, has no effect on banks' lending growth.</td>
<td>H0 rejected</td>
<td>Paired T-test, Regression analysis</td>
<td>Significant difference between 'before' and 'after' at the 5% level. Capital Ratio significant at the 10% level with a negative sign.</td>
</tr>
<tr>
<td>Hypothesis 2</td>
<td>Regulatory measures, as indicated by increased capital requirements, has no effect on banks' cost of capital</td>
<td>H0 rejected</td>
<td>Paired T-test, Regression analysis</td>
<td>Significant difference between 'before' and 'after' at the 1% level. Capital Ratio significant at the 1% level with a negative sign.</td>
</tr>
<tr>
<td>Hypothesis 3</td>
<td>Regulatory measures, as indicated by increased capital requirements, has no effect on banks' default risk</td>
<td>H0 rejected</td>
<td>Paired T-test, Regression analysis</td>
<td>Significant difference between 'before' and 'after' at the 1% level. Risk-based Capital Ratio not significant in the regression model, natural Capital to Assets Ratio significant at the 1% level with a positive sign.</td>
</tr>
<tr>
<td>Complementary tests</td>
<td>Changes in banks held equity since regulatory changes</td>
<td>N/A</td>
<td>Paired T-test</td>
<td>Significant difference between 'before' and 'after' at the 1% level.</td>
</tr>
<tr>
<td></td>
<td>Changes in banks reported Risk-Weighted Assets since regulatory changes</td>
<td>N/A</td>
<td>Paired T-test</td>
<td>No significant difference between 'before' and 'after'</td>
</tr>
</tbody>
</table>
7. Analysis

The purpose of this chapter is to relate the main empirical findings and connect them to presented theoretical framework. Additionally, the analysis will try to discern the main causes behind the results presented in the earlier chapter. The chapter is concluded with an analysis of possible shortcomings of the presented results.

The aim of the analysis section is to analyze the potential underlying reasons for achieving the results presented in the study as well as to try and connect the results to the provided theoretical framework. The analysis performed will use both own knowledge of the field of study, as well as the theoretical framework provided earlier. The analysis will start by trying to determine what causes the result of each individual variable as well as their connection to the theoretical framework, and later discuss the potential linkages between each result and the likely final overall effects.

7.1 Hypothesis one

The purpose of the first hypothesis was to determine if and how increased capital ratios affects lending growth. The first T-test showed a significant difference in means between the period 2010-2013 and 2014-2017, where lending growth has increased in the later period. This is contrary to most prevalent theory on the subject, claiming that increases in regulatory capital would cause reductions in lending growth, which would damage the economy (Aiyar et al., 2012; IIF, 2010; BCBS, 2010). The paired T-test on capital ratio shows that the capital ratio has significantly increased in the post regulation period, which according to theory should, ceteris paribus, decrease lending growth.

Granted, there are a lot of other factors at work in increasing lending growth. The performed regression analysis attempts to find what factors are significant in its determination, and to what extent. The first regression model found two significant variables in the capital ratio and the cost of capital. The regression also checked for changes in business cycle, interest rate environment, leverage and bank size, neither of which were significant in determining bank lending growth.

In order to improve the original model, several insignificant variables were removed. It was also clear that some variables not present in the model were driving increases in lending growth, as both significant variables had negative relationships. One idea was that increasing real estate prices were forcing households to increase their lending, thus driving increases in the lending growth. Theoretically this would make sense as a significant portion of bank lending, especially in Sweden and Denmark are due to real estate investments. Given an equal number of individuals buying homes each year, increases in house prices would force the individuals to take on larger amount of loans, which would increase lending growth. To test this theory, data on real estate prices was gathered for the three countries for the given years. The new regression model did however not show a significant impact of real estate prices on lending growth.

Another possible reason explaining the increase in lending growth in the 2014-2017 period is that the effects of the crisis had a more significant effect on the period closer to
the financial crisis. This would cause the lending growth of the years close to the crisis to be low, whereas lending growth would increase as the economies started to recover. However, this effect is intended to be picked up by the business cycle variable. Major macroeconomic shocks naturally cause GDP growth to fall, whereas when the economy starts recovering, so too would the growth in GDP. Given that the business cycle variable is not significant in the model, it indicates that these effect does not have an impact on the lending growth of the economies in question.

As shown in the results section, the final model contains business cycle, interest rate, capital ratio and cost of capital. Out of these variables, capital ratio and cost of capital were significant. Looking at the coefficients of the significant variables, we can see that both are negative, meaning that as cost of capital and capital ratio increases, lending growth decreases. This lends support to the mechanism initially argued by the IIF (2010) and further by Aiyar et al. (2012); Bridges et al. (2014) and De Nicolò (2015) where economies are damaged by increased regulation as it would increase banks cost of capital leading to reduced lending growth.

However, it is not only the cost of capital channel that has academic support on the reduction on lending growth. A more recent work by Aiyar et al., (2015) argues that a reduction in bank lending can come from the fact that as banks are forced to increase their capital ratios, they can choose to achieve this by either increasing the amount of equity, or reduce the amount of lending. If a bank were to increase the amount of equity, the argument is that as equity is more expensive than debt, the overall cost of capital would increase, which would be the driving factor in reducing lending growth. However, if a bank chooses to improve their capital ratios by directly reducing their lending, the cost of capital is no longer the driving factor in reducing lending. Instead, there is a direct linkage between increasing capital ratios and reduced lending growth.

To fully understand this mechanism, it is important to have some insight in how bank lending and capital ratios work. As have been described in the chapter on the Basel Accord, the regulation of capital ratios is focused on increasing the amount of equity over risk-weighted assets. A reduction in the amount of risk-weighted assets while equity stays the same results in an increase in the capital ratio. The connection to lending comes from the fact that when banks give out a loan, they gain an asset on their balance sheet in the form of a loan that will need to be repaid by the customer but also a liability in the form of a deposit in the amount of the loan that the customer can use on demand. From this mechanism, a straight reduction in lending would decrease both the amount of assets and debt on the balance sheet of the bank, and consequently improve their capital ratio.

It could be argued that this theory also finds support in the study, as the capital ratio has a significant and negative relationship with lending growth. It is however important to note that the regression cannot say anything about the causality in the presented relationships. While theory argues that the causality runs from increased capital ratios to decreased lending, it is possible that it in reality works the other way around. Furthermore, the T-tests showed that both lending growth and capital ratios have significantly increased in the period 2014-2017, a situation that would be unlikely if the lending reduction channel was the main driver of increasing capital ratios.

It should here be noted that the true cost of regulation is given by comparing the lending growth in a situation with no capital requirements to a situation where capital requirements are introduced. The regression model constant, that is the value of lending growth when other variables in the model are equal to zero, is roughly 19.5 %.
does however disregard several macro- and microeconomic factors that continuously affect lending growth, in addition to capital ratios. The coefficient of the capital ratio indicates that ceteris paribus, a one unit increase in the capital ratio would decrease lending growth by 0.236 units. This figure is lower than what is found in current academic research, as well as the report done by the Basel Committee, who found the effect to be in the range of 0.7 – 3.6% (BCBS, 2010). This would indicate that the macroeconomic costs of increased regulation are smaller in the sample compared to most other regions. One possible explanation for this is that banks in the sample do not increase lending spreads as much as they do in other regions of study, or perhaps more likely that increased lending spreads has a less deterring effect on consumers in the sample region. Given the current low interest-rate environment, an increase in the cost of lending might not be detrimental to consumer choice, as the overall costs are still very low. Furthermore, the second regression showed that capital ratios have not increased bank cost of capital. In such a situation, there would be no need for banks to increase their lending spreads, as they are not facing increased costs of financing.

Some of the factors in previous academic work can also be noted to not have an impact on the sample studied. Elkedag & Wu (2011) found in their study that business cycle effects, interest rates and balance sheet soundness were significant determinants of lending growth. Neither of these effects find support in this study as all three factors were shown to be insignificant in the regression model. This would indicate that compared to other banking regions, the sample, and potentially the Nordic banking industry, is relatively robust against certain macroeconomic factors such as business cycle effects and interest rate environment, as well as microeconomic factors such as leverage ratios. One caveat is that due to the selection process of the sample, one should be careful about extensive generalizations. Given that the sample was not completely random, generalization is only possible over the sample, rather than over the whole region. The sample does however include almost all large banks in both Sweden and Denmark, and should therefore be somewhat representative over their respective industries.

The overall assessment of the performed tests is that they are successful. Both the T-test as well as the regression model are significant, which is a positive sign. The explanatory power of the regression model is, given the number of independent variables, reasonable, even though a higher number would have been preferable. The results are good enough to be able to convincingly answer the research question and we can say that increased capital ratios have a significant and negative impact on lending growth. While the mechanism with which this happens cannot be proven with absolute certainty, it seems likely that as banks are forced to hold more equity, they also increase lending spreads to cover the additional costs, which results in a lower amount of lending being done on a macroeconomic level.

An interesting thing to note however is that capital ratios in the sample reduce banks cost of capital, which puts this mechanism somewhat into doubt. It is possible that banks assume that the regulation will force increases in their cost of capital, and thus increase their lending spreads even though the cost of capital effect is in fact the opposite. Due to lack of data on lending spreads in the countries, this relation cannot be checked for, but remains an interesting avenue of study. While the regression does leave us with some answers regarding the relation between lending growth, capital ratios and capital requirements, it also leaves us with some questions. For instance, given that both capital ratio and cost of capital effects drives down lending growth, what is the major factor that
has caused lending growth to increase in the period 2014-2017 compared to the period 2010-2013?

7.2 Hypothesis two

The purpose of the second hypothesis was to determine if and how increased capital ratios affect banks cost of capital. The T-test showed a significant difference between 2010-2013 and 2014-2017, where cost of capital has decreased in the latter period. Given the theoretical foundation, particularly the work done by the IIF (2010), Aiyar et al. (2012) and Briges (2014), this seems counterintuitive. As the capital ratios have increased in the 2014-2017 period, theory would expect the cost of capital to increase as well. The deviation from theory is further exacerbated with the results of the initial regression analysis, showing that capital ratios had a significant and negative relationship with cost of capital. The other significant variable, interest rates, did however have the expected positive sign.

Given the results of the tests, one could argue that the M&M theorem does not apply to the sample. Were the M&M theorem to hold over the sample, there should not be any significant effect of capital ratio on cost of capital. It should however be noted that the variable soundness was insignificant in the model. This is interesting as the soundness measure is the amount of equity over debt, and could as such also serve as a measure of capital structure, as capital structure usually refers to the amount of equity and debt financing used by a firm. Overall, the soundness measure is likely a more accurate estimator of a firms’ capital structure than capital ratio, as the capital ratio describes the amount of equity to risk-weighted assets, rather than the amount of financing required. The insignificance of the soundness variable indicates that the capital structure of the banks does not significantly impact their cost of capital, as argued by Modigliani & Miller (1958).

Drawing any conclusions from the soundness measure is however hard given the large amount of uncertainty that surrounds it. The first regression resulted in a coefficient of 0.0013 and a standard deviation of 0.0116. This means that a one standard deviation change in the soundness coefficient would increase or decrease the coefficient by roughly 890%. This would more than likely affect the significance of the variable and shows its high amount of uncertainty, making it hard to draw reliable conclusions.

To improve the model, all insignificant variables was eventually removed from the regression in addition to introducing lending growth to the model. Removing the ones who had the least significance caused the significance of the other insignificant variables to decrease substantially, resulting in their removal as well. The final regression thus only included interest rates, capital ratio and lending growth as independent variables.

The regression shows that an increase in the banks’ capital ratio by one unit decreases their cost of capital by 0.018 units, ceteris paribus. Since this result is somewhat unexpected, an analysis was conducted to try and understand the reason behind it. One potential reason is that the cost of capital variable is influenced by the model of which it is calculated. As the estimation of the banks cost of equity was done using three different methodologies, it is possible that some models are particularly suitable for capturing certain kinds of results, which would bias the model. To ensure that this was not the case, the regression models were run with each one of the cost of capital measures, and they all found a significant and negative relationship between capital ratio and cost of capital.
While the different cost of capital variables resulted in differently sized coefficients, the overall relationship between capital ratio and cost of capital seems solid. The fact that all different cost of capital measures show similar results should furthermore appease worries that erroneous cost of equity calculations would impact the outcome of the study.

As the results oppose most of the theory, it is important to find a reasonable explanation as to why the expected outcome is not present in this study. Generally, the impact of capital ratios on cost of capital is likely driven by two forces. The first is the one argued by the IIF (2010), Aiyar et al. (2012), Bridges (2014), and De Nicolò (2015), where increased capital requirements forces banks to acquire more equity, which is costlier than debt. This would increase the overall cost of capital, as cheaper finance has been replaced by more expensive finance.

However, there is a counteracting force that should be taken into account. The purpose of increased capital ratios is to make banks safer. By increasing the losses banks can withstand without defaulting, higher regulatory capital does indeed make banks safer. An age-old financial relationship is the one regarding risk and reward, where lower risk generates lower rewards and vice versa. Following this, an investor investing in a safe asset would expect the potential payoff to be low, whereas an investor who invests in a high-risk asset would expect the potential payoff to be high. By making banks significantly safer investments, it is reasonable for the expected rate of return on investing in them to fall as well. The expected rate of return of investors is also known as the equity cost of capital for the firm. Thus, by virtue of reducing bank risk, increased capital ratios should also reduce bank cost of capital. This argument was presented by the BCBS (2010) in their report on the effect on regulation, claiming that studies that disregard this potential fact might be overly negative, a stance which is supported by this study. Furthermore, the same conclusion was drawn by Kayshap, et al., (2010) who found that increasing equity ratios resulted in reductions in the required rate of return of investors, and thus a lower cost of capital.

The likely scenario is that these two forces work in tandem with each other, where the larger effect will dictate the direction of the relationship. This would further explain why most academic work has found the relationship to go in the opposite direction. Which mechanism dominates the other would then depend on for instance the market conditions or investment cultures of each country or region. Given that most research has been done on either the U.S, UK or the Euro Area, it is not unreasonable to expect a different result in the Nordic region, as the cultures by all likelihood are significantly different.

The prevalence of this mechanism would further help to explain the high explanatory power of the regression model, even though the number of independent variables was low. The reported cost of capital variable used the CAPM model in calculating the cost of equity. As have been described in the methodology, the CAPM model uses firm beta as a variable in the cost of equity calculation. Given that increased capital requirements make banks safer, their beta should decrease. There is thus a direct link between the capital ratio and the cost of capital calculations, which could work to increase the R-squared of the regression model. One worry would then again be that the calculation model of the cost of equity significantly impacted the results of the study. This does however not seem to be the case, as the negative relationship remains while using the other cost of capital estimators. In fact, the coefficient of capital ratios impact on cost of capital was lowest when using the CAPM model as basis for the cost of equity calculations, compared to the DCM and average models.
Overall, the effect of reducing bank risk leading to lower cost of capital has been disregarded in most of the current academic literature (IIF 2010; Aiyar et al. 2012; Aiyar et al. 2015; Bridges 2014; De Nicolò 2015), as well as the public debate. The unwillingness of academia to entertain this mechanism is somewhat puzzling. Even the BCBS (2010) in their report only mentioned it in passing, while still using the increased cost of financing as the sole mechanism in their calculations. The theoretical foundation for the risk-reduction mechanism is very sound and there should be little doubt that it exists in reality. Even so, finding empirical evidence that it exists and that it even is larger than the increase in the cost of finance in the sample is significant as it has the potential to influence future academic work on the subject. The results of this study could drive us to the point where there is little reason for researchers not to include this mechanism in their argumentation.

The overall assessment of the tests is that they are successful. Both the T-test and the regression model are significant and the explanatory power of the regression is high. Following the performed tests, we can say that increased capital ratios have a significant and negative relationship with banks cost of capital. Even though the relationship between cost of capital and capital ratio found is contrary to most popular theory, the reasons provided for the results are reasonable and based on established financial theory where the effects of lower bank risk and investor expectations outweigh the increased cost of equity relative to debt. The results are sufficient to be able to convincingly answer the research question. It would however be interesting to conduct a similar study using even more different methods of calculating bank cost of equity to see how they might impact the final results.

### 7.3 Hypothesis three

The purpose of the third hypothesis was to determine if and how increased capital ratios affect banks default risk. The T-test showed a significant difference between the 2010-2013 and the 2014-2017 period, where Z-score has increased in the latter. This shows that banks have indeed become safer since the introduction of the 2014 Basel framework. Since the Z-score measures distance to default based on their ability to withstand a fall in their return on assets, what has caused the increase in Z-score is not clear from the T-tests.

The first regression model had interesting results, where only size and soundness were significant, and only at the 10 % level. Most notably however was that banks capital ratios, as calculated by total equity over risk-weighted assets, did not significantly affect Z-score. However, in accordance with earlier work by Bitar et al. (2018), using a standard capital to assets ratio instead of the one using risk-weighted assets showed a significant and positive relationship between capital ratios and Z-score.

This is particularly interesting as much of the regulatory focus to improve bank stability has been devoted to the implementation of capital ratios based on a risk-weighted assets model. If they are in fact not a driving factor in decreasing default risk, the effectiveness of the regulation can be put into question. The final regression model included the standard capital to assets ratio and bank cost of capital, who in addition to size were significant in the model. This result supports the recent study by Bitar et al. (2018) and Altunbas et al. (2007) who find that risk-weighted capital ratios are inefficient in reducing bank risk whereas a standard capital to asset ratios have a significant impact. A positive
impact of capital ratios on reducing default risk was also found by Rizwan et al. (2018), a result which this study supports. It should however be noted that using risk-weighted assets in the regressions determining lending growth and cost of capital produces significantly better results than using a standard capital to assets ratio.

The regression shows that an increase the capital to assets ratio by one unit increases the Z-score by 265 units. That means that following a capital injection equal to a one unit increase in the capital to assets ratio, a bank is able to withstand an additional 265 standard deviation fall in the return on assets, which is a substantial amount. It should be noted here that the capital to assets ratio is widely different than the risk-weighted capital ratio and needs a much larger capital injection to end up with a one unit increase. Additionally, the average return on assets for the sample is quite low. This together with the high amount of capital held by banks results in large Z-scores for the sample.

The fact that risk-weighted capital ratios are insignificant in determining default risk does have potential practical consequences. It should be noted that the results do not mean that risk-weighted capital ratios are useless. Their implementation will likely still improve the soundness of the banking industry. This will however be done through a secondary effect of increasing the total equity to total assets ratio rather than through a direct effect of the risk-based ratio. This is problematic as it makes it complicated to assess the potential positive effect of the regulation. To find how the risk-based capital ratios affect bank risk, one has to determine what effect the regulation has on the actual capital to assets ratio, and from there draw conclusions.

This result should also be discussed in the context of the criticism that has been directed at the Basel framework. Many of the perceived issues with the Basel framework stem from its unnecessary complexity. This will be further exacerbated by the fact that one of their main tools for improving bank safety does not impact it directly. Pakravan (2014) argued that the Basel risk-weight calculations were backward-looking, and thus not suitable to avoid future crisis, as well as claiming that the Basel regulation overall was too complex. The results of this study confirm these findings.

It is then interesting to ask why the Basel Committee has decided to use a risk-based measure of capital ratio as one of their main tools in bank regulation. As has been discussed earlier, the risk-weighted assets method is an artifact of the first Basel Accord. The original idea was that as not all assets carry equal amount of risk, they should not require the banks to hold an equal amount of capital (Balthazar, 2006, p. 18). This should further incentivize banks to hold more secure assets, in relation to risky ones, as their overall capital requirements would be lower, making banks safer. Furthermore, given that the capital ratios could be kept relatively low, the effect on the overall economy would be minimized. By employing a risk-weighted model, regulators could theoretically minimize the amount of capital that banks are required to hold, while maintaining the positive risk-reducing effects. In the context of the studies by Aiyar et al., (2012); Bridges (2014) and the IIF (2010), this model would minimize the cost of capital effects of the regulation, in order to keep lending growth as high as possible to not stifle economies.

Theoretically the idea is sound, as banks with a large amount of risky assets should be required to hold more capital, as their potential losses would be larger. However, the risk-weighted assets model became problematic as the introduction of Basel II allowed approved banks to use their own calculations to determine their risk-weighted assets. This produced a high variability in the amount of risk-weighted assets between otherwise
similar banks, causing insecurity and confusion as to the effectiveness of the measure, as argued by Le Leslé & Avramova (2012).

Given the result of the study, one way to remedy the increased complexity that comes from the risk-weighted assets measure would be to use total assets rather than risk-weighted assets as foundation for the capital ratio calculations. This would make it easier to determine what effects the regulation actually has had on the banking industry, as well as level the playing field for the amount of capital that banks would be required to hold, thus reducing insecurity. This would in essence be equal to giving all assets a risk-weight of one, which is problematic from a theoretical perspective as not all assets are equally risky. Additionally, it would incentivize banks to increase the amounts of risky assets relative to safe ones, as to maximize profits. Another issue is that given current regulatory requirements, this would force banks to heavily increase their capital, which, as have been discussed, could tend to be costly.

Another possibility would be to replace the risk-weighted assets system with the standard capital assets ratio and introduce an asset composition requirement, where banks are forced to hold a certain percentage of their total assets in what is determined to be safe assets. This would circumvent the incentive problem, as to increase the amount of risky assets, banks would need to equally increase the amount of safe assets. This would however further increase the complexity of the regulatory framework, which in many cases have been the main source of criticism.

A perfect solution to the problem is unlikely to exist. What can be said is that it does not seem reasonable to keep advocating for, and building the regulatory framework around, a measure that in reality does not achieve what it is supposed to achieve. Add in the fact that in many cases internal models of risk-weighted asset calculations seem arbitrary and promotes variability and there is a case to be made for its abolishment. The latest edition of the Basel framework does take measures in this direction, in that it puts a lower bound on the internal calculation models equal to 72.5 % of risk-weighted assets as calculated via the standardized model. As this study uses banks own reported figures on their total risk-weighted assets, it is possible that the result is affected by the variability of internal calculation models, and the floor improves the relevance of the risk-weighted assets measure. It would therefore be interesting to perform a study testing the validity of the risk-weighted assets measure after the latest regulation has come into effect. In its current iteration however, following Bitar et al. (2018), Altunbas et al. (2007) and this study, the risk-weighted assets measure is in need of rework.

Another interesting result is that cost of capital is significant and negative in determining Z-score. This means that banks with a higher cost of capital have a higher risk of default. Theoretically this makes sense, as a higher cost of capital means more expensive financing of the banks assets, leading to lower profitability. As the risk measure used in this study is based on return on assets and its variability, a volatile cost of capital will reduce Z-score. As most previous studies have shown that increases in regulation results in increases in cost of capital, there is the potential of increased regulation leading to a less stable banking sector. This relates to the work done by Tchanat Tchanata (2014) who found that in the Indonesian banking industry, higher reserve requirements resulted in less stable banks. While Tchanat Tchanata (2014) never analyzed the causality behind this result, and it is unlikely to be the same mechanism as argued here, if increased regulation leads to higher cost of capital, and higher cost of capital leads to less stable banks, there is the potential of regulatory measures causing the very problem it is intended to fix.
The study also allows the drawing of some conclusions on the too-big-to-fail doctrine in the sample. As the final regression shows, size was significant and positive in determining Z-score. This means that larger banks in general are safer than smaller banks, whereas the TBTF hypothesis claims that larger banks expose themselves to more risk as they are under the impression or have the knowledge that they would not be allowed to fail. It can be argued that the TBTF doctrine does not work for just any large banks, as the size measure would indicate, but only for the very largest banks. The first regression model included the DSIB variable, that is the very largest systemically important banks, which also was positive but insignificant due to the correlation with size. Additionally, the second model was tested with the DSIB variable instead of size, and was then significant and positive, with a coefficient larger than size. However, as the explanatory power of the model dropped, size was used in the final model. What we can tell from this is that even the very largest banks in the Nordic region are significantly safer than their smaller counterparts, which points toward the fact that the TBTF doctrine is not applicable to the sample in the study, and likely not in the Nordic region overall.

The overall assessment of the tests is that they are successful. While the capital ratio with risk-based assets did not prove significant in increasing bank safety, a standard capital to assets ratio did, which is interesting and prompts further discussion and analysis. The results provided are deemed sufficient to convincingly answer the research question of the study and we can say that increasing capital ratios does lead to significantly safer banks, given that banks increase their capital in relation to total assets. However, given the academic support for the inefficiency of the risk-based asset model, as well as the results from this study, an interesting question that remains is whether risk-based asset calculations really should remain as a primary measure of the Basel Accord or if there are better alternatives out there?

### 7.4 Complementary tests

The additional tests performed provide some insight into how banks generally have adapted to the new regulation. As the theoretical framework stated, there exist two main ways for banks to make sure they comply with increased capital ratios. They can do this by either increasing the amount of equity held in comparison to their total risk-weighted assets, or by reducing their lending (Aiyar et al., 2012; Aiyar et al., 2015). Depending on the path chosen, the mechanism and impact on the overall economy changes. Banks who choose to strictly reduce their lending are likely to have a greater impact on the economy, as lending growth is mostly recognized as a macroeconomic factor of importance (Levine, 1997). Banks who choose to increase their amount of equity will have another mechanism where lending growth is affected by changes in banks cost of capital, following the argument that equity is costlier than debt.

As the performed T-test of this study shows, banks have significantly increased the amount of equity held in the post-regulation period, indicating that most banks choose to increase equity rather than reduce lending. It could however be argued that the increase in equity might not be done in order to comply with stricter regulations, but rather to finance an increase in assets. To combat this argument, a T-test on total reported risk-weighted assets was performed which showed that total risk-weighted assets has stayed more or less the same in the two periods. This would indicate that the main reason for increasing equity is to comply with new regulation, as there should not be a significant increase in assets in need of financing. That banks prefer to increase equity over reducing
lending is further strengthened by the T-test showing an increase in lending growth in the 2014-2017 period compared to the 2010-2017 period. If banks were to prefer to reduce their lending, a significant increase in the lending growth would likely not be observed.

7.5 Criticism

While the study has shown some interesting results, there are criticisms that could be directed towards it. One of the major issues which could have an impact on the results is the comparison of the chosen periods. In order to determine changes following a regulatory introduction, it is reasonable to use data a few years before and a few years after the introduction. Conducting such a study at this point in time does come with issues. One of the main issues is that the first period, consisting of the years 2010-2013, are immediately subsequent to the financial crisis. This is problematic as tests have been made using balance sheet data from the period immediately after a crisis, and comparing them to data from a point which is further away from the crisis period. It stands to reason that the further you move away from a crisis, the more likely the economy is to recover. While this does not affect the results of the regression models directly, and thus the main hypothesis of the study, it could have an impact on the results of the performed T-tests.

To handle this issue, all T-tests were also performed using the periods 2012-2013 and 2014-2015. By eliminating the observations both closest to the financial crisis as well as those furthest away, major macroeconomic effects following the crisis should be minimized meaning that changes in the variables should be focused on the effects of increased regulation. It does however mean that the number of observations were halved, testing on 40 observations rather than 80. The T-tests on these altered periods does in most cases show the exact same result. With the exception of the test on lending growth having a P-value of 0.057, the significance and direction of the tests are all the same as before. This means that proximity to the financial crisis should not be biasing the results of the study in any significant way.

Another issue is that banks can start adapting to future regulation at the point when it is presented, rather than when it is implemented. As future Basel regulatory requirements are known by banks in advance of them being fully implemented into national legislation, it is likely that banks are adjusting their behavior in anticipation of regulatory changes, rather than at the point of implementation into legislation. While this is certainly true, the impact this would have on the study would if anything be to make it harder to find significant differences between the two periods, as the potential adjustments would start sooner. Since the result of most T-tests already show significant results, any impact of this behavior seems to be negligible. Another possibility is that the banks in the sample tend to wait until the regulation is adopted into national legislation to adjust their capital ratios, likely in order to minimize costs. Overall, earlier compliance should not affect the results of the study in any significant way.

As has been discussed in the method chapter, there are also issues present with some of the variables included in the model. While most variables are either directly taken from the banks annual reports, some of them are either manually calculated or taken from external sources. The information taken from external sources has been critically analyzed in order to ensure its validity. Overall, the external sources are either widely recognized international bodies such as OECD, BIS or professionals in data gathering and
analyzing. The potential impact of bias following from bad data is thus deemed to be small.

The most pressing issues refer to the calculations of the cost of capital variables. These problems come from the fact that the cost of capital is not an explicitly stated figure, but usually an internal measure that differs for each bank. Assessing how close the calculated figures are to their true value is therefore impossible. However, it is possible to analyze the calculated capital costs for each bank and determine whether they seem reasonable. In general, the calculated capital costs do seem low. This is mainly due to the fact that the calculations for banks cost of debt are very low, as well as the calculations for cost of equity using the CAPM providing low figures. The cost of debt is calculated by dividing reported interest expenses with the amount of interest bearing debt, whereas the CAPM uses risk-free interest rates, risk premiums and firm betas to determine cost of equity.

The probable culprit in producing these low cost of capital figures is the low interest rate. A bank's interest bearing debt is mostly composed of either customer deposits or bank bonds. In the current financial climate, receiving any interest at all on customer deposits is rare, and bank bonds are considered very safe assets and should thus pay little interest. The very low cost of debt is therefore not unreasonable, considering the current interest-rate environment. Additionally, as banks are highly levered institutions, financing their assets mostly through debt, the cost of debt is far more impactful in calculating cost of capital in comparison to cost of equity. While the cost of capital estimates might seem low, given the current financial environment they are likely more accurate than they might seem at first glance.

Even if the cost of capital estimates would be inaccurate, it would not drastically impact the conclusions drawn from the study. As the focus of the study has been on the relationship between increased capital ratios and lending growth, cost of capital and default risk, the absolute values of the cost of capital are not the most interesting. Instead, focus should be put on the direction of the relationships. As all cost of capital estimates have been treated identically, inaccurate estimates should not have an impact on the direction of the relationship. We can thus reliably claim that increased capital ratios lead to lower cost of capital as was shown in the regression model. We should however be careful in the claims on how much an increase in capital ratios would impact cost of capital, as the absolute numbers might be affected by inaccurate estimates. It should also be noted that the tests on lending growth and Z-score should not suffer from these issues, as their calculations are straightforward and fully based on annual report data.
8. Conclusions

The purpose of this chapter is to answer the research question given in the introduction as well as highlighting the most important or interesting findings. Additionally, the chapter includes the contributions of the study, suggestions for future research in the field, ethical considerations and a short discussion on quality criteria.

8.1 Capital requirements and lending growth

One of the main fears of introducing more stringent capital requirements is its potential macroeconomic effects. Through the avenue of decreased lending growth, the banking industry has, amongst others, argued that higher capital requirements can have detrimental effects for the national and global economy (IIF, 2010; Aiyar et al., 2012; Bridges et al., 2014; De Nicolò, 2015). Through this study we can see that increased capital ratios do indeed lead to lower lending growth in the sample. This finding gives credence to the mechanism argued by Aiyar et al. (2012) and Bridges et al. (2014) where banks when faced with stricter regulation increase their lending spreads to make up for the additional costs associated with increased regulation, leading to a reduction in lending.

It should be noted however that even though capital ratios have significantly increased in the sample from the period 2010-2013 to the period 2014-2017, lending growth has risen. This indicates that the negative effect of regulation on lending growth is not severe enough to outweigh other macro or micro factors. The overall macroeconomic effect is however harder to discern. Bankers would argue that the relevant measure would be a comparison between the lending growth if there were no increase in regulation compared to the lending growth after the increase. Thus, an increase in lending growth of for instance five percentage points might lead you to claim that there has been no adverse macroeconomic effect, but had the lending growth been 25 percentage points without the regulation, the costs are obviously quite large. The study shows that an increase in the capital ratio of one percentage point will lead to a reduction of the lending growth by 0.236 percentage points. This would indicate that both the macroeconomic costs of increasing regulation as well as the added institutional costs requiring increased lending spreads are small in the sample.

8.2 Capital requirements and cost of capital

The cost of capital channel, where increased regulation lead to banks increasing their equity and thus their overall cost of capital has substantial support in theory, to the point where it is the main focus of almost all studies. The fact that banks choose to increase their capital to comply with new regulation is further strengthened by this study, where we can observe a significant increase in capital during the 2014-2017 period, while total risk weighted assets stayed mostly the same. While it is shown that capital ratios have a significant impact on banks’ cost of capital, the direction of the relationship does not follow the most common theory. The regression finds that as capital ratios increase, cost of capital does in fact decrease in the sample.
While most common work finds the inverse relationship, the result is not outside the realm of possibility. BCBS (2010) argued that the negative effects of increased regulation can be offset by reduced risk of the individual institution as well as the industry overall. This was further supported by Kayshap et al. (2010) who finds that cost of capital fall when institutions become safer, as investors expect lower profits. There are thus likely two counteracting forces in determining the effect on banks’ cost of capital, where the more prominent one determines the direction of the relationship. The result of the study would indicate that the cost of capital diminishing effects of reducing bank risk are larger than the forced increases in bank capital which works to increase overall cost of capital. This is significant as much of modern research (IIF, 2010; Aiyar et al., 2012; Bridges et al., 2014; De Nicolò, 2015) fail to acknowledge it altogether.

8.3 Capital requirements and default risk

While increased capital requirements are generally associated with increased costs, they are also expected to bring some benefits in the form of a safer banking industry. The most long-lasting tool used by regulators to achieve this is the risk-based capital ratios. Since the introduction of Basel I, capital ratios based on risk-weighted assets have been a staple of all regulatory changes. However, this study, together with previous work (Bitar, et al., 2018; Altunbas, et al., 2007) finds that risk-based capital ratios are not significant in determining banks default risk. This is an important finding, as it puts into question the efficacy of the current regulatory framework. The capital ratios do however have a significant and positive impact on Z-score if they are not based on risk-weighted assets, but instead on total assets. This indicates that banks do not get safer following the regulatory mandated capital ratios, but instead through the side-effect of increasing capital in relation to total assets. Banks who choose to comply with new regulation by means other than increasing capital, such as reducing total risk-weighted assets, would thus be just as risky as they were before the regulation.

It is possible that the results are driven by flawed internal calculation models by approved banks. Allowing approved banks to use internal calculation models for their risk-weighted asset calculations have since its inception been met with heavy criticism. Studies have found that allowing banks to calculate their own risk-weighted assets have increased the variability of how much capital banks are required to hold, meaning in essence that banks are able to adjust the models to suit their own needs (Le Leslé & Avramova, 2012). In its latest update, the Basel Committee has taken measures to combat this problem. Internal models are no longer allowed to achieve a value of total risk-weighted assets below 72.5 % of the value as calculated by using the standardized model. Extremely positive models that have significantly reduced the amount of capital that banks need to hold are thus no longer valid. It would be interesting to see if this change improves the significance of the risk-weighted assets model in determining bank default risk. If it does not, it could be high time to consider whether the risk-weighted models should be used as a regulatory tool at all.

8.4 Answering the research question

The research question, as outlined in the introduction was:
“What effects have the increased capital ratios of Basel III had on Swedish, Danish and Finnish banks’ lending growth, cost of capital and default risk?”

Given the results of the study we can say that Basel III increased capital ratios have had a negative effect on lending growth in the sample. A one percentage point increase in the capital ratios would have an estimated reduction in lending growth of 0.236 percentage points. In terms of cost of capital, the increased capital ratios have had a positive effect, meaning that banks in the sample have reduced their cost of capital due to the regulatory increase. Like for lending growth, the effect is small, where a one percentage point increase in regulatory capital would lead to a 0.018 percentage points decrease in cost of capital. As for default risk, the Basel III capital ratios does not directly impact banks default risk in the sample. However, the study has shown that to comply with regulatory changes, banks tend to increase capital, rather than reduce risk-weighted assets. Increasing capital in relation to total assets does significantly improve banks Z-score, and thus reduces their default risk. This means that the Basel framework does achieve what it is supposed to achieve, but not through the means they originally intended.

8.5 Practical and theoretical contribution

The results of the study can be significant in both a practical and theoretical sense. One practical contribution is that Scandinavian banks have been critical towards new regulation that increases capital ratios, claiming them to be excessively costly. The study shows that while lending growth is negatively affected by higher capital ratios, bank cost of capital is seemingly reduced following higher capital ratios. This means that individual banks should not face significant increases in their costs following a regulatory tightening. Additionally, the negative impact on lending growth, and thus on the economy as a whole, is small. In fact, the report by the Basel Committee presents higher numbers then what was shown in this study. Overall, the argument that increased capital ratios would be excessively costly for Scandinavian banks seems highly exaggerated. Banks in the sample regions should have little reason to worry about increased regulatory capital, as it seems to affect them to a low degree. This should additionally decrease existing uncertainty surrounding regulatory changes, providing further stability to the banking sector.

Another important practical contribution is the insignificance of risk-based capital ratios in determining banks’ default risk. For risk-based capital ratios to actually reduce default risk, banks need to increase their capital in relation to total assets, rather than reduce their risk-weighted assets. Banks who leave their capital unaffected and only choose to change their amount of risk-weighted assets are thus likely just as risky post-regulation as they were before. Current regulation on capital ratios is therefore dependent on banks’ choosing a specific avenue of adaptation to comply with new regulation to achieve its intended effects. As this finding is supported in other studies, it might be time for the Basel Committee to question whether risk-based capital ratios really are the best way of achieving their goals of a safer banking industry.

The main theoretical contribution consists of furthering the knowledge in the field by adding empirical results from a previously ignored region. The Scandinavian banking industry can be seen as unique, given its high concentration and already high capital demands. Providing insights into potential costs and benefits of increased regulation could therefore be particularly interesting. The study shows that even in a region with
already high capital ratios, increasing them further does damage the overall economy. The critical reports of the IIF (2010), Aiyar et al (2012), and Bridges (2014) are thus correct in that regulators need to be careful when implementing new regulation, as the consequences can be damaging. It should however be noted that the results provided are closest to those by the Basel Committee (2010), in that the macroeconomic effects on the economies following increased regulation are low and that the risk-reducing effects on banks can work to decrease their cost of capital. This last point also holds theoretical significance. As most research has been poor in acknowledging the fact that as regulation reduces bank risk, investors will expect lower return on their investments in the sector, thus leading to lower cost of capital for the banks. Studies that do not take this fact into account are seemingly missing an important piece of the puzzle as to the effects of regulation.

Finding support for the studies of Bitar et al. (2018) and Altunbas et al. (2017) is also theoretically significant. As the study provides further incidence of risk-weighted assets not being a suitable measure for determining bank risk, there is a call for further academic interest into whether risk-weighted assets really is an appropriate regulatory measure. Further academic attention could potentially come up with alternatives that might work better, thus helping us improve the efficacy of current regulation.

The study has further shown that TBTF doctrine does not seem to have gotten a foothold in the Scandinavian region. There are no indications that larger banks would be significantly riskier than smaller banks. This in a region that could be particularly vulnerable to the TBTF hypothesis, given that the industries are heavily dominated by few very large actors.

8.6 Suggestions for future research

The results provided in this study has also given way for avenues of future interest. One such avenue, as has been discussed, is further research into the validity of the risk-weighted assets model. As there is now a significant amount of evidence claiming that they do not work in achieving their supposed targets, further research could either provide further insight into whether this is the case in other regions, or explore potential other metrics that could work better as a regulatory ratio.

Another possibility would be to expand upon the work done here. Given the time constraints, the sample and the methodology employed in this study is evidently restricted. It would thus be interesting to conduct a study that included a fully random sample of banks in this region or others, and one that uses additional models in their cost of capital calculations to overcome some of the major flaws of this study. Conducting similar research but focusing on other unexplored regions would also be interesting, as it provides a further basis for academics to build upon.

The results on the relationship between capital ratios and cost of capital presented in this study also conflicts with much of common theory, which would suggest that there is a need for further research to be done as to what is the true relationship, and why it might be different in different regions. While some theoretical possibilities have been outlined in the study, there is clearly room for further empirical evidence to be provided on the topic.
As this study has focused on the effects on the banking industry as a whole, it would be interesting to conduct a similar study but focus on each individual bank. Understanding how regulatory changes have affected individual banks, and particularly why, is surely an interesting topic for academia and the banking industry alike. This would however require a large sample of banks and years, which would consume a large amount of time, as well as resources.

Another way to build upon the work done here would be to employ more advanced statistical models. This was not possible here due to limitations in time as well as knowledge. More advanced models could possibly find better relationships between the variables as well as explanations to the surrounding factors. It is furthermore likely that more advanced statistical models would circumvent some of the major issues present in this study.

8.7 Ethical and social considerations

Given the central role banks play in our entire financial system, it is important to acknowledge any ethical and social considerations, both as to the results presented, and to the study as a whole. Since the financial crisis, ethics in banking has become even more important, as a major source of the crisis was unethical practices and skewed incentives of both banks and rating agencies. The need of regulation is connected to a fear of unethical behavior by banks that could cause major disruptions to the financial system. The topic of the study is thus connected to ethics in a significant way.

The research question of the study does require some ethical considerations. As the study tries to quantify some of the costs and benefits of increased regulation, the results presented could potentially have legitimized unethical practices. The question that then has to be answered is if the topic is of enough relevance to outweigh these potential ethical risks. Given the current relevance of the topic, particularly due to the announcement of new regulatory standards in December 2017, as well as the fact that the risk of a severely unethical result was small, the research question seemed adequate from an ethical perspective.

Ethical considerations have also influenced the choice of methodology in the study. For instance, the study focuses on the overall sample and does not name any specific bank in connection with either variables or results. This ensures that full objectivity is present throughout the study and that personal opinions on banks or their reports are not in any way dictating the results. Furthermore, all data used in the study is freely available to anyone, and is thus freed from any potential ethical considerations. One could argue that conducting research on entities that are not aware of it is unethical, however given the public nature of the data used and the frequency of which research is done on the banking industry, this should not be a significant worry.

The results are also somewhat affected by ethical decisions made during the course of the study. Given the large variance of bank sizes in the employed sample, there were cases were outliers were of possible significance. One important point when handling outliers is to make sure that they represent a true relationship, rather than miscalculations in the sample. This has been done thoroughly for each outlier to make sure mishandling of the data have not impacted the result of the study. Given the continued existence of outliers, the next step would be to remove them from the sample. A conscious decision has been made to avoid the removal of outliers, mainly due to ethical considerations. Removing
outliers significantly increases the risk of trying to fit the data to the model, rather than vice versa. This could potentially bias the result and is a major problem from an ethical point of view. The tradeoff for keeping the outliers in the sample is a worse fit of the models. Overall however the assessment is that this has not impacted the results of the study in any significant way.

In terms of the analysis the most obvious connection is connected to the TBTF hypothesis. A firm that leverages its size and importance to the economic system in order to pursue risky operations and maximize profits, at the potential detriment and cost of the society at large is clearly not ethical. However, the study finds that no such firms are present in the sample. From a pure profit-maximizing point of view, this is likely the optimal course of action for very large banks. However, in the studied sample, banks are either aware of the ethical perspective of such practices or the current regulation is effective in deterring unethical behavior, which would by most be considered a good sign.

Another discussion worth having is that of the validity of risk-based capital ratios. If additional studies can further show that risk-based capital ratios are not and have not been effective in reducing default risk, it is interesting to ask why the Basel Committee continues to employ and develop them. The risk-weighted assets model has been criticized for a long time by both sides of the spectrum, claiming that they are either too harsh or too arbitrary. Basing the capital ratios on risk-weighted assets rather than total assets gives some leniency to the banking industry in their capital requirements. If the Basel Committee would knowingly or through negligence employ a model with its preferences skewed towards the banking industry rather than the good of society, it would be problematic from an ethical point of view.

8.8 Quality criteria

An important final step in the research process is to assess the quality criteria of the study. This is to ensure that the study upholds a sort of minimum standard in terms of quality, and that potential issues are highlighted. The three areas most commonly analyzed are reliability, validity and replicability (Saunders et al., 2012, p. 192-193). It should be noted that the analysis of the quality criteria will inevitably be subjective. Even though a clear ambition of objectivity has been present throughout the study, it can never be truly guaranteed. The reader is thus encouraged to approach this section, as well as the overall study while employing a critical perspective.

8.8.1 Reliability

As the name suggests, the reliability of a study concerns how reliable the results are. That is, if the study was to be redone by another individual, the results achieved would be the same (Saunders et al., 2012, p. 192). As for this study, the reliability can be assumed to be high, given that the same data is used. A researcher using the same set of years, calculations and overall methodology would find identical results as the ones presented. Even employing a different methodology would probably present the same overall results, in the sense that the direction of the relationships would more than likely be the same, whereas the coefficients would surely differ. Given that the sample used in this study also uses most major banks in the regions, a study using additional banks would likely find
similar results, although this cannot be fully guaranteed. Performing the study but altering the years or the regions studied would naturally produce different results. The overall assessment of the reliability of the study is however high.

8.8.2 Validity

Validity can generally be split up into three different sections: construct validity, external validity and internal validity (Saunders et al., 2012, p. 193-194). Construct validity regards whether the study actually investigates what it originally intended to. The study does suffer from some concerns about its’ construct validity. As have been previously discussed, the calculations of the cost of capital did pose some problems. While acknowledged models and methods have been used throughout the study, the very nature of firms cost of capital is problematic from the perspective of construct validity. Since there is no clear answer to a firms’ cost of capital, the construct validity of the measure cannot be guaranteed. It is thus possible that the cost of capital variable is measuring something it is not intended to measure, which is important to be aware of. However, given that the models used for the calculations are established in large amounts of literature, this risk should be fairly low.

External validity concerns the extent to which the results of the study can be generalized (Saunders et al., 2012, p. 194). As the sample used in the study is one of either convenience, or given through a set of criteria, rather than one of chance, the generalizability of the study is rather low. The findings are both context and sample specific. However, given the concentration of the banking industry in the countries studied, it is likely that the results can be generalized to some extent, although this cannot be guaranteed.

The internal validity regards to what extent the conclusions drawn from the study are warranted (Saunders et al., 2012, p. 193). As the study finds significant relationships between the important variables and there is a theoretical foundation behind the signs of the coefficients, the internal validity can be assumed to be high. The most problematic area from this perspective is the finding that capital ratios leads to lower cost of capital in the sample. While this result is rare in existing research, it is not fully unprecedented. Additionally, a theoretical explanation has been given as to why these results are not following most common theory. Overall, the assessment is that the finding represents a true relationship of the sample, rather than potential bias or faults in the model. As such, the internal validity of the study should be high.

8.8.3 Replicability

A studies replicability concerns whether the study can be redone (Bryman & Bell, 2011, p. 165). Given that the data used in the study is publicly accessible, as well as the fact that the methodological choices and steps have been detailed in earlier sections, if anyone would wish to replicate the study, it would be possible. One caveat could be that the amount of annual reports published on banks webpages might be limited as time goes by. However, given access to certain databases or by simply asking banks for the annual reports of the given years, it should be relatively easy to access these documents. The replicability of the study is therefore high.
8.9 Final thoughts

While not free from issues, the conducted study has given way to some interesting findings. Certainly, the depth of which could be improved given additional time and resources, but as a starting point of discussion, the study is somewhat successful. If the findings of the study can provide some inspiration into future research in the field, or promote discussion of any kind, it would be viewed as a success. Whether the costs of regulation have outweighed the benefits or vice versa is left for everyone to decide for themselves.
Literature Sources


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**Data sources**


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Appendix 1: List of banks and their country of origin

<table>
<thead>
<tr>
<th>Bank name</th>
<th>Bank origin</th>
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<tbody>
<tr>
<td>Swedbank</td>
<td>Sweden</td>
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<tr>
<td>Handelsbanken</td>
<td>Sweden</td>
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<tr>
<td>Nordea</td>
<td>Sweden/Finland*</td>
</tr>
<tr>
<td>SEB</td>
<td>Sweden</td>
</tr>
<tr>
<td>Avanza Bank</td>
<td>Sweden</td>
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<tr>
<td>Danske Bank A/S</td>
<td>Denmark</td>
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<tr>
<td>Jyske Bank</td>
<td>Denmark</td>
</tr>
<tr>
<td>Sydbank A/S</td>
<td>Denmark</td>
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<tr>
<td>Alm. Brand A/S</td>
<td>Denmark</td>
</tr>
<tr>
<td>Jutlander Bank A/S</td>
<td>Denmark</td>
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<tr>
<td>Lån &amp; Spar Bank A/S</td>
<td>Denmark</td>
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<tr>
<td>Spar Nord Bank A/S</td>
<td>Denmark</td>
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<tr>
<td>Vestjysk Bank</td>
<td>Denmark</td>
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<tr>
<td>Møns Bank</td>
<td>Denmark</td>
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<tr>
<td>Nordjyske Bank</td>
<td>Denmark</td>
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<tr>
<td>Östjysk Bank**</td>
<td>Denmark</td>
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<tr>
<td>Salling</td>
<td>Denmark</td>
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<tr>
<td>Totalbanken</td>
<td>Denmark</td>
</tr>
<tr>
<td>Aktia Bank Abp</td>
<td>Finland</td>
</tr>
<tr>
<td>Ålandsbanken</td>
<td>Finland</td>
</tr>
</tbody>
</table>

* Nordea has decided to move their headquarters to Finland, however for the years included in this study they were of Swedish origin

** Over the course of the study, Östjysk Bank merged with, and changed name to Sparekassen Vendsyssel
Appendix 2: Residuals vs. predictor plots

Model one
Model two
Model three