Not a financial crisis, but a pandemic outbreak – what happened to Norwegian banks' willingness to lend?

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Preface

Exactly one year ago - a few months after the outbreak of COVID-19, I decided to study the impact a reduction in the countercyclical capital buffer had towards the Norwegian banks lending activity. By having a big interest towards financial stability and the macro-financed linkages, this theme was extremely interesting to investigate further. It has been incredibly exciting and instructive to dive deep into a topic that has interested me for a long time.

I would like to thank Jin Cao for an extremely good guidance towards the entire process as my supervisor, both through help with collecting the necessary data, coding in STATA and overall good discussions and reflections regarding the findings. Thank you for always giving me a fast respond to all of my questions, at any time of the day.

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ABSTRACT

This study contributes to the existing empirical studies regarding the effects of the countercyclical capital buffer (CCyB), by extending the analysis due to the COVID-19 situation where the CCyB was reduced for the first time in Norwegian history. We will investigate the impact of a reduction in the countercyclical capital buffer towards Norwegian banks’ lending activity, by using data collected from Norges Bank at the bank- and loan-level. We ask as the main question: “Has a reduction in the countercyclical capital buffer affected the Norwegian banks’ willingness to lend?”. Because the countercyclical capital buffer is risk-based, we will answer this question by looking at the risk-perspective buffer.

The theoretical framework for analyzing the impact of a reduction in the countercyclical capital buffer on bank lending is based on Cao (2021) discussion towards the implementation of a countercyclical capital buffer, and the leverage cycle from Geanakoplos (2010) discussing how macro shocks affects the banks’ balance sheet. An empirical study of Arbatli-Saxegaard & Juelsrud (2020), and Jiménez et al. (2012) is also provided to support empirical results of a cut in the countercyclical capital buffer.

The data collected from Norges Bank is used in two separate difference-in-difference analysis, where all of the economic methods and calculations were conducted using STATA. By comparing the results from the two different analysis, we see that banks will react differently to a CCyB cut based on their risk decisions both before and after the CCyB cut. A bank that has chosen to expose themselves for a higher risk share before a cut in the CCyB is made, will reduce their exposure to risk by cutting back on lending. While a bank that has been more capital constrained before a CCyB cut will expose themselves to a higher share of risk after the CCyB cut is made by expanding lending.

Content

1.0 Introduction

2020 - the start of a new decade, little did we know that just in a couple of months Norway and the rest of the world would experience a deep global crisis. The 13th of March 2020 Norge AS was shut down, just as the rest of the world. Shops were closed, people had to work from home, no one could travel and a big share of the population got temporarily laid off from their jobs. The reason for this was the virus COVID-19 which spread at record speed worldwide. As a result of the global lockdown, the entire economy was in turmoil. The stock markets fell at record speed, people hoarded in the shops and the fear of the unknown became a fact. The central banks responded with their monetary policy tools by lowering the interest rate, where the central bank governor Øystein Olsen (Norges Bank, 2020) said the 13th of March that "A lower interest rate can not prevent the corona outbreak from having consequences for the Norwegian economy. It will nevertheless be able to cushion the downturn and limit the risk of more long-term consequences for production and employment".

With an interest rate close to zero, there is need for other tools for stabilizing the economy, where a combination of monetary policy tools and fiscal policy tools are needed when an entire market is in turmoil. The Ministry of Finance concluded the same date to reduce the countercyclical capital buffer (CCyB) for all Norwegian banks from 2.5 percent to 1 percent with immediate effect, after an assessment done by The Central bank of Norway. In the statement from the government they justifies the reduction in the CCyB to counteract a tighter lending practice for banks, which would have strengthen the decline in the market (Regjeringen, 2020).

This thesis will argue for the government's statement that "a reduction in the countercyclical capital buffer will counteract a tighter lending practice for banks" (Regjeringen, 2020). To discuss this statement, we will use data collected from Norges Bank regarding all Norwegian banks. The results from the analysis will be discussed towards the theory from Genakoplos (2010) which states that a negative macro shock will have a negative impact on the banks' balance sheet combined with theory from Cao (2021), Admati and Hellwig (2013) which are discussing how there is different outcomes of a CCyB cut. We are also including empirical studies regarding the effect of a reduction in the CCyB from Arbatli-Saxegaard and Juelsrud (2020) working paper studying the effect of new capital requirements from the implementation of Basel III, and Jiménez et al. (2012) study regarding the dynamic Spanish provisioning system implemented in the late 1990s also looking at the effects of a reduction in a procyclical capital requirement.

1.1 Introduction of the countercyclical capital buffer

In the light of the financial crisis back in 2009, we saw that banks play an important role for the financial stability of the economy. The CCyB was implemented after the financial crisis of 2009 as a part of the Basel III regulation (Basel Committee, 2010), to make banks more robust. The main purpose of the CCyB is to reduce the risk of credit supply being constrained in economic downturns. The buffer is due to the Basel Committee argumentation implemented for banks to build more capital in good times. In bad times, or times where there are financial imbalances, the CCyB can be reduced to smooth negative business cycles. The capital requirement for the buffer should lie between 0 to 2.5 percent of the banks risk-weighted assets, but can be set higher in special cases (Norges Bank, 2019). It is the Ministry of Finance in Norway who are setting the CCyB four times a year, where the central bank of Norway is forwarding a recommendation to the government before the decision is made. Due to the outbreak of the COVID-19 pandemic in March 2020, the CCyB was reduced for the first time ever from 2.5 percent to 1 percent in Norway (Regjeringen, 2020).

1.2 Contribution with this article and setup

The literature on the effect of a reduction in the countercyclical capital buffer is still limited, but some research has been done (Jiménez et al., 2012), (Drehmann & Gambacorta, 2012), (Arbatli-Saxegaard & Jueslrud, 2020). In 2020 it was the first time the CCyB was reduced, making it interesting to investigate how an impact of a reduction in the CCyB is affecting the banks, and if the buffer gives the intended effects that it should. Trough this thesis we will try to shed a light on how a reduction in the CCyB can affect the bank lending. The CCyB is a new fiscal policy tool, and has been lowered for the first time in Norwegian history. Due to this (and the short timeline), there is hard to conduct enough empirical evidence to define the real effects on banks' lending activity of a lower CCyB during the outbreak of COVID-19. However, this thesis will contribute to give a sense of flavor of how effective the CCyB can be during a downturn in the economy, like the one we are facing now. It can also open up for further research when more empirical evidence is available.

The overarching structure of this thesis starts with a theoretical implementation on the background of the intended effects of the CCyB on banks' lending. Further we will connect this to the theoretical framework of the more modern view on the macro financed linkages, and how the monetary – and fiscal tools works in times of crisis. After the theoretical foundation, we will introduce the from the lending market of Norwegian banks and the methodology behind before heading to the analysis. The analysis is based on numbers collected from Norges Bank, combined with different macroeconomic data containing important factors which has affected the lending numbers for banks during the given time period. In the analysis we will look at the effect on banks' lending from different aspects, trying to explain how a cut in the CCyB can affect banks and loans differently. We start the analysis by looking at all non-IRB banks in Norway trying to distinguish the CCyB cut effect from the interest rate cut effect. We will do so by assuming that corporate loans are more risky than private loans, and that the effect of a CCyB cut would affect the loans differently compared to an interest rate cut. Further the analysis is based on the discussion from Arbatli-Saxegard and Juelsrud (2020) article, that more capital constrained banks would react differently to a CCyB cut than banks with a higher capital. At the end, we will connect the theoretical framework towards the results from the analysis into a discussion on the real effects of the reduction in the CCyB.

Writing this thesis there needed to be lines drawn in terms of what one should include. The outbreak of COVID-19 was an unexpected global crisis, where several financial and political tools were established to keep the economy going. Some important tools are not taken into account, which is important to notice. There is especially one tool which is important to notice, that is not include in this analysis. Where the government proposed the 15th of March 2020 to establish a government guarantee on 90 percent for new loans, in the market for small- and medium-sized enterprises that were affected by the COVID-19 outbreak and the restrictions which followed (Regjeringen II, 2020). The 27th of March the law on state guaranteed loans for small and medium- sized companies (2020, §1) were granted, stating that "The law is intended to strengthen small and medium-sized enterprises access to liquidity, by the state offering risk relief to financial firms through a temporary guarantee scheme. This scheme will secure partially government-guaranteed loans to companies facing an acute shortage of liquidity as a result of the outbreak of Covid-19". This new law will have an impact on the lending market for the Norwegian banks, but to which extent is to another thesis. It is also important to note that the outbreak of COVID-19 has impacts on the demand for credit from both households and non-financial institutions, affecting the growth in lending for banks. Many corporations may for example have investments on hold to after the pandemic is over, due to uncertainty in the market. Households may also wait to buy or sell their houses. because of high uncertainty in the market. Also, people who are laid-off their jobs and do not have an income at this given time, is not able to receive any loans. These are only some factors affecting the demand for new loans.

2.0 Reform of banking regulation the implementation of the CCyB

2.1 Why the need for new regulations in the banking sector?

The regulation of banking is special compared to regulations of other institutions due to the crucial role they have in providing resources and other desirable financial services to the entire economy (Cao, 2021, page 462). It is one of the most heavily regulated industries across countries because of the important role they play for the financial stability, to further avoid bank failure and banking crisis, which incur a huge cost. The Basel Committee on Banking Supervision is a committee with the purpose of improving the worldwide regulatory bank framework, with members from all around the world. The committee comes with advising regulations setting global standards for banks. Financial crisis can be looked at as one of the most important driving forces for new banking regulations, as we saw after the financial crisis in 2008. Here the need to address systemic risk, and not only idiosyncratic risk became a fact meaning that the linking between banks creates a risk to the entire banking system and economy as a whole. This macroprudential perspective has become an important point of view of the regulation of financial institutions, showing how the entire banking industry can go from boom to bust in a short amount of time (Cao, 2021, page 406). The goal of bank regulations is to provide stability and efficiency to the entire financial system, which failed under the financial crisis and the banking regulations based on Basel II. Due to lack of some important factors from Basel II, the framework of Basel III was introduced in 2011, and gradually implemented towards the banking industry. Basel III introduced a tighter capital requirement than the earlier frameworks (Basel Committee, 2010), to address the weaknesses connected to the system risk between banks.

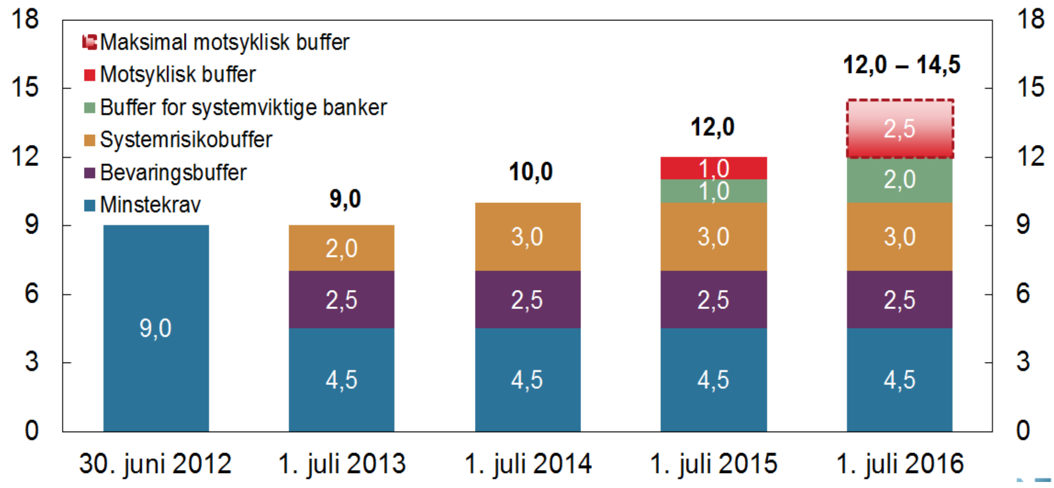
2.2 Basel III - new capital requirements

After the last global financial crisis, and the collapse of Lehman Brothers the banks have adapted new regulations and requirements to reduce the systematic risk. In 2013 the Norwegian government implemented new legislation for the capital requirements for all Norwegian credit institutions, based on the European CRR/CRD IV framework developed from the Basel III-standards (DNB, 2016), improving the regulation determined in Basel II. The new requirements would adapt banks that are more robust and reduce the possibility of future financial crisis, based on the experiences from the financial crisis of 2009. The regulations applies to all financial institutions within the European Economic Area (EEA), and was gradually implemented in Norway.

But first, we have to define a capital requirement. A capital requirement is a regulatory tool that puts an upper bound on how much banks can lend relative to their net worth (Arbatli-Saxegard & Juelsrud, 2020). The calculation of a banks' capital ratio is done by risk-weighting the exposure of loans due to the risk of unexpected losses. The higher possibility to a loss on the loan, the more risky the loan is and therefore a higher risk-weighted asset. Higher capital ratios improve the banks loss-absorbing capacity, which further reduces the possibility of a new crisis (Norges Bank, 2017). From the Basel III-standards we have several different capital requirements, where the countercyclical capital buffer is one of them. The new capital requirements for banks in Norway consist of two different pillars and buffer requirements, which all financial institutions needs to fulfil. The Pillar-1 require all banks to have a core capital adequacy on 4.5 percent of the institutions calculation basis. The Pillar-2 requirement comes in addition to the other requirements, and is determined individually for each institution based on their own risk, which is not covered in Pillar-1, determined by Finanstilsynet (Finanstilsynet, 2020).

The capital buffers implemented in Basel III exists of four different buffers. The full conservation buffer, the systemic risk buffer, an own buffer for systematically important institutions and the countercyclical capital buffer (Regjeringen, 2019, page 2) From figure 2.1 below we see the escalation of the capital requirements in percent for pure tier 1 capital adequacy over the last decade.

Figure 2.1 Escalation of capital requirements for pure tier 1 capital adequacy



(Norges bank, 2014, page 3)

The full conservation buffer is on 2.5% of all Norwegian banks risk-weighted assets and are the same for all banks (Regjeringen, 2019, page 1). This buffer is the first element in the capital requirements from Basel III. Further we have the systemic risk buffer, this buffer is intended to reduce the systemic risk the banking industry are carrying. The financial crisis in 2009 showed us that the banks are not only carrying an individual risk, but also a systemic risk connecting the entire banking systems together at a macroprudential level. This risk involves the relation between banks, and together the banks are fragile for a setback in the real economy (Freixas & Laeven, 2015). As a small open economy, the structural systemic risk in Norway is high. Both due to economic turmoil abroad, but also because Norwegian credit institutions have similar funding structure, making the institutions vulnerable to market turmoil (Regjeringen, 2019, page 8). The buffer for systematically important institutions, also called O-SIIs, is aiming towards specific institutions which are important for the entire financial system. The O-SII buffer will reduce the probability for financial difficulties, which can contribute to serious financial consequences for the entire economy. In Norway we have two financial institutions defined as an important institution under the O-SII buffer, this is DNB and Kommunalbanken (Regjeringen, 2019, page 25). The countercyclical capital buffer is the last buffer, which is established to dampen another form for systematic risk - relating to pro-cyclicality in the financial systems, and not the long-term systemic risk (Regjeringen, 2019, page 16). This buffer involves building up cushions in a boom period to absorb shocks and losses from this in bust periods, to be one step ahead (Cao, 2021, page 445). The buffer also intend to dampen the credit activity in boom periods, reducing the chances of a future negative shock. The CCyB is risk-weighted, which means that banks have the opportunity to lend more relative to their capital, when the risk which comes within it is assumed to be low compared to when it is assumed to be high (Arbatli-Saxegard & Juelsrud, 2020). The CCyB was implemented as an additional capital requirement varying between 0 to 2.5 percent of a banks risk weighted assets (Norges Bank II, 2019).

It is also important to note that Norwegian banks uses different types of models for calculating their capital requirements for the credit risk, where some of the biggest Norwegian banks are using an Internal Ratings Bases (IRB) model. This method implies that the capital requirement is calculated at the level of client-commitment, based on the probability that the customer will default and the expected loss rate if a default would occur. The non-IRB banks on the other hand, have a more standardized model (Finanstilsynet, 2018). Most of the Norwegian banks are following the standardized model, because the requirements for implementing an own IRB-model have a lot of strict requirements and needs an approval from Finanstilsynet. This results in that only the bigger Norwegian banks are using the IRB approach today.

2.3 When should the CCyB decrease?

The Central Bank of Norway states that the capital buffer should be reduced in times when the economy is experiencing a severe setback, where we see that the access to credit is clearly reduced (Norges Bank II, 2019). The Central bank is giving their advice before the ministry of Finance are setting the CCyB each quarter. The framework consists of different principles and information from the economic situation within the country involving that

- The banks should build and hold a countercyclical buffer when financial imbalances are building up, or has already been built up
- The buffer should be activated in the early stage if there are signals towards an increase in financial imbalances
- The buffer shall make the banks more resistant to setbacks and should not be changed frequently
- In the event of a big downturn and clearly reduced access to credit, the buffer should be reduced to increase the banks’ lending capacity
- The requirement for a countercyclical capital buffer shall as a general rule lie between 0 and 2.5 percent, but can in special cases be higher than 2.5.

- The buffer requirements should be seen in the light of the banks' adaption to the overall capital requirements.

(Norges Bank II, 2019)

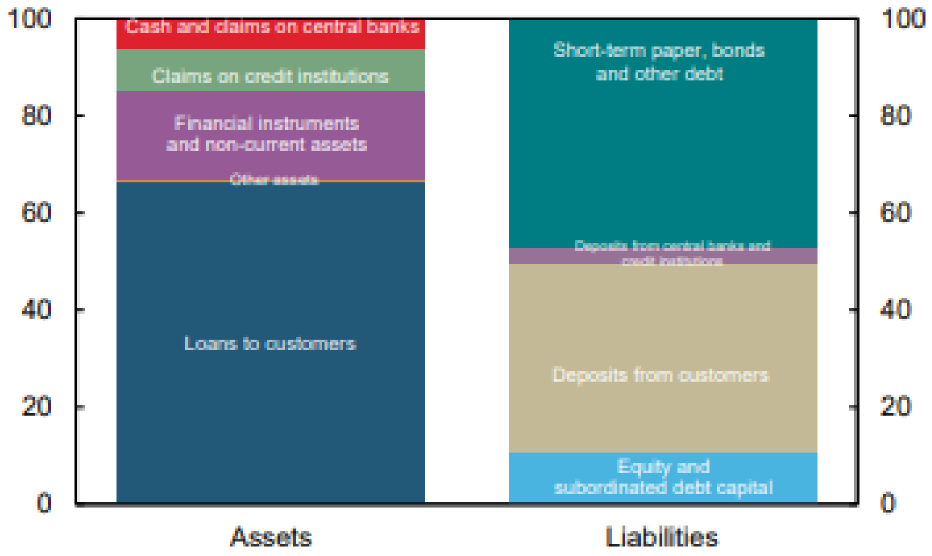
The recommendation is based on information given from four different information platforms (Norges bank III, 2020), regarding financial imbalances, the availability of credit, the banks' ability to absorb losses and the effect of a change in the buffer requirement on both banks and the entire economy. The argumentation for the reduction in the CCyB the 13th of March 2020 relied on the observable turmoil in the financial markets the last couple of weeks due to the outbreak of Covid-19. Where the measures were implemented to limit the spread of the virus, would lead to a clear slowdown in the Norwegian economic growth on an uncertain time horizon. They stated that "Norwegian banks are solid. They have enough capital to bear losses in the event of a sharp downturn. However, tighter lending practices may intensify the downturn in the economy" (Norges bank II, 2020). With the latest press release in November 2020 the Central bank recommended to keep the CCyB at a 1 percent level although the economy had risen since March 2020 (Norges bank III, 2020). The reason for this was because Norway was still experiencing setbacks in the economy due to new outbreaks of the virus, and stronger infection control measures.

3.0 Literature review

3.1 The effect of a capital requirement on banks' balance sheet

When looking at how a reduction in the CCyB will affect the banks under a crisis like COVID-19, we need to first understand how a capital requirement in theory affect the banks. To explain this their balance sheet is a nice place to start. We are separating between the banks' assets- and liability- side illustrated below:

Figure 3.1 Norwegian banks' balance sheet



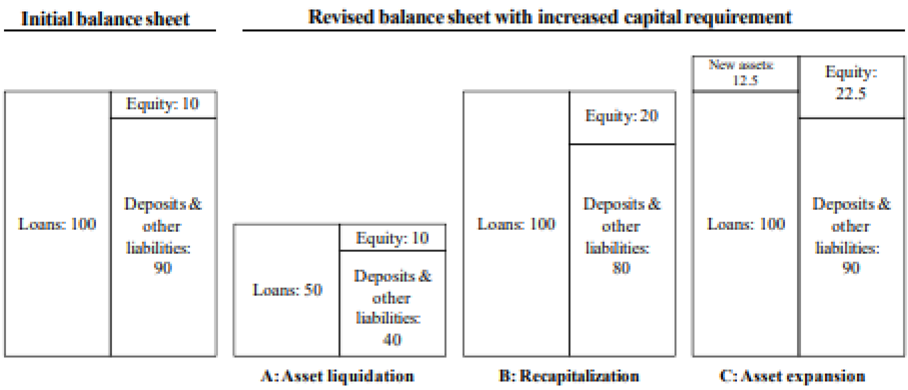
(Norges Bank IV, 2020, page 51)

Looking at the asset side of the banks' balance sheet from figure 3.1 we see that most of the assets for an average Norwegian bank consists of loans to customers, both private and corporate ones. The liability side of the banks' balance sheet shows how banks have funded their assets. As we can see from the figure 3.1 above, Norwegian banks are mainly financed by deposits from their customers and bonds. This is mainly a stable funding source, but can be less stable in times of financial turmoil. In addition to this, banks can also be financed with equity, the owners money. Banks can issue more equity by 4 different sources: 1) Raise new capital, 2) retaining all or part of their profits, 3) reduce lending capacity or 4) change their risk-weighted balance sheet (changing the customer pool of borrowers reducing the higher risk-weighted loans) (Finans Norge, 2013).

According to the older theorem of Modigliani and Miller (1958) stating that the composition of equity and debt (deposits) should not have an impact on the total financing costs, the theorem is more than often violated in reality. As we saw from figure 3.1 above, banks are often highly leveraged firms with a smaller share of equity in their liabilities. Banks have good reasons for choosing higher leverage, as higher leverage increases the return to equity (ROE) which is the main target for banks (Cao, 2021, page 453). Without capital requirements banks tend to hold too little equity, as equity is usually more costly than other sources from a bank shareholders' perspective. This can be explained as higher equity ratio reduces ROE. Cao (2021) also presents other financial frictions making funding cost of equity higher than other bank liabilities. Where equity higher the amount of taxes banks pay, compared to debt financing that gives some tax advantages. This is documented in for example Rajan and Zingales (1995), stating that banks therefore may prefer debt to equity due to a cost advantage. Another example is due to asymmetric information, where a bank manager knows more about the bank than investors, and that a new equity issuance as a bad signal on the bank's performance discussed from Myers and Majluf (1984).

Based on these studies, capital seems to be more costly for banks giving them the incentives to hold less equity. As a reason for this, regulatory capital buffers are necessary to ensure sufficient capital in the banking system. The banking regulations does not only set the capital requirement, but they also assign risk weights for the different loans, where they have a higher requirement for risky loans (Cao, 2021, page 454). This means that the higher probability of a default, the higher risk the loans have and the more equity the bank is required to hold for the given loan. Cao (2021, page 457) is further discussing how it is often believed that increasing capital requirements reduced the banks' risk-taking for mainly two reasons. First, that a higher capital ratio implies banks to have more skin-in-the-game, meaning that they have to incur higher cost from losses if they take on more risk. Secondly, higher capital ratio restricts banks' leverage, making it harder for banks to expand their balance sheets, which accommodates banks' credit supply and limits the volume of risky lending. This does not need to be the case where Cao (2021) uses several arguments stating that in reality capital is not necessarily costly, or whether capital is costly or not depends on how much banks benefit from holding more capital. He presents three different scenarios represented in figure 3.2 below based on the studies done by Admati and Hellwig (2013), where a capital increase could lead to A) Asset liquidation, B) Recapitalization and C) Asset expansion. In this illustration they use a simplification stating that all loans are risky, meaning that they need to be 100% covered by the banks' liabilities. As we discussed above this is not the reality, where not all loans are equally risky.

Figure 3.2 Alternative responses to increased capital requirement



(Cao, 2021, page 458)

From the first scenario A) they show the effect of an increase in capital requirement if capital is too costly for the bank. Here a new capital requirement is implemented increasing from 10% to 20%, because capital is too costly the bank will not issue new equity. As a result, the bank has to cut back 50 units of risky lending to meet the new capital requirement. In scenario B) they show the effect of more risky loans giving a sufficiently higher return. Here the same capital requirement is being implemented, but due to the high return on the risky loans, the bank is willing to keep the loans and invest in more costly capital instead. In the last scenario C) they expand the scenario in B), where the return on the risky loans is high enough making it even more attractive for the bank to invest even more in their capital stock leading to asset expansion. As a result, stricter capital requirement may restrict risky lending, but it is not guaranteed.

Another empirical study by Admati etc. (2013) are also arguing for that higher capital requirements do not bring a higher cost for the banks. They argue for that the return on equity (ROE) contains a risk premium which go down if the banks have more equity, and that it is incorrect to assume that the require on equity for the shareholders remains fixed if the capital requirements increase. They are also arguing for that better capitalized banks suffer fewer distortions in lending decisions and would perform better, and that capital regulation can be a powerful tool for enhancing the role of banks in the economy.

3.2. What happens in the banking sector due to a crisis

For further understanding how the CCyB is affecting the banks' lending activities under COVID-19, we need to understand what types of risk the banks are facing, especially under crisis. There are different types of risk that the banks need to handle which is affecting their volume of lending, these are credit risk, liquidity risk and systemic risk. The credit risk involves the risk for banks not getting repaid for their lending to non-financial institutions and private customers (Norges Bank, 2010). The risk connected to non-financial firms relies on the profitability to the firms, and the risk connected to private customers relies on the percentage of unemployment and housing prices. By banks holding a capital buffer they have more to go on if the credit risk increases, especially in times of turmoil.

We have further seen how the banks are funded, where liquidity service is one of the most important services that the banks provide (Cao, 2021, page 442). By providing this service, banks are exposing themselves to liquidity risk. The liquidity risk is connected to the difference in time between the banks' assets and liabilities, which brings a possible scenario where the banks cannot repay their debt (Norges Bank, 2010). Liquidity risk is a part of the banks daily business, where a primary reason is the maturity mismatch between the banks' assets and liabilities side. As Cao (2021, page 442) presents in his book, banks often issue risky, long-term loans with high yields and borrow from lenders by taking short debt. From this maturity transformation the banks create the necessary liquidity to the society, and at the same time provide liquidity insurance for the depositors. This results in a higher market liquidity risk for the banks - where they may not be able to convert assets to cash when needed without incurring a large discount on these assets, and a funding liquidity risk – where banks may not be able to raise funding by rolling over existing debt or taking on more debt. The liquidity risk was a fact during the financial crisis of 2007-2009, where banks struggled with financing their debt and paying a higher price for getting financed (Strahan, 2012), from the Basel III regulations the capital requirements changed to reduce this problem (Basel Committee, 2010).

The last type of risk, systemic risk, was especially one risk highlighted after the financial crisis in 2007-2009. This risk involves the risk connected between all financial institutions, and how dependent they are of each other (Freixas & Laeven, 2015). As we saw after the financial crisis back in 2007-2009, there has been a bigger focus on the macro-finance linkage, and how macro frictions are affecting the entire banking sector. We can separate between two different types of frictions: business-driven business cycles, in which macro shocks are intensified by the banking sector like COVID-19, and the credit-driven business cycle in which shocks are generated from inside the banking sector and spilled over to the real economy like the financial crisis in 2007-2009 (Cao, 2021, page 282).

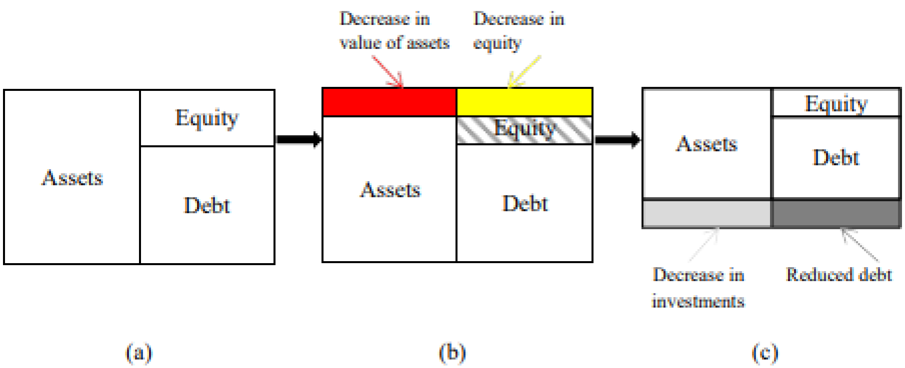
Further we can define the lender-side friction, also called the leverage cycle (Geanakoplos, 2010), that explain how macro shocks affects the banks' balance sheet. This theory by Geanakoplos is based on the assumption that banks are managing their balance sheet using VaR (Value-at-risk), and are subject to the VaR requirements. The VaR of a banks' lending portfolio is at a confidence level α, meaning that in the event of a realized loss L exceeds VaR happens only at a probability which is no higher than $(1-\alpha)$, meaning $Prob(L < VaR) \geq \alpha$. From being subject to the VaR requirements it means that banks should always be able to repay the depositors when the payoff from their assets is at their lowest. The leverage cycle shows then that in good economic times, the asset prices are too high, and in times of crisis the prices are too low (Geanakoplos, 2010, page 2). By a negative macro shock, the return on their securities decreases. For banks balance sheet the direct effect from the leverage cycle by a negative macro shock will be a lower equity on leverages, given that the debt (deposit) level remains the same. The bank has then not the incentive to take on more debt, and their balance sheet is tightened. After the outbreak of COVID-19 the economy fell into a recession, where a lockdown slows down the economic activity. This can lead to an increase in banks losses and reduce the bank's equity value (Cao, 2021, page 456).

3.3 Fiscal and monetary policy tools in crisis – the intuition with a procyclical capital requirement

Macroeconomic shocks can cause significant losses in the banking sector trough different channels as seen above, and can be challenging to handle. In these types of shocks/crisis monetary and fiscal policy tools contributes (and plays an important role) in stabilizing the economy. The most known and efficient monetary policy tool used by the Central Bank is the nominal interest rate. Central banks are using the monetary policy rate to achieve its targets, and for stabilizing the economy when in turmoil. When the interest rate is at zero (or close to), the conventional monetary policy tools become less effective. The use of unconventional monetary policy tools and fiscal tools become then more important and effective with an economy in turmoil. When big shocks hit, like COVID-19, the monetary policy tools are not enough. Norway hit the ZLB in March 2020, where the need for other tools were necessary. One tool used then was the fiscal tool of a reduction in the CCyB.

To illustrate how the CCyB is affecting the banks' balance sheet under an economic downturn we present the illustration from Cao (2021) in figure 3.3 below, showing how a procyclical capital requirement are holding the banks' lending activity under an economic downturn.

Figure 3.3 Balance sheet contraction in a bust



(Cao, 2021, page 445)

Here, the bank starts with the balance sheet in chart (a), then the real economy goes into a downturn and the bank suffers from a loss in their asset value explained with the leverage-cycle above (Geanakoplos, 2010). The reduction in their asset values further reduced their equity in the shaded area in (b). A lower equity value is binding the value-at-risk constraint and forces the bank to cut back on their lending until the capital requirement becomes binding again illustrated in (c). This further leads to a vicious circle in a bust. By a countercyclical capital buffer, this is no longer a problem. When banks suffer from an equity loss during an economic downturn, if the required capital holding decreases by a reduction in the CCyB to the shaded area in (b), the bank's capital requirement will be met so the bank is not cutting back on lending further avoiding a credit crash.

3.4 Empirical review

The countercyclical capital buffer is a relatively new concept, without much empirical evidence assessing its effectiveness. Arbatli-Saxegaard and Juelsrud (2020) wrote an article in November 2020 discussing how the reduction in the CCyB would affect the banks' lending. They state in their study by looking at the capital requirement changes from Basel I to Basel II, the new capital requirements led to a broad-based increase in lending for both household and corporate loans. The analysis was done by looking at the loan volumes and interest rates, where banks with a larger reduction in the capital requirements decreased their interest rate significantly while they at the same time increased the amount of loans. In their study they argue that banks with lower capital ratios responds stronger to capital reductions, as these banks are more likely to perceive the capital requirement as a binding requirement. By this argumentation they suggest that reductions in the capital requirement can be more effective if banks are (or are close to being) constrained. It is important to note that this study is based on the new permanent capital requirements from the Basel II and not a temporary reduction as the CCyB is. Their closing statement say that banks probably responded more strongly to these new requirements compared to a similar one from the CCyB, but the results still suggests that lowering the CCyB can be a tool for stabilizing macroeconomic outcomes during downturns in the economy.

Another interesting study to notice when looking at the effect of a cut in the CCyB, is the dynamic provisioning system implemented in the late 1990s in Spain. This system required Spanish banks to build up a capital buffer in good times from their retained profits, which they could use in economic downturns to cover losses. Jiménez et al. (2012) analyzes a series of policy experiments in Spain from good time periods (2000 and 2005), to economic downturns (2008 and 2009). The main results from this analysis is that a countercyclical capital buffer have positive effects on bank lending during economic downturns, both for more (and less) capital constrained banks. The banks build-up in good times helped banks to mitigate the credit crunch in bad times, and that bank procyclicality can be mitigated with countercyclical capital buffers. This also results in less need for costly governmental bailouts, and expansive monetary policy in crisis (Jimènez et al, 2012, page 46). Drehmann and Gambacorta (2012) are also using Spain in their studies, to simulate how the countercyclical capital buffer impact bank lending. Their results shows that the buffer can help to reduce credit growth during booms and attenuate the credit contraction once it is released.

4.0 Data and methodology

4.1 Data and limitations

The calculations done for looking at the effects on the lending market for Norwegian banks due to a cut in the CCyB, are based on a data source from Norges Bank. The dataset is received internal from Norges Bank containing banking statistics on all Norwegian banks financial reporting including the balance sheet variables, performance variables and losses variables. The data is represented with quarterly data for the time period 2018-2020. The banking variables are limited to some extent, where some data is not available for several banks, which has forced us to exclude some banks from this regression. In addition to these datasets, we add several features to the models to enhance the empirical relevance and strengthen our panel regression. The control variables are primarily collected by official numbers from SSB and Norges Bank.

The CCyB was cut for the first time in Norwegian history in March 2020, only giving us empirical evidence of a CCyB cut to a limited time period. When analyzing the effects of a monetary policy tool one usually need data samples for a longer time period, for looking at the real effect upon the economy. The CCyB is however a procyclical policy tool which is implemented to affect current business cycles, giving us the opportunity to see the effects the CCyB is giving to the real economy right away. The dataset starts from a time period where the economy was relatively stable, with no drastic changes in the economy. As a result, we have chosen to use data from January 2018 – December 2020

4.2 Methodology

When analyzing the effects of a change in the countercyclical capital buffer there are especially one main challenge. Namely that it will be hard to verify that banking outcomes are caused by monetary policy (CCyB) and not anything else, and further to separate between a monetary policy rate cut-and a CCyB cut. A monetary policy rate cut leads to a fall in loan rates for all loans, meaning that all types of loans may increase in similar ways. The changes in the CCyB also involves all banks, making it hard to identify how the different banks in would have behaved if the reduction did not take place. However, a reduction in the CCyB could have different effects on different types of loans compared to an interest rate cut, because the CCyB is risk-weighted (Cao, 2021, page 454). This is because banks will be able to lend more relative to their capital if the risk connected to the loan is lower. Mortgage loans have a lower risk weight than the corporate loans. Why? This is because firms have higher financial frictions than households. By this means that firms have a more limited liability to their loans than households, meaning that loan losses are more borne by the banks. A reduction in the CCyB can therefore make different types of loans react differently, or even in opposite ways. Can we distinguish this effect? If so, can we define a real effect of the reduction in the CCyB? We will do so by using the assumption that corporate loans are more risky than private loans running two different difference-in-difference analysis.

In our first analysis, we will discuss how banks can react differently to a CCyB cut due to the risk they have been willing to take before the cut occurred, by looking at their composition of private and corporate loans. After the first analysis, we will further discuss how banks can react differently to a cut in the CCyB due to the risk they are willing to take after the CCyB cut. This is based on the discussion from Arbatli-Saxegaard and Juelsruds' paper (2020), that more capital constrained banks will react differently to a CCyB cut than a less capital constrained bank. When analyzing all of the Norwegian banks we are only using data from non-IRB banks. This is because of big differences in how an IRB-bank and a bank following the standard model (non-IRB bank) are calculating their capital requirement due to credit risk, which could lead to misleading results. By only looking at non-IRB banks we will analyze a smaller share of the total lending in Norway, however the sample of non-IRB banks is much larger compared to the sample of IRB banks giving us a wider panel sample than otherwise.

The applied methodology includes the use of a difference-in-difference method with the purpose of highlighting the effect of the CCyB cut from different aspects. The results will further be discussed against the represented theory in practice and the empirical studies done by Arbatli-Saxegaard & Juelsrud (2020) and Jiménez et al. (2012). In the end, there will be a critical discussion about the regression, and how the effects of a reduction in the CCyB can be explained in reality. In this analysis we are investigating how a lower capital requirement affects bank lending, by comparing the time period before the CCyB was reduced with the time after. Will we see that banks adjust to a reduction in the capital requirement by increasing lending, and find a positive relationship between lending growth and a reduction in the capital requirement? We will try to show the estimated effect of getting a lower capital requirement from the CCyB on banks' lending growth in Norway.

5.Results

5.0 Findings

From the two followed analysis regarding the effect of a reduction in the CCyB, we present two sets of results. First, we find in our first analysis that based on banks earlier risk decisions, the banks with a higher share of risk before the CCyB cut (due to a higher share of corporate lending) reduced their risk after the cut by reducing the growth in corporate lending by -3.11% (Table 5.3(2)). Secondly, we find that based on banks future risk decision, the banks which were more capital constrained before the CCyB cut increased their risk after the cut by increasing the growth in corporate lending by 3.64% (Table 5.5 (2)).

5.1 Impact of CCyB cut on entire banking sector

Before starting at the analysis using the difference-in-difference method we first show the impact of a CCyB cut over the entire banking sector without being conditional on any bank heterogeneity. We do so by running the regression line below

$$Y_{it} = \beta_0 + \beta_1 post_{it} + \beta_3 x_{it1} + .. + \beta_k x_{itk} + u_{it} \qquad (1)$$

Y_{it} is the outcome of interest, the growth in net lending to all non-IRB banks. $post_{it}$ is the time dummy equals 1 if t is after the CCyB cut and 0 otherwise. The $\beta_3 x_{it1} + .. + \beta_k x_{itk}$ is a vector of other control variables represented in table 5.1, that controls for observable differences within and between the groups. u_{it} is the error term for unobserved characteristics affecting the lending outcome. Running the regression we get the results below represented in table 5.0. Here we see that the average non-IRB bank increased their total growth in lending by a significantly effect on 3.7% after the CCyB cut. This was driven by the growth in private lending, and not the corporate lending which decreased on average by -2.98% for all non-IRB banks after the CCyB cut. A problem by this result is that the interest rate and the CCyB was cut at the same time, both having effects on the lending market for the Norwegian banks. From this regression we cannot separate between the interest rate cut effect and the CCyB effect. Due to this, we will further run a difference-in-difference method represented in the next section.

Table 5.0 Results of CCyB cut on entire banking sector

	Growth in total lending (1)	Growth in corporate lending (2)	Growth in private lending (3)
$post_{it}$	3.707*** (0.007)	-2.989** (0.015)	3.560*** (0.009)

Bank FE	Yes	Yes	Yes
Macro controls	Yes	Yes	Yes
Bank controls	Yes	Yes	Yes

Notes: The table reports results from regression equation (1), with quarterly data for all Norwegian non-IRB banks. The results show the percentage change in bank lending after the CCyB cut, where the dummy variable $\text{post}_{\text{it}} = 1$ if the quarterly date is after the CCyB cut. In this case it means if the date is after 1st of April 2020. The control variables used are represented in table 5.1. There is also an explanation of the control variables in the appendix. Bank-Quarter standard errors are in parentheses.
*p<0.1, **p<0.05, ***p<0.01

5.2. DID regression 1 - Do banks react differently to a CCyB cut based on their past risk choices?

5.2.1 Intro to DID-regression

The 13th of March the interest rate and the CCyB was cut, both having effects on the lending market for the Norwegian banks. In this analysis, we will try to distinguish between these two effects, by having an assumption that corporate loans are more risky than private loans which makes us able to distinguish the CCyB cut from the interest rate cut. By this assumption we have defined banks to be either a *high-exposure bank* or a *low-exposure bank*. A high exposure bank will be the banks who are having a composition of corporate loans on over 26% of their total lending volume. This number were found by calculating the median for all banks composition on corporate loans, which were 26%. The median is calculated based on the banks' average composition of corporate loans in the time period before the CCyB cut, meaning the average composition of corporate loans between January 2018 until March 2020. By this separation between high- and low-exposed banks, we will look on the effect of a CCyB cut due to the risk they had taken before the cut occurred. We will use a DID method for this regression with the regression line below

$$Y_{it} = \beta_0 + \beta_1 post_{it} + \gamma * post_{it} * T_{it} + \beta_3 x_{it1} + .. + \beta_k x_{itk} + u_{it} \qquad (2)$$

Y_{it} is the outcome of interest, the growth in net lending to all non-IRB banks. $post_{it}$ is the time dummy which equals 1 if t is after the CCyB cut and 0 otherwise. This variable will control for unobserved changes affecting both groups. T_{it} is the treatment group dummy that equals 1 if bank i is defined as a high exposure bank, and 0 otherwise. This estimate controls for unobserved time constant differences between the two groups. $post_{it} * T_{it}$ is the time * treatment interaction, showing us the intended effect of a reduction in the CCyB on growth in lending for Y_{it}, where the DID estimate will be γ. The $\beta_3 x_{it1}+..+\beta_k x_{itk}$ is a vector of other control variables, that controls for observable differences within and between the groups and u_{it} is the error term. By using a DID regression we will reduce the omitted bias from potential differences in time trends between the banks. The sign of the DID estimator γ then shows us the effect in percentage of the coefficient we wanted to see the effect of, in this case the effect on high-exposed banks growth in lending due to a reduction in the CCyB. The DID is a tool used to estimate the CCyB effect by comparing the pre- and post- differences in the outcome of the lending market for both private and corporate loans separating between high- and low-exposed banks. By using the difference-in-difference method, we can distinguish between the effects of a monetary policy rate cut and the CCyB cut due to the assumption that corporate loans are more risky than private.

One problem that could arise running a DID regression, is that the treatment (CCyB cut) may be correlated with unobserved events that differently affected the treatment and control group. We therefore include necessary control variables to the regression, which reduces the problem. In this first DID regression we run with several control variables both individual banking variables and macro variables. The macro variables are the same for all banks for different time periods. For the total panel data we get a statistical overview below represented in table 5.1.

Table 5.1 Statistical data review of DID-regressions

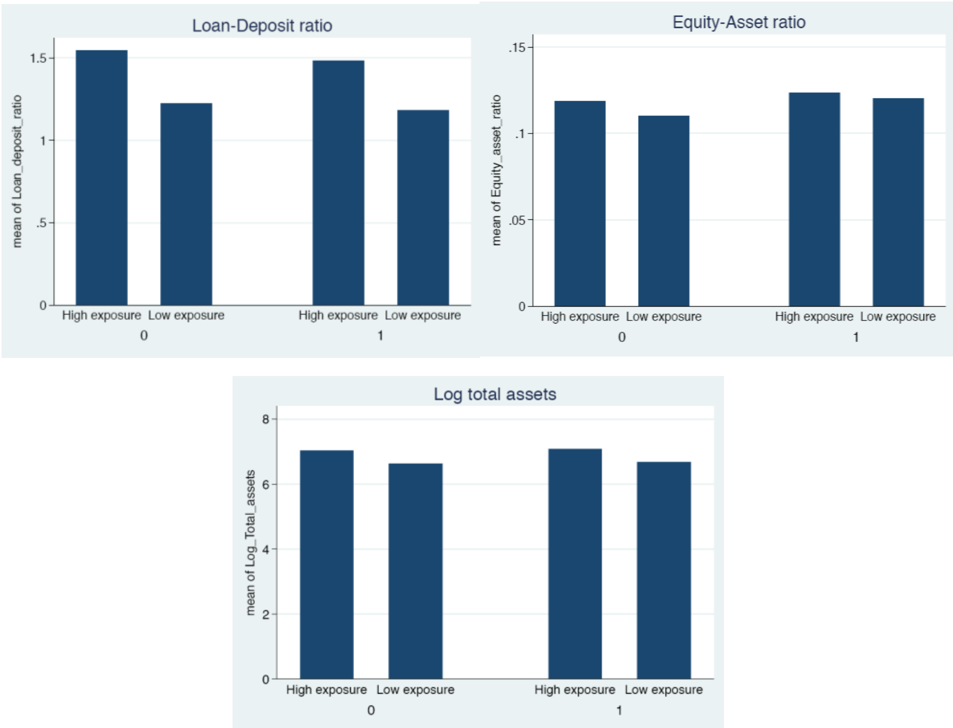
Variable	N	n	Mean	Std.Dev	Min	Max
(Growth total lending)	1259	105	-0,002	0,110	-0,45	1,25
(Growth corporate lending)	1259	105	0,00	0,174	-0,596	2,622
(Growth private lending)	1259	105	0,001	0,104	-0,584	1,069
Control variables						
log (Total assets)	1259	105	-0,058	0,095	5,535	8,643
Equity asset ratio	1259	105	0,051	1,068	0,092	9,716
Loan deposit ratio (LDR)	1259	105	-0,007	0,026	-0,007	0,555
GDP Growth (mainland)	1259	105	1,367	1,432	-1,940	2,870
DID-regression 1						
After_CCyB_cut (time dummy)	1259	105	0,249	0,432	0	1
CCyB_lending (DID-estimate)	1259	105	0,119	0,324	0	1
DID-regression 2						
After_CCyB_cut (time dummy)	1259	105	0,249	0,432	0	1
CCyB_lending (DID-estimate)	1259	105	0,087	0,249	0	1

Notes: Numbers shows the changes in the variables from the average sum pre and post corona
= (Average from January 2018 to March 2020) – (Average from April 2020-December 2020)
N and n are constant, and are just representing the observations. For further explanation about the control variables, see appendix.

The key assumption when running a DID regression is the zero conditional mean assumption: $E[u_{it}|post_{it} * T_{it}] = 0$, where the interaction between the post treatment period dummy and the treatment group dummy is uncorrelated with our error term. With this method we also have the common trend assumption, stating that in absence of intervention (a reduction in the CCyB) the high-exposed banks and low-exposed banks would have the same trend in Y (lending growth). If this assumption is violated, it means that the treatment and control group may have experienced different trends in the dependent variable (lending growth) prior to when the CCyB cut occurred. What we are observing then with the average treatment effect is not a causal effect of treatment (CCyB cut), but a time trend going on before we started analyzing the data. For this assumption to hold we can look at the problem by checking for pre-treatment trends in the banks' lending activity prior to the CCyB cut. Due to the short time-line within the dataset, it will be hard to distinguish any effects where we would need to look at a longer time. This is a clear weakness with the regression, and important to take into account.

The last assumption which needs to hold for running the DID regression is that the panel is based on a random sample selection, where the treatment and control group are only different in being a high- and low-exposed bank while all other things are equal. For confirming this we need to run a t-test on all bank variables. Is there a significant difference between the high- and low-exposed banks? If not, they only differ by the exposure of corporate and private lending and the assumption holds. By looking at the banks' characteristics represented by their total assets, equity-asset ratio and loan-deposit ratio (LDR) we see in figure 5.1 below there is differences between the high- and low-exposed banks.

Figure 5.1 DID 1 - Control for random sample selection



By running a t-test on these variables we see there is a significant difference between the groups for all control variables represented in table 5.2 below. This is violating the random sample selection assumption for running a DID-regression. The fact that the treatment- and control-group differ in various dimensions does not invalidate the results further below, because we are controlling for these dimensions in the following regression. It is although necessary to discuss how such fact may bias the results. A difference between the high- and low-exposed banks LDR could affect their results in lending growth, where a higher ratio means that the bank may not have enough liquidity to cover unforeseen funds and should decrease the amount of loans. Or if the ratio is low, the bank may not be earning as much as it could and should increase the amount of loans. From table 5.2 below, we see that the high-exposed banks have a 0.3% higher equity-ratio on average, meaning that there is a difference which could affect the results in the analysis. Further, a difference between the groups equity ratio could also affect the banks choice of lending. The ratio shows how the banks has raised capital for running their business. If they have a low equity ratio, they will be more capital constraint making it harder to expand lending due to the requirement of holding a given amount of equity on their loans. By looking at the difference between the groups we see that there is only a 0.07% change between the groups' equity-ratio on average, indicating that this will not be a big threat to our analysis. Last, the difference in a banks' total assets (taken in logs) will not directly affect the banks lending activity as much as the LDR and equity-ratio, because we are looking at the growth rate in lending, where we have excluded the different sizes between the banks.

Table 5.2 DID 1 - Results of control for random sample selection

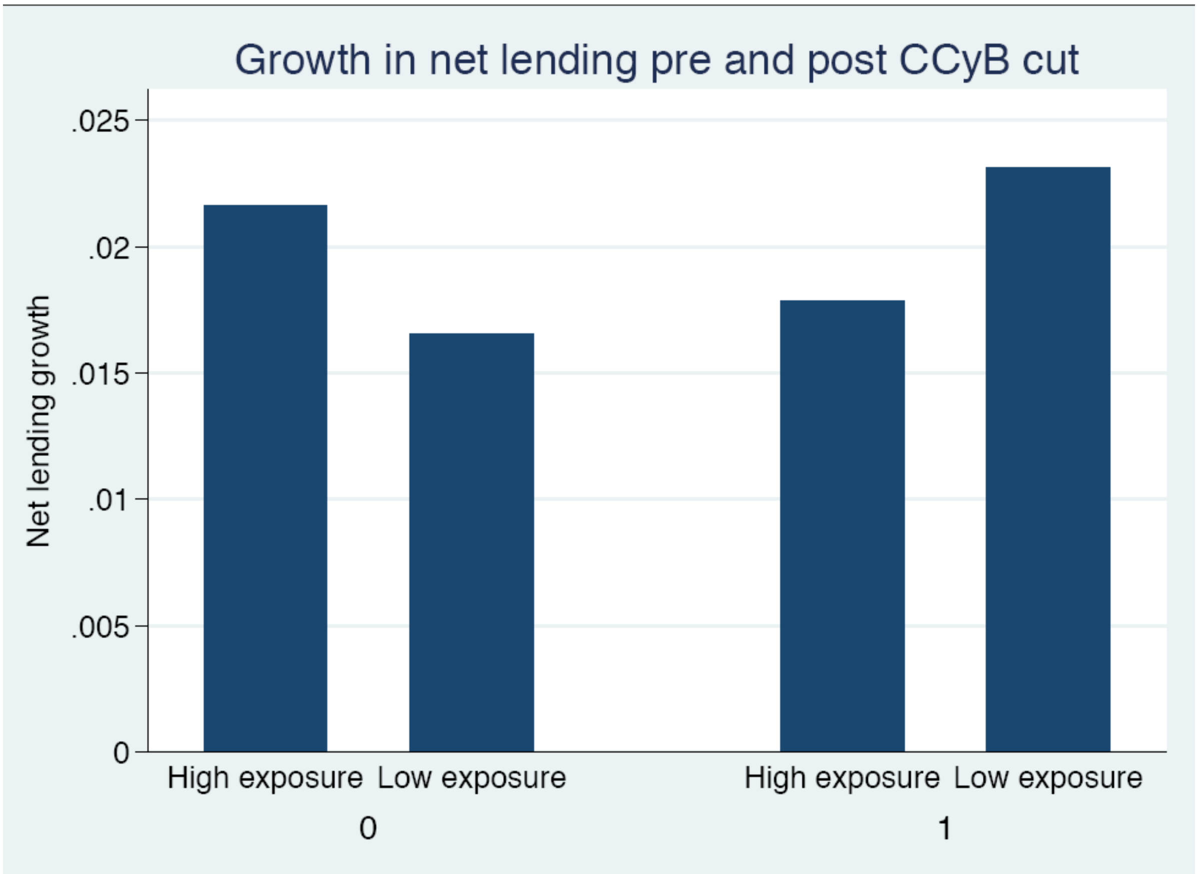
	LDR	Equity-ratio	Log [Total Assets]
Diff mean $[(T_{it} = 0) - (T_{it} = 1)]$	-.3173*** (.0601)	-.072*** (.0502)	-.4075*** (.0249)

Notes: The table reports results from running a t-test on the control variables used in regression (2) between the treatment and control group, with quarterly data for all Norwegian non-IRB banks. $T_{it} = 0$ represents low-exposed banks (control group), and $T_{it} = 1$ represents the high-exposed banks (treatment group). The high-exposed banks are banks with a share of corporate loans above the median for all non-IRB banks (26%). The results show the Difference in the control variables between the treatment and control group. The control variables used are represented in table 5.1. There is also an explanation of the control variables in the appendix. Bank-Quarter standard errors are in parentheses.
*p<0.1, **p<0.05, ***p<0.01

5.2.2 Total growth as dependent variable

We start the regression looking at the effect on total growth for high-exposed banks due, to the cut in the CCyB. From the data sample we see in figure 5.2 that before the CCyB cut the high-exposure banks had a higher total lending growth than the low-exposure banks. After the CCyB cut the tables turned, and the low-exposure banks increased their lending growth while the high-exposure banks reduced their growth.

Figure 5.2 Growth in lending for total loans



Looking at this statistically we get the results in table 5.3 (1) below, showing that due to the cut in the CCyB the high-exposed banks (banks with a higher share of corporate loans than the median), has reduced their growth in total lending by -0.87% but the effect is not statistically significant. Looking at the margin of total growth for all non-IRB banks the CCyB cut lead to a significant increase in total lending on 3.7%* for an average non-IRB bank. The growth in total lending due to the CCyB cut is therefore not driven by the high-exposed banks. By this finding we see that banks with a higher share of risk (due to a higher composition of corporate loans before the CCyB cut), are not willing to take on more risk by increasing their total composition of loans after the CCyB cut and the outbreak of COVID-19. The average non-IRB bank are increasing their growth in loans, and are willing to take on more risk after the CCyB cut.

* 3.7% at a significant level on 0.01. The output is represented in table A.1 (1) in appendix.

Table 5.3 DID 1 - Results of growth in lending after CCyB cut

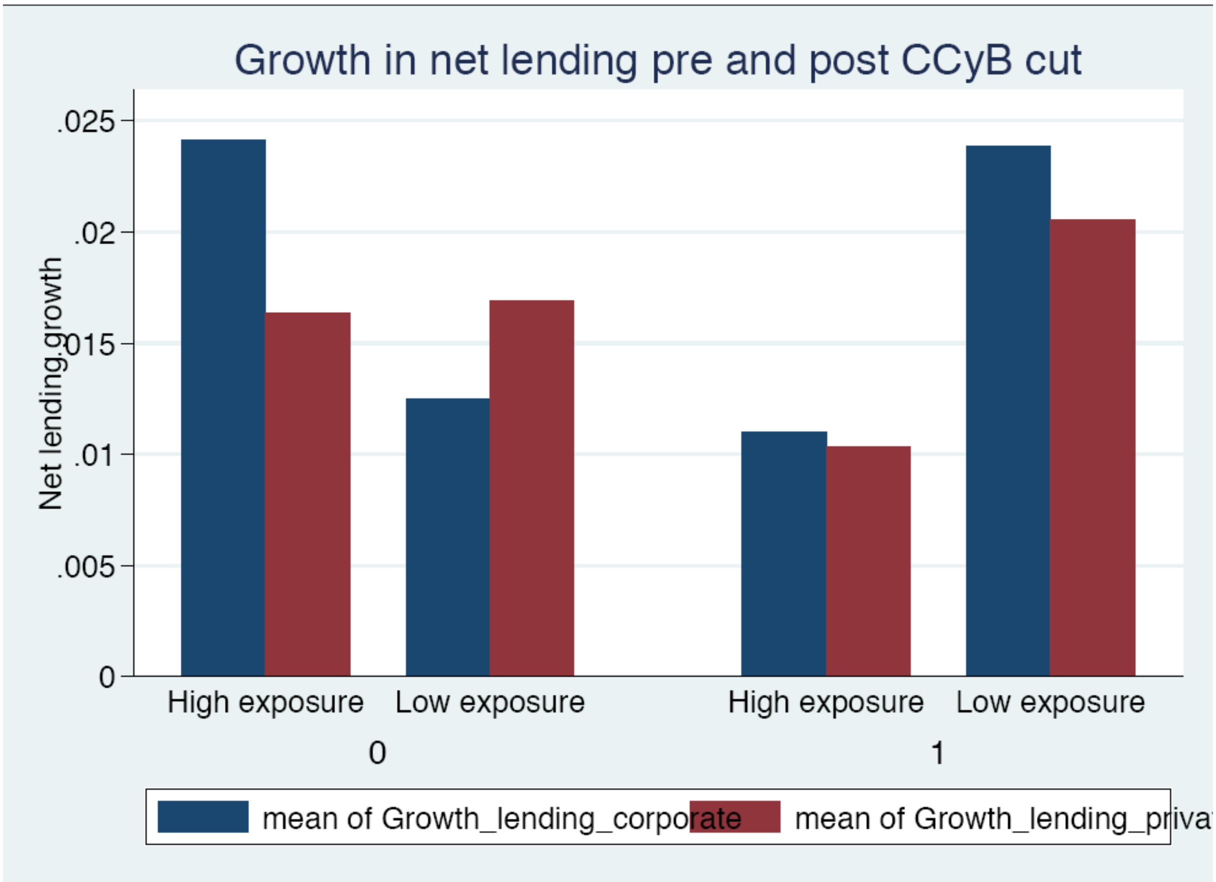
	Growth in total lending (1)	Growth in corporate lending (2)	Growth in private lending (3)
$post_{it} * T_{it}$	-0.869 (0.0074)	-3.111** (0.014)	-1.601* (0.01)
$post_{it}$	4.117*** (0.008)	-1.505 (0.165)	4.315*** (0.011)
N	1151	1141	1151
Bank FE	Yes	Yes	Yes
Macro controls	Yes	Yes	Yes
Bank controls	Yes	Yes	Yes

Notes: The table reports results from regression equation (2), with quarterly data for all Norwegian non-IRB banks. The dummy variable $T_{it} = 1$ represents high-exposed banks (treatment group) and are banks with a share of corporate loans above the median for all non-IRB banks (26%). The results show the percentage change in bank lending after the CCyB cut, where $post_{it} = 1$ if the quarterly date is after the CCyB cut. In this case it means if the date is after 1st of April 2020. The control variables used are represented in table 5.1. There is also an explanation of the control variables in the appendix. Bank-Quarter standard errors are in parentheses.
*p<0.1, **p<0.05, ***p<0.01

5.2.3 Corporate and private growth as dependent variables

Since we could not prove statistically that banks with a higher share of corporate loans (high-exposed banks) would react differently to a cut in the CCyB looking at the growth in total loans, another strategy is to look on the growth of corporate- and private- loans separately. Here one possibility is that although high-exposure banks do not change total lending shown from the regression above, the CCyB cut may affect high-exposed banks to tilt towards riskier corporate lending or safer private lending. Followed we use the growth rates of mortgage lending and corporate lending for banks as the dependent variables in separate regressions, with otherwise the same regression line (2). Looking at the growth of corporate loans and private loans pre and post the CCyB cut in figure 5.3, we see that high-exposure banks have reduced their growth in both corporate and private loans, while the low-exposure banks has increased the growth in both corporate and private loans.

Figure 5.3 Growth in lending for private and corporate loans



Further looking at this statistically we get the results for corporate lending in table 5.3 (2) showing that due to the cut in the CCyB the high-exposed banks (banks with a higher risk before the CCyB was cut) has reduced their growth in corporate lending by -3.11%. The effect is statistically significant. By further looking at the marginal effect on all non-IRB banks we see that the CCyB cut lead to a significant decrease of $-3.0\%^{*}$ on growth in corporate lending for an average non-IRB bank. Compared to the results of total growth we saw that banks with a lower risk share before the CCyB cut increased their total lending, but not by expanding their growth in corporate lending. This indicates that the average non-IRB banks are not willing to take on too much risk after the CCyB cut. The decrease in corporate lending is further driven by the high-exposed banks, which had a higher share of risk in their composition of loans before the cut. After the CCyB cut the high-exposed banks decreased their exposure to risk by decreasing their growth in corporate lending.

As the last part of the first analysis looking at the growth in private lending for high-exposed banks, we get the results in table 5.3 (3) above showing us that due to the cut in the CCyB the high-exposed banks also reduced their growth in private lending by -1.6%. The results are not statistically significant for the high-exposed banks. Looking at the average non-IRB bank we see that the CCyB lead to a significant increase on 3.6%** on growth in private lending, stating that the effect of an increase in private lending is not driven by the high-exposed banks. By the last finding we see that the average non-IRB bank has increased their growth in lending by choosing the high-quality borrowers (private lending) and not the more risky corporate loans. For the high-exposed banks which were more risky before the CCyB cut, do not want to take on any more risk after the outbreak of COVID-19 by neither increase corporate or private lending.

* −3.0% at a significant level on 0.05. The output is represented in table A.1 (2) in appendix.

** 3.6% at a significant level on 0.01. The output is represented in table A.1 (3) in appendix.

5.3. DID regression 2 – do banks react different to a CCyB cut based on future risk taking?

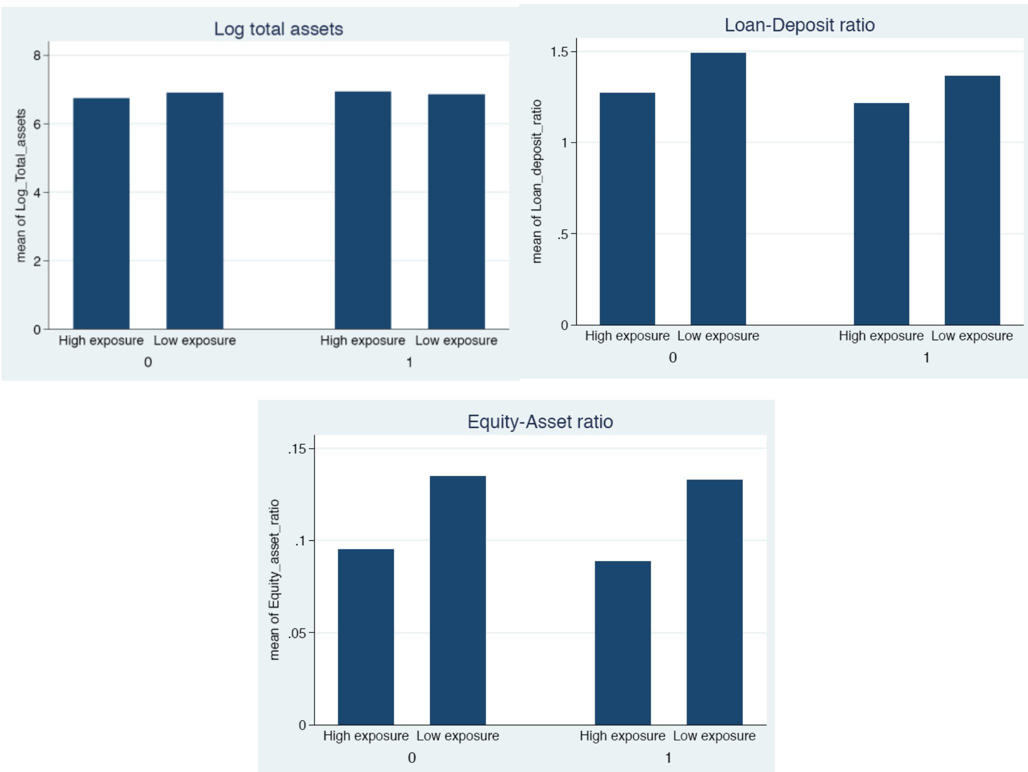
5.3.1 Intro to regression

Another identification strategy looking at the CCyB cut, is to explore to what extent a bank is capital constrained. Meaning that when a bank's capital level is low and close to the regulatory constraint, the bank will be very cautious about capital costs when it issues new loans, as represented in Arbatli-Saxegaard and Juelsrud article (2020). With a cut in the CCyB, the bank will suddenly be off-constraint and be able to lend more freely. The change in the banks' behavior is by bigger change due to the CCyB cut, compared with other banks that were previously not capital constrained. Banks that had a higher capital ratio than the regulatory requirement before the CCyB cut, will not change much of its lending behavior due to a reduction in the CCyB cut. This is because the capital constraint was never a concern compared to many of the smaller banks being more capital constrained. Compared to our earlier regression we studied the effect of a CCyB cut due to the risk they had taken before the CCyB cut. For this regression we are discussing how much risk the banks will take after the CCyB cut.

We will explore this by again separating between a high-exposed bank, as a bank with low pre-COVID capital ratio, and vice versa for a low-exposure bank. A bank with low pre-COVID capital ratio will be defined as a bank with a lower capital ratio than the median of all non-IRB banks. The calculation of the capital ratio defined from Norges bank and Finanstilsynet (2020) is calculated by dividing the banks' capital by its risk-weighted assets. The capital ratio used in this regression collected from Norges Bank's database, consists of total equity divided by total assets, and are not risk-weighted. We will define a high-exposed bank as a bank with a low pre-COVID non-weighted capital ratio on below 12%. It is important to notice that this capital ratio is not risk-weighted, and can therefore not be compared to the real regulatory capital requirements. As we did in the last analysis, we will use a difference-in-difference method here as well using the same regression line (2). The only difference in this DID regression compared to our earlier is the control and treatment group (high- and low-exposed banks) represented in table 5.1.

Because of the new control and treatment group, we need to test again the assumption that the panel is based on a random sample selection again. Including that the treatment and control group are only different in being a high- and low-exposed bank, while all other things are equal. Looking at the distribution for the total assets, loan-deposit ratio (LDR) and the equity-asset ratio between high- and low-exposed banks we the differences in figure 5.4 below.

Figure 5.4 DID 2 - Control for random sample selection



By running a t-test on these control variables we see from table 5.5 a significant difference between all of the control variables. As discussed from our earlier discussion regarding the first analysis the difference between the groups LDR could give us a biased result, where the low-exposed banks have a 0.18% higher ratio than the high-exposed banks. A difference between the high- and low-exposed banks LDR could affect their results in lending growth, where a higher ratio means that the bank may not have enough liquidity to cover unforeseen funds and should decrease the amount of loans. Or if the ratio is low, the bank may not be earning as much as it could and should increase the amount of loans. From table 5.4 below we see that there is a significant difference between the groups' equity-ratio, which is obvious because this has defined them as a high- or low-exposed bank. When looking at the difference in banks total assets this will not directly affect the banks' lending activity as much as the LDR because we are looking at the growth rate in lending, where we have excluded the different sizes between the banks.

Table 5.4 DID 2 - Results of control for random sample selection

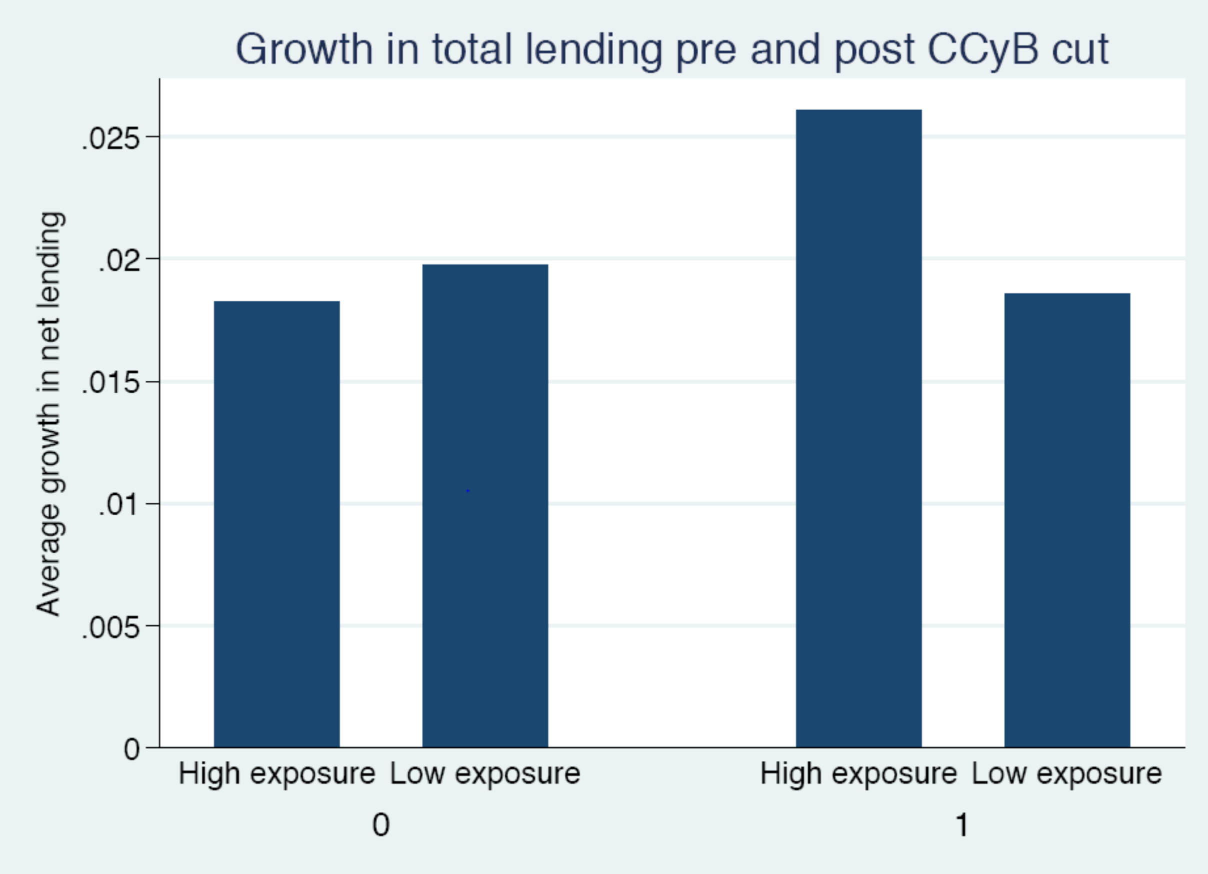
	LDR	Equity ratio	Log[Total Assets]
Diff mean	.1850***	.0396***	.1142***
$[(T_{it} = 0) - (T_{it} = 1)]$	(.0606)	(.0017)	(.0273)

Notes: The table reports results from running a t-test on the control variables used in regression (2) between the treatment and control group, with quarterly data for all Norwegian non-IRB banks. $T_{it} = 0$ represents low-exposed banks (control group), and $T_{it} = 1$ represents the high-exposed banks (treatment group). The high-exposed banks are banks with an equity-asset ratio below the median for all non-IRB banks (12%). The results show the Difference in the control variables between the treatment and control group. The control variables used are represented in table 5.1. There is also an explanation of the control variables in the appendix. Bank-Quarter standard errors are in parentheses.
*p<0.1, **p<0.05, ***p<0.01

5.3.2 Total growth as dependent variable

We start the analysis by looking at the total growth in lending for all non-IRB banks as the dependent variable in the regression equation (1). From the data sample we see in figure 5.5 that the high-exposed banks (banks with a lower capital ratio than the median) has increased their growth in lending after the CCyB cut. We will further look at the statistical data to see if these results can be proven to be significant.

Figure 5.5 Growth in total lending for all non-IRB banks



From the results in table 5.5 (1) below we see that due to the CCyB cut the high-exposed banks have increased their lending by 2.72%, where the effect is statistically significant. Further looking at the marginal effect on all non-IRB banks, we see that a reduction in the CCyB lead to a significant increase on 4.35%* of total lending for an average non-IRB bank. By these results the growth in total lending is driven by the high-exposed banks (more capital constrained banks). Compared to our first regression where banks with a higher share of corporate loans (high-exposed banks) reduced their growth in total lending, the more capital constrained banks (high-exposed banks) increases their growth in total lending due to the CCyB cut. A CCyB cut will increase more capital constrained banks risk appetite, allowing banks to take on more risk by increasing growth in loans.

* 4.35% at a significant level on 0.01. The output is represented in table A.3 (1) in appendix.

Table 5.5 DID 2 - Results of growth in lending after CCyB cut

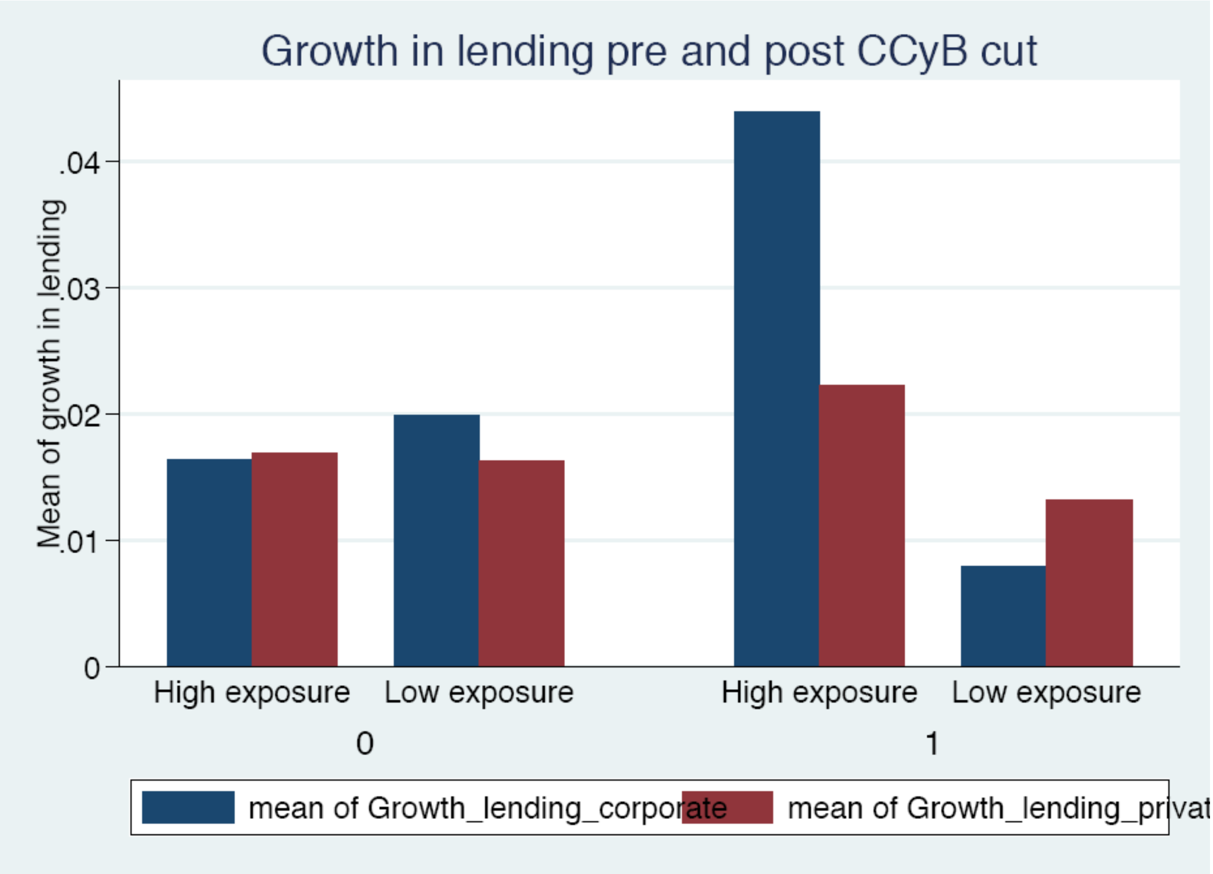
	Growth in total lending (1)	Growth in corporate lending (2)	Growth in private lending (3)
$post_{it} * T_{it}$	2.720*** (0.008)	3.647** (0.016)	1.904* (0.010)
$post_{it}$	3.142*** (0.007)	-3.700** (0.153)	3.164** (0.009)
N	1151	1141	1151
Bank FE	Yes	Yes	Yes
Macro controls	Yes	Yes	Yes
Banking controls	Yes	Yes	Yes

Notes: The table reports results from regression equation (2), with quarterly data for all Norwegian non-IRB banks. T_{it} represents high-exposed banks (treatment group) and are banks with an equity-asset ratio below the median for all non-IRB banks (12%). The results show the percentage change in bank lending after the CCyB cut, where $post_{it} = 1$ if the quarterly date is after the CCyB cut. In this case it means if the date is after 1st of April 2020. The control variables used are represented in table 5.1. There is also an explanation of the control variables in the appendix. Bank-Quarter standard errors are in parentheses.
*p<0.1, **p<0.05, ***p<0.01

5.3.3 Corporate and private growth as dependent variables

Further, we want to see the if the banks' lending to corporate- and private loans have different effects after the CCyB cut. We use the growth rates of mortgage lending and corporate lending for banks as the dependent variables, in separate regressions using the same regression line (2). Looking at the growth of corporate loans and private loans pre and post the CCyB cut in figure 5.5, we see that high-exposure banks have increased the growth in both corporate and private loans. The low-exposure banks have on the other hand decreased the growth in both corporate and private loans.

Figure 5.6 Growth in private and corporate lending for all non-IRB banks



Looking at the statistically effect on growth in corporate lending, we get the results in table 5.5 (2). The high-exposed banks increased their growth in corporate lending due to the CCyB cut by a significantly effect on 3.65%. By looking at the marginal effects on corporate lending for an average non-IRB, the corporate lending decreased by $-2.07\%^{*}$ for an average non-IRB bank, but the effect is not significant. From this, we can state that the marginal effect of a decrease in corporate lending is not driven by the more capital constrained banks (high-exposure banks). The high-exposed banks do not mind take on more risk, compared with the average non-IRB bank. The reason for why the marginal effect is not significant is due to the different reactions between high- and low-exposed banks.

Further looking at growth in private loans, we get the results represented in table 5.5 (3) above. Here we see that the CCyB cut lead to a 1.9% increase in private lending for high-exposed banks, but the effect is not statistically significant. By further looking at the margin of an average non-IRB bank, the CCyB cut lead to a $4.0\%^{**}$ significantly increase, stating that the marginal effect of an increase in private lending growth is not driven by the high-exposed banks.

Both high- and low-exposed banks increased their growth in private lending after the CCyB cut, where we can argue for that all banks likes private customers with less risk.

$*$ -2.07% not statistically significant at a significant level on 0.05. The output is represented in table A.3 (2) in appendix.
$**$ 4.0% at a significant level on 0.01. The output is represented in table A.3 (3) in appendix.

6. Discussion - The real effects of a cut in the CCyB due to the outbreak of covid-19

6.1 DID 1 - Do banks react different to a CCyB cut based on their earlier risk decisions?

From the first analysis discussing that banks react different to a CCyB cut based on their earlier risk decisions, by the assumption that corporate loans are more risky than private loans. We see that a CCyB cut will affect banks with a higher risk share, in another way than the banks with a lower risk share. Further, we also see that the effect of a CCyB cut is different for more risk weighted corporate loans than the safer private loans.

We proved this statistically where we found that the total growth in loans increased after the CCyB cut for an average non-IRB bank by 3.7% (table A.1(1)), this increase was driven by the growth in private lending for an average non-IRB bank, and not from the high-exposed banks which reduced their growth in private lending (table 5.3(3)). The high-exposed banks reduced both their corporate and private lending by respectively -3.11% (table 5.3(2)), and -1.60% (table 5.3(3)). They were also the driver for reducing the growth in corporate lending.

As a final conclusion from our first analysis, we see that banks with a higher share of risky loans before the CCyB cut reduced their growth in both corporate and private lending. This indicates that a bank with a higher risk share before the CCyB cut, was not willing to increase their exposure to any more risk after the CCyB cut and the outbreak of COVID-19. A bank with a lower share of risky loans before the CCyB cut on the other hand, was willing to increase their exposure to risk by increasing growth in loans, but only by the safer private lending.

These results can further be connected to Geanakoplos (2010) leverage cycle, where we can explain the findings by when the negative macro shock occurred (outbreak of COVID-19) the direct effect on the high-exposure banks' balance sheet was a lower equity level (assuming that deposits level remains the same as before). We run a regression on the change in their equity ratio using the same regression line (2), but the dependent variable Y_{it} is now the change in the equity-ratio. From table 6.1 below we see that the high-exposed banks reduced their equity ratio significantly after the CCyB cut by -0.49%, while an average non-IRB increased their equity ratio significantly by a marginal effect on 1.52%*. A lower equity value is binding the value-at-risk constraint and forces the bank to cut back on their lending (Geanakoplos, 2010). The reduction in the CCyB will from figure 3.3 (page 19) reduce this problem, such that banks are not cutting back on their lending. By the results on banks' lending growth, we can argue for that banks with a higher share of risk before the CCyB cut experienced a bigger effect of the leverage cycle reducing their equity value. This forced them further to cut more back on lending. We only got a significant effect of the high-exposure banks' cut in corporate lending, indicating that when the banks needed to cut back on their lending, they reduced the corporate lending that requires a higher share of equity due to risk (Cao, 2021 page 457).

$*$ 1.52% at a significant level on 0.01. The output is represented in table A.3 (1) in appendix.

Table 6.1 Results of changes in equity-asset ratio after CCyB cut

	Change in equity-asset ratio (1)
$post_{it} * T_{it}$	-0.491*** (0.002)
$post_{it}$	1.758*** (0.002)
N	1151
Bank FE	Yes
Macro controls	Yes
Bank controls	Yes

Notes: The table reports results from regression equation (2) but now looking at the change in the equity-ratio as the dependent variable, with quarterly data for all Norwegian non-IRB banks. The dummy variable $T_{it} = 1$ represents high-exposed banks (treatment group), and are banks with a share of corporate loans above the median for all non-IRB banks (26%). The results show the percentage change in banks equity-asset ratio after the CCyB cut, where $post_{it} = 1$ if the quarterly date is after the CCyB cut. In this case it means if the date is after 1st of April

2020. The control variables used are represented in table 5.1. There is also an explanation of the control variables in the appendix. Bank-Quarter standard errors are in parentheses.
*p<0.1, **p<0.05, ***p<0.01

The overall effect of an average non-IRB bank (not only looking at the high-exposure banks) to a CCyB cut on the other hand has different results, where we see that the average non-IRB bank increased their growth in total lending (table A.1 (1)). The growth in total lending was further driven by higher private lending (table A.1(3)), and not by corporate lending which was reduced (table A.1(3)). From the discussion of Cao (2021) how it is often believed that increasing capital requirements are reducing the banks' risk-taking. By this assumption, decreasing capital requirements by the CCyB cut should increase the banks' risk-taking. From the results above, we see that this assumption does not hold for a CCyB cut, where both the high-exposure banks and the average non-IRB bank decreased their growth in more risky corporate loans.

From Admati and Hellwig (2013) studies regarding different scenarios of a capital requirement change, we see that the effect of a CCyB cut for banks with a higher risk of share (high-exposed banks) decreased their growth in lending leading to the scenario of an asset liquidation. This can be explained that when the outbreak of COVID-19 occurred (a negative macro shock), the banks equity value decreased explained by the leverage cycle. The effect of a CCyB cut reduced this problem, but the leverage cycle effect was bigger such that the high-exposed banks still cut back on their lending for both private and corporate loans. By these results, we can discuss that the banks which were more risky before the CCyB cut (by the assumption that corporate loans are more risky than private), looked on capital as too costly for issue even more equity. For an average non-IRB banks' lending on the other hand, they reacted to the scenario of an asset expansion increasing their growth in private lending, after the change in the CCyB. By these results, we can discuss that the banks which were less risky before the CCyB cut (by the assumption that corporate loans are more risky than private), looked on capital as not to costly.

6.2 DID 2 - Do banks react differently to a CCyB cut based on their future risk taking?

From this second regression discussing that banks would react differently to a CCyB cut based on their future risk decision, by the assumption that corporate loans are more risky than private loans**.** We see that a CCyB cut will affect more capital constrained banks in another way than the less capital constrained ones based on several findings. Further, we also see that the effect of a CCyB cut is different for more risk weighted corporate loans than safter private loans.

First by looking at the total growth in lending after the CCyB cut, we found a significant increase on total lending for an average non-IRB bank on 4.35% (table A.3(1)), where the effect of growth in total lending were driven by the more capital constrained banks increasing their total growth by 2.72%. (table 5.5 (1)). By further separating between corporate and private lending, our second finding showed us that the CCyB cut lead more capital constrained banks to increase their risk by increasing corporate lending by 3.64% (table 5.5 (2)). The average non-IRB bank decreased their growth in corporate lending but not with significant results (table A.3 (2)). From the results in private lending, we found that both the high-exposed banks and the average non-IRB bank increased their growth (table A.3(3)), but the effect was not driven by the high-exposed banks (table 5.5(3)). As a final conclusion from this second analysis we see that the banks' which were more capital constrained before the CCyB cut, were willing to take on a higher future risk by increasing their growth in corporate loans, compared to the less capital constrained banks who reduced their growth in corporate lending.

These results can further also be connected to Geanakoplos (2010) leverage cycle, where we can explain the findings by when the negative macro shock occurred (outbreak of COVID-19) the direct effect on the high-exposure banks' balance sheet was a lower equity level (assuming that deposits level remains the same as before). As we see from table 6.2 below, the high-exposed banks reduced their equity ratio significantly by -0.57%, compared to an average non-IRB bank which increased their equity-ratio by 1.17%*. A lower equity value is binding the value-at-risk constraint, and forces the bank to cut back on their lending. Further, from the mechanism behind the CCyB in figure 3.3 (page 19). the reduces this problem such that banks are not cutting back on their lending. By the results on banks' lending growth we can argue for that banks which were more capital constrained before the CCyB cut were experiencing a bigger effect of the leverage cycle, reducing their equity value. But a cut in the CCyB, gave a bigger effect on more capital constrained banks compared to less capital constrained banks reflecting the results of their lending growth. The more capital constrained banks increased their growth significantly in corporate lending (table 5.5(2)), being willing to take on higher risk after the CCyB cut. While the less capital constrained banks only increased their growth in private lending (table A.3(2,3)).

Table 6.2 Results of changes in equity-asset ratio after CCyB cut

	Change in equity-asset ratio (1)
$post_{it} * T_{it}$	-0.568*** (0.001)
$post_{it}$	1.423*** (0.002)
N	1151
Bank FE	Yes
Macro controls	Yes
Bank controls	Yes

Notes: The table reports results from regression equation (2) but now looking at the change in the equity-ratio as the dependent variable, with quarterly data for all Norwegian non-IRB banks. The dummy variable $T_{it} = 1$ represents high-exposed banks (treatment group), and are banks with an equity-ratio below the median for all non-IRB banks before the CCyB cut occured (12%). The results show the percentage change in banks equity-asset ratio after the CCyB cut, where $post_{it} = 1$ if the quarterly date is after the CCyB cut. In this case it means if the date is after 1st of April 2020. The control variables used are represented in table 5.1. There is also an explanation of the control variables in the appendix. Bank-Quarter standard errors are in parentheses.
*p<0.1, **p<0.05, ***p<0.01

$*$ 1.17% at a significant level on 0.01. The output is represented in table A.4 (1) in appendix.

From the discussion of Cao (2021) how it is often believed that increasing capital requirements are reducing the banks' risk-taking. By this assumption, decreasing capital requirements by the CCyB cut should increase the banks' risk-taking. This is the case for the bank which were more capital constrained before the CCyB cut. When the CCyB cut arrived, the more capital constrained banks (high-exposed banks) saw their opportunity by a slack in the capital requirement, to increase their exposure to risk by increasing the growth in corporate lending (table 5.5(2)). For the average non-IRB bank on the other hand, they reduced their exposure to risk by decreasing growth in lending (table A.3(2)). By these results we see that decreasing capital requirements does not necessarily increase the banks' risk-taking, by the assumption that corporate loans are more risky than private loans.

From Admati and Hellwig (2013) studies regarding different scenarios of a capital requirement change, the high-exposed banks increased their growth in both private and corporate lending (table 5.5(2,3)), leading to the scenario of an asset expansion. Here the return on the more risky corporate loans are high enough, making it even more attractive for the bank to invest further. By these results, we can discuss that the banks which were more capital constrained before the CCyB cut, did not look on capital as too costly for issue even more equity by expanding lending. For an average non-IRB banks' lending, they also increased their growth in total lending but only by expanding their growth in corporate loans (table A.3(3)). By these results, we can also state that the banks which were less capital constrained before the CCyB cut, did not look on capital as too costly for issue even more equity by expanding lending.

6.3 Combining the results from DID 1 and DID 2

From the first DID-analysis we saw that banks with a higher risk share before the CCyB cut reacted differently than an average non-IRB bank, after the CCyB was cut. The banks with a higher risk share cut back on all lending, while the less risky banks increased private lending and only cut back on their corporate lending. This indicates that banks with a different risk share from before the CCyB cut would react differently after the cut was made. The banks with a higher share of risk before the cut would reduce their future risk by reducing all lending, while the banks with a lower share of risk will increase their exposure to risk, but only by the increasing private lending.

From the second DID-analysis, we further found that banks which were more capital constrained before the CCyB cut reacted differently than an average non-IRB bank after the CCyB cut. Here, the banks which were more capital constrained increased the growth in both private and corporate lending, while the banks which were less capital constrained only increased their growth in private lending and cut back on their corporate lending. This indicated that banks who are more bound by the capital requirements, will have a bigger effect of a CCyB cut and expose themselves to a higher risk share after the cut is made.

From the theory of Geanakoplos (2010) and the leverage cycle, we can explain this effect by banks with a higher share of risk before the CCyB cut, experienced a bigger effect of the leverage cycle than the CCyB cut. This made them reduce their corporate lending, since it requires a higher share of equity due to risk. For banks that were more capital constrained before the CCyB cut, the effect of the CCyB cut was higher than the effect of the leverage cycle increasing their corporate lending, being willing to take on higher risk after the CCyB cut. Further from the theory of Cao (2021), we can discuss that by looking at the banks' exposure to risk before the CCyB cut. Here, the banks are not willing to increase their exposure to more risky corporate loans after the CCyB cut. The banks which were more capital constrained would on the other hand increase their exposure to risk by increasing growth in corporate lending, after the CCyB cut was made. From Admati and Hellwig (2013) studies regarding that there is different scenarios of a capital requirement change due to the view on capital as too costly or not, we see that based on banks earlier risk-taking (from analysis 1) that more banks which were more exposed to risk before the cut, would look on capital as too costly for issuing even more. While the banks which were more capital constrained before the cut would expose themselves to higher risk after the cut, not looking on capital as too costly for issuing more loans.

Compared to the earlier findings based on the articles of Arbatli-Saxegaard and Jueslrud (2020), stating that a reduction in the CCyB will increase more capital constrained banks' lending for both private and corporate loans. We see that we get the same results, stating that both corporate and private lending significantly increased for more capital constrained banks (table 5.5 (1,2,3)), but only by a significance level of 0.1 for private lending. From Jiménez et al. (2012) stating that a reduction in the CCyB will increase lending for both more and less capital constrained banks' lending, we find that both groups increased their growth in private lending. Further we could only confirm a significant increase in corporate lending for capital constrained banks.

7. Conclusion

Based on our findings, the risk-perspective is an interesting angle to look on the effect of a CCyB cut because the capital requirement is risk-based. By comparing the results from the two different analysis we see that banks will react differently to a CCyB cut, based on their risk decisions both before and after the cut. From our first analysis based on banks risk decisions before the CCyB was cut, we see that a bank that has chosen to expose themselves for a higher risk share before a cut in the CCyB is made, will reduce their exposure to risk by cutting back on lending by -3.11%. From our second analysis based on banks risk decisions after the CCyB was cut, we see that a bank that has been more capital constrained before a CCyB cut, will expose themselves to a higher share of risk after the CCyB cut is made by expanding lending by 3.65%.

Further we discussed the theory of Geanakoplos (2010) leverage cycle towards both of these results. Here we first argued that banks with a higher share of risk before the CCyB cut, experienced a bigger effect of the leverage cycle reducing their equity value. This forced them to further cut back more on lending, indicating that when the banks needed to cut back on their lending, they reduced the corporate lending that requires a higher share of equity due to risk. From our second analysis we argued that banks which were more capital constrained before the CCyB cut were experiencing a bigger effect of the leverage cycle, reducing their equity value. The cut in the CCyB gave further a bigger effect on more capital constrained bank than the effect of the leverage cycle. The more capital constrained banks therefore increased their growth significantly in corporate lending, being willing to take on higher risk after the CCyB cut.

From the discussion of Cao (2021) where he discusses that increasing capital requirements not necessarily reduce the banks' risk taking, we argued the other way around that decreasing capital requirements not necessarily increases the banks' risk taking. Here we found that this assumption does not hold for a bank with a higher risk before the CCyB cut, which reduced their risk by decreasing their growth in corporate lending. Looking at the second analysis, we concluded that the banks which were more capital constrained before the CCyB cut saw their opportunity by a slack in the capital requirement, to increase their exposure to risk by increasing the growth in corporate lending. From this we can therefore confirm that decreasing a capital requirement not necessarily reduces the banks' risk taking.

In the end studying different scenarios of a capital requirement from Admati and Hellwig (2013) discussion due to the view on cost of equity. We discussed that banks which were more risky before the CCyB cut, looked on capital as too costly for issue even more equity resulting in an asset liquidation. For more capital constrained banks, we discussed that the return on the more risky corporate loans were high enough. Meaning that capital was not too costly for issuing more equity, resulting in an asset expansion. This also confirms their discussion that in reality, capital is not necessarily costly and that a change in the capital requirement will give different effects on banks.

For our main question through this thesis: “Has a reduction in the countercyclical capital buffer affected the Norwegian banks’ willingness to lend?”, we state as our final conclusion that the effect of a reduction in the countercyclical capital buffer will affect banks different based on their risk choices. From our analysis we see that a bank which has exposed themselves to a higher risk before the CCyB cut will decrease their growth corporate lending. While a bank which were more capital constrained before the CCyB cut will increase their growth in corporate lending.

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Appendix

Variables in regression

VARIABLE	EXPLANATION
After_CCyB	The time dummy variable = 1 if the date is after the CCyB cut (April 2020, since the data were represented in quarters), and 0 otherwise.
Bank_ID	Each bank has gotten its own number ID to be able to distinguish between the banks, since STATA is not able to read text variables when using the xtreg model.
high_exposure	The treatment dummy variable = 1 if the banks are a high-exposure bank and 0 otherwise.
CCyB_lending	The time * treatment interaction (DID estimate), showing us the intended effect of a reduction in the CCyB for high-exposed banks
Growth_lending_total/private/corporate	The percentage growth from last period to another, making all banks comparable, using formula: $Growth\ lending = \frac{Present\ value - Past\ value}{Past\ value}$
Log_total_assets	The log of the banks total assets for each quarter controlling for scale effects
Equity_asset_ratio	The ratio that matter for banks (not the total amount of equity only). An indicator on how leveraged the company is, meaning how effectively they fund assets without using debt, using formula: $Equaty\ ratio = \frac{Total\ equity}{Total\ assets}$

Loan_deposit_ratio	Ratio that matter for banks (not the total amount of deposits only). The LDR is used to assess a banks liquidity, if the ratio is high it means that the bank may not have enough liquidity to cover unforeseen funds, or if the ratio is too low the bank may not be earning as much as it could be – using formula: $(LDR) = \frac{total\ amount\ of\ loans}{total\ amount\ deposit}$
GDPGrowth_Mainland	macro control variables are highly correlated so at the end we are only using the growth in GDP (mainland). We ended up choosing GDP growth, which is a natural indicator for the aggregate business cycle for the entire economy. The GDP is not always synchronized to real date time, since the results of an economic downturn is often later than with the outbreak, we have therefore used the lagged value of the GDP.

Note: We have taken the lags on all control variables (t-1) to reduce the problem of simultaneity. The lagged variables does still not reduce the error term correlation. This can be due to that bank managers make decisions based on a given history, which is much longer than one quarter (which the lagged variables are here). As a result the error term correlation does not fall. I tried to take more lags to the control variables including t-2, but the results become worse of. The reason for this could be due to the short time period within the dataset, where excluding one more time period will reduce the panel sample sufficiently. But this is important to notice, and I am aware of the problem. If I have had a bigger dataset for a longer time period I could have used the "AIC" formula in STATA to compute the optimal number of lags.

Results of marginal effects for all non-IRB banks

Table A.1 – DID 1 Results of growth in lending after CCyB cut for an average non-IRB bank

	Growth in total lending (1)	Growth in corporate lending (2)	Growth in private lending (3)
$post_{it}$	3.702*** (0.007)	-3.002** (0.015)	3.551*** (0.01)
N	1151	1141	1151
Bank FE	Yes	Yes	Yes
Macro controls	Yes	Yes	Yes
Banking controls	Yes	Yes	Yes

Notes: The table reports the marginal effect of an average non-IRB bank from regression equation (2), with quarterly data for all Norwegian non-IRB banks. The results show the percentage change in bank lending after the CCyB cut, where $post_{it} = 1$ if the quarterly date is after the CCyB cut. In this case it means if the date is after 1st of April 2020. The control variables used are represented in table 5.1. There is also an explanation of the control variables in the appendix. Bank-Quarter standard errors are in parentheses.

*p<0.1, **p<0.05, ***p<0.01

Table A.2 DID 1 – Results of changes in equity-ratio after CCyB cut for an average non-IRB bank

	Change in equity-asset ratio (1)
$post_{it}$	1.524*** (0.002)
N	1151
Bank FE	Yes
Macro controls	Yes
Bank controls	Yes

Notes: The table reports the marginal effect from regression equation (2) but now looking at the change in the equity-ratio as the dependent variable, with quarterly data for all Norwegian non-IRB banks. The results show the percentage change in banks' equity-ratio after the CCyB cut, where where $post_{it} = 1$ if the quarterly date is after the CCyB cut. In this case it means if the date is after 1st of April 2020. The control variables used are represented in table 5.1. There is also an explanation of the control variables in the appendix. Bank-Quarter standard errors are in parentheses.

*p<0.1, **p<0.05, ***p<0.01

Table A.3 DID 2 - Results of growth in lending after CCyB cut for an average non-IRB bank

	Growth in total lending (1)	Growth in corporate lending (2)	Growth in private lending (3)
$post_{it}$	4.350*** (0.007)	-2.070 (0.0155)	4.010*** (0.010)
N	1151	1141	1151
Bank FE	Yes	Yes	Yes
Macro controls	Yes	Yes	Yes

Banking controls	Yes	Yes	Yes

Notes: The table reports the marginal effect of an average non-IRB bank from regression equation (2), with quarterly data for all Norwegian non-IRB banks. The results show the percentage change in bank lending after the CCyB cut, where $post_{it} = 1$ if the quarterly date is after the CCyB cut. In this case it means if the date is after 1st of April 2020. The control variables used are represented in table 5.1. There is also an explanation of the control variables in the appendix. Bank-Quarter standard errors are in parentheses.
*p<0.1, **p<0.05, ***p<0.01

Table A.4 DID 2 - Results of changes in equity-asset ratio after CCyB cut for average non-IRB bank

	Change in equity-asset ratio (1)
$post_{it}$	1.170*** (0.001)
N	1151
Bank FE	Yes
Macro controls	Yes
Bank controls	Yes

Notes: The table reports the marginal effect from regression equation (2) but now looking at the change in the equity-ratio as the dependent variable, with quarterly data for all Norwegian non-IRB banks. The results show the percentage change in banks' equity-ratio after the CCyB cut, where where $post_{it} = 1$ if the quarterly date is after the CCyB cut. In this case it means if the date is after 1st of April 2020. The control variables used are represented in table 5.1. There is also an explanation of the control variables in the appendix. Bank-Quarter standard errors are in parentheses.
*p<0.1, **p<0.05, ***p<0.01