# THE CONNECTION BETWEEN BANK CREDIT RATINGS AND LOAN LOSS PROVISIONS IN WESTERN EUROPEAN BANKING SECTOR

**Jyväskylä University**
**School of Business and Economics**

**Master's Thesis**

**2021**

**Author: Anna Salo**
**Subject: Economics, banking and international finance**
**Supervisors: Juha Junttila, Jari-Mikko Meriläinen**

JYVÄSKYLÄN YLIOPISTO
UNIVERSITY OF JYVÄSKYLÄ

**ABSTRACT**

Author
Anna Salo

Title
The connection between bank credit ratings and loan loss provisions in Western European banking sector

| Subject | Type of work |
|---|---|
| Economics, banking and international finance | Master's thesis |
| Date<br>28.5.2021 | Number of pages<br>79 |

Abstract

The validity of credit rating formation in banking sector gained attention after the global financial crisis in 2007. Some banks that were financially sound and low-risk according to their credit rating were forced to rely on government bailout or even faced bankruptcy. The credit rating agencies and their rating policies received a lot of criticism due to incoherence between the credit rating and bank's actual financial condition. This study aims to examine the financial indicators and other related features that have an influence on the bank's credit rating. While the aim is to provide general view of the credit rating formation process, the study concentrates on the impact of loan loss provisions on the credit rating. Credit losses diminish the bank equity which is considered as the most noteworthy indicator in credit rating process by the rating agencies. Therefore, clarifying the extent of the connection between the loan loss provisions and credit rating is important.

This thesis conducts the empirical study by utilizing banking data from Western European banks. In addition to the banking data, the credit ratings that are examined in this study are obtained from Fitch Ratings' data base. The aim of this research is to examine the changes in credit rating when bank faces credit losses. In order to capture the credit losses on a yearly basis, the study utilizes loan loss provision variable to reflect the probable or already executed loan defaults. The findings show that there is a connection between the loan loss provisions and changes in credit rating, however, the effect is not always linear. The magnitude of the influence on the credit rating depends on the level of loan loss provisions. Even though the correlation between these two variables is usually negative, in some cases the influence of loan loss provisions is positive instead. Furthermore, in these circumstances the loan loss provision is beneficial to the bank's credit rating.

This study improves knowledge in optimization of loan loss provisions and influence of banking regulation on credit formation processes and policies. It allows an insight to indicators that have an effect on bank credit ratings in Western Europe and provides a basis for subsequent research.

Key words
credit rating, loan loss provision, credit loss, banking regulation, OLS regression

Place of storage
Jyväskylä University Library

**TIIVISTELMÄ**

Tekijä
Anna Salo

Työn nimi
Luottoluokituksien ja luottotappiovarausten välinen yhteys Länsi-Euroopan pankkisektorilla

| Oppiaine | Työn laji |
|---|---|
| Taloustiede, pankkitoiminta ja kansainvälinen rahoitus | Pro gradu -tutkielma |
| Päivämäärä<br>28.5.2021 | Sivumäärä<br>79 |

Tiivistelmä

Luottamus luottoluokittajien kykyyn arvioida pankkien vakavaraisuutta mureni finanssikriisin jälkeen. Pankkeja, joita oli arvioitu vakavaraisiksi ja vähäriskisiksi toimijoiksi kaatui tai ne joutuivat turvautumaan erilaisiin tukipaketteihin toimintansa jatkamiseksi. Epäjohdonmukaisuus pankeille asetettujen luottoluokitusten ja todellisen vakavaraisuuden välillä asetti luottoluokittajat kritiikin kohteeksi. Tämän tutkimuksen tarkoituksena on selvittää taloudellisia indikaattoreita ja muita ominaisuuksia, jotka vaikuttavat pankin luottoluokitukseen. Tutkimus pyrkii luomaan kokonaiskuvan luottoluokituksen muodostamiseen liittyvistä prosesseista keskittyen luottotappiovarausten vaikutukseen. Luottotappiot vähentävät pankin pääomaa, joka on yleisesti luottoluokittajien keskuudessa tärkein tekijä luottoluokitusta muodostettaessa. Tästä syystä voidaan olettaa, että luottotappioiden ja luottoluokituksen välillä on yhteys. Tutkimuksen tarkoituksena on hahmottaa tämän yhteyden laajuutta.
Tämä pro gradu -tutkielma hyödyntää empiiristä tutkimusta käyttäen Länsi-Euroopan pankkien taseen ja tuloslaskelman tunnuslukuja. Tutkimuksessa hyödynnetään luottoluokittajan Fitch Ratings -luottoluokituksia. Tarkoituksena on selvittää, mitä muutoksia luottoluokituksessa tapahtuu, kun pankki kärsii luottotappioita. Luottotappioiden mittaamisessa hyödynnetään pankkien asettamia luottotappiovarauksia, jotka auttavat hahmottamaan mahdolliset tulevat tai jo toteutuneet luottotappiot. Tulosten mukaan luottotappiovarausten ja luottoluokituksen välillä on negatiivinen yhteys. Tämä yhteys ei kuitenkaan ole lineaarinen, sillä vaikutuksen laajuus on riippuvainen luottotappiovarausten määrästä. Joissakin tapauksissa vaikutus on positiivinen.
Tämä tutkimus antaa syvempää tietoa luottotappiovarausten optimointiin sekä pankkien sääntelyn vaikutuksiin luottoluokituksen muodostamiseen ja käytäntöihin liittyen. Tutkimuksen tarkoituksena on antaa tarkempi käsitys indikaattoreista, jotka vaikuttavat pankkien luottoluokituksen muutoksiin keskittyen luottotappiovarausten vaikutuksiin sekä antaa vakaa perusta jatkotutkimukselle.

Asiasanat
luottoluokitus, luottotappiovaraus, luottotappio, pankkisääntely, OLS-regressiomalli

Säilytyspaikka
Jyväskylän yliopiston kirjasto

# CONTENTS

# LIST OF FIGURES AND TABLES

# 1 INTRODUCTION

The global financial crisis starting in 2007 turned the attention to the rating agencies and their policies in credit rating formation. The question about the reliability of credit ratings gained importance, as many banks that were previously considered as financially stable according to their rating collapsed or had to be rescued by the governments (Caporale, Matousek & Stewart, 2012). For this reason, the formation process and, more precisely, what qualities or characteristics are considered the most important in deciding suitable rating for bank in question gained interest. As credit ratings failed to reflect the credit risk and misaddressed the financial stability, they caused relentless damage to the reputation of the rating agencies (Caporale et al., 2012). It seemed that the features that had a remarkable role in rating formation were miscalculated or had inaccurate emphasis, as credit rating should offer quick and comparable information about the financial stability and credit risk.

Credit rating is formed from different indicators that measure, for example, bank's profitability, liquidity, capital, efficiency, and quality (Shen, Huang & Hasan, 2012). More precise structure and key components of the credit rating formation process will be introduced in the following chapters of the thesis. To state it simply, the rating is a sum of qualities that possess different weighting of influence on the final rating. This thesis aims to study and clarify the possible connection between the credit losses and credit rating in the Western European banking sector. Credit agency Fitch, whose credit formation structure and ratings are utilized in this thesis, considers the bank capital as one of the most important features when forming the suitable rating (Fitch Ratings, 2020). Therefore, the relationship between the credit losses and credit ratings could be relevant, as credit losses diminish the level of bank capital.

The determinants that have an influence on credit ratings have been studied variously in the previous literature. Meriläinen & Junttila (2020) examined how the size of liquid asset portfolio affects the credit rating. The results suggest that transition in bank credit ratings have been more advantageous for banks that hold more liquid assets in their portfolios. The discussion implies that new liquidity regulations that were updated in the Basel III enhance the stability of banking sector. Caporale et al. (2012) have previously stated that bank asset liquidity does not have a linkage to bank credit ratings. This is inconsistent with the results of Meriläinen & Junttila (2020), which can be partly explained by the different sample periods. While Caporale et al. (2012) included time period from 2000 to 2007, Meriläinen & Junttila (2020) analysed years from 2005 to 2017. During the more extensive time period that consists also two spectacular crises – global financial crisis starting in late 2007, followed by sovereign debt crisis in

2010 – the regulations have also been modified. In order to prevent similar banking sector crises in the future, the bank regulation has been modified so that it would require banks to maintain better financial soundness and execute more transparency in their business operations (Ambrocio, Hasan, Jokivuolle & Ristolainen, 2020). Therefore, the connection might indeed have been non-existent before the crisis periods, but it could have been established in the aftermath of the crises. Thus, the study of this thesis takes into account time period that covers the years from 2004 to 2019. By doing this, it also aims to clarify whether the connection between credit losses and credit ratings has fluctuated and changed before and after the crisis periods due to the changes in regulation during the years.

## 1.1 Research questions and objectives

Bank's credit rating plays significant role in bank's business operations. Banks that hold better rating have access to cheaper external funding with lower interest rates, and they are considered more reliable and less risky institutions that have smaller chance of default (Shen et al., 2012). Therefore, aiming for good rating is advantageous in many ways for banks themselves. The benefits of satisfactory credit rating are discussed more thoroughly in the next chapter. As the credit rating gives important information for both internal and external users, it is important to understand how the credit rating is formed and what characteristics of the bank affect the most. In this study, the concentration is in the credit losses and their influence in Western European banking sector.
The thesis aims to answer the following research questions:

1. To what extent the realized credit losses and loan loss provisions affect to bank's credit rating?
2. Is the influence of loan loss provisions on the credit rating linear or nonlinear?

The first research question can be considered as the main objective in the thesis. Apart from actual executed credit losses, the aim is to clarify the role of loan loss provisions as well. Loan loss provisions are comparably large accruals for a bank. They are set aside for possible defaults by outstanding loans. The purpose of provisions is to reflect expected future losses (Ahmed, Takeda & Thomas, 1999). This means that loan loss provisions bind bank's equity, which can not be further utilized in other business operations. Therefore, the optimal level of loan loss provisions requires modification from time to time and it obviously depends on the risks associated with the loan customers. It is essential to be able to define

adequately credit risk associated with the loan borrower in order to evaluate the possibility of default by a particular borrower (Freixas & Rochet, 2008, p. 266-267). Risks associated by a particular borrower could also include, for example, country risks and industry risks (REFITIV/Thomson Reuters Datastream, 2020). Minimum level of loan loss provisions is also regulated and set up by the up-to-date Basel standards (BIS, 2018). In this study, by measuring changes in the level of loan loss provision it is possible to capture the realized credit losses. Thus, the loan loss provision ratio (loan loss provision to total assets percentage) is one of the key variables to capture the credit losses and further, to explain how they affect to the credit rating. The aim is not only to clarify the extent of the influence but also study if the effect changes depending on the economic conditions. In other words, the study attempts to resolve whether the economic downturn or boom has an effect to the connection between credit losses and credit rating. The sample period from 2004 to 2019 allows the interpretation of these changes during economic cycles, as both the global financial crisis as well as European sovereign debt crisis took place during these years.

The second research question intends to analyse the linearity of the effect of the loan loss provisions. In other words, it aims to reveal whether the impact of loan loss provisions is different between banks with high amount of loan loss provisions compared to banks with low amount of provisions. The key focus is to clarify whether the influence is independent from the bank's existing level of provisions or is the relationship nonlinear. This is an interesting question, as it could provide the optimal level of loan loss provisions for banks to hold in order to obtain the best possible credit rating. That is, the loan loss provision has a significant effect to the credit rating. As mentioned before, having a massive amount of provisions might be oppressive for banks to maintain continuously, as it affects the amount of equity that can not be invested in other business actions. Therefore, ability to resolve the ideal level of provisions is important for banks from the profitability point of view. However, having a massive amount of provisions does not necessarily imply attempts to maintain financial soundness in long run and proactive protection against possible defaults that might occur in the future. The ECB Report (2004) showed the effects from the movements of loan loss provisions ratio in 1990's and early 2000's. The outcome showed that instead of proactive securing of possible defaults, the provisions were set only after the loans had already defaulted or the economic downturn by that time had set in (ECB Report, 2004). This could lead to a situation where sudden increase in provisions results to an as increase in defaults, and this affects negatively to bank's financial soundness and credit rating. By examining this relationship, the study aims to resolve whether the influence is linear or if there exists nonlinearity as well.

## 1.2 Research methods and structure

The data used in this thesis contains balance sheet and income statement information from 66 Western European banks. In addition, the study utilizes rating agency Fitch's credit rating formation reports and their available and addressed credit ratings for the banks in question. The empirical study focuses on eight different banking variables and their influence on the credit rating. The main variable of interest is the loan loss provision-ratio (loan loss provision to total assets percentage). Panel study method and time period of 15 years allows longitudinal examination of the changes in variables and their relationships through the time. Because these years include two crises, global financial crisis and European debt crisis, it is possible to examine the relationships during the recession and recovery period as well.

The structure and outline of research are the following: After the introduction to the research background and research questions as well as aims and objectives, chapter two consists of the literature review and more through-out examination of the theory and previous studies about the subject. Theoretical framework presents widely acknowledged approaches to the theme as well as up-to-date studies about the features and reliability of credit ratings. Chapter three will focus more on the regulation framework behind the requirements and how regulation system affects to the credit rating formation. Chapter four about the chosen data and methodology explains the content of the data and how it is constructed in the study. The chapter introduces the ordinary least square regression model that is applied in the research, in addition with chosen banking variables and macroeconomic variables. The result chapter explains the outcome of the study and aims to analyse and compare the results side-by-side with previous studies and primary data about the theme. Discussion will provide in-sight about the research objectives and the validity of the study as whole. It discusses the results of the study more precisely and compares the findings with previous theory. Finally, the conclusion will summarise the work, in addition to research aims and objectives and whether they were met.

## 1.3 Limitations of the study

The empirical results obtained from the study may be subject to several limitations. This research utilizes rating agency Fitch's credit ratings, therefore the results rely only on their credit rating evaluation and formation convention. Combining multiple rating agencies and their valuation for the sample banks, it would have been possible to gain differing results. Even though the rating agen-

cies aim to provide information about the creditworthiness and financial condition of the bank in question, their practises and adoption of different rating scales may give results that are challenging to compare reliably. The rating agencies may use complementary methodologies in credit rating formation, however, they operate separately from each other. This leads to a situation where the approach and outcome of the rating determination may differ in certain conditions (Santos, 2012). Analysing credit ratings from different agencies could provide contradictive results and give different reflection about the condition of the bank in question. By taking into account two big rating agencies, S&P and Moody's, the sample would have been wider and the expansion of the sample of ratings might have given more elaborated results.

The second limitation relates to the sample banks and their geographic attributes. The study sample consists of the banking data from Western European banks, more precisely from EU15 countries in addition to Iceland, Norway and Switzerland. The sample excludes Luxembourg from the EU15 countries that are studied. Therefore, the results presented are based on homogeneous economies and omits, for instance, transition economies in the Europe. Thus, the results of the study can not be generalised as such. Shen et al. (2012) studied how the bank's country of origin affects the credit rating formation, as the results stated that banks with similar financial performance were addressed different credit ratings determined by their country of origin. In other words, for example banks that operate in emerging countries are considered riskier compared to banks in high-income countries in Western Europe or in North America. Due to this, the results about the relationship between credit losses and credit ratings and its extent may not be suitable for banks in transition economies or emerging countries. In other words, the correlation or causality between loan loss provisions and credit rating may be different if the sample includes diverse economies.

Regulations have guided banking sector in order to maintain stable financial conditions and to prevent future crises. Before and during the crises, the connection between loan loss provisions and credit ratings has been significant, thus, and this can be seen from the results of this thesis as well. The connection seems to weaken in the aftermath of the sovereign debt crisis in 2010's. As the study time period ends in 2019, it excludes the very early parts of the influence of the current pandemic COVID-19. An expanded time period would have allowed to study the possible influence of crisis conditions to the credit ratings and whether the pandemic has affected to the connection between loan loss provisions and credit rating, as the previous crises have strengthened their relationship.

# 2 THEORETICAL FRAMEWORK

## 2.1 Credit rating formation

### 2.1.1 Overview

The purpose of bank's credit rating is to transfer comparable and beneficial information to investors. The objective is to give easily comprehensible overview about the financial position of the bank and insight on credit riskiness (Caporale, Matousek & Stewart, 2012). Thus, credit ratings can be observed as determinants of risk, as they assimilate all of the pertinent risk factors identified by rating agencies. Bank's strength evaluation is mainly based on different indicators, such as economic and financial factors. Financial indicators obtained from bank's balance sheet are frequently used in explaining different ratings and transition between them. Capitalization ratio – total debt to equity – is usually stressed the most in credit rating criteria. In addition to financial ratios, also factors such as country of domicile, information asymmetry, variety in accounting standards and level of rule of law in specific country have had influence in the determination of bank's credit rating (Shen, Huang & Hasan, 2012). Therefore, formation of comparable credit rating systems is not necessarily a straightforward process. The credit rating process and determination of attributes that have an influence on rating, as well as stresses of these attributes, have gone through transitions during the history.

Global financial crisis in 2007-2009 showed that even banks which were maintaining adequate credit rating for financial soundness were greatly affected by the outcomes of the crisis. Banks which were considered as "too big to fail" suffered major damages and were enforced to conclude their operations. Some had to be rescued by governments. Contradict between credit rating and real capability to maintain financial stability through downfall created mistrust towards rating agencies (Caporale et al., 2012). Formation of credit rating system seemed to fail and the process of evaluation of rating required major changes in behold of the future. Thus, the global financial crisis can be considered as a turning point for rating agencies and rating criteria as well as international regulatory basis for banks and other financial institutions. By setting new globally unified regulation system that contains higher capital requirements and for example stronger liquidity coverage ratios, it is believed that similar global and severe crises could be avoided.

Supervision regulations for banks are in almost constant transition or at least under examination. One important regulated feature is the amount of minimum capital that bank is supposed to withhold during all times (Ambrocio et

al., 2020). Realized credit losses diminish bank's financial solidity as well as liquidity and make it more challenging to attain these requirements of capital. Therefore, the stress of focus is on how the credit rating is affected due to the losses of capital, as well as inability to meet internationally agreed level of minimum capital.

### 2.1.2 Credit rating formators and agencies

The main objective of credit rating agencies is to measure reliably and give external information about the ability of institutions to fulfil their financial commitments. The credit ratings assigned by agencies do not directly cover any other risks than the credit risk specifically. It excludes for instance market risk and changes in interest rates (Fitch Ratings, 2020). In this thesis, the main focus is in rating agency Fitch Ratings' methodology for formation of bank credit rating. The agency covers bank ratings from 140 countries, making the agency international leader in credit ratings. The closest competitors for Fitch group are considered to be Standard and Poor's (S&P) and Moody's, both of being highly acknowledged and globally trusted credit rating agencies. The formation of ratings follows similar indicators and factors of measurement. However, the classification and rating scales differ slightly. Even though rating scale varies between the agencies, the level of credit rating is independent from the agency in question.

By assessing suitable credit ratings for institutions and companies, credit rating agencies give essential information for instance for external financial institutions that are ordered to provide external financing for the company. Reliable and up-to-date credit rating gives fast and throughout cross-section of the credit risk that is assessed to the company and the likelihood of credit default. The rating gives quick and effective overview of the condition of the company – as credit rating is consisting of many financial and economic indicators, just by obtaining the credit rating gives away precise information about the credit risk attached to the company in question. As the economic and financial indicators that are affecting to the credit rating can change fundamentally during a short period of time, the agencies are demanded to constantly monitor the companies in question. On the other hand, the credit ratings for financial institutions themselves and for banks, are measured when they are seeking for outside financing. Financial institutions and banks that are addressed weaker credit rating by the agencies are considered to be riskier – therefore the financing is typically more expensive with higher interest or with less providers for financing in general. Taking this into account, it is advantageous for both parties that the addressed credit rating is on decent level and indicates trustworthiness as well as decrease in possibility of credit losses. Maintaining higher credit rating is a way to present trustworthy image to the other external stakeholders as well. However, the weighting and order of importance of financial indicators is not evenly distributed. The credit

rating agencies consider capital as the most important factor for banks to defend against default and to maintain financial soundness. Capital also has more weighted effect in credit rating calculations, implying that banks with greater capital are assigned with better credit ratings (Shen et al., 2012).

### 2.1.3 Measurement system for formation of credit rating

Fitch Rating's methodology for formation of ratings to banks differs from the case of non-bank financial institutions. The ratings for banks mirror the particular key drivers of the bank credit (Fitch Ratings, 2020). The cut-down of rating framework is displayed in Figure 1. It separates different rates for creditworthiness (VR) as well as the probability of requirement of external financial support in case of requirement (SR and SRF). Bank's Issuer Default Ratings (IDR) are acquired from the VR. Apart from presenting the simplified framework for banks' rating, the concentration of examination is focused on key rating drivers that are affected by credit losses and loss of economic capital.

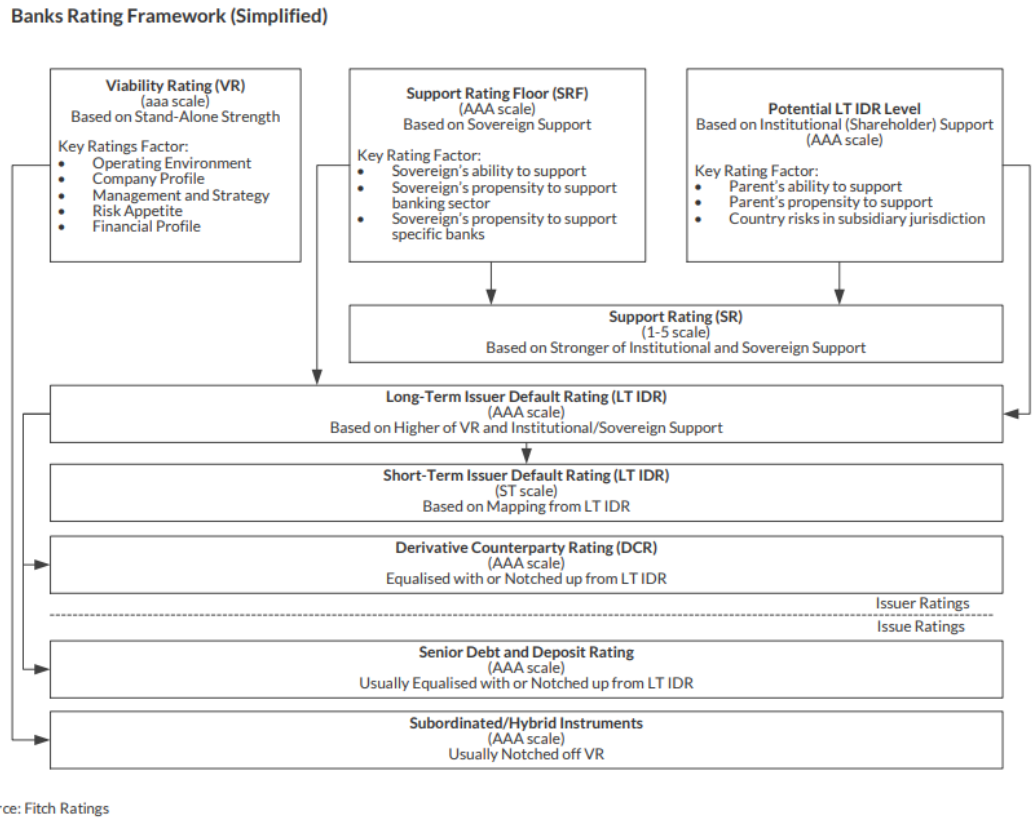


Figure 1. Fitch Ratings' framework for credit rating criteria of banks (Fitch Ratings, 2020).

According to Fitch's rating criteria and policy, Issuer Default Rating IDR presents the bank's relative exposure to the default and therefore lack of being able to meet its fiscal obligations. The risk of default that IDR specifically addresses is covering typically those obligations, that being left unpaid would lead to unavoidable downfall of that bank. Fitch is stating in its criteria that these obligations generally are so-called "senior obligations to third-party", meaning creditors that are non-government. To put it simple, the purpose of IDR is to predict the probability and likelihood of default. Bank's IDR does not commonly mirror default risk that is associated with any kind of "junior debt" – debt that is issued with lower priority compared to senior debt - or liabilities to government authorities. Even so, if inability to meet junior debt obligations is considered to lead into a situation where the senior debt obligations are defaulting, this may lead to bank's Long-Term IDR decreasing and downgrade of the rating. Furthermore, it is added in clarification in Fitch Ratings that if default in lower priority debts causes bankruptcy actions, IDR may be graded downwards to default level extremely quickly (Fitch Ratings, 2020). In other words, meeting the obligations of senior debts is a top priority liability for bank to meet in IDR, but even if inability to meet junior debts causes untrust in banks financial soundness and liquidity it might lead to downgrade of rating very fast.

**Long-Term IDR Scale**

| Category | Brief description |
|---|---|
| AAA | Highest credit quality |
| AA | Very high credit quality |
| A | High credit quality |
| BBB | Good credit quality |
| BB | Speculative credit quality |
| B | Highly speculative credit quality |
| CCC | Substantial credit risk |
| CC | Very high levels of credit risk |
| C | Exceptionally high levels of credit risk |
| RD | Restricted default |
| D | Default |

The modifiers '+' or '–' may be appended to a rating to denote relative status within categories from 'AA' to 'CCC'
Click here for full descriptions of each rating category
Source: Fitch Ratings

Figure 2. Long-Term IDR scale. (Fitch Ratings, 2020).

Short-Term IDR's mirror bank's sensibility to default in the short term. This period usually refers up to 13 months. Short-term IDR's are authorized to every

bank that has Long-Term IDRs. The only exception is if the bank in question does not have material short-term obligations to meet. Short-Term IDR's have similar table of scaling, however, these two obligations are combined in Rating correspondence table in Fitch's ranking. It will take into account the bank's Long-term IDR rating and combination of Short-term IDR through making the combination of suitable rating as seen in Figure 3. If the Long-Term IDR are supported institutionally, Fitch tends to assign better Short-Term IDR rating, if the table of scale allows it. This is because the tendency of support is generally more certain in the near term. However, if Long-Term IDR's are gaining sovereign support only, the possibility to assign lower Short-Term IDR is more probable (Fitch Ratings, 2020).

**Short-Term IDR Scale**

| Rating | Brief description |
|---|---|
| F1 | Highest short-term credit quality |
| F2 | Good short-term credit quality |
| F3 | Fair short-term credit quality |
| B | Speculative short-term credit quality |
| C | High short-term default risk |
| RD | Restricted default |
| D | Default |

A '+' modifier may be appended to the 'F1' rating to denote exceptionally strong credit quality
Click here for full descriptions of each rating category
Source: Fitch Ratings

**Rating Correspondence Table**

| Long-term rating | Short-term rating |
|---|---|
| From AAA to AA- | F1+ |
| A+ | F1 or F1+ |
| A | F1 or F1+ |
| A- | F2 or F1 |
| BBB+ | F2 or F1 |
| BBB | F3 or F2 |
| BBB- | F3 |
| From BB+ to B- | B |
| From CCC+ to C | C |
| RD | RD |
| D | D |

Source: Fitch Ratings

Figure 3. Short-Term IDR scale and Correspondence scale for Long-Term and Short-Term IDR. (Fitch Ratings, 2020).

According to Fitch, Viability ratings measures the fundamental creditworthiness of the bank. It displays the formator's view about the probability that the bank will fail. A bank is considered to fail when it for instance faces a default, has ended providing its senior obligations to a third-party or entered into bankruptcy proceedings or it requires so-called extraordinary support (Fitch Ratings, 2020). Ordinary support is considered to be benefits that are available to all banks due to their status – it consists of accessibility to the liquidity of the central bank and possible lower cost of funding and other benefits in terms of stability. Ordinary support consists of support that is beneficial in normal business procedures. Extraordinary support consists of procedures that are crucial for bank to attain when it failed or is failing, in order to recover its viability (Fitch Ratings, 2020). VR does not mirror bank's extraordinary support, as this is measured by Support

Rating SR and/or Support Rating Floor SRF. The differentiation between extraordinary support and ordinary support is not necessarily definite. Thus, usually analytical consideration is essential in determining whether bank has indeed "failed". In addition to the solvency of the bank, Fitch will determine if the bank is viable or not based on whether the bank is facing or has faced a material capital shortfall. In other words, evidence of a bank failure is clarified as follows: Augmentation of capital by shareholders or government authorities in response of material capital shortfall or/and relying on central bank funding. This is considered as extraordinary support (Fitch Ratings, 2020). Fitch views new capital provided by existing shareholders in purpose of increasing business growth as ordinary support, as it does not hold the similar position of capital shortfall, with few more exceptions also determined. This also consists situations where bank is insisted on getting excess capital due to stricter regulatory capital rules. Optimal levels of capital are defined in international regulatory policy for banks, Basel Committee system.

Key ratios that are taken into account while calculating Viability rate are for instance the bank's risk appetite and financial profile. Assessment for financial profile consists of indicators for capitalisation and leverage ratio as well as balance of funding and liquidity – key dimensions when considering the creditworthiness of the bank (Fitch Ratings, 2020). It is stated in the bank rating criteria that weak capital competency "may override" other VR factors and cause significant negative effect on the VR rating. In other words, capital adequacy is considered as a higher weighted indicator when determining suitable level for VR compared to other ratios. Caporale et al. (2012) found in their study that banks that hold greater equity and more assets do have higher bank credit ratings as well. The relationship between capitalisation and bank ratings is significant. Equity capital operates as a buffer against unreserved and other unexpected losses bank may face and guards against failure, thus, Fitch Ratings uses Common Equity Tier 1 ratio CET1 as a measure of bank's solvency. Tier 1 capital is considered as core capital of the bank, and it is easier to liquidate compared to Tier 2 capital. Tier 2 capital can be thought as second layer or buffer of bank's required capital reserves. Drago & Gallo (2017) found in their study of sovereign banking rates that the weighting of capital structure and capital ratio is more affected if the credit rating faced downgrade. Downgrade in rating is demonstrated to represent liquidity shock that in the end leads to a situation where domestic and foreign lending for bank decreases due to decline of rating sensible sources of external funds (Karam, Merrouche, Souissi & Turk, 2014). Therefore, it could be stated that there is a bond between the capital structure and shocks that affect the level of capital and credit rating assigned to the bank.

**Key Capitalisation and Leverage Ratios**

| |
|---|
| **Core metric:** |
| CET1 regulatory capital ratio (%) |
| **Complementary metrics:** |
| Basel leverage ratio (%) |
| Tangible common equity/tangible assets (%) |
| |
| Impaired loans less loan loss allowances/ Core Capital (%) |

Source: Fitch Ratings

**Implied Capitalisation & Leverage Factor Score (%)**

| Implied factor score | aa | a | bbb | bb | b & below |
|---|---|---|---|---|---|
| Operating environment | Core capital ratio | | | | |
| aa | ≥16 | ≥10 | ≥8 | ≥6 | <6 |
| a | ≥18 | ≥14 | ≥9 | ≥7 | <7 |
| bbb | | ≥19 | ≥13 | ≥8 | <8 |
| bb | | | ≥20 | ≥12 | <12 |
| b & below | | | | ≥22 | <22 |

Source: Fitch Ratings

Figure 4. Capitalisation & Leverage ratios used by Fitch Ratings and factor scoring. (Fitch Ratings, 2020).

## 2.2 Impacts of changes in credit rating

Even though rating agencies utilize analytical research and prediction models to clarify the creditworthiness and financial soundness of a bank, their abilities to assign reliable information are often questioned. Caporale et al. (2012) state that every rating agency was uncapable of predicting the late 1990s Asian crisis and its effects to banks. However, rating agencies have undeniable ascendancy in providing information for external stakeholders as well as influence in bank's accessibility to outside funding. Ratings are used in financial markets as well as in regulation system, while the latest financial crisis caused heavier auditing on credit rating agencies performance (Alsakka, Gwilym, & Vu, 2014). Cantor & Mann (2007) state that credit rating agencies aim at providing stabile and accurate information that in normal conditions would not face extreme volatility between the given credit ratings. This creates the need for consistent, right timed, and open information about the credit rating adjustments and changes in banks'

credit ratings. Alsakka et al. (2014) highlight the impact of downgrade actions in credit formation, as decrease in credit ratings gain often more publicity than credit market valuation – thus, rating agencies are occasionally blamed for intensifying financial crises. The criticism of rating agencies deepened during the global financial crisis after 2007. Debt crisis in Europe led to increase in borrowing costs and speeded the process of downfall. One of the reasons to blame was considered to be the erroneous decrease of European sovereigns (Alsakka et al., 2014). This is seen as a link to banking crisis as well. Number of banks that were comparatively financially sound had to reach out for extraordinary support from government or faced default as whole (Caporale et al., 2012). Thus, the importance of accurate credit ratings to investors and economy is inevitable.

Sovereign rating downgrades have substantial influence on bank rating downgrades during the time of financial crisis. Alsakka et al. (2014) report that this substantially affects to bank rating negatively as well. As rating policies between the credit agencies are not identical, the steepness between the correlation of sovereign and bank rating might vary. Even though policies might differ, rating agencies should attempt to provide coherent information about the bank's creditworthiness and avoid contradictory or conflicted message. Credit rating decisions are strongly linked - multiple-notch downgrades in sovereign rating have stronger impact on the probability to bank rating downgrade as well. A bank that faces downgrading rating from one credit rating agency also has remarkably higher probability to be addressed more severe downgrade from competing rating agency as well (Alsakka et al., 2014). Downgrade in banking rating may lead to uncertainty in global economic conditions but also lack of confidence in bank's ability to carry on its primary obligations. This weakens the position of bank's credibility in the minds of investors and other stakeholders as bank rating is direct indicate of the financial position and soundness of the bank in question (Caporale et al., 2012). This leads to higher cost of external funding and higher probability of decrease in outside finance providers. Therefore, impact of negative changes in bank's credit rating can be crucial for bank's overall ability to continue its everyday operations normally.

# 3 DEVELOPMENT OF BASEL REGULATORY

## 3.1 Formation of regulatory structure for banks

The focus on bank regulation has intensified significantly after the global financial crisis 2007-2009. In the aftermath of the crisis, it was inevitable that banking regulation was not at an adequate level to monitor and regulate banking efficiently. Regulation structure has evolved since, and stricter policies concerning risk management and minimum bank capital requirements dominate the current regulation system (Ambrocio et al., 2020). Since the global financial crisis, the central banks have become more active, among other public authorities, in controlling financial stability across the world. Adjusting the optimal level of shareholder's equity relative to risk-adjusted asset level is one of the policies set to support the stability of the economy (Tölö & Miettinen, 2018).

### 3.1.1 Basel I

To serve as the provider of supervisory practises and other banking regulations, The Basel Committee was initially created by the Group of Ten central banks in 1974. Its main purpose was to provide remedy for the international disruption of currencies and banking sector. The aim was to improve overall quality of banking supervision, through unified and globally accepted regulation system. Capital sufficiency became quickly the main focal point of the activities the Committee was pursuing. Importance of stabile international banking system increased after the Latin American debt crisis in the 1980s. Aftermath of the crisis showed that capital ratios of banks needed adjustments to minimize risks attached to the lack of capital adequacy which led to a need for multinational accord in 1987. This was the starting point of Basel regulation structure and Basel I framework. The core aim was to prevent excess and hazardous use of capital. The target ratio of capital to risk-weighted assets was defined to be 8% and was presented to all countries that had international bank operations (Basle, 1988). The main focus of the first version of the accord was to protect banking sector from implied credit risk. After the relatively big attraction to derivatives and greater volatility of the financial markets due to that, it became obvious that not only credit risk, but market risk was also an issue to supervise. In 1996 the accord was attached with Market Risk Amendment, which induced requirements consisting not only to the amount of capital but also interest, commodities, currency as well as equity risk. (Balthazar, 2006, pp. 209-210).

The impact of Basel I Accord to banking regulations has been inevitable. Interpreted as a global benchmark it offered unite guidelines for regulations in over 100 countries worldwide (Balthazar, 2006, pp. 32-33). Thus, the country of bank's origin should not influence the capital requirements due to a consistent set of rules. This improved equivalence between the banks that compete on the same markets but in different countries (Balthazar, 2006, pp. 32-33). The capital ratios of the G10 banks increased on average by about 2 percentage (from 9.3 in 1988 to 11.2 in 1996) after the adaption of Basel I. However, it is hard to confirm the causality of the argument that the higher capital level was in fact outcome of Basel I regulations. Balthazar (2006) argues that reasons for increased capital ratios might also be due to better overall economic conditions. Jackson et al. (1999) suggest that these increases in capital ratios could have been caused by increased transparency of banks' operations and overall improvement of the market's competence to bear pressure. Nevertheless, it is difficult to certify whether these outcomes were direct effects of the Basel I regulation. Jackson et al. (1999) add that the beginning of minimum capital requirements may lead to a situation where bank is obligated to cut down lending. This most likely has a negative effect on bank's profitability, as the bank is restricted to control its business operations in terms of credit lending. The influence that regulated minimum capital requirements have on the credit rating – as capital is considered as one of the most important indicators of bank's creditworthiness according to rating agencies – is discussed later in chapter 3 of the thesis.

### 3.1.2 Basel II

The framework for banking regulations, from its first form of Basel I, was meant to evolve over time. With Basel II, new minimum capital requirements were added, and transparency was highlighted in order to strengthen the market discipline. The changes were targeted to improve especially the risk management functions and capital adequacy requirements (BIS, 2004). The new accord was a response to the inefficiencies Basel I was criticised, including international arbitrage opportunities that had risen from the loopholes of the previous version of the regulation. New risks had to be taken into account, such as cybersecurity or internal and external frauds that had increased their likelihood. These types of risks were bundled together as operational risks that bank must prepare itself against. Basel II was aimed to solve these problems and lessen the ambiguousness of the regulation (Balthazar, 2006, pp. 33). The new accord also had strong emphasis on *economic capital* – the amount of capital that bank is requiring to obtain protection against default for creditors. Intended for as a guard against credit losses, it can be thought as a warrant for solvency in the worst-case scenario. Determining the suitable economic capital include methods used for the calculation of risk-adjusted return of capital (RAROC) or value-at-risk (VaR), (Herring, 2002). Recognition of the usefulness of internal VaR models was a major step forward,

as inefficiency could be the outcome of too simplified and non-moderated models. Economic capital is the necessary capital to cover risk given by the bank's risk appetite, when measured with their own internal models. Balthazar (2006) also states that foremost stress of economic capital as well as concept of operational risk were one of the main adjustments that Basel II had compared to previous regulation structure.

Aftermath of the global financial crisis led to discussion about the incompetency and inability of current regulation structure. Many parts of the current accord demanded throughout revision. The attention turned to banks' overall level of capital and more precisely the quality and proportion of it. It was also questioned whether the regulation system was incapable to recognize the riskiness of certain banks that had major problems in capital allocation already prior to the crisis (Cornford, 2009). The identification of risks and sufficient procedures to avoid global banking crisis were not adequate in Basel II. Especially the lack of clarified regulation towards bank's securitization was blamed to create the seed of the crisis. However, the inadequate rules for practises of securitization stem originally from Basel I procedures already (Cornford, 2009).

### 3.1.3 Basel III

The need for amendments to Basel II became topical at the latest during the downfall of Lehman Brothers in September 2008. The banking sector was considered to bear too much leverage as well as incompetent buffers for liquidity. Combined with weak risk management, overweighted credit growth and unsatisfactory governance led to situation where regulators were demanded to recreate the principles of the Basel accord. New design for capital requirements and liquidity ratios were introduced in 2010, with reference of Basel III (BIS, 2010). The adjustments included more accurate condition of quality and scale of capital regulations and more layered capital buffer. The aim of better-quality capital means greater loss-absorbing capacity, which will lead to better endurance during the stress periods (Shah, 2013). Any excess leverage taking was measured by leverage ratio, calculating the minimum extent of loss-absorb capital relative to bank's assets. In the aftermath of financial crisis, the trustworthiness of banking industry took serious damage. This kind of leverage ratio requirement did not exist under the Basel II accord. However, a lot of stakeholders considered reports of risk-weighted capital ratios insufficient in the previous version of regulation. The update and revision of the regulation was aimed to patch this loss of credibility in the calculations of the risk-weighted assets (RWA). The purpose was to gain risk sensitivity and improve robustness of the previously standardised approaches for operational risk and credit risk (BIS, 2016).

Furthermore, according to survey of Ambrocio et al. (2020) academic researchers generally think higher capital requirements among Basel III have higher likelihood to prevent the probability of further banking crises and social costs associated with them. Thus, negative effects to aggregate economy level are considered to be rather minimal. Cosimano & Hakura (2011) as well as Martynova (2015) came to alternative conclusion in their study, where bank behaviour in response to Basel III capital requirements might affect to loan growth negatively. Banks that face higher requirements of capital can diminish their credit supply and at the same time increase lending rates which leads to decrease in overall demand of credit. This may lead to a decrease in economic growth (Martynova, 2015). Therefore, the optimal level of capital requirements of Basel III that would guarantee stability in banking industry but not deepen the economic downturn is debated continuously. Bech & Keister (2017) show that banks may adapt to regulation by using funding that is treated in most favourable way. The regulations have simultaneously different effects on bank's interbank interest rates between short-term and long-term loans. According to Bech & Keister (2017) this may lead to trading incentives in interbank markets and further affect to banks' compliance with the regulations. Furthermore, it might affect the central banks' ability to control market interest rates.

## 3.2 Influence of Basel III to current credit rating formation framework

The impact of Basel III framework to bank lending rates as well as loan growth has been widely studied since the new capital requirements came into effect. Increase in desired level of capital boosts the marginal cost of funding and therefore ultimately increases lending rates. Cosimano & Hakura (2011) point out that there exists difference in banks' response to regulations depending on their country of origin, including the impacts on loan growth. In addition, capital inadequacy puts extensive pressure on the Viability Rating of Fitch and may override other VR factors when rating agency formats the suitable rating for bank in question. The additional capital is addressed by Basel III depending on their financial status in the end of the year 2009. Basel III is defining the capital requirements depending on the size and riskiness of the bank in question – Group 1 banks are holding Tier 1 capital more than three billion and are also internationally active. All the other banks that do not fit into this category are considered as Group 2 banks (BIS, 2016). Caporale et al. (2012) showed in their study that sizable banks tend to have better credit ratings as well. They form a conclusion that banks which hold greater equity and more assets have higher bank ratings as well. Whenever available, Fitch Ratings adapts Basel leverage ratio and Basel-based

CET1 ratio linearly as its denominator in credit rating formation. Therefore, it can be concluded that Fitch follows current Basel regulation ratios and calculations when determining the suitable scaling for bank credit ratings.

### 3.2.1 Effects to bank's credit risk and profitability

The major focus point in critical discussion about the optimal level of capital requirements has been its possible negative influence on bank's profitability and changes in credit risk. While attempting to maintain current level of lending and at the same time meeting the capital requirements, banks must issue more equity (Fraisse, Lé & Thesmar, 2019). Kashyap and Stein (2004) state that higher capital requirements have the potentiality to diminish lending and investment, which may reflect negatively in bank's profitability as well and further to economy. Contrary to results Kashyap and Stein found out, De Bandt, Camara, Maitre & Pessarossi (2018) suggest that regulatory in capital appears to have minimal or non-existential effect on bank's profitability. This indicates that even though capital requirements have increased during the years, they do not affect to a bank's profitability unfavourable.

Poor risk management, inadequate liquidity cushion and inordinate leverage led to crucial consequences in 2007. Risk assessing rating agencies had conflicts of interests and inventive methods of calculating the credit risk added up with complicated financial instruments like derivatives deepened the outcome of the crisis (Ibrahim & Rizvi, 2018). Even though Basel III created framework for limits of credit risk that bank should carry, the interpretation of the credit risk may be equivocal. The credit rating agencies' ability to calculate the credit risk adequately has also been questioned, as banks that were misnamed as sound and stable faced default in the aftermath of the crisis (Caporale et al., 2012). Caporale et al. (2012) discuss that there is no assurance that the rating agency could calculate the credit risk better than the bank itself.

### 3.2.2 Basel IV

The dependence of different internal models to measure capital requirements and whether the buffers are set on optimal level have gathered a lot of attention and inspection among the authorities. In December 2017, "the Basel IV-package" was published in order to increase even more the capital of banks and banking institutions. Bodellini (2019) states that even though capital requirements have been proofed to be effectual mechanisms in order to intensify the financial soundness, they also have faced a lot of criticism. He adds that maintaining financial stability with capital requirements is essential, however, the legal framework

does and "one-size-fits-all" – regulation might have negative and unfair consequences amid different market participants.

Under Basel III regulations, banks were claimed to be constantly over-confident about their internal models for measuring their risk-weighted assets, thus, it gave too much leeway for bank's real amount of capital (Bodellini, 2019). Basel IV influences especially to the risk-weighted assets and their calculation, in addition of direct or indirect effect to the amount of capital to hold under the regulation. Capital requirements were proved to be insufficient concerning operational risks, as they were inadequate to cover the losses acquired by some banks. Sands, Liao & Ma (2016) point out that the main problem associated with the ability to measure operational risks sufficiently was due to the internal models and their deficient calculations. The feedback for new set of regulations has been contradictory. On the other hand, the stricter requirements for capital are widely understood, however, its probability of negative effect on the bank's profitability has gained attention. Similarly, to its predecessor accords, Basel IV also attempts to prevent any future financial crisis. However, the implementation of Basel IV standards was delayed due to global pandemic of Covid-19. The implementation of new standards was meant to be set on January 1 in 2022. The new exertion date has been postponed by a year to January 1 in 2023 (BIS, 2020). This thesis will focus on current regulation and appliance of Basel III as its source of bank capital requirements.

# 4 DATA AND METHODOLOGY

This chapter specifies the conducted research methodology of this study. First, the research method utilized in this thesis is clarified. Furthermore, the suitability of the method for this study in question is explained. Later on, the data collection process will be defined as well as the implementation and brief analysis of the data. The outcome and explanation of the study will be further discussed in the results chapter.

## 4.1 Choice of the research method

The purpose of the research is to examine the changes in credit ratings between the years 2004 – 2019. In addition to changes in ratings, the study aims to clarify the connection between the credit losses and bank credit ratings. The results are based on a longitudinal study that allows to examine changes in data during the years obtained. Longitudinal research allows to study certain sample of observations during extended period of times. It is suitable research tool for studies, where it is essential to track the sample of observations repeatedly number of times. Longitudinal study aims to point out and clarify answers to causes and consequences – causality – among the sample. It has the ability to offer basis for demonstrated explanatory theory (Adams, Khan, Hafiz & Raeside 2014, p. 5-9). The long observation period gives the opportunity to examine the changes in data before and after the global financial crisis 2007-2009.

## 4.2 Data collection, implementation and analysis

The bank-specific data for this study were obtained from REFINITIV/Thomson Financial Datastream database. The database offers also macroeconomic data from over 70 years and across 175 countries. Economic variables and indicators can be further utilized in time series analyses and for testing impacts of wanted events. It offers statistical information for example about the financial markets, stock prices and company accounts, but the concentration and interest in this study were in bank-specific variables. The study period and the sample consists bank data from 2004-2019 and coverage of the total of 66 bank groups in Western Europe. This sample period covers preliminary observations before the global financial crisis and allows further the examination about the aftermath following

the sovereign debt crisis as well. The Basel regulations were also formally updated repetitively during this sample time period, which means that the capital requirements have changed during the years of observation data. The Basel III accord and latest capital requirements among the regulation update were implemented shortly after the financial crisis. Therefore, this study aims to point out the possible influences on the bank credit rating in the aftermath of the crisis due to these stricter capital requirements. Shocks in bank variables due to the economic crises as well as recovery stages will be included in the data due to the adopted longitudinal approach. European economies were strongly affected by the crises, and some countries more deeply than the others. For example, so-called GIIPS-countries were unable to some extend to rearrange their government debt or were in need of support from European Union countries in order to rescue their indebted banks. GIIPS-countries include Portugal, Italy, Ireland, Greece, and Spain (Peón & Rey, 2013). Sometimes United Kingdom is also included in this group of countries. The GIIPS-countries are also included in the country sample of this thesis.

The banking data utilized includes information of European countries belonging to the group EU15, excluding Luxembourg, in other words the countries for this part are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden and United Kingdom. In addition to these, the data set covers observations from Iceland, Norway and Switzerland as well. The formation of the sample countries aims to take into account cognate and comparable European economies in order to provide more validity in the results. Therefore, for example Eastern European economies are removed from this study. By excluding Eastern European countries from the sample, it is possible to remove heterogeneous economies from the study. The heterogeneous approach is due to their position of more centrally planned economy in their transitional phase of moving to a market economy (Meriläinen & Junttila, 2020).

The credit ratings utilized in this study are obtained from Fitch ratings, therefore, the rating criteria follows their scaling process. Fitch uses credit scaling from AA+ to RD, from highest rating to default. In addition to letter scaling, Fitch uses as correspondence a numerical credit rating scale, from 19 to zero (Fitch ratings, 2020). This scale is presented below in Figure 5. The rating variables were originally obtained from REFINITIV/Thomson Datastream. Similar kind of statistical information provider is the Bankscope/Bankfocus database. The Bankscope is part of the Bureau van Dijk packages, that provides banking information based on income statements and balance sheets. Its purpose is to offer data for analysing and monitoring banks and other financial institutions. In other words, the Bankscope is a collection of banking information from different countries. However, Bhattacharya (2003) points out that the Bankscope does not take into account the entirety of banks in a certain country, but it should be treated as

a sample of them. Therefore, it is important to recognize how valid and exemplary the sample in question is. Bhattacharya (2003) adds that banking structures in economies are usually heterogeneous and disjointed. To avoid possible decrease in data quality and, primarily, damage to the validity and reliability to the study results, the divergent transitional economies were executed from the study of this thesis. After the publication of the working paper, nowadays Bankscope is operating under the name BankFocus. It is not the only authority providing banking data, but it has gained competitors, for example FitchConnect, S&P Global Market Intelligence and previously mentioned REFINITIV/Thomson Datastream. The bank-specific credit ratings rated by FitchRatings were also obtained from the REFINITIV/Thomson Datastream database. The bank-specific variables that were obtained from the same database and relevant in this study are introduced in Table 11.

Credit rating range and correspondence

| Rating | Points |
|---|---|
| AA+ | 19 |
| AA | 18 |
| AA- | 17 |
| A+ | 16 |
| A | 15 |
| A- | 14 |
| BBB+ | 13 |
| BBB | 12 |
| BBB- | 11 |
| BB+ | 10 |
| BB | 9 |
| BB- | 8 |
| B+ | 7 |
| B | 6 |
| B- | 5 |
| CCC+ | 4 |
| CCC | 3 |
| RD | 0 |

Figure 5. Credit rating range in data and the correspondence in numerical Fitch Ratings points.

## 4.3 Selection of the model

Fitch Ratings is one of the biggest rating companies especially for the banking industry. As discussed in the theoretical framework, Fitch Ratings bases their rating heavily on the financial performance of the bank. In their rating criteria, weak capital competency might lead to credit downgrading, even though other financial variables would show relatively good condition (Fitch Ratings, 2020). The aim of this study is to capture the relevant determinants reflecting capital losses that might have an effect on the bank's individual rating and analyse their influence. The goal is to display the connection between the credit rating and the credit losses that bank in question undergoes during the sample period. The regression method utilized in this study is the Ordinary Least Squares regression (OLS) model. OLS model allows studying of linearity, in other words, relationship between dependent variable (Y) and independent variable (X). OLS is a standard method and extremely popular model to use to analyse the sample data, when attempting to estimate the relationships between the variables that we are interested in. In this method, the attempt is to find and optimize the most fitting model for the sample in question. The purpose is to minimize the sum of square differences between the observed values and predicted values from the regression. From all the possible regression lines that go through the real data points, the best model has the smallest value for the sum of square errors (SSE). SSE stands for the variation in the dependent variable that the regression is unable to explain. This regression model allows us to estimate the effect on $Y_i$ of changing values of variable $X_{1i}$ holding the other regressors ($X_{2i}$, $X_{3i,}$ $X_{4i}$ and so on) constant (Stock & Watson, 2012, p. 151-152). With simple OLS regression, it is possible to find answers to many everyday empirical research questions. A simple regression model is formed as below:

$$y_i = \beta_0 + \beta_1 x_i + \varepsilon_i$$

where $Y_i$ denote the observations on the dependent variable, $x_i$ denotes the observations on the independent variable, and $\varepsilon$ is the error term of observation unit $_i$. $\beta_0$ is the intercept of the population of regression line while $\beta_1$ represents the slope of the regression line in question. The aim of OLS is to minimize the sum of squares of this error term, in other words, minimize the squared errors (Stock & Watson, 2012, p. 156). The OLS estimator picks the suitable regression coefficients in a way that the regression line is as close as possible to the data observed. This closeness of the regression line is calculated by the sum of the squared mistakes made when estimating the value of Y given the value of X. The OLS estimator extends the idea of simplified linear regression model, as it is formulated

above. As an example, we can let $b_0$ and $b_1$ be estimators of $\beta_0$ and $\beta_1$. Based on these estimators, the regression line is $b_0 + \beta_1 X$, implying that the value of $Y_i$ predicted while utilizing this line is $b_0 + \beta_1 X_i$. The mistake in predicting the $i^{th}$ observation would be $Y_i - (b_0 + \beta_1 X_i) = Y_i - b_0 - \beta_1 X_i$ (Stock & Watson, 2012, p. 156-157). The sum of squared prediction mistakes over *n* observations can be formulated as below:

$$\sum_{i=1}^{n} (Y_i - b_0 - b_1 X_1)^2$$

The estimators of the intercept as well as the slope that decrease the sum of squared mistakes in the above formula are referred to as the OLS estimators of $\beta_0$ and $\beta_1$. The OLS estimator of $\beta_0$ signifies as $\hat{\beta}_0$ , and the estimator of $\beta_1$ signifies as $\hat{\beta}_1$. The estimators $\hat{\beta}_0$ and $\hat{\beta}_1$ are sample counterparts of the population coefficients $\beta_0$ and $\beta_1$. Furthermore, the OLS regression line $\hat{\beta}_0 + \hat{\beta}_1 X$ is the sample counterpart of the population of simple regression line $\beta_0 + \beta_1 X$, while residuals $\hat{u}_i$ are the sample counterparts of the population errors $u_i$ (Stock & Watson, 2012, p. 156-157). The OLS estimators of the slope $\beta_1$ and intercept $\beta_0$ are formulated as below:

$$\hat{\beta}_1 = \frac{\sum_{i=1}^{n} (X_i - \bar{X})(Y_i - \bar{Y})}{\sum_{i=1}^{n} (X_i - \bar{X})^2}$$

$$\hat{\beta}_0 = \bar{Y} - \widehat{\beta_1} \bar{X}$$

The OLS predicted values $\widehat{Y_i}$ and residuals $\widehat{u_i}$ are formulated as below:

$$\widehat{Y_i} = \widehat{\beta_0} + \widehat{\beta_1} X_i, i = 1, \ldots, \mathrm{n}$$

$$\widehat{u_i} = Y_i - \widehat{Y_i}, i = 1, \ldots, n.$$

The estimated intercept, slope, and residual ($\hat{\beta}_0$ , $\hat{\beta}_1$ , $\hat{u}_i$) are computed from a sample of *n* observations of $X_i$ and $Y_i$, I = 1,…, n. In other words, these are estimates of the unknown true population intercept, slope and error term ($\beta_0$ , $\beta_1$ , $u_i$), (Stock & Watson, 2012, p. 157).

There are many advantages in using OLS estimators $\hat{\beta}_0$ and $\hat{\beta}_1$. As mentioned previously, OLS is an extremely widely used and dominant method, thus, it can be interpreted as *common language* utilized for regression analysis. The OLS estimator is also considered as unbiased and consistent method (Stock & Watson, 2012, p. 159-161). In other words, using OLS leads to wider understanding among the target audience. Apart from general approach to regression analysis, OLS regression has other advantages in this precis study as well. However, the OLS regression model has also faced criticism due to its limitations. If the dependent variable in the model is categorial while explanatory variables are fixed, the errors of the regression are heteroscedastic. This leads to inefficiency in estimates of parameters while the significance levels of test statistics may turn out to be unreliable (Noreen, 1988). However, unwanted heteroskedasticity can be sorted out by 'robust' command in Stata, a statistical software which is used in this study as well. Therefore, the estimates can be corrected by using heteroscedasticity-consistent standard errors and this correction will be conducted in this study.

Previous studies about bank rating variation have also utilized ordered logit and probit model estimations in their research (see for example Caporale et al., 2012). Probit and logit are nonlinear regression models, that are precisely intended for binary dependent variables. Logit regression attempts to estimate the probability of a certain outcome (Pohlmann & Leitner, 2003). The OLS, on the other hand, forms the relationship between the dependent variable and independent variables. The implication of a dependent variable is formed as a linear consolidation of the independent variable plus an error term (Pohlmann & Leitner, 2003). In this study, we are interested in changes in the bank credit ratings. Therefore, the OLS method was chosen as the main model to interpret the data and variables available. Even though probit/logit model are often used in predicting future positions of the examined research question, for example bond ratings or financial soundness of firm, the OLS model is also utilized in many studies examining changes in the dependent variable outcome as accurately or even more precisely than with probit/logit models (see for example Noreen, 1988; Meriläinen & Junttila, 2020; Pohlmann & Leitner, 2003). Previous studies have evidenced the suitability of OLS modelling research questions similar to the one focused in this thesis, therefore, it was selected instead of probit and logit modelling.

## 4.4 Selection of the variables

In this study, we will focus on loan loss provision (LLP-ratio) as an explanatory variable from the bank-specific variables, and the main focus is to find the connection between the bank credit rating and credit losses. Loan loss provision

expresses the provisions that are made for the possible future defaults by customers and loans that have been given out by the bank in question. The size of the required and optimal provision is set up based on different factors. These factors include for example level of country risk, industry risk and a particular risk related to the group of borrowers. In the database we use here, in case of customer default, the loan loss provision diminishes and further is refilled in the following fiscal period (REFINITIV/Thomson Reuters Datastream, 2020). LLP-ratio aims to capture expected credit losses and further expresses the connection how the credit losses affect the credit rating, and therefore utilizing the ratio allows us to answer the research question well. Loan loss provision ties up the capital of the bank, as it is saved for *"bad day"* and the amount of money that is put on hold in the accounts as a provision can not be utilized actively in the execution of business operations instead. The level of capital plays an important role in Fitch's credit rating criteria, hence, the position of equity can be reasoned to affect the bank's credit rating. The purpose is to reflect the bank's adequacy in capital of that time and monitor its changes during the examination period from 2004 to 2019 on bank level. Thus, the interest is in how the changes in the LLP-ratio affect the changes in the credit rating (CR). Here, LLP-ratio is utilized as the dependent variable as we predict how the changes in credit losses affect the credit rating (CR). The country-specific variations are taken into account by including sovereign credit rating and GDP growth in the chosen econometric model. The regression model and equation that is utilized in this study is presented below:

$$CR_{i,t} = \alpha_i + \beta_1 \text{LLP-ratio}_{i,t-1} + \beta_2 \text{L-ratio}_{i,t-1} + \beta_3 \text{E-ratio}_{i,t-1} + \beta_4 \text{D-ratio}_{i,t-1} + \beta_5 \text{ROA}_{i,t-1} + \beta_6 \text{logTA}_{i,t-1} + \beta_7 \text{sovCR}_{I,j,t-1} + \beta_8 \text{GDPgrowth}_{i,j,t-1} + \sum_{k=1}^{15} \beta_k \ \text{Dyear} + \varepsilon_{i,t}$$

This equation includes the main variables of interest in the study (CR as the dependent and LLP-ratio as the independent variable) and control variables that are supposed to affect the current credit rating with a lag. The equation takes into account bank specific constant term α, and controls the amount of cash to total assets (L-ratio), the total debt to equity and amount of total equity (E-ratio), the deposit funding made to the bank in question (D-ratio), the return on assets and profitability of the bank (ROA) as well as quantity of total assets (logTA). Country specific variables are also included in order to specify differences between the nations. Country specific variables concentrate on sovereign credit rate as well as the country economic growth measured by gross domestic product. The *j* represents the country, whereas *i* identifies the individual bank. Furthermore, the equation takes into account controlling fixed effect of time by including dummy variables for all years during the study period, subtracted by one year. By omitting one year variable from the study period, it is possible to avoid *the dummy variable trap*, in other words, perfect multicollinearity (Stock & Watson, 2012, p.

243-244). In this equation, a perfect multicollinearity is originating from set of multiple binary dummy variables. These year dummy variables are jointly exclusive and if all dummy variables are included in the equation among with a constant, it will lead to perfect multicollinearity (Stock & Watson, 2012, p. 243-244). To avoid this, one year dummy is excluded from the equation. In this study, the first entire year 2005 is omitted in order to eliminate perfect multicollinearity.

As the main research question of the thesis concentrates on the relationship between the credit losses and credit rating, these variables from bank's income statement and balance sheet were chosen due to their close relation to this question. The bank's amount of equity diminishes when it suffers from credit losses, therefore, equity ratio acts as one of the main explanatory variables of the equation. The hypothesis predicts that a decrease in the level of capital due to credit defaults affects to the credit rating negatively. The other variables were chosen also due their similar importance and influence on the credit rating. Equity-ratio displays the total amount of equity items on the balance sheet. Liquidity ratio aims to clarify the influence of cash to total assets-ratio on the credit rating. Loan loss provision attempts to cover the financial institution against credit losses that can be predicted. The loan loss provision ties up the equity of the bank, the amount usually related to the riskiness of the certain loan and the size of the financial institution. Thus, the equity tied up in loan loss provisions will be unavailable for further utilization in terms of increasing the bank's profitability by lending it further. The loan loss provisions reflect the bank's estimation for credit losses in the future. Therefore, it is the main variable of interest in the equation. By clarifying the changes in loan loss provisions, it is possible to get information about the relationship between the credit losses and credit ratings. This is one of the main purposes of the study of the thesis. As previously discussed in theory behind the Basel III regulations, the adequate level of capital requirements further affect to the amount of capital bank is required to withhold at any times. It can be assumed that excessively large amount of LLP can therefore affects the profitability and return on assets ROA, a variable, which is also taken into account in this model.

The deposit ratio (D-ratio) aims to capture the relation between the deposits made by the customer and the loans credited by the bank. Along with variable A representing totals assets of the bank as the size proxy, these aim to catch the size-effect of the bank more precisely and further make it easier to compare the results based also on the bank's size. The quantity variables attempt to clarify whether there are significant differences depending on the size of the bank. In other words, the aim is to clarify does the size of the bank affect the credit rating it is addressed with.

In order to examine country-specific differences among the EU15 countries (excluding Luxembourg), and with Iceland, Norway and Switzerland, the sovereign credit rating variables are included in the final equation. Alsakka et al. (2014)

showed that there exists a connection between the sovereign rating of a country and the bank specific credit rating operating in the home country in question. Alsakka et al. (2014) show in their study that during the period of financial crisis, downgrade of sovereign rating and negative forecast signals have great influence on bank rating downgrades as well. Shen et al. (2012) studied the influence of information asymmetry between different countries and how credit ratings differ among nations even though the financial ratios of banks remained constant. The study displayed bank credit ratings issued by Standard and Poor in 86 countries and presented results that show the influence of the bank's country of origin has on the final credit rating formation. In other words, it can be stated that even though financial ratios have weighted influence on the final form of credit rating, the influence of sovereign rating should not be underestimated. Thus, there is a need to control for the country-specific effect. Therefore, the sovereign ratings are included in the final version of the equation.

The final variable in the equation is the country specific gross domestic product growth (GDP Growth). The aim is to clarify whether the past condition of the economy has an effect on the credit ratings. To put it differently, the purpose is to examine if economic boom or recession leads to an increase or decrease in bank's credit rating. An economic boom can be expected to have a positive influence on the banking sector and therefore to the financial position of the bank, ultimately leading to stronger credit rating as well. Similarly, if economy faces a recession, it can be predicted that credit ratings are affected by the downfall of economic conditions. The research period consists global events that affected the European economy, including global financial crisis starting in 2007. The variable $GDPgrowth_{i,j,t-1}$ captures economic growth of a country $_j$ where the bank $_i$ is based. By separating country specific differences and variation between the influence of economic growth, the study aims to examine whether the changes in economic conditions have differently weighted impact on the credit ratings depending on the country of origin. Iannotta, Nocera & Sironi (2013) state in their study about the impact of government ownership on bank risk that controlling that banks which receive governmental operational support and controlled by governments tend to have better credit ratings than banks which are privately owned. That is one of the reasons, why Iannotta et al. (2013) highlight the importance to control for the country-specific economic growth rates, especially when taking into account country-specific sovereign credit rating as well. Otherwise, the results might end up being based as governmental assistance towards banks, that has the potential to affect the credit ratings addressed by the rating agencies.

## 4.5 Descriptive statistics of the variables

This section examines the average (mean) values of the variables that are utilized in the study. The number of total observations, mean value, standard deviation and minimum as well as maximum value of the variable in question are presented in Table 1. The variables that are presented in more detail here are variables that are applied in the regression model that was introduced more precisely in the previous section. Here, the key focus is especially on the mean values of numerical credit ratings as well as in the loan loss provision ratio. These two variables and their average values will be further illustrated in figures 6, 7 and 8.

Table 1. Descriptive statistics of the Western Europe bank variables applied in the study.

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Numerical credit rating | 686 | 14.343 | 3.472 | 0 | 19 |
| LLP-Ratio | 840 | .129 | .257 | -.524 | 3.586 |
| L-Ratio | 854 | 8.078 | 6.402 | 0 | 72.465 |
| E-Ratio | 865 | 6.213 | 3.298 | -4.204 | 36.405 |
| D-Ratio | 851 | 56.368 | 15.688 | 1.383 | 98.757 |
| ROA | 862 | .127 | .426 | -5.83 | 3.259 |
| logTA | 865 | 11.888 | 1.786 | 7.511 | 14.7 |
| sovCR | 871 | 17.79 | 3.81 | 3 | 20 |
| GDPGrowth | 871 | 1.386 | 2.617 | -9.1 | 25.2 |

The time development of average numerical credit rating of banks during the sample period is presented below in Figure 6.

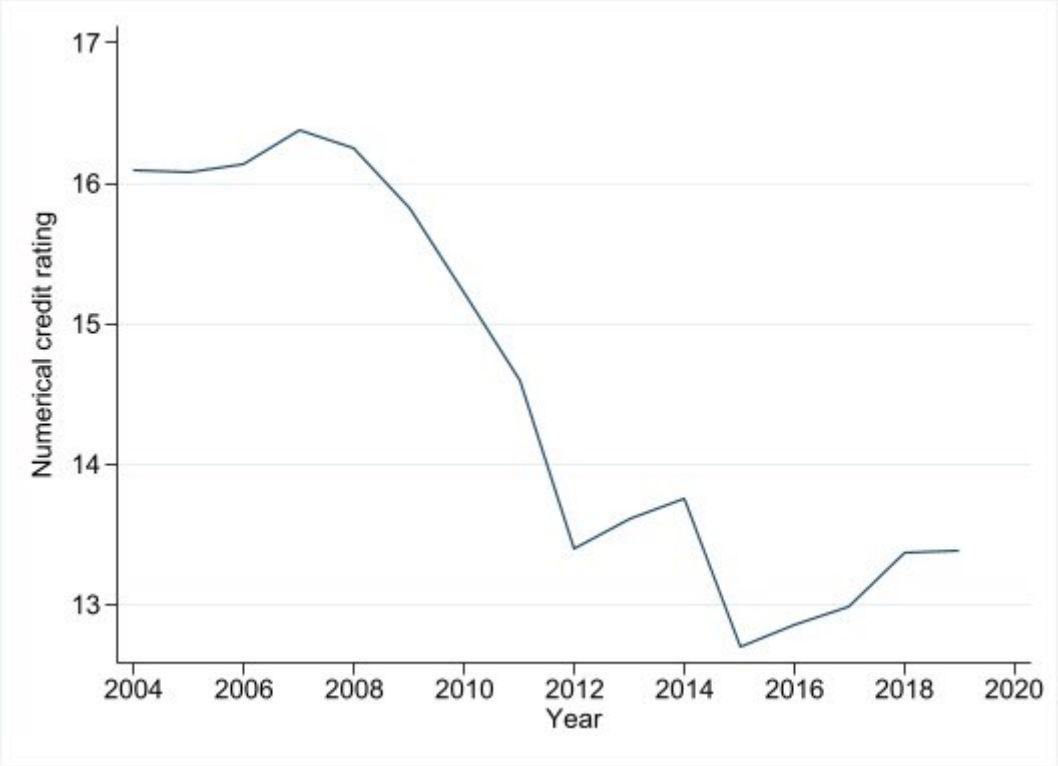


Figure 6. Development of a numerical credit ratings from 2004 to 2019.

Figure 6 describes the average of numerical credit rating the sample banks gained during the sample period from 2004 to 2019. From over 650 observations, the average (mean) credit rating is 14.34. This correspondences to the letter credit rating of A- to A in Fitch's credit rating scale, which is also presented in Figure 5. The standard deviation of ratings is 3.47. In this case, standard deviation of 3.47 can be interpret as rather strong variation. It can be interpreted from the figure that drastic decreases in the ratings have occurred after 2008, and lasted until 2012. After 2012, the average value seems to have increased few years, until it resumes back to where it was before, reaching the lowest point in 2015 when the average credit rating was below 13, corresponding to letter credit rating of BBB. The curve follows closely major economic crises that Europe faced, including global financial crisis starting in 2007 and sovereign debt crisis following afterwards. Some evidence from recovery among Western European banks can be seen from the graph, however, the pace of the restoration has been relatively slow and far from its highest level in 2007 before the downfall.

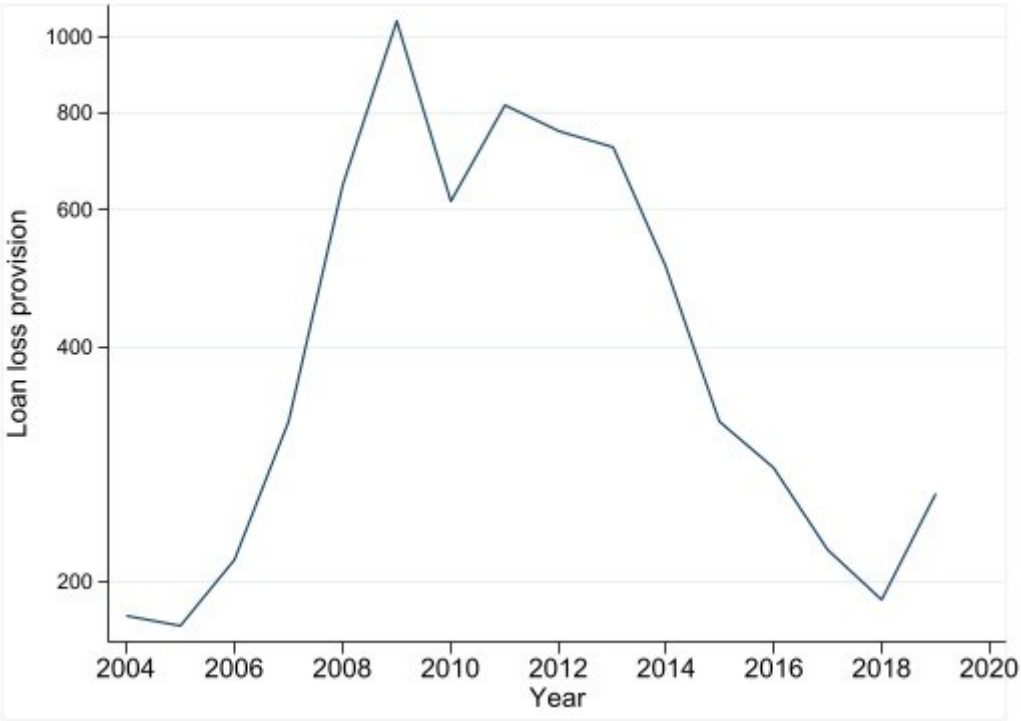


Figure 7. Average of loan loss provision from 2004 to 2019.

Figure 7 presents the average loan loss provisions that the sample banks possessed between 2004 to 2019. REFINITIV/Thomson Reuters Datastream describes loan loss provisions as an establishment for possible future defaults. In case of borrower default, the provision that is set up will be reduced and restored in the following fiscal period. The decreases in the graph follow closely, but with delay, the movements of the numerical credit rating graph in Figure 6. The highest peak in the average amount of loan loss provisions among Western European banks was during 2009, when the highest numerical credit ratings were addressed in 2007. In 2008, the average loan loss provisions continued to increase sharply while the average credit rating was decreasing rapidly. Here, obviously seem to have a negative relationship. After 2009, the average amount of loan loss provisions decreased drastically but faced uplift again in 2010 until the graph starts to decrease again in 2011. This downgrade does not fold earlier than only in 2018. In 2010 the increase in loan loss provision is shown as steeper downfall in the numerical credit rating, too. As loan loss provision declines in 2012, at the same time average numerical credit rating is increasing. In 2015, average numerical credit rating shows signs of recovery, while average loan loss provision continues to decrease. The increase of average numerical credit rating slows down and becomes almost steady, while it is the same year when average loan loss

provisions starts to increase again. Through the whole sample period of 15 years, the average numerical credit rating and level of loan loss provisions seem to have relationship in their upgrade and downgrade swifts in graphs. When loan loss provision shows increasing in 2010, the numerical credit rating started to decrease steeper. The steepest downfall for both graphs in figures 6 and 7 can be seen to begin in 2013 for loan loss provisions and 2014 for credit rating. In 2014 average level on loan loss provisions shows sign of upturn, as the graph loses some of its steepness. At the same time, credit ratings on average started to decrease drastically, as can be seen in Figure 6. Again, it can be interpreted that at first the average level of loan loss provision starts to decrease, and the average level of numerical credit rating will follow this movement to opposite direction. Therefore, it can be concluded from the graphs' that these variables could have a significant negative relationship.

The amount of average loan loss provisions rocketed before the global financial crisis, which is visible in the Figure 7. Cohen & Edwards (2017) analyse the role of setting provisions for expected credit losses after the crisis. They state that the crisis emphasised the penalties of delayed awareness and acknowledgement of credit losses on the behalf of banks and other financial institutions. Cohen & Edwards (2017) suggest that before the crisis, the utilization of existing standards was considered as having averted banks from provisioning accordingly and suitably for credit losses presumably to originate from emerging risks. These postponements culminated in the awareness of credit losses that were extensively considered as "*too little, too late*". Cohen & Edwards (2017) add that questions rose about the role of regulatory models concerning for example capital levels in the aftermath of the crisis. The possibility that capital provision levels lead to procyclicality by arousing exaggerated lending during the time of boom and obligating sudden cutback in the following crash. This major rise in loan loss provisions during the time of pre-crisis, followed by drastic fall during the crisis years can be seen in the Figure 7. Cohen & Edwards (2017) highlight the differences between countries and regions in terms of defining the optimal relationship between loan loss provisions and impaired loans. The bank has the potential to judge the level of quantity of the impaired loans that will be revived. The bank might decide the optimal level of recovery depending on the quality of assets by setting loan loss provisions. For example, in Spain – which is one of the sample countries of the study – the formed policies to support increases in provision levels had positive impact, leading to provisions that were above the impaired loans ahead of crises. However, the following consecutive increase in impaired loans was nonetheless well above of the provisions that had been set up earlier (Cohen & Edwards, 2017).

The amount and changes in loan loss provisions attempt to capture the credit losses the bank in question faces during the sample period. Fitch Ratings highlight the importance of capital adequacy and bank's equity position in their

credit rating policy. Therefore, it can be reasoned to utilize and concentrate interest in this variable while explaining changes in credit rating. The guidance of capital requirements arise also based on Basel regulation framework, which has been modified after the crisis in order to prevent similar events occurring in the future. Both the global financial crisis as well as the sovereign debt crisis took place during the sample period. Therefore, in order to create more stabile banking sector in the future, the regulation framework and buffer against defaults required rearrangements. The fluctuation in Western European banks' loan loss provision percentage during the sample period is displayed in Figure 8. The value of loan loss provision to total assets is relatively small, the average (mean) percentage being 0.13%. In practise, in nearly all euro area countries, the provisions for loan losses are often made only after the loan has become defaulted. This arrangement is due to common accounting standards. However, the standards might vary due to different regulation system among countries. This settlement leads to a situation where the level of provisioning might increase relatively remarkably only after the cyclical downturn of the economy has set in (ECB report, 2004). The steep increase in the level of loan loss provisions during the global financial crisis in 2007-2008 could be explained at least partly by this theory.

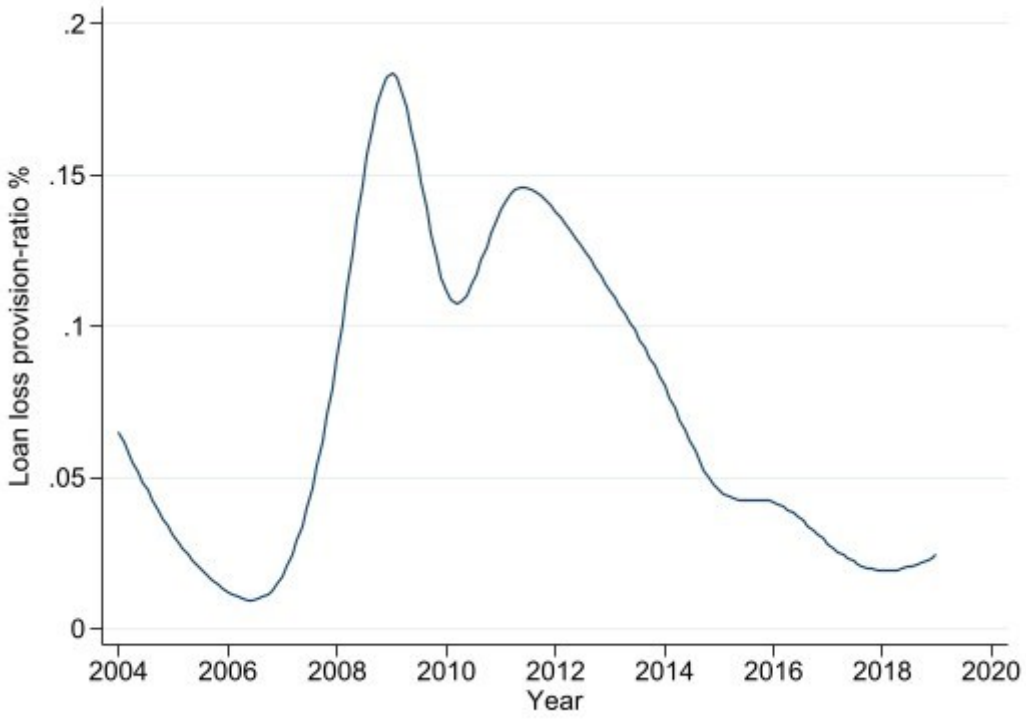


Figure 8. Loan loss provision to total assets percentage during 2004 to 2019.

European Central Bank released in March 2004 their monthly bulletin, where one of the key topics of interest was the development of loan loss provision in 1990's and early 2000's. The study displays how from the long-term viewpoint, loan loss provisions have continued to linger remarkably low compared to the peaks in early 1990's. According to the report, the highest percentage of loan loss provision to total assets was reached in 1993 (0.7 percentage). After early 1990's, the average level of loan loss provision in the euro area has not ever since reached similar peak again. The comparable small-scale level trend has continued during more recent years in 2010's, as can be adopted from Figure 8.

The ECB report (2004) presents the movements in the level of banks' loan loss provisions during the 1990s and early 2000s. It implies that the amount of securing bad loans by loan loss provisions increases remarkably usually only after economic downturn has once set in (ECB report, 2004). This trend can be seen in the analysed sample of this thesis as well. On average, loan loss rates rise significantly during 2007 to 2013, broadly. After 2013 the level on loan loss provision keeps on decreasing. On the other hand, we see from Figure 6, that the level of credit ratings decreases as well during late 2007 to 2015. As discussed previously, from these similar movements it is possible to interpret that both credit ratings and loan loss provisions could have a statistically significant relationship. The movements mimic and follow each other closely especially during the different years of crises and their aftermath. However, the recovery level for credit ratings on average has not been able to meet the similar readjustment and restoration as the loan loss provision level has gained, on average. This change in the correlation after the years of crises is heavily noticeable, as the connection seems to weaken in the beginning and during the upturn of the economy that followed the crisis period. Therefore, the relationship between the credit rating and loan loss provision seems to be stronger during the crises but weaker during the boom of economy. The results of ECB report (2004) show that the fluctuation and rise in loan loss provision is dated in economic downturn, as banks tend to start securing their loans often when the loans have already defaulted. This could be due to profitability maximisation, as loan loss provision captures equity that can not be utilized in creating profitability from other bank operations. Rather sudden trend of securing loans by provisions causes increase in the level of loan loss provision in the ECB report in 2004, which can be seen in this study sample from Figure 8 as well. The weaker connection between credit ratings and loan loss provisions during more stable economical time period could be partly explained by this – banks tend to secure their loans and brace their financial solvency more seldom or at least not to the same extent as they do when the economy starts to show signs of recession.

The addition of Basel III standards considered these "*too little, too late*" -actions and in order to secure and minimize the inevitable loan losses, suitable level of provisions was essential in new regulation setting formation (BIS, 2016). Due to updated regulatory and standard requirements for the amount of provision that a bank must hold during all times might have affected to the correlation of

credit ratings and loan loss provisions. After the adjustments in provisions rates by the Basel III, the increase in provisions would not necessary reflect possible upcoming defaults, and therefore would not affect drastically negatively to credit ratings, as it has before the modification of the regulatory. After the global financial crisis both the G20 country leaders and Basel committee recommended changes in accounting standard so that the formators would create provisions in forward-looking estimation for possible future credit losses, rather than only implying damage control for inevitable current or upcoming loan defaults (BIS, 2016). This could partly explain why the increase in provisions after the crises does not affect as negatively to the average credit rating level as it affected during the crises. After the adjustments in banking regulations, the sign of increase in loan loss provisions does not necessarily suggest high level of upcoming defaults, but rather newly normalized precaution and preventing actions supporting bank's financial stability.

The regression equation of this thesis utilizes total of six bank specific variables, that were introduced previously. In addition to these variables, in order to add the country specific factor, sovereign credit rating and GDP growth are included in the equation. Previous studies about the influence of sovereign rating to the bank credit rating has showed the significant relationship. Shen et al. (2012) displayed in their study how the country origin of the bank affects to its credit rating. Even though the financial ratios that are considered as backbone of credit rating formation were consistent, the bank's country of origin affected to its credit rating. Alsakka et al. (2014) concluded in their study how the sovereign rating downgrades has significant effects on bank credit rating downgrades during the period of crisis. On the other hand, upgrade in sovereign ratings does not seem to have the same effect. Huang & Shen (2015) discuss about a term of *"sovereign ceiling"*, which suggests that bank ratings rarely surpass the sovereign credit ratings of the bank's country of origin. Therefore, it can be assumed that average (mean) sovereign rating would be higher than the average (mean) credit rating for banks.

The data sample of Western European banks used in this thesis gives results that support this presumption of Huang & Shen (2015). The average (mean) sovereign rating among the study sample is greater than the bank credit rating. While the average bank credit rating was 14.34 (corresponding A- to A in Fitch's letter credit rating scale), the average (mean) sovereign rating was 17.79 (corresponding AA- to AA in Fitch's letter credit rating scale). The standard deviation among the sovereign credit ratings is more disperse compared to the bank credit ratings. While standard deviation of bank credit ratings is 3.47, for sovereign credit rating it is 3.81. Therefore, it can be concluded that the variation between sovereign credit ratings is greater in this sample compared to the bank credit ratings. The sovereign rating has both greater minimum value as well as greater maximum value (minimum of three, and maximum of 20, ranging from RD default to AA+ in letter grading), whereas the bank credit ratings have minimum

of zero and maximum of 19, i.e., going from CCC to AAA, respectively. The sovereign credit ratings of sample countries are more disperse around the mean. However, they are greater in average terms in comparison to the bank credit ratings. This outcome supports the theory of *sovereign ceiling* discussed by Huang & Shen (2015).

Basel III has set the target levels of capital requirements that bank are regulated to obtain and follow. Optimal level of Tier 1 capital has been modified in different versions of the accord during the recent years. In the current version of regulation, the required level of Tier 1 capital is around 6% (BIS, 2016). The average amount of Tier 1 capital among the sample banks was 8.7% and the amount of total equity to total assets (E-ratio) 6.2%. Thus, on average, the optimal level of Tier 1 capital is met.

The second research question of the thesis concentrates on the possible linearity or nonlinearity in loan loss provisions' influence on the credit rating. In other words, the aim is to resolve whether the effect of loan loss provision is independent from the bank's existing level of provision in the beginning or does there exist some dependency of the existing level of loan loss provision. This is important question, as maximizing the profitability is usually the aim of every business operator. As loan loss provisions tie the bank equity, it may be seen as a burden for profitability. This can be seen also from Table 2 as the return on assets and loan loss provision have negative correlation. Thus, it is important for a bank to acknowledge the optimal level of loan loss provisions, as excessive provisions may affect negatively the profitability. We can see from Table 2 that LLP-ratio correlates negatively with the dependent variable credit rating. Therefore, holding excessive amounts of loan loss provision is unbeneficial for banks in terms of possible downgrade for their credit rating as well. The study aims to resolve whether the negative effect is linear or does it reach breakeven point or change its influence at some level.

In order to capture the potential nonlinearities between the loan loss provisions and credit rating, this study utilizes similar regression that includes years that have above the median value in level of loan loss provision. This regression model of median values is used in Meriläinen & Junttila (2020) study as well, where the attempt is to resolve the potential nonlinearities between the bank liquidity and credit rating. This study utilizes the regression model Meriläinen & Junttila (2020) introduced in their study, however, with minor changes according to the variable of interest. The regression model used in this thesis in order to capture the possible non-linearities in the loan loss provision influence is the following:

$$CR_{i,t} = \alpha_i + \beta_1 Median_{i,t}^{LLP\text{-}ratio} + \beta_2 LLP\text{-}ratio_{i,t-1} + \beta_3 E\text{-}ratio_{i,t-1} + \beta_4 L\text{-}ratio_{i,t-1} + \beta_5 D\text{-}ratio_{i,t-1} + \beta_6 ROA_{i,t-1} + \beta_7 \log(TA)_{i,t-1} + \beta_8 SOVCR_{I,j,t-1} + \beta_9 GDPgrowth_{i,j,t-1} + \sum_{k=1}^{15} \beta_k \ Dyear + \varepsilon_{i,t}$$

The regression model above takes into account median values of LLP-ratio, which is the variable of main interest in this study. By concentrating on the movements of above-median values in loan loss provision, it is possible to capture whether the changes are linear or nonlinear above the median. On the other hand, the study also calculates the below-median values for LLP-ratio, in order to resolve whether the changes in loan loss provision affect to the credit rating more if the already existing level of provision is below the median. The findings of this regression model are presented in the Results chapter.

Table 2. Correlation matrix of the variables utilized in the study.

| Variables | CR | LLP | L | E | D | ROA | logTA | sovCR | GDP |
|---|---|---|---|---|---|---|---|---|---|
| (1) CR | 1.000 | | | | | | | | |
| (2) LLP-ratio | -0.408 | 1.000 | | | | | | | |
| (3) L-ratio | 0.097 | -0.061 | 1.000 | | | | | | |
| (4) E-ratio | -0.332 | 0.106 | -0.051 | 1.000 | | | | | |
| (5) D-ratio | -0.609 | 0.334 | 0.061 | 0.330 | 1.000 | | | | |
| (6) ROA | 0.309 | -0.710 | 0.048 | 0.143 | -0.135 | 1.000 | | | |
| (7) logTA | 0.401 | -0.095 | 0.221 | -0.403 | -0.421 | -0.036 | 1.000 | | |
| (8) sovCR | 0.877 | -0.428 | 0.059 | -0.231 | -0.632 | 0.326 | 0.231 | 1.000 | |
| (9)GDPGrowth | 0.230 | -0.291 | 0.009 | 0.158 | -0.169 | 0.220 | 0.006 | 0.285 | 1.000 |

# 5 RESULTS AND ANALYSIS

This chapter goes through more in detail the empirical results obtained from running different regression model variations with chosen variables. Table 3 presents outcomes from different models that were ran in Stata. Furthermore, Table 7 presents results from nonlinear effects of LLP-ratio. Variables were included in the model one by one, starting with only LLP-ratio's relation to credit rating, and ending with all the eight variables in the same model. All the variables are adjusted by changing them to one period lagged values.

## 5.1 Results from relationship between credit rating and LLP-ratio

The regression model used in this study was modified by adding one variable at time. Starting with only loan loss provision ratio and its influence on credit rating, it is possible to interpret from model 1 in Table 3 that LLP-ratio does have significant relation to credit rating. When LLP-ratio acts as the only explanatory variable (model 1) the variable gets negative value of -1.897. This is statistically significant at 10% level as its p-value is <0.1. The negative parameter estimate implies that loan loss provision ratio has a decreasing effect to the credit rating. This could be seen from Figure 6 and Figure 7 as well, where average credit rating and loan loss provision seemed to have negative relationship especially during the crisis periods. However, the relationship might not have been negative during the whole sample period. Table 4 presents the results for yearly changes for the same eight models that are presented in Table 3. The value for parameter estimate on LLP-ratio has been positive during the years from 2006 to 2008. After 2008, the value drops drastically and reaches its most negative value of -3.484*** in 2016. In other words, in 2016 the relation between LLP-ratio and credit rating was the most negatively correlated in this study sample. In 2007 and every year after 2010 the LLP-ratio gets statistically significant value with p<0.01. Positive value during 2006 to 2008 could be partly explained by the actions that banks have operated before the crisis. We can see from Figures 6 and 7 how before 2009, both the numerical credit ratings and loan loss provisions rose. During these years, LLP-ratio and credit rating have positive relationship. Setting more provision aside implicated good buffer against credit losses, but as the ECB report already in 2004 notes, the sudden increase in provision levels does not necessarily implicate better risk management but bank's attempts to cover already defaulted loans or

loans that will most likely default in the near future (ECB report, 2004). Therefore, the drop after 2008 is drastic and the positive relation between LLP-ratio and credit rating changes so that the variables correlate negatively after the global financial crisis.

Model 2 takes into account LLP-ratio and cash to total assets, in other words the liquidity ratio or L-ratio. Similarly to model 1, the value of LLP-ratio remains statistically significant in this model as well. When the L-ratio is taken into account, the value of LLP-ratio rises slightly. In other words, the negative effect that LLP-ratio had on its own decreases, as it goes from -1.897 to -1.767. The parameter estimate on L-ratio itself is positive, which can be interpret so that the L-ratio has a positive effect on the credit rating. The highest coefficient of the model two is 0.493*** in 2007, which is also statistically significant ($p<0.01$) in 2007. In 2016 the most negative coefficient during this sample is reached, when value of coefficient drops to -3.636***. Again, all year coefficients starting from 2010 have negative value and years from 2011 all have statistically significant coefficient. The year dummy 2007 is slightly more statistically significant than in model one, as it gets p-value of <0.01. As R-squared value is bigger in model two as well, it is able to explain the credit rating more precisely. R-squared value increases every time the more variables are added in the model, however, model 7 and model 8 have same R-squared values of 0.772.

Table 3. Results from the model testing the influence of different variables on credit rating for the whole panel data during sample period.

| | (1) CR | (2) CR | (3) CR | (4) CR | (5) CR | (6) CR | (7) CR | (8) CR |
|---|---|---|---|---|---|---|---|---|
| LLP-ratio | -1.897* | -1.767** | -1.745* | -1.738** | -1.249 | -1.237 | -.403 | -.446 |
| | (.946) | (.87) | (.875) | (.863) | (.822) | (.801) | (.471) | (.491) |
| L-ratio | | .067 | .068 | .07 | .069 | .069 | .019* | .019 |
| | | (.049) | (.049) | (.048) | (.047) | (.049) | (.011) | (.011) |
| E-ratio | | | .045 | .016 | 0 | .034 | -.116 | -.111 |
| | | | (.082) | (.098) | (.092) | (.126) | (.074) | (.074) |
| D-ratio | | | | -.038 | -.038 | -.032 | 0 | -.001 |
| | | | | (.028) | (.027) | (.031) | (.016) | (.016) |
| ROA | | | | | .437 | .448 | -.071 | -.081 |
| | | | | | (.517) | (.523) | (.265) | (.266) |
| logTA | | | | | | .992 | .905* | .902* |
| | | | | | | (1.078) | (.528) | (.526) |
| sovCR | | | | | | | .759*** | .763*** |
| | | | | | | | (.086) | (.088) |
| GDPGrowth | | | | | | | | -.02 |
| | | | | | | | | (.028) |
| _cons | 16.303*** | 15.847*** | 15.644*** | 17.96*** | 17.887*** | 5.74 | -8.738 | -8.717 |
| | (.431) | (.457) | (.591) | (1.965) | (1.968) | (14.441) | (6.788) | (6.759) |
| Observations | 623 | 613 | 613 | 608 | 605 | 605 | 605 | 605 |
| R-squared | .435 | .463 | .464 | .474 | .477 | .483 | .772 | .772 |

*Robust standard errors are in parentheses*
**** p<.01, ** p<.05, * p<.1*

Table 4. Yearly results from the models testing the influence of different variables on credit rating for the whole panel data.

| | (1) CR | (2) CR | (3) CR | (4) CR | (5) CR | (6) CR | (7) CR | (8) CR |
|---|---|---|---|---|---|---|---|---|
| D2005 | | | | | | | | |
| D2006 | .141 | .211 | .207 | .028 | .035 | -.249 | -.069 | -.093 |
| | (.116) | (.142) | (.141) | (.168) | (.168) | (.259) | (.152) | (.157) |
| D2007 | .352** | .493*** | .482*** | .256 | .235 | -.154 | .158 | .159 |
| | (.133) | (.178) | (.175) | (.226) | (.227) | (.332) | (.217) | (.217) |
| D2008 | .152 | .191 | .175 | -.04 | -.034 | -.572 | -.154 | -.161 |
| | (.155) | (.165) | (.163) | (.201) | (.201) | (.506) | (.338) | (.337) |
| D2009 | -.122 | -.16 | -.155 | -.36 | -.334 | -.925 | -.679* | -.737* |
| | (.233) | (.253) | (.253) | (.283) | (.298) | (.59) | (.362) | (.369) |
| D2010 | -.532 | -.565 | -.605* | -.726** | -.743** | -1.388* | -.899** | -1.042** |
| | (.333) | (.353) | (.347) | (.336) | (.34) | (.733) | (.406) | (.447) |
| D2011 | -1.196*** | -1.232*** | -1.294*** | -1.421*** | -1.365*** | -2.071*** | -1.124** | -1.161*** |
| | (.357) | (.367) | (.342) | (.328) | (.327) | (.734) | (.427) | (.428) |
| D2012 | -2.282*** | -2.451*** | -2.462*** | -2.555*** | -2.465*** | -3.193*** | -1.497*** | -1.541*** |
| | (.525) | (.543) | (.528) | (.503) | (.501) | (.816) | (.516) | (.52) |
| D2013 | -2.269*** | -2.565*** | -2.579*** | -2.638*** | -2.596*** | -3.35*** | -.929* | -1* |
| | (.501) | (.562) | (.546) | (.521) | (.527) | (.837) | (.546) | (.554) |
| D2014 | -2.287*** | -2.495*** | -2.572*** | -2.597*** | -2.54*** | -3.281*** | -.778 | -.836 |
| | (.518) | (.54) | (.537) | (.517) | (.52) | (.945) | (.565) | (.573) |
| D2015 | -3.289*** | -3.457*** | -3.544*** | -3.605*** | -3.559*** | -4.333*** | -1.89*** | -1.912*** |
| | (.654) | (.668) | (.669) | (.642) | (.645) | (1.049) | (.518) | (.517) |
| D2016 | -3.484*** | -3.636*** | -3.747*** | -3.763*** | -3.684*** | -4.455*** | -1.593** | -1.601** |
| | (.717) | (.727) | (.732) | (.722) | (.72) | (1.086) | (.603) | (.601) |
| D2017 | -3.355*** | -3.555*** | -3.675*** | -3.649*** | -3.611*** | -4.362*** | -1.348** | -1.375** |
| | (.717) | (.74) | (.744) | (.737) | (.742) | (1.099) | (.594) | (.595) |
| D2018 | -2.999*** | -3.306*** | -3.453*** | -3.342*** | -3.242*** | -3.989*** | -1.112* | -1.127* |
| | (.606) | (.655) | (.678) | (.711) | (.712) | (1.132) | (.646) | (.645) |
| D2019 | -2.986*** | -3.29*** | -3.423*** | -3.289*** | -3.217*** | -3.983*** | -1.381** | -1.407** |
| | (.596) | (.648) | (.665) | (.705) | (.699) | (1.129) | (.591) | (.594) |
| _cons | 16.303*** | 15.847*** | 15.644*** | 17.96*** | 17.887*** | 5.74 | -8.738 | -8.717 |
| | (.431) | (.457) | (.591) | (1.965) | (1.968) | (14.441) | (6.788) | (6.759) |
| Observations | 623 | 613 | 613 | 608 | 605 | 605 | 605 | 605 |
| R-squared | .435 | .463 | .464 | .474 | .477 | .483 | .772 | .772 |

*Robust standard errors are in parentheses*
**** p<.01, ** p<.05, * p<.1*

In model 3, the variable equity ratio (E-ratio) is added as the third explanatory variable. E-ratio describes the percentage of bank's total equity to total assets. When E-ratio is added in the model, the LLP-ratio effect increases even further, even though its statistical significance decreases. E-ratio's coefficient is positive, which is reasonable – high total equity to total assets has an increasing effect to bank's credit rating. Contrary to models 1 and 2, model 3 has statistically significant year 2010 effect with coefficient -0.605*.

Model 4 adds deposit ratio (D-ratio) to the model. D-ratio describes the amount of total customer deposits to total assets. The value of the regression coefficient on D-ratio is negative (-0.038). Negative value implies that high amount of deposits compared to total assets has a decreasing effect on bank's credit rating. This is understandable, as deposits are liabilities for a bank. If the deposits take a huge portion of compared bank's total assets, it may be considered riskier business operator as it does not have relatively big amount of total assets compared to total deposits. Thus, in the event of bank run, it may be in trouble in paying back customer deposits. Similarly to the earlier models, the coefficient is positive before the global financial crisis, however, it decreases so it gets negative value in 2008. Including D-ratio drops the model's statistical significance in 2007 and it becomes statistically insignificant. Therefore, the model in unable to explain the coefficient of the year 2007 as statistically significantly as the previous models 1, 2 and 3.

Model 5 takes into account bank's return on assets, more precisely pretax returns to total assets percentage or ROA. In this model, the key variable LLP-ratio loses its statistical significance. Here, it can be interpreted that in this model, while including return on assets -variable the amount of loan loss provision becomes more insignificant. LLP-ratio's value changes from -1.738 to -1.239. L-ratio, E-ratio and D-ratio values drop, while LLP-ratio's value increases once again. The value of constant has been rising steadily or maintaining its value almost the same through the first five models. The value of constant drops remarkably after this, and has even negative value in model 7 and model 8. The results from yearly changes can be interpret so that ROA increases the positive value of the other variables, and further impacts improvingly on the credit rating.

The model 6 contains the influence of log of total assets or logTA. It attempts to capture information about whether the size of the bank has an effect to the credit rating. The total assets have relatively more positive value compared to other variables in this model. However, the constant drops remarkably from 17.887 (model 5) to only 5.74. Taking into account the log of total assets, the statistical significance of the year 2010 drops slightly as well from $p<0.05$ to $p<0.1$.

Models 7 and 8 include the macroeconomic variables of sovereign credit rating and GDP growth. First, when sovereign credit rating variable is added in model 7, it gains statistically significant value with coefficient 0.759. At the same time, both variables L-ratio and logTA become statistically significant as well. This could mean that these three variables have meaningful relationship. Values of L-ratio and logTA drop when adding sovereign credit rating into the model, so sovereign credit rating variable has negative effect to these two variables. In other words, when adding sovereign credit rating in the model, it makes changes in L-ratio and logTA correlate with changes in dependent variable Credit rating. However, when it comes to LLP-ratio, the impact is remarkably positive. In the earlier models, the coefficient on LLP-ratio has shown steady growth every time a new explanatory variable is added. With sovereign credit rating included, the value increases from -1.237 (model 6) to -0.403. Hence, the negative effect of loan loss provisions weakens when the sovereign credit rating is taken into account. Here, it could be seen as the country of origin and the credit rate level of the bank's country has more impact to the credit rating of the bank than the loan loss provision would have negative impact. What is important to notice, however, is the negative value of -8.738 that the constant gets in this model 7. From all eight models in total, the constant gets the most negative value in this model 7. For model 8, it gets slightly less negative value of -8.717. Unlike in any earlier models, in model 7 the results show the value of year 2009 to be statistically significant. The R-squared value jumps in model 7 compared to previous models, which supports the model's ability to describe the dependent variable's relation to independent variables better than former models 1-6. The r-squared value remains the same between the model 7 and model 8, as it gets value of 0.772 in both models. If R-squared value is over 0.7, it is generally considered as strong effect size (Moore, Notz & Flinger, 2013). Therefore, these last two models are the most suitable ones and explain the dependent variable Credit rating with the independent variables most precisely out from these 8 models.

The model 7 is the first model where the coefficient of E-ratio has a negative value. This could be indicated so that the high level of equity decreases the credit rating and directs to bad credit changes. Higher level of equity could be interpreted so that the bank in question has riskier structure. The same characteristics could be observed of high level of loan loss provision as well. Regulations guide the optimal amount of equity that bank must hold depending on the riskiness of the operator and the riskiness of loans in question (Fitch Ratings, 2020). Therefore, a high amount of equity can be understood as a reflection of riskier operations and therefore more unstable financial conditions of the bank. In addition, the coefficient of return on assets (ROA) gets a negative value in this model. This may seem as a surprising result, as profitability could be considered as upgrading quality of credit rating. However, it is possible to interpret from Table 2 the correlations of the variables. Table 2 presents the negative correlation of LLP-ratio and ROA. In model 7, the negative effect of LLP-ratio drops drastically, in other

words the negative effect of LLP-ratio to the credit rating weakens. The LLP-ratio does not have as negative influence on the credit rating as it had in the first 6 models. However, at the same time the ROA coefficient gets negative value. This could be partly explained by the significant increase in LLP-ratio. As these two variables have negative correlation, an increase in the value of LLP-ratio leads to decrease in value of ROA. Furthermore, the negative correlation indicates that high level of loan loss provision affects negatively to the bank's profitability. Therefore, regulation for optimal amount of loan loss provisions that bank must hold during all the times needs to be carefully and justifiably set, as otherwise it may influence remarkably negatively on the bank's effectiveness and business lucrativeness.

The final model 8 adds the second macroeconomic variable to the regression model. Along with sovereign credit rating, including country specific gross domestic product growth allows to examine the role of macroeconomic conditions of the bank's country of origin. The results follow rather closely the results obtained from the previous model 7. The negative impact of LLP-ratio strengthens slightly from -0.403 to -0.446 in this model, meaning that if we take into account the GDP growth as the second macroeconomic variable the bank's loan loss provision rate will affect more negatively to the credit rating. However, if compared to the value of LLP-ratio in previous models without the macroeconomic variables, the change is not remarkable. In model 8, the value of sovereign credit rating coefficient stays statistically significant and rises its value slightly from 0.759 in model 7 to 0.763 in model 8, and it is statistically significant at 1% level in both models. All the sample year effects that were statistically significant in model 7, stay as significant in model 8 as well. Here, the E-ratio remains to have negative value similarly to model 7. In other words, when taking into account all the variables in the model the high level of equity has a downgrading effect to the credit rating. Furthermore, as seen in model 7, model 8 also has negative coefficient value for ROA. The GDP Growth gets negative coefficient value in this model 8, which may seem to be surprising result. The sovereign credit rating and GDP growth are positively correlated, as can be interpreted from Table 2**.** GDP growth remains to have positive value during all the times except when adding sovereign credit rating into the model. However, the GDP growth does not seem to have a statistically significant effect to the credit rating. This supports the results that Meriläinen & Junttila (2020) obtained in their study about the asset liquidity and its role in credit rating formation. The asset liquidity or L-ratio gains statistical significance in model 7 but loses its statistical significance in model 8. This supports the results from Caporale et al. (2012), where the bank's liquid assets' influence the bank credit rating. They suggested that asset liquidity does not have significant or strong impact on the credit rating. This is somewhat contradictive result from Meriläinen & Junttila (2020), which presented in their results that banks holding large liquid portfolio do indeed have more beneficial credit rating

changes. However, in this model 8 the L-ratio drops its statistical significance compared to previous model 7.

When examining these eight models, models 7 and 8 seem to provide the best explanation about the relationship between the dependent variable and independent variables. If we concentrate on loan loss provision and its ability to capture the credit losses bank faces, in these models 7 and 8 the relationship between this independent variable to credit rating is insignificant. In other words, based on these two models LLP-ratio seems not to have direct influence on the credit rating. The negative value that LLP-ratio has held through the earlier models weakens drastically, implying that the negative effect on LLP-ratio to the credit rating is not that strong when taking into account the country's sovereign credit rating as well as the level GDP growth. However, changes in sovereign credit rating seems to have strong effect on the dependent variable. In this case, changes in country's sovereign rating affects the bank's credit rating as well. The country-specific effects on the credit rating were studied by Shen et al. (2012). Even though financial performance of banks was similar, the ground-breaking aspect and reason for different credit rating between these banks was their country. The country specification included for example different accounting standards, but also riskiness that varied between different countries. Huang & Shen (2015) discussed about *sovereign ceiling effect,* which implies that bank's credit rating very rarely exceeds the country sovereign rating where bank is located. These previous studies have given results, that support the outcome of these results from this thesis as well. In addition, in models 7 and 8 the effect of the size of a bank represented by variable log of total assets (logTA) is statistically significant. This variable did not gain statistical significance before adding these two macroeconomic variables in the model as well. When adding the final variable, GDP Growth, the L-ratio looses its statistical significance, and it does not have strong effect to the dependent variable in model 8. This could be interpreted as an overlap between L-ratio and GDP Growth – when the GDP Growth is added to the model, it weakens the effect of L-ratio. The changes in the ratio of liquid assets to total assets does not influence on the credit rating as strongly when the GDP growth is taken into account.

LLP-ratio is the key variable of interest in this study. The models 1-4 gave statistically significant coefficients for the LLP-ratio. In other words, the influence on this independent variable to the dependent variable CR was the strongest when variables L-ratio, E-ratio and D-ratio were included in the model. If more variables were included, the LLP-ratio lost its statistical significance. LLP-ratio obtains statistically significant parameter estimates when all the three formerly mentioned bank variables are included in addition to the log of total assets (logTA). These variables all describe the existing position bank has in its equity, and how its assets are allocated compared to its liabilities. When these five variables are included to the model, LLP-ratio maintains its statistical significance. The coefficient on LLP-ratio is negative in every model utilized, which implies

that the more loan loss provisions bank holds, the worse its credit rating will be. Correlation matrix in Table 2 shows that LLP-ratio correlates negatively with credit rating, liquidity ratio, ROA, log of total assets, sovereign credit rating and GDP growth as well. The positive correlation exists with the variables E-ratio and D-ratio. The negative correlation of LLP-ratio and credit rating could be seen in figures 6 and 7 as well. Even though the influence of loan loss provision on to the credit rating is not statistically significant, there exists heavy negative correlation between these variables. The highest correlation interpreted from the Table 2 is, however, the correlation between sovereign credit rating and bank credit rating with the positive value of 0.877. This correlation coefficient indicates remarkably high positive correlation between these two variables. This connection can be seen as statistically significant from the research models 7 and 8 as well.

Table 5. Results from additional Model 9 containing bank variables that describe the equity structure as well as assets and liabilities of a bank.

| | (9)<br>CR |
|---|---|
| LLP-ratio | -1.737* |
| | (.879) |
| L-ratio | .069 |
| | (.049) |
| E-ratio | .051 |
| | (.132) |
| D-ratio | -.032 |
| | (.031) |
| logTA | .984 |
| | (1.07) |
| _cons | 5.891 |
| | (14.363) |
| Observations | 608 |
| R-squared | .481 |

*Robust standard errors are in parentheses*
**** p<.01, ** p<.05, * p<.1*

From Table 5 it is possible to illustrate that when model 9 takes into account variables that describe the equity position and the relation between liabilities and assets, the loan loss provision remains its statistical significance, but only at 10% risk level. The R-squared value of model 9 is 0.481, which is higher than the model 5 r-squared value of 0.477 but slightly lower than model 6 r-squared value of 0.483. However, according to the r-squared values, the model 9 can explain the relationship between the variables more suitably than the first five models of this study.

From these results from all the models it is possible interpret that loan loss provision does not affect significantly to the bank's credit rating when all the eight variables are taken into account. LLP-ratio maintains its statistical significance only when variables describing asset and liability position and equity are added in the model. This is in line with Fitch's credit rating formation policy, where capital adequacy and equity requirements have major influence in bank's credit rating when concentrating on bank's financial performance and financial variables. According to these models 1-5, the return on assets which can be seen as profitability does not affect to the bank's credit rating statistically significantly. However, adding variables that measure cash to total assets, equity position, deposit ratio and bank size by assets change the effect of loan loss provisions to credit rating as well. From these outcomes, the influence of sovereign credit rating increases its importance in credit rating formation.

As mentioned earlier, Shen et al. (2012) concentrated on their study about the asymmetries in bank credit rating formation especially in intercountry divergences between banks. In their study, Shen et al. (2012) proposes that information asymmetries lead to relatively lower bank credit ratings compared to countries with low information asymmetry. The results showed that credit rating formation is conducted differently depending on the country of origin due to information asymmetries. However, rating agencies treat capital differently compared to other financial ratios (Shen et al., 2012). The capital has the greatest weight in credit rating formation. In this thesis, when macroeconomic variables are included in the model, the sovereign credit rating becomes statistically significant and overlaps with the statistical significance of loan loss provision and overcomes with LLP-ratio's influence on credit rating. The size of the bank measured by assets (logTA) becomes statistically significant when sovereign credit rating is added in the model. Here, we can predict that when taking into account country-specific credit rating, the size of a bank becomes significant as well. Even so, including gross domestic product growth lessens the impact of size of a bank. Sovereign credit rating maintains its statistical significance, in other words, changes in it have a strong effect to the credit rating. Therefore, sovereign effect can be seen to have strong impact on the credit rating.

When examining the yearly differences in Table 4, it can be interpreted that year 2007 was statistically significant in models 1-3. Statistical significance in these models during 2007 might be due to pre-crisis boom, as positive coefficients imply that credit ratings increased on average. ECB report (2004) points out banking behavior during pre-crisis conditions, one of them attempting to cover already defaulted or loans that will default in the near future. Therefore, it may be important for credit agencies to acknowledge these actions in their credit formation policies when calculating and valuating suitable credit rating for a bank in question.

Caporale et al. (2012) studied country-specific variation in bank credit ratings. They utilized bank credit ratings that were assigned by Fitch Ratings as well as bank financial variables in order to capture inconsistencies between the country-specific factors. The aim was to catch country -effects that impact on the final credit rating formation addressed for the bank. The results showed that systematically banks that operate in some countries indeed have better ratings than others (Caporale et al., 2012). The country effect for credit rating is strong, which supports the outcome of the study in this thesis as well. Meriläinen & Junttila (2020) suggested in their study that sovereign rating downgrades cause decrease in bank credit rating as well. This can be seen especially during the crisis periods (Meriläinen & Junttila, 2020; Alsakka et al., 2014). The connection is stronger so that if sovereign credit rating downgrades, the bank credit rating will follow, however, the relation is not as strong other way around. If the sovereign credit rating upgrades, the impact on the credit rating is not as strong as downgrade of sovereign rating would be (Huang & Shen, 2015).

## 5.2 Years with positive correlation between credit rating and LLP-ratio

Figures 6 and 7 presented how loan loss provisions and credit ratings gave fluctuated during 2004-2019. It can be seen from the figures that LLP-ratio and credit rating have strong negative correlation. However, there are few years when the correlation is exceptionally positive.

During pre-crisis years of 2006 to 2007 the relationship between LLP-ratio and credit rating is positive, as both increased during these two years. This is contradictive to more typical negative correlation, which can be seen from the Figures 6 and 7. This unusual positive movement might be due to rating agencies' incorrect interpretation of bank's financial condition. Continuous rise of LLP-ratio could have misleadingly reflected better profitability, if banks were able to give out more loans than before and therefore placed higher provisions as well. Average LLP-ratio continued to increase until 2009, but similar rise of credit rating only lasted for 2006-2007 until the credit ratings started to drop drastically. The positive influence that LLP-ratio had on the credit rating during the sample period lasted only during these years, if we take into account the whole sample of banks without any division. Roughly after 2007, the only times average loan loss provisions had positive relationship between the credit rating was during years, when both of these variables were decreasing.

Average LLP-ratio continued to increase after 2007, while at the same time credit ratings had started to decrease already. The positive relationship where both variables would rise at the same time did not occur during the sample years after the pre-crisis conditions. Roughly, after 2007 all the signs of increase in LLP-ratio affected negatively to the level of credit rating. However, these variables typically correlated negatively during the sample period. Exceptionally during year 2009 they seem to have positive relationship, as both variables decrease. The previous rise of LLP-ratio stopped roughly at 2009. During this year, both LLP-ratio and credit rating started to decrease.

While average credit rating showed signs of small recovery during 2012 until the beginning of 2014, during 2014 its value dropped again. Average LLP-ratio had been decreasing from 2011. In 2014, both variables decreased. The decrease was significant especially to average credit rating, which could be partly explained by European debt crisis that was on-going during 2014. The decrease of average credit rating is deepest in 2014, if we look the whole sample period. Again, even though these variables tend to have negative relationship, during 2014 both decreased their average value.

Table 6 presents these unexcepted positive relationships during years 2006-2007, 2009 and 2014. During 2006-2007 both of these variables increased their average value, while in 2009 and 2014 their value decreased drastically. In order to examine the possible yearly differences of the influence of LLP-ratio to credit rating, interaction terms for each year are added into regression model. The interaction term multiplies year dummy with LLP-ratio. Models 1-4 include the interaction term with the year and LLP-ratio in regression with all the other variables, where models 5-8 concentrate only on LLP-ratio.

Table 6. Results from unconventional years with positive relationship between average credit rating and average LLP-ratio.

| | (1) CR | (2) CR | (3) CR | (4) CR | (5) CR | (6) CR | (7) CR | (8) CR |
|---|---|---|---|---|---|---|---|---|
| LLP-ratio | -.467 | -.49 | -.493 | -.501 | -1.882** | -1.89* | -1.966* | -1.912* |
| | (.491) | (.494) | (.501) | (.498) | (.934) | (.942) | (.982) | (.975) |
| L-ratio | .019 | .018 | .02* | .021* | | | | |
| | (.011) | (.011) | (.011) | (.012) | | | | |
| E-ratio | -.107 | -.108 | -.108 | -.115 | | | | |
| | (.075) | (.074) | (.074) | (.075) | | | | |
| D-ratio | 0 | 0 | -.001 | -.001 | | | | |
| | (.016) | (.016) | (.016) | (.015) | | | | |
| ROA | -.095 | -.111 | -.091 | -.05 | | | | |
| | (.264) | (.262) | (.27) | (.297) | | | | |
| logTA | .933* | .928* | .921* | .885 | | | | |
| | (.531) | (.533) | (.527) | (.529) | | | | |
| sovCR | .759*** | .759*** | .759*** | .769*** | | | | |
| | (.088) | (.088) | (.089) | (.089) | | | | |
| GDPGrowth | -.02 | -.021 | -.021 | -.018 | | | | |
| | (.028) | (.028) | (.027) | (.028) | | | | |
| D2006 x LLP-ratio | 3.985 | | | | 16.022** | | | |
| | (2.511) | | | | (7.526) | | | |
| D2007 x LLP-ratio | | 4.59* | | | | 14.615** | | |
| | | (2.606) | | | | (5.798) | | |
| D2009 x LLP-ratio | | | 2.149* | | | | 5.238** | |
| | | | (1.266) | | | | (2.531) | |
| D2014 x LLP-ratio | | | | 1.944*** | | | | .268 |
| | | | | (.573) | | | | (.756) |
| _cons | -9.037 | -8.959 | -8.845 | -8.639 | 16.302*** | 16.307*** | 16.315*** | 16.304*** |
| | (6.792) | (6.812) | (6.749) | (6.757) | (.436) | (.437) | (.433) | (.432) |
| Observations | 605 | 605 | 605 | 605 | 623 | 623 | 623 | 623 |
| R-squared | .773 | .773 | .773 | .776 | .445 | .445 | .44 | .435 |

*Robust standard errors are in parentheses*
**** p<.01, ** p<.05, * p<.1*

Table 6 presents years 2006, 2007, 2009 and 2014, all of which have positive relationship between LLP-ratio and credit rating. During 2006 and 2007, both average credit rating and average LLP-ratio increased, which can be seen from figures 6 and 7 as well. Here, all the interaction terms that are presented in Table 6 are positive. This can be interpreted so that the impact of LLP-ratio on the credit rating is bigger during these years which are presented in the Table 6. Even though the direct values of LLP-ratio are negative in all the models 1-8, the positive value of interaction term during the years are relatively more positive. This indicates that the impact of LLP-ratio is bigger during these years observed. Especially during 2006 and 2007 the interaction term in models 5 and 6 is remarkably positive and statistically significant. This could be interpreted so that during the years

2006 and 2007, the effect of LLP-ratio was substantial to average credit rating. Furthermore, this could mean that the impact of LLP-ratio was considerable especially before the global financial crisis.

The coefficient of interaction term decreases by each year studied here, the only exception being model 2 where the value of interaction term rose compared to previous model 1. However, it could be interpreted that the impact of LLP-ratio to the credit rating has been decreasing during the years with downward trend. Especially the difference between the interaction term of model 5 and 8 is remarkable (16.02*** in model 5 and only 0.268 in model 8). The coefficient of the interaction term also loses its statistical significance in model 8.

The values for interaction terms are statistically significant in models 2-7. In model 8, the effect of LLP-ratio is smaller compared to other models, even though it is still positive. During year 2014, the direct effect of LLP-ratio is more negative than the effect of interaction term during the same year. Therefore, the combined result from these coefficients is negative. This could mean that the effect of LLP-ratio is not as big during 2014 as it has been during previous years examined in these models. If the downward trend is continuous, it could mean that the connection between LLP-ratio and credit rating is less strong and less influential than it was especially before the financial crisis. In other words, the connection between LLP-ratio and credit rating is not as substantial as it has been during the earlier years of the sample period.

## 5.3 Nonlinear effects of LLP-ratio to credit rating

The second research question aims to resolve the possible non-linearities that exist in the influence that loan loss provision has to the bank's credit rating. The earlier results and correlations showed how the relationship between loan loss provision and credit rating is negative, in other words, LLP-ratio weakens the bank's credit rating. Therefore, large amount of provision damages bank's credit rating. The second research question's objective is to clarify, whether this negative effect to the credit rating is linear, in other words, whether the LLP-ratio affects to the credit rating similarly and independent from the existing level of provision. As holding excessive amount of provision during all the times, the question is important. By seeking an answer to this research question, it is possible to get guidance to the optimal level of loan loss provision that bank should hold if thought about diminishing the negative influence on to the credit rating. The main interest is to resolve whether the negative effect of LLP-ratio is linear or does the extent of influence on to the credit rating face turning point when certain level is reached.

The potential non-linearities in the relationship between credit rating and LLP-ratio was calculated with the regression model presented in the previous chapter. It introduced modified version of the original regression model used in the main study of this thesis. The difference is that in order to capture the potential non-linearities, it divides the values of LLP-ratio in two sections. These sections are below the median values of LLP-ratio and above the media values of LLP-ratio. This regression model was introduced by Meriläinen & Junttila (2020) in their study of bank asset liquidity. In their study, one of the aims was to clarify the possible non-linearities of the effect of liquidity of assets on the bank's credit rating. Therefore, the model is suitable for the study of this thesis as well, with small modification. By dividing the LLP-ratio values into below median and above median sections, it is possible to clarify whether the influence of LLP-ratio is different when the existing level of provision is low. Contrarily, it is possible to present whether the influence for bank's that hold above the median value of loan loss provision is different. The hypothesis suggests that there exists some non-linearity. This is partly due the reason that capital requirements and risk management regulations have changed among the study period years by the Basel regulation standards. As European economies have faced two major crises during the study period, it is understandable that regulation setters have been forced to modify the existing guidance for adequate amount of buffer, for example. Provisions are set up in order to cover the possible defaults, so in that sense they should be considered as a tool for risk management. However, ECB Report (2004) showed that high level of loan loss provision may also indicate high level of realized credit losses or defaults that are executed in the near future. Therefore, setting up an optimal level of loan loss provision might be challenging, as the existing level and volatilities can be interpreted differently. Here, the aim is to solve how credit rating agency has considered the influence of LLP-ratio to the credit rating based on the existing level of provisions and changes in it. The results are shown in Table 7, Table 8, Table 9 and Table 10 below.

Table 7. Nonlinear development of loan loss provisions. Table consists results from banks that had below the median amount of LLP-ratio.

| | (1) CR | (2) CR | (3) CR | (4) CR | (5) CR | (6) CR | (7) CR | (8) CR |
|---|---|---|---|---|---|---|---|---|
| LLP-ratio below median | 1.05 | .979 | .816 | .895 | .628 | -.161 | -.903 | -1.478 |
| | (1.592) | (1.629) | (1.36) | (1.327) | (1.527) | (1.525) | (.997) | (.962) |
| L-ratio | | -.038 | -.04 | -.032 | -.032 | -.016 | -.018 | -.019 |
| | | (.025) | (.025) | (.027) | (.027) | (.024) | (.023) | (.023) |
| E-ratio | | | -.112 | -.073 | -.118 | -.004 | -.003 | -.005 |
| | | | (.206) | (.211) | (.202) | (.148) | (.106) | (.107) |
| D-ratio | | | | -.025 | -.024 | .006 | -.001 | 0 |
| | | | | (.018) | (.017) | (.02) | (.02) | (.02) |
| ROA | | | | | 1.252* | 1.257** | .541 | .663 |
| | | | | | (.625) | (.581) | (.592) | (.596) |
| logTA | | | | | | 2.378*** | 2.247*** | 2.248*** |
| | | | | | | (.564) | (.533) | (.538) |
| sovCR | | | | | | | .443** | .426** |
| | | | | | | | (.193) | (.188) |
| GDPGrowth | | | | | | | | -.049 |
| | | | | | | | | (.039) |
| _cons | 16.184*** | 16.512*** | 16.933*** | 18.032*** | 17.981*** | -12.509* | -19.304*** | -18.831*** |
| | (.306) | (.38) | (.965) | (1.273) | (1.209) | (7.318) | (6.921) | (6.826) |
| Observations | 291 | 283 | 283 | 280 | 278 | 278 | 278 | 278 |
| R-squared | .312 | .358 | .366 | .37 | .388 | .481 | .562 | .566 |

*Robust standard errors are in parentheses*
**** p<.01, ** p<.05, * p<.1*

Table 8. Yearly results from the eight models testing nonlinear development of the relationship between credit rating and below the median LLP-ratio. Table presents the changes of credit ratings on average.

| | (1) CR | (2) CR | (3) CR | (4) CR | (5) CR | (6) CR | (7) CR | (8) CR |
|---|---|---|---|---|---|---|---|---|
| D2005 | | | | | | | | |
| D2006 | -.084 | -.19 | -.154 | -.231 | -.247 | -.746*** | -.596*** | -.653** |
| | (.205) | (.229) | (.194) | (.201) | (.201) | (.265) | (.22) | (.246) |
| D2007 | .387*** | .388** | .404** | .259 | .176 | -.644** | -.547* | -.564** |
| | (.125) | (.153) | (.154) | (.191) | (.195) | (.262) | (.278) | (.28) |
| D2008 | -.136 | -.22 | -.169 | -.362 | -.368 | -1.514*** | -1.221*** | -1.23*** |
| | (.293) | (.328) | (.3) | (.323) | (.308) | (.417) | (.409) | (.41) |
| D2009 | -.167 | -.383 | -.378 | -.7 | -.441 | -1.515* | -1.299* | -1.363* |
| | (.613) | (.72) | (.706) | (.687) | (.82) | (.813) | (.742) | (.764) |
| D2010 | -.655 | -.76 | -.659 | -.849* | -.804* | -1.763*** | -1.366*** | -1.651*** |
| | (.494) | (.555) | (.443) | (.421) | (.424) | (.492) | (.424) | (.519) |
| D2011 | -.707* | -.796* | -.684** | -.883** | -.886** | -2.283*** | -1.927*** | -1.935*** |
| | (.351) | (.409) | (.332) | (.33) | (.337) | (.436) | (.433) | (.429) |
| D2012 | -1.013** | -1.045** | -.926** | -1.154** | -1.084** | -2.707*** | -2.364*** | -2.414*** |
| | (.412) | (.479) | (.429) | (.44) | (.435) | (.514) | (.527) | (.536) |
| D2013 | -1.059** | -1.123** | -.927** | -1.161** | -1.063** | -2.71*** | -2.351*** | -2.5*** |
| | (.397) | (.46) | (.452) | (.456) | (.456) | (.479) | (.516) | (.548) |
| D2014 | -.821* | -.83 | -.571 | -.759 | -.664 | -2.258*** | -1.847*** | -1.967*** |
| | (.439) | (.5) | (.515) | (.526) | (.512) | (.504) | (.539) | (.565) |
| D2015 | -1.526*** | -1.55*** | -1.307*** | -1.507*** | -1.378*** | -2.998*** | -2.445*** | -2.505*** |
| | (.484) | (.522) | (.479) | (.477) | (.459) | (.518) | (.554) | (.563) |
| D2016 | -1.491*** | -1.513*** | -1.237** | -1.418** | -1.347** | -2.975*** | -2.385*** | -2.435*** |
| | (.471) | (.492) | (.568) | (.564) | (.551) | (.586) | (.623) | (.636) |
| D2017 | -1.239** | -1.204** | -.884 | -1.076* | -.974* | -2.562*** | -1.983*** | -2.075*** |
| | (.472) | (.488) | (.563) | (.579) | (.563) | (.568) | (.645) | (.663) |
| D2018 | -1.143** | -1.059** | -.701 | -.842 | -.724 | -2.435*** | -1.89*** | -1.941*** |
| | (.465) | (.487) | (.593) | (.602) | (.585) | (.579) | (.65) | (.657) |
| D2019 | -1.198** | -1.122** | -.763 | -.908 | -.825 | -2.66*** | -2.062*** | -2.153*** |
| | (.467) | (.485) | (.645) | (.656) | (.636) | (.597) | (.675) | (.692) |
| _cons | 16.184*** | 16.512*** | 16.933*** | 18.032*** | 17.981*** | -12.509* | -19.304*** | -18.831*** |
| | (.306) | (.38) | (.965) | (1.273) | (1.209) | (7.318) | (6.921) | (6.826) |
| Observations | 291 | 283 | 283 | 280 | 278 | 278 | 278 | 278 |
| R-squared | .312 | .358 | .366 | .37 | .388 | .481 | .562 | .566 |

*Robust standard errors are in parentheses*
**** p<.01, ** p<.05, * p<.1*

Table 9. Nonlinear development of loan loss provisions. Table consists results from banks that had above the median amount of LLP-ratio.

| | (1) CR | (2) CR | (3) CR | (4) CR | (5) CR | (6) CR | (7) CR | (8) CR |
|---|---|---|---|---|---|---|---|---|
| LLP-ratio above median | -1.797** | -1.638** | -1.656** | -1.636** | -1.305* | -1.24* | -.346 | -.319 |
| | (.729) | (.64) | (.64) | (.636) | (.661) | (.649) | (.47) | (.482) |
| L-ratio | | .078 | .079 | .079 | .078 | .072 | .029 | .029 |
| | | (.067) | (.067) | (.067) | (.066) | (.066) | (.019) | (.019) |
| E-ratio | | | .071 | .055 | .047 | .066 | -.096 | -.101 |
| | | | (.075) | (.105) | (.102) | (.12) | (.066) | (.067) |
| D-ratio | | | | -.012 | -.012 | -.012 | .015 | .015 |
| | | | | (.037) | (.037) | (.036) | (.024) | (.024) |
| ROA | | | | | .299 | .307 | -.062 | -.04 |
| | | | | | (.479) | (.484) | (.272) | (.263) |
| logTA | | | | | | .933 | .411 | .411 |
| | | | | | | (1.19) | (.752) | (.756) |
| sovCR | | | | | | | .747*** | .736*** |
| | | | | | | | (.082) | (.089) |
| GDPGrowth | | | | | | | | .025 |
| | | | | | | | | (.038) |
| _cons | 16.835*** | 16.057*** | 15.703*** | 16.567*** | 16.474*** | 5.638 | -3.205 | -3.083 |
| | (.836) | (.919) | (1.036) | (2.865) | (2.847) | (15.36) | (8.481) | (8.557) |
| Observations | 325 | 323 | 323 | 321 | 320 | 320 | 320 | 320 |
| R-squared | .608 | .625 | .628 | .631 | .632 | .636 | .837 | .837 |

*Robust standard errors are in parentheses*
**** p<.01, ** p<.05, * p<.1*

Table 10. Yearly results from the eight models testing nonlinear development of the relationship between credit rating and above the median LLP-ratio. Table presents the changes of credit ratings on average.

| | (1) CR | (2) CR | (3) CR | (4) CR | (5) CR | (6) CR | (7) CR | (8) CR |
|---|---|---|---|---|---|---|---|---|
| D2005 | | | | | | | | |
| D2006 | -.213 | -.073 | -.082 | -.145 | -.162 | -.533 | -.075 | -.037 |
| | (.399) | (.408) | (.411) | (.435) | (.439) | (.405) | (.267) | (.281) |
| D2007 | .617** | .712** | .676** | .587 | .563 | .153 | .525 | .517 |
| | (.296) | (.317) | (.301) | (.395) | (.392) | (.535) | (.329) | (.329) |
| D2008 | -.5 | -.368 | -.394 | -.451 | -.458 | -1.042 | -.101 | -.081 |
| | (.5) | (.46) | (.459) | (.457) | (.456) | (.747) | (.517) | (.524) |
| D2009 | -1.208* | -1.035* | -1.011* | -1.024* | -1.019* | -1.691* | -.628 | -.542 |
| | (.617) | (.57) | (.565) | (.548) | (.553) | (.844) | (.558) | (.592) |
| D2010 | -1.502** | -1.313* | -1.367** | -1.344** | -1.36** | -2.095** | -.984 | -.784 |
| | (.718) | (.673) | (.666) | (.645) | (.651) | (.994) | (.602) | (.702) |
| D2011 | -2.326*** | -2.113*** | -2.212*** | -2.222*** | -2.181*** | -2.937*** | -1.196* | -1.123 |
| | (.783) | (.735) | (.705) | (.696) | (.69) | (.991) | (.669) | (.701) |
| D2012 | -3.916*** | -3.888*** | -3.842*** | -3.864*** | -3.787*** | -4.534*** | -1.494** | -1.419* |
| | (1.057) | (.985) | (.954) | (.971) | (.936) | (1.196) | (.733) | (.751) |
| D2013 | -3.941*** | -4.164*** | -4.127*** | -4.153*** | -4.13*** | -4.899*** | -.877 | -.788 |
| | (.947) | (.903) | (.871) | (.878) | (.88) | (1.172) | (.783) | (.803) |
| D2014 | -4.115*** | -4.133*** | -4.21*** | -4.225*** | -4.191*** | -4.974*** | -.721 | -.658 |
| | (1.008) | (.923) | (.913) | (.935) | (.929) | (1.275) | (.837) | (.856) |
| D2015 | -5.841*** | -5.807*** | -5.903*** | -5.939*** | -5.923*** | -6.771*** | -2.777*** | -2.768*** |
| | (1.338) | (1.231) | (1.233) | (1.248) | (1.246) | (1.589) | (.87) | (.875) |
| D2016 | -6.179*** | -6.102*** | -6.255*** | -6.237*** | -6.19*** | -7.018*** | -2.304** | -2.322** |
| | (1.384) | (1.269) | (1.277) | (1.298) | (1.277) | (1.536) | (1.033) | (1.036) |
| D2017 | -6.471*** | -6.382*** | -6.552*** | -6.501*** | -6.501*** | -7.309*** | -2.196** | -2.208** |
| | (1.393) | (1.288) | (1.305) | (1.359) | (1.358) | (1.617) | (.995) | (.996) |
| D2018 | -5.697*** | -5.624*** | -5.89*** | -5.836*** | -5.873*** | -6.625*** | -1.658 | -1.678 |
| | (1.116) | (1.018) | (1.068) | (1.135) | (1.139) | (1.48) | (1.112) | (1.113) |
| D2019 | -5.573*** | -5.552*** | -5.764*** | -5.701*** | -5.666*** | -6.392*** | -2.423*** | -2.425*** |
| | (1.071) | (1.012) | (1.038) | (1.124) | (1.118) | (1.42) | (.897) | (.9) |
| _cons | 16.835*** | 16.057*** | 15.703*** | 16.567*** | 16.474*** | 5.638 | -3.205 | -3.083 |
| | (.836) | (.919) | (1.036) | (2.865) | (2.847) | (15.36) | (8.481) | (8.557) |
| Observations | 325 | 323 | 323 | 321 | 320 | 320 | 320 | 320 |
| R-squared | .608 | .625 | .628 | .631 | .632 | .636 | .837 | .837 |

*Robust standard errors are in parentheses*
**** p<.01, ** p<.05, * p<.1*

Similarly to the previous study of bank variables affecting to the credit rating in Table 3 and Table 4, in order to measure the possible non-linearities the study adds one variable at the time to the model in question. All together 8 models were conducted for the first section of the research. Table 7 presents the findings of LLP-ratio, when taking into account the below the median values. Variables are added one by one to a model, in similar order as in previous study in Table 3. However, in order to measure possible nonlinearities within the effects of LLP-ratio, the sample group is divided into two different groups. The aim is to clarify whether the influence of LLP-ratio is different for banks that have below the median value in loan loss provision compared to banks that have above the median value in loan loss provision. From the values that are presented in Table 7, it is possible to interpret that if the bank's existing level of loan loss provision is below the median, it will affect more positively to the credit rating. In other words, these banks will benefit if they increase their provisions if only concentrated on the upgrade of the credit rating Models 1-5 have positive value for LLP-ratio, which is contradictory to the results shown in Table 3 when the concentration was only on changes in LLP-ratio among the whole sample group. Thus, it can be interpreted that when the existing level of loan loss provision is below the median, it will affect positively to the credit rating. This can be seen from the positive value of below median LLP-ratio in models 1-5. This could be interpreted so that banks that have loan loss provision level below the median, will benefit from the increase of LLP-ratio in terms of better credit rating. For rating agencies, this may designate as a good risk management operation and as an attempt to defend oneself against possible credit losses. Further, it may be interpreted as an action to maintain financial stability and guard against unpredictable losses while maintaining financial soundness.

However, the value of LLP-ratio turns negative when the Model 6 adds log of total assets variable in the regression model. LogTA variable also gets statistically significant value of 2.378***. In model 6 also variable ROA gets statistically significant value of 1.257**. Variable ROA is statistically significant in Model 5 as well. However, below the median value of LLP-ratio and logTA seem to correlate negatively, as adding variable logTA to the model decreases LLP-ratio drastically. LogTA stays statistically significant in all the models 6, 7 and 8. Therefore, it could be interpreted that size of a bank correlates negatively with the loan loss provision level. Negative correlation between these two variables can be seen from Table 2 correlation matrix as well. Further, Model 7 adds sovereign credit rating to the model and it decreases LLP-ratio even more. Similarly to previous regression in Table 3, sovereign credit rating also gets statistically significant value of 0.443** in model 7 and 0.426** in model 8. Therefore, the influence of sovereign credit rating can not be explained by coincidence or randomness. Adding GDP growth into the model 8 decreases the value of LLP-ratio even more.

Therefore, the country's economic condition and growth has a positive relationship between the LLP-ratio in this model, as GDP growth gets negative value of -0.049 while the LLP-ratio decreases remarkably from -0.903 to -1.478.

From these regression models in Table 7, it is possible to interpret that LLP-ratio has positive effect on the credit rating if the bank's level of loan loss provision is below the median and if model 1-5 are used. Positive value indicates that banks that hold below the median amount of loan loss provisions, the influence of LLP-ratio is actually positive on the credit rating. This result is contradictive to the results gained in previous study, where the concentration was on LLP-ratio's influence on the credit rating within the whole study group.

The yearly changes of the credit ratings from models 1-8 are presented in Table 8. Table shows how models 1-5 get the positive value during 2007, indicating that credit ratings rose during the year 2007 in study group consisting banks that had below the median amount of loan loss provisions. These values for year 2007 are also statistically significant in models 1-3. Year 2007 in these models 1-5 is the only year that has positive coefficient, if we take into account all the years and different models of this sample. This positive value is an oddity among the other values during all the sample years and in all the different models. The positive effect during the year 2007 may be reasoned by the global financial crisis starting in 2007. On average, credit ratings increased during that year. The yearly value of 2007 changes into negative during models 6, 7 and 8. These three negative values are also statistically significant. Last three models 6, 7 and 8 get the most statistically significant values in total, as every year conducted in this study in these last three models have statistically significant value.

It is possible to conclude that increase in loan loss provision actually does have the possibility to have a positive impact the bank's credit rating if the existing LLP-ratio is below the median in this study group. Table 9 and 10 present results from running similar regression model as before, however, now with above the median LLP-ratios within the study group. When LLP-ratio increases in the study group that hold above the median amount of loan loss provision already, the impact to the credit rating is negative in all the eight models. This leads to a conclusion that the effect of loan loss provision is indeed non-linear, as it depends on the level of provision whether it affects negatively or positively to the credit rating and the scale of the impact. The negative value of variable LLP-ratio gets statistical significance in models 1-6, in other words in all the models that take into account the bank variables. When macroeconomic variables sovereign credit rating and GDP growth are included in Model 7 and 8, the LLP-ratio loses its statistical significance. Especially the variable sovereign credit rating increases the value of LLP-ratio, meaning it weakens the negative impact of LLP-ratio from -1.24* to -0.346.

The direct value that LLP-ratio gets from above the median study group in model 1 is -1.797**. This means that LLP-ratio has negative impact on the credit rating, if only taken into account the LLP-ratio variable. Compared to below the median regression values, the LLP-ratio variable got value 1.05 in model 1. This difference is notable. The negative value of LLP-ratio remains through all the 8 models, however, the negative impact weakens considerable in model 7 and 8, as mentioned before. In contradiction, within the below the median study group, the LLP-ratio gets negative value only in models 6, 7 and 8. Thus, it can be concluded that LLP-ratio affects more negatively to the credit rating if the level of loan loss provision is above the median. To support this, the LLP-ratio gets statistical significance among the above median study group in models 1-6, indicating that these results should not be caused by randomness or coincidence.

The negative value of LLP-ratio remains similar through models 1-4. When adding variable ROA in model 5, the LLP-ratio increases from -1.636** to -1.305*. At the same time, statistical significance weakens slightly. ROA gets positive value of 0.299 and simultaneously has a positive influence on the LLP-ratio. Further, model 7 includes logTA in the regression model. LogTA adds the size of the bank measured by the assets into the model, and this addition has also positive impact on the LLP-ratio, increasing it to -1.24*. However, the biggest positive impact comes in model 7 with sovereign credit rating. In this model 7, sovereign credit rating gets statistically significant value of 0.747***, turning value of LLP-ratio to -0.346. This scale of the change of LLP-ratio is biggest between all these models in Table 9. The LLP-ratio increases slightly in model 8, where GDP growth is added into the model. When GDP growth is taken into account, also sovereign credit rating decreases slightly from 0.747*** in model 7 to 0.736*** in model 8. This connection between sovereign credit rating and GDP growth is similar in below the median study group as well. The sovereign credit rating effect has more positive value for study group above the median LLP-ratio, as corresponding values of sovereign credit rating variables in below the median study group are 0.443** in model 7 and 0.426** in model 8.

If the comparison is between the models 8 from both below the median study group and above the median study group, the impact of LLP-ratio is different than what has been discussed earlier. Whereas the value of LLP-ratio from above the median study group starts from negative -1.797** in model 1 and ends up being -0.319 in model 8, for the below median study group these corresponding values are 1.05 in model 1 and -1.478 in model 8. The impact of LLP-ratio is therefore more negative for below the median study group if all the other variables are also taken into account. For above the median study group, the corresponding value if all the other variables are taken into account is less negative. However, the direct values of LLP-ratio are more in favor of below the median study group.

Yearly changes of the credit ratings among banks that have above the median amount of LLP-ratio are presented in Table 10. Similarly to yearly changes of the below the median study group, the year 2007 also has statistically significant value with the first three models. The values of all the models remain positive during the year 2007, even though the values lose their statistical significance after the first three models. This leads to conclusion that on average, the credit ratings rose in both below and above the median study groups. Previous year 2006 as well as the following year 2008 already have negative values, when credit ratings drop on average. The values seem to steadily grow more negative year by year after the peak in 2007. The lowest and most negative value of average credit rating can be seen in model 6 during 2017 (-7.309***). According to these models and their results, on average the credit ratings decreased the most during 2017. During the last two years of sample period 2018 and 2019, the values of coefficients show slight increase in all the models except model 7. During 2019, which is the last year of the sample period, all the models have statistically significant coefficients. However, the trend is remarkably more negative than in the beginning of sample period. Especially after 2011, where the beginning of European debt crisis could be placed as well, the average credit rating has dropped significantly year after year. 2018 is a turning point for almost all the models utilized, which could indicate possible positive turn in the credit ratings on average.

When conducting the results from both below the median LLP-ratio influence on the credit rating, as well as results from above the median LLP-ratio impact on the credit rating it can be interpreted that there exists non-linearities within these values. The correlation between the LLP-ratio and credit rating is negative if concentrated on the study group as whole, indicating that the increase in LLP-ratio leads to decrease in credit rating. On the other hand, the decrease in LLP-ratio affects positively to the credit rating. However, as the results from the study suggest, the influence of LLP-ratio is not linear as in terms the increase or decrease of loan loss provision would impact to the credit rating similarly, independent from the existing level of loan loss provision. Further, banks with below the median value of loan loss provision should increase their LLP-ratio in order to upgrade their credit rating. Banks that have above the median level of provision do not benefit from increasing the level of LLP-ratio, on the contrary. In order to optimize LLP-ratio, this is extremely important observation. Increasing the level of provision not only capture equity that can not be further utilized in business operations to gain profitability, but also weakens the credit rating if the starting level of provision is already above the median or the increase leads to crossing the median. In a situation like this, increasing provisions may seem unattractive option. Even though loan loss provisions are considered as tools to manage risks and guard against defaults, the realistic outcome of holding major provisions all the time is financially consuming and, as can be seen from the study, also affecting negatively to the credit rating in the very end. Therefore, according

to these study results, increasing level of LLP-ratio above the median is not necessarily beneficial for a bank at least if aiming to maintain good credit rating or attempting to execute operations that would lead to better credit rating that bank currently is addressed.

## 5.4 Conclusion of the findings

According to these study results, banks that currently have below the median amount of loan loss provisions benefit if they increase their LLP-ratio compared to the banks that hold above the median value of LLP-ratio. The increase in LLP-ratio gains positive value and impacts advantageously on the credit rating. If the existing level of loan loss provision is below the median, the increase of it may indicate better capital level in total, as well as better administration and proactiveness for the possible future defaults. Rating agencies tend to consider capital as the most important feature when valuating suitable credit rating for a bank in question (Shen et al., 2012), therefore, adequate level of capital as a buffer against possible future loan defaults may be considered as a good portrayal of bank's financial stability. This supports the study results, as increase in loan loss provisions is seen to have positive impact on credit rating if the level of LLP-ratio is below the median. Banks that have below the median level of loan loss provisions but make an increase in their provision may be considered better in managing their risks and obtaining more sound level in everyday business as well. Therefore, in order to upgrade a bank credit rating, the bank should increase their level in LLP-ratio if the existing and targeted LLP-ratio falls below the median of this study group. Nonetheless, the values of LLP-ratio variables in below the median study group are not statistical significance. However, above the median study group gets statistically significant value for LLP-ratio in models 1-6. These values are negative, which indicates that the LLP-ratio's influence on the credit rating is negative and is hardly explained by randomness. From this result it is possible to draw conclusion that LLP-ratio has more negative impact on the credit rating among the above the median study group if conducted the models 1-6.

The non-linearities between the impact of bank variables to the credit rating is not completely surprising. Meriläinen & Junttila (2020) studied the impact of bank's asset liquidity to the credit rating. The results showed that the influence of a liquid portfolio to the credit rating is not linear, in other words it is not completely independent from the existing liquid ratio of the total assets. Banks that already held very liquid portfolio gained smaller positive effect for their credit rating if they increased their asset liquidity. The findings showed that increases in asset liquidity especially among illiquid banks increased their credit rating (Meriläinen & Junttila, 2020). The beneficial effect of liquidity to the credit rating

was smaller for banks that held more liquid assets already, however, the overall effect was still positive. From the results it possible interpret that bank's that had lower level or below median level of existing liquid assets benefitted from increase of liquid ratio more than banks that already had high level of liquid assets and further high level of liquid ratio. Therefore, nonlinearities exists among other bank variables as well that have an effect to the credit rating formation. However, according to Meriläinen & Junttila (2020) the banks that increase their liquid assets to total assets ratio and have low level of existing level of L-ratio benefit from the increase more than banks that already hold very liquid portfolio. Therefore, the incentive for increasing one's liquid position is stronger for banks that possess illiquid assets in order to upgrade their credit rating.

In the study of this thesis, the similar kind of beneficial nonlinearity for below the median study group can be interpreted from the results as from study of Meriläinen & Junttila (2020). The influence of LLP-ratio on to the credit rating depends on the level of loan loss provision, as can be seen from the findings. Banks that already hold below the median amount of loan loss provisions actually benefit from their existing level of loan loss provisions than the banks that hold above the median amount of loan loss provisions. This can be interpreted from the results if we concentrate on the direct value of LLP-ratio in Table 7 and 9. The banks that have below the median amount of LLP-ratio may be considered as riskier operators, therefore the LLP-ratio variable is seen as a protection against loan defaults. Therefore, its size indicates buffer against possible credit risks. In cases like these, credit rating formators may interpret LLP-ratio as a positive variable that has a beneficial influence on the credit rating. On the other hand, banks that already have above the median value of loan loss provisions, the value of LLP-ratio is negative in all the models 1-8 and the value of LLP-ratio remains negative no matter what other variables are included in the regression model. Therefore, it can be conducted from these results that above the median value of loan loss provision affects negatively to the credit rating and also gains statistical significance for its negative value in models 1-6. Above the median value in LLP-ratio may portray better risk management and proactiveness in defense of possible future defaults. Even so, at some point the increases in LLP-ratio are considered as a negative reflection about the financial condition of the bank, and credit rating agency starts to consider LLP-ratio's impact as a burden for credit rating. From both study groups, the model 7 changes the impact of LLP-ratio the most. Model 7 includes sovereign credit rating into the regression model. In above the median study group, the change is positive as the value of LLP-ratio shifts from -1.24* to -0.346 in model 7. For below the median study group, the corresponding change is from -0.161 to -0.903. In this study group, the addition of sovereign credit ranking weakens the value of LLP-ratio or, to put it differently, it makes the negative influence worse. This may indicate that banks that hold below the median amount of LLP-ratio the sovereign credit rating and LLP-ratio correlate negatively. For above the median study group, this relation between

LLP-ratio and sovereign credit rating is positive. The GDP growth variable also gets different values depending on the study group. For above the median, GDP Growth gets a value of 0.025, while correspondently it gets a value of -0.049 for study group below the median. This means that banks that hold above the median amount of loan loss provisions have positive impact on credit rating from their country-specific GDP growth.

Study results present that the sovereign credit rating has remarkable influence on bank credit rating. The effect is outstanding when testing all the variables and their influence on credit rating in Table 3, as well as when testing nonlinear effects of LLP-ratio in tables 7 and 9. The relationship is significant in all the regression models that were utilized in this study. The connection between sovereign credit rating and LLP-ratio is also noteworthy, as adding sovereign credit rating into model increases the value of LLP-ratio parameter estimate in all cases except for the study group that has below the median amount of loan loss provisions. For this study group, adding sovereign credit rating to the model decreases the value of LLP-ratio instead. In other words, seems that banks that hold less loan loss provisions are affected negatively from sovereign credit rating. This could mean that higher amount of provisions may shield the bank from the negative effects of sovereign credit rating. The effect of sovereign credit rating on LLP-ratio is strongest in Table 3, where the value of LLP-ratio coefficient increases from -1.237 to -0.403 when sovereign credit rating is added to the model. To conclude, in most cases the sovereign effect dominates over the effect of loan loss provisions to the credit rating. The effect of sovereign credit ratings on bank credit ratings has been widely studied in previous literature (see for example Huang & Shen, 2015; Meriläinen & Junttila, 2020) and findings from these studies support the strong connection between the sovereign credit rating and bank credit rating seen from the findings in this thesis as well.

Table 6 presented unordinary years when LLP-ratio and credit rating on average had positive correlation. The results suggest that before the global financial crisis, LLP-ratio had strong influence on the credit rating. Combined impact of both direct value of LLP-ratio and value of interaction term is positive, meaning the influence on credit rating was beneficial. This can be seen from figures 6 and 7 as well. However, the impact of LLP-ratio seems to decrease significantly after the financial crisis. In 2014, the connection is a lot weaker than it was during pre-crisis 2006-2007. This could mean that the role of LLP-ratio in credit rating formation process was reformed after the global financial crisis, as the positive correlation between these two variables has weakened remarkably during the study period.

Table 11. Explanation of variables.

Variable explanations

| Variable | Explanation |
|---|---|
| CR | Fitch Ratings long-term credit rating scale 1-20 |
| LLP-ratio | Loan loss provision to total assets percentage |
| L-ratio | Cash to total assets percentage |
| E-ratio | Total equity to total assets percentage |
| D-ratio | Total customer deposits to total assets percentage |
| ROA | Pretax return on total assets percentage |
| logTA | Log of total assets |
| sovCR | Fitch Ratings sovereign credit rating |
| GDPGrowth | Growth rate percentage of GDP (original source: OECD) |
| D-year | Year dummies |

# 6 DISCUSSION

The study of the thesis aimed to clarify the relationship between the loan loss provisions and credit rating in Western European banks. In order to capture credit losses as precisely as possible, the study utilizes loan loss provision as a variable to capture the credit losses that bank may face. Resolving the relationship is important, as the loan loss provisions require bank's capital. Therefore, it is essential for a bank to modify optimal amount of loan loss provisions also keeping in mind the external regulations concerning capital requirements and risk management in every-day banking operations, set up by Basel committee. The study's goal was to clarify how and to what extend these credit losses or loan loss provisions affect to the credit rating addressed to a bank in question by credit rating agency. This study utilizes Fitch Ratings' credit ratings for the banks in this study group.

Credit rating is an important indicator of the bank's creditworthiness and financial stability. It is widely understood scaling system, that provides a lot of information in just few characters. Bank's credit rating reflects the condition of the bank, it also affects to the reputation and image of the bank. In addition to reputational aspects, the credit rating also affects for example the price that bank acquires external funding, as the interests tend to be higher for banks with lower credit rating. The banks with better credit rating are considered to be less risky and more reliable institutions compared to banks that have been addressed with lower credit rating (Shen et al., 2012). Therefore, banks should aim for as good credit rating as possible. Further, banks should pay attention to actions and business operations that support the qualities that construct the characteristics of the credit rating. Credit formation agencies have different scaling of bank qualities that are measured when credit ratings are constructed. However, they tend to consider capital as one of the most important factors in credit rating, so that it has the most influence (Shen et al., 2012). Therefore, it is important to optimise the level of loan loss provision as it ties up the capital. One of the aims of the study was to clarify the extension of this relationship between the loan loss provision and the credit rating.

The results suggest that usually loan loss provision ratio (LLP-ratio) has negative influence in credit rating and that LLP-ratio and credit rating have negative relationship. However, there has been some years where the correlation is actually positive. During most of the study years when LLP-ratio increases, it affects decreasingly to the credit rating. However, the scale and extent of the influence on the credit rating is not always linear. In some cases, depending on the level of loan loss provisions, the influence may also be positive on the credit rating. This is important take-away, as bank can optimise their personal level of LLP-ratio so that is affects as positively as possible to the credit rating. As setting

up provisions ties the bank's capital, it is essential to clarify the required level so that it is suitable according to the regulation system but also not too excessive, as it may affect to the bank profitability negatively. The value of LLP-ratio also changes in relation to other variables. These changes in relations are presented more precisely in the previous Results and analysis -chapter.

The sample study group consisted of banks from Western Europe. More specifically, it consisted EU15 countries in addition to Iceland, Norway and Switzerland and excluding Luxembourg. Therefore, it excluded for example Eastern European economies. Due to rather homogeneous sample, it may be challenging to generalize these results to concern different economies that were excluded from the study. Also, the sample consisted only European economies. Therefore, it excludes banks from different continents. Shen et al. (2012) studied the credit rating inconsistencies between different countries, concentrating on country-specific risks and differences in credit rating addressing. As seen from the results of this study as well, the sovereign credit rating has a statistically significant relationship between the credit rating. Therefore, banks in emerging countries may face lower credit rating than bank in Western Europe, even though the financial performance would be on the same level. This leads to a presumption that results from the study of the thesis could be generalised to some extend to concern banks that operate in countries that have similar economies and country-specific risks as in this study. In addition, the latest major crises – global financial crisis and European sovereign debt crisis – may have had different influence on European banks, compared to banks in other continents. For that reason, the relationship between the variables that are utilized in the regression models in this study may give different information, if the study would have been conducted in different continent or during different time period. As the world economy is once again facing unconventional times due to the COVID-19 pandemic, this could also affect the relationship between the variables if credit rating agencies are changing their rating formation processes due to possible new risks attached to the global pandemic.

The true indication of loan loss provisions is challenging to form, as it provides different portrayal of the financial stability depending on the bank in question. The challenge in analysis of loan loss provisions lays in its multilateral and ambiguous attributes. Its primary aim is to create protection against the possible future credit losses (REFINITIV/Thomson Reuters, 2020), which may be first indicated as a proactive risk management action, further, an operation that should give an image of well-functioning and financially stable banking business. However, the explanation and interpretation of loan loss provision is not always so simple. Increase in loan loss provisions can also be seen as a sign of already defaulted loans, in other words, rise will indicate definite credit losses that are already realized or will be realized in the near future (ECB Report, 2004). For this reason, the analysis of loan loss provisions is bound to the time and place, as

economic crises in Europe during 2000's and 2010's have forced credit rating agencies re-consider the role of loan loss provisions and re-think what does the existing level and changes in provisions actually tell about the bank in question. The yearly changes in the influence that loan loss provision ratio has on credit rating has variated during the study period, which can be observed from the study results and especially from Table 6. Table 6 presents interaction terms during unordinary years when loan loss provisions and credit rating seem to have positive relationship. The effect of loan loss provisions was remarkably strong before the financial crisis in 2006 and 2007 but has slowly decreased since. If the downward trend is continuous, this could mean that the connection between LLP-ratio and credit rating is getting weaker and slowly becoming even more unimportant. This could be due to changes in banking regulations and further changes in credit rating agencies' policies. It might be possible, that the relationship between loan loss provisions and credit rating has been estimated erroneously to some extent. The positive correlation of these variables in 2006 and 2007 when both increased their values on average was unconventional movement, if we look at the changes in their relationship during later years of sample period. Perhaps the role of LLP-ratio was estimated erroneously before the financial crisis, when it was considered that increase in provisions is positive reflection of bank's risk management and financial performance and this interpretation led to increase in average credit ratings as well. The financial crisis proved that many banks were addressed with overly optimistic credit ratings and rating formation processes and policies required rearrangements. After the crisis, the required level of loan loss provisions has also gained attention in banking regulation processes (BIS, 2016). Perhaps due to these reasons, the positive correlation between credit rating and loan loss provisions has lost its magnitude during the study period, as roughly the last year of positive correlation was 2014. Even then, the connection is already rather weak in 2014.

# 7 CONCLUSIONS

The thesis concentrated on the relation between the loan loss provisions and credit rating in Western European banks. The aim was to clarify the extension of influence that credit losses have on the credit rating. First research question of this master's thesis concentrated on how the credit losses affect to the credit rating. In order to capture credit losses as accurately as possible, loan loss provisions are used to concretize the credit losses. This study utilizes loan loss provisions to total assets ratio (LLP-ratio) in its regression model. With OLS-regression model the study concentrated on the main variables of credit rating and LLP-ratio and changes in their relationship during the sample period. Total of eight variables were included in the models, in which credit rating was the main dependent variable and LLP-ratio the main independent variable of interest. The findings suggested that credit rating and LLP-ratio have negative relationship which extent has variated during the sample period. However, increase in LLP-ratio suggests negative influence on the credit rating on average, if the concentration is on the whole study group as whole.

The second research question was about whether the effect of LLP-ratio on the credit rating is linear or will there exist some nonlinearities in its influence. In other words, the research question studied whether the influence of LLP-ratio on the credit rating is independent from the existing level of LLP-ratio or will there exist some dependency on the current or targeted level of LLP-ratio. In order to answer this question, the banks in the study group were divided by their level of LLP-ratio into below and above the median study group. By doing this division, it was possible to model whether the LLP-ratio has different influence on the credit rating depending on whether the banks had small amount of provisions compared to the banks with large amount of provisions. The study results showed that there indeed existed nonlinearities in the extent of the influence that LLP-ratio has. It can be interpreted from the findings that banks that hold below median level of LLP-ratio benefit from their LLP-ratio if concentration is on the influence on to the credit rating. Below the median value and direct value for LLP-ratio variable was positive, indicating that it has positive impact on the credit rating. The more variables were taken into account and added into the model, the positive effect of LLP-ratio decreased and ultimately turned negative. However, the corresponding value for LLP-ratio in study group that consisted banks that held above the median level of LLP-ratio, the value was negative in all the models that were tested. Therefore, it could be interpreted that there exists some kind of *ceiling* for optimal LLP-ratio – if this ceiling of LLP-ratio is exceeded, the excessive LLP-ratio actually has a negative effect on the credit rating. However, if the existing level of LLP-ratio is below the median, controversially it benefits the bank in terms of having positive impact on its credit rating. Therefore, it should not be stated that LLP-ratio would always have a negative influence on

the credit rating, even though the correlation of credit rating and LLP-ratio was negative during the first part of the study when examining the study group of banks as whole. This is an important takeaway from the study of this master's thesis.

The findings suggest that the sovereign credit rating has remarkable influence on bank credit rating. The so-called sovereign effect has been studied in previous literature as well (see for example Huang & Shen, 2015; Meriläinen & Junttila, 2020) and results support the hypothesis that these two variables have strong connection, however, the sovereign effect is not always linear. In this study, the parameter estimate of sovereign credit rating is statistically significant in all models, indicating significant relationship between the bank credit rating. Sovereign credit rating has strong effect on the LLP-ratio as well. In most cases, the influence is positive, hence, the strongest positive effect can be seen from Table 3. Therefore, sovereign credit rating not only significantly directly affects to the credit rating but also affects the influence that loan loss provision has on the credit rating. This is important takeaway and supported by the findings of Shen et al. (2012) where concentration was on inconsistencies in credit ratings due to bank's country of origin. In their study, the results showed how banks with similar financial performance were addressed with different credit ratings based on their country of origin. Therefore, it can be concluded that sovereign credit rating has strong influence on the credit rating but also to other indicators, for example to the influence the level of loan loss provision has on the credit rating.

In addition to the study conducted in the thesis, it also provided theoretical background about previous studies related to the topic. The concentration was also on the credit formation processes and concretion of the role of credit ratings in general. Along with the credit rating formation factors, the banking regulation system and the role of administration in banking sector was also applied in the theoretical background. The implementation of history of banking regulation was essential, as credit rating agencies also follow the unite regulation system when modifying their credit rating processes. The credit rating agency which was focused on this thesis was Fitch Ratings. The credit ratings addressed by Fitch Ratings were also utilized in the study of the thesis.

For future work on the topic, it would be interesting to conduct the study among banks from countries with different economical structure. As the study of the thesis concentrates on Western European banks and all possible generalisations from the findings must be done while keeping the homogeneity of the economies in mind, it would be relevant to conduct the study for example among emerging countries. Further studies could also consider the influence of COVID-19 or European central bank's unconventional monetary policy have on the banking regulation and further on the credit rating agency policies.

As seen from the findings of this study, the impact of LLP-ratio on credit rating seems to follow downward trend. In other words, the effect of LLP-ratio on the credit rating seems not to have as substantial effect on credit rating on average as it had before the global financial crisis. For future work on the topic, it would be interesting to concentrate more specifically on the reasons behind the weaker relationship.

Even though generalisation of the findings must be done with caution, this thesis provides useful information for banks themselves about the role of loan loss provisions and their effect on the credit rating. As loan loss provisions tie up capital that cannot be further utilized in other business actions, it is essential for banks to optimize their level of loan loss provisions through different times. This thesis provides insight to the role of loan loss provisions and their influence on bank's credit rating. Therefore, the results of this thesis could offer incentive for banks to moderate and optimise their current level of loan loss provisions in order to upgrade their prevailing credit rating. Even though the role of loan loss provisions is not always unambiguous, these findings clarify its characteristics and impact on the credit rating under different circumstances. This is important observation from the findings, as the magnitude of the impact of loan loss provisions vary as well as whether the impact on the credit rating is positive or negative.

This thesis increases awareness of the credit formation process and if there are some inconsistencies in the policies. As mentioned previously, the strong impact of sovereign effect can be witnessed from the study findings. The validity of the impact can be considered as questionable, if some banks are addressed fundamentally with weaker credit ratings due to their country of origin. Different accounting standards and asymmetric information can lead to lower credit ratings, even though the financial performance and indicators are on adequate level (Shen et al., 2012). If the determinants of the impact of sovereign credit rating are incoherent and difficult to define accurately, the credit rating agencies should reconsider or reconstruct the impact of sovereign credit rating on the credit rating. Otherwise, the information that credit rating should provide might be biased, as the sovereign effect has relatively large impact on the credit rating as whole. Fitch Ratings follow closely the regulations set up by Basel committee and modify their credit formation processes according to the up-to-date policies by banking regulation system (Fitch Ratings, 2020). Therefore, the possible changes for credit formation process in the future might have to be executed by top-down policies. In order to impact the credit rating formation practises, the modification should be carried out by bank regulation.

# LIST OF REFERENCES


Adams, J., Khan, T.A Hafiz & Raeside, R. (2014). *Research methods for business and social science students*. (2th ed.). SAGE Publications Asia-Pacific Pte Ltd. 5-9.

Adelino, M. & Ferreira, M.A. (2016). Bank Ratings and Lending Supply: Evidence from Sovereign Downgrades. *The Review of Financial Studies*, 29(7), 1709-1746. https://doi.org/10.1093/rfs/hhw004

Ahmed, A. S., Takeda, C., & Thomas, S. (1999). Bank loan loss provisions: a reexamination of capital management, earnings management and signaling effects. *Journal of Accounting and Economics*, 28(1), 1–25. https://doi.org/10.1016/S0165-4101(99)00017-8

Alsakka, R., Gwilym, O. & Vu, T. (2014). The sovereign-bank rating channel and rating agencies' downgrades during the European debt crisis. *Journal of International Money and Finance*, 49(Part B), 235-257. https://doi.org/10.1016/j.jimonfin.2014.03.012

Ambrocio, G., Hasan, I., Jokivuolle, E. & Ristolainen, K. (2020). Are bank capital requirements optimally set? Evidence from researchers' views. *Journal of Financial Stability*, 50. https://doi.org/10.1016/j.jfs.2020.100772

Amorello, L. (2016). Beyond the horizon of banking regulation: What to expect from Basel IV. *Harvard international law journal*, 58.

Balthazar, L. (2006). *From Basel 1 to Basel 3: The Integration of State-of-the-Art Risk Modeling in Banking Regulation*. Finance and Capital Markets Series. Palgrave Macmillan, London.

BankFocus About us. (2021, February). Retrieved from https://www.bvdinfo.com/en-gb/our-products/data/international/bankfocus

Bech, M. & Keister, T. (2017). Liquidity regulation and the implementation of monetary policy. *Journal of Monetary Economics*, 92, 64-77. https://doi.org/10.1016/j.jmoneco.2017.09.002

Berg, T. & Koziol, P. (2017). An analysis of the consistency of banks' internal ratings. *Journal of Banking & Finance*, 78, 27–41. https://doi.org/10.1016/j.jbankfin.2017.01.013

Bhattacharya, K. (2003, September). How good is the BankScope database? A cross-validation exercise with correction factors for market concentration measures. BIS Working Papers No 133. Retrieved from https://www.bis.org/publ/work133.pdf

BIS Basel committee on banking supervision (2018, July). Accounting provisions and capital requirements – Executive summary. Bank for international settlements. Retrieved from https://www.bis.org/fsi/fsisummaries/acprov.pdf

BIS Basel committee on banking supervision. (2004, June). Basel II: International convergence of capital measurement and capital standards: a revised framework. Bank for international settlements. Retrieved from https://www.bis.org/publ/bcbs107.pdf

BIS Basel committee on banking supervision. (2006, June). Basel II: International convergence of capital measurement and capital standards: A revised framework – comprehensive version. Bank for international settlements. Retrieved from https://www.bis.org/publ/bcbs128.pdf

BIS Basel committee on banking supervision. (2010, September). Group of governors and heads of supervision announces higher global minimum capital standards. Press release, Bank for international settlements. Retrieved from https://www.bis.org/press/p100912.pdf

BIS Basel committee on banking supervision. (2016, March). Basel III monitoring report. Bank for international settlements. Retrieved from https://www.bis.org/bcbs/publ/d354.pdf

BIS Basel committee on banking supervision. (2016, October). Regulatory treatment of accounting provisions. Discussion paper, Bank for international settlements. Retrieved from https://www.bis.org/bcbs/publ/d385.pdf

BIS Basle committee on banking supervision. (1988, July). International convergence of capital measurement and capital standards. Retrieved from https://www.bis.org/publ/bcbs04a.pdf

BIS, About the BCBS. History of Basel Committee. (2021, February). Retrieved from https://www.bis.org/bcbs/history.htm

BIS: Governors and Heads of Supervision announce deferral of Basel III implementation to increase operational capacity of banks and supervisors to respond to Covid-19. (2020, March). Press release. Retrieved from https://www.bis.org/press/p200327.htm

Bodellini, M. (2019, April). The long 'journey' of banks from Basel I to Basel IV: has the banking system become more sounf and resilient than it used to be? Europäische Rectsakademie ERA Forum 20, 81-97. https://doi.org/10.1007/s12027-019-00557-x

Cantor, R. & Mann, C. (2007). Analyzing the Tradeoff Between Ratings Accuracy and Stability. *Journal of Fixed Income*, 16(4), 60-68. https://doi.org/10.3905/jfi.2007.683318

Caporale, G., Matousek, R. & Stewart, C. (2012). Ratings assignments: Lessons from international banks. *Journal of International Money and Finance*, 31(6), 1593-1606. https://doi.org/10.1016/j.jimonfin.2012.02.018

Cohen, B. H. & Edwards, G. (2017, March). The new era of expected credit loss provisioning. BIS Quarterly Review, 39-56. Retrieved from https://www.bis.org/publ/qtrpdf/r_qt1703f.pdf

Cornford, A. (2009). Revising Basel II: The Impact of the Financial Crisis. De Boeck Supérieur, 2, (34-35), 60-77.

Cosimano, T. & Hakura, D. (2011). Bank behavior in response to Basel III: A cross-country analysis. IMF Working Paper, 11/119. Retrieved from https://www.imf.org/external/pubs/ft/wp/2011/wp11119.pdf

Datastream. Official webpage. (2021, February). Retrieved from https://solutions.refinitiv.com/datastream-macroeconomic-analysis/?utm_content=Product%20Name-OTHER-EMEA-G-EN-Exact&utm_medium=cpc&utm_source=google&utm_campaign=434508_PaidSearchEN&elqCampaignId=13781&utm_term=datastream&gclid=EAIaIQobChMIzP3R2u_r7gIVCWgYCh0DeQDJEAAYASAAEgJCI_D_BwE&gclsrc=aw.ds

De Bandt, O., Camara, B., Maitre, A. & Pessarossi, P. (2018). Optimal capital, regulatory requirements and bank performance in times of crisis: evidence from France. *Journal of financial stability*, 39, 175-186. https://doi.org/10.1016/j.jfs.2017.03.002

Dechow, P. (1994). Accounting earnings and cash flows as measures of firm performance: The role of accounting accruals. *Journal of Accounting and Economics*, 18(1), 3-42. https://doi.org/10.1016/0165-4101(94)90016-7

DeYoung, R., Distinguin, I. & Tarazi, A. (2018). The joint regulation of bank liquidity and bank capital. *Journal of Financial Intermediation*, 34, 32-46.

Drago, D. & Gallo, R. 2017. The impact of sovereign rating changes on the activity of European banks. *Journal of Banking & Finance*, 85, 99-112. https://doi.org/10.1016/j.jfi.2018.01.006

ECB Monthly bulletin. (2004, March). Report of European Central bank. Retrieved from https://www.ecb.europa.eu/pub/pdf/mobu/mb200403en.pdf

Fitch Ratings. (2020, February). Bank rating criteria. Retrieved from Bank Rating Criteria (fitchratings.com)

FitchConnect About us. (2021, February). Official webpage. Retrieved from https://www.fitchsolutions.com/fitch-connect

Fraisse, H., Lé, M. & Thesmar, D. (2019). The real effects of bank capital requirements. Management Science, 66(1). https://doi.org/10.1287/mnsc.2018.3222

Freixas, X. & Rochet, J. C. (2008). *Microeconomics of banking*, (2nd ed.). MIT Press.

Glossary of statistical terms. EU15. (2021, February). Retrieved from https://stats.oecd.org/glossary/detail.asp?ID=6805

Governors and Heads of Supervision announce deferral of Basel III implementation to increase operational capacity of banks and supervisors to respond to Covid-19. (2020, March). Press release Banking international settlement. Retrieved from https://www.bis.org/press/p200327.htm

Herring, R. (2002). The Basel 2 Approach to Bank Operational Risk: Regulation on the Wrong Track. *The Journal of Risk Finance*, 4(1), 42-45. https://doi.org/10.1108/eb022953

Huang, Y-L. & Shen, C-H. (2015). The sovereign effect on bank credit ratings. *Journal of financial services research*, 47(3), 341-379. https://doi.org/10.1007/s10693-014-0193-7

Iannotta, G., Nocera, G. & Sironi, A. (2013). The impact of government ownership on bank risk. *Journal of financial intermediation,* 22(2), 152-176. https://doi.org/10.1016/j.jfi.2012.11.002

Ibrahim, M. H. & Rizvi, S. A. R. (2018). Bank lending, deposits and risk-raking in times of crisis: A panel analysis of Islamic and conventional banks. *Emerging markets review*, 35, 31-47. https://doi.org/10.1016/j.ememar.2017.12.003

Jackson, P. et al. (1999, April). Capital requirements and bank behaviour: The Impact of the Basle Accord. Basle Committee on Banking Supervision Working Papers, No 1. Retrieved from https://www.bis.org/publ/bcbs_wp1.pdf

Jensen, M. & Meckling, W. (1976). Theory of the firm: managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3(4), 305-360. https://doi.org/10.1016/0304-405X(76)90026-X

Karam, P., Merrouche, O., Souissi, M. & Turk, R. (2014). The transmission of liquidity shocks: The role of internal capital markets and bank funding strategies. International monetary fund. Working paper 14/207.

Kashyap, A. K. & Stein, J. C. (2004). Cyclical implications of the Basel II capital standards. Federal reserve Bank of Chicago. *Economic perspectives*, 28(1).

Martynova, N. (2015). *Effect on bank capital requirements on economic growth: a survey.* Netherlands Central Bank. Working Paper, No 467. http://dx.doi.org/10.2139/ssrn.2577701

Meriläinen, J-M. & Junttila, J. (2020). The relationship between credit ratings and asset liquidity: Evidence from Western European banks. *Journal of International Money and Finance*, 108. https://doi.org/10.1016/j.jimonfin.2020.102224

Moore, D. S., Notz, W. I, & Flinger, M. A. (2013). *The basic practice of statistics*. (6th ed.). New York, NY: W. H. Freeman and Company. 138.

Noor, U. R., Kashiramka, S. & Singh, S. (2018). Basel I to Basel III: Impact of credit risk and interest rate risk of banks in India. *Journal of emerging market finance*, 17, 83-111. https://doi.org/10.1177/0972652717751541

Noreen, E. (1988). An empirical comparison of probit and OLS regression hypothesis tests. *Journal of accounting research*, 26(1), 119-133. https://doi.org/10.2307/2491116

Peón, D. & Rey, F. (2013). Playing with fire: Internal devaluation for the GIPSI countries. Hindawi Publishing Corporation. http://dx.doi.org/10.2139/ssrn.2200176

Pohlmann, J. T. & Leitner, D. W. (2003). A comparison of ordinary least squares and logistic regression. *Ohio journal of science*, 103 (5), 118-125.

S&P Global Market Intelligence. Official webpage. (2021, February). Retrieved from https://www.spglobal.com/marketintelligence/en/

Sands, P., Liao, G. & Ma, Y. (2016). Rethinking operational risk capital requirements. M-RCBG Associate working paper series, 68.

Santos, K. (2012). Corporate credit ratings: a quick guide. The Association of corporate treasurers handbook 2012. 45-49.

Shah, M. (2013). Basel-3 and Its Impact on Indian Banking Sector. *Journal of Indian Research*, 1(1), 53-58. Retrieved from https://d1wqtxts1xzle7.cloudfront.net/32845900/JIR_Final.pdf?1390730632=&response-content-disposition=inline%3B+filename%3DJIR_Final.pdf&Expires=1621848390&Signature=HVJEkDN3A6UymW9AgPl1bBJ9juUJH~S7ig-QrDguuToMVyNmbcmPQdBD1mlS1oDlWdKEno~DvsL~khdqVS-uJ68KhJC1PaRNVhTvMYpL0OdaDI4ZRbBUnRQVNjlvDM5yVhKaHjx3VP8BKJhYdrjMuO~lTSGwSWktBhj~wVXdzOCLlqAbsFd5jLMMkNxj7zGprRkrweXQGPnDmDRHtqGrVCBbyYt0JHXIc9vYFmJLUhycVM7Z5tcBRCdn1w9jjjZ1gQHD2y6yScwrXj8y21sBjnCNhec~VEnI~Sr7hbEWCb4szqi6J8uKxSd2t18gbTV7tXUXFH4W8aeCp2~1BorCQ__&Key-Pair-Id=APKAJLOHF5GGSLRBV4ZA#page=53

Shen, C-H., Huang, Y-L. & Hasan, I. (2012). Asymmetric benchmarking in bank credit rating. *Journal of International Financial Markets, Institutions & Money*, 22(1), 171-193. https://doi.org/10.1016/j.intfin.2011.08.004

Stock, J. H. & Watson. (2012). *Introduction to Econometrics*. (3rd ed.). Essex, England: Pearson Education Limited.

Tölö, E. & Miettinen, P. (2018). How do schocks to bank capital affect lending and growth? Bank of Finland Research Discussion Paper, 25. Retrieved from https://ssrn.com/abstract=3292737

Vilkka, H. (2007). *Tutki ja mittaa – Määrällisen tutkimuksen perusteet*. Helsinki: Tammi. 13-14, 24.