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CRR/CRD IV: An empirical analysis on the impact of the regulatory requirements on the dividend policy and pay out of European banks.

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Abstract

The 2007/2008 financial crisis led to several discussions regarding the impact of financial market regulation. Primarily, such a crisis was caused by the problems in the international and interconnected financial system and their effects on several levels, which led to policy to develop new rules for the system (ECB, 2015, p. 2; Schenk, 2020, p. 3; Claessens and Kodres, 2014, p. 8; Cappelletti et al., 2020, p. 4). The shareholders of European banks and non-financial corporates suffered substantial losses in their equity value positions (KPMG, 2016, p. 7; Admati et al., 2013, p. I). Simultaneously, the funding for the interbank market was shut down, so that the capitalization of banks was not burdened by possible loan defaults (Reddy, Nangia and Agrawal, 2014, p. 258 in Allen and Giovannetti, 2011, p. 2; Chen, Mrkaic and Nabar, 2019, p. 5; Cevik and Miryugin, 2020, p. 13; Vivar, Wedow and Weistroffer, 2020, p. 10). To prevent a system shutdown, the European Central Bank (ECB), with their banking authority institution, developed and introduced a new banking system framework (Maddaloni, 2018, p. 2; Khan, 2017, p. 4; BCBS, 2011, p. 1-2). The new requirements may reduce the ability of credit institutions to take up riskier businesses for a profit. Since the regulatory requirements affect the dividend policy, the banks' management is not completely transparent to shareholders to monitor the risk-portfolio because shareholders cannot wholly evaluate all taken risks. The dissertation should answer how the new regulatory requirements influence the dividend policy of the European banks. Additionally, it is essential to appropriately acknowledge the short- and long-term effects of the regulatory requirements. Hence, this work examines the extent of the consequences of the new capital, risk, and liquidity standards on the dividend policy.

Quantitative research is performed to investigate the identified relationship between the CRR/CRD IV and the dividend policy. It is necessary to consider each component's effect on the dividend policy since the regulatory requirements have several components. The period from 2005 to 2019 is chosen for examining the impact before, during, and after the implementation of the regulatory requirements. The data set is divided into two data frames (before 2013 and after 2013) to perform and assess the quantitative analysis. The impact of the CRR and CRD IV on European banks' dividend policy is tested by several instruments. For the explorative statistic, several single and multiple regression model analysis are performed. During the period 2005 to 2013, the banks total capital ratio has a statistically significant negative influence of banks dividend payout ratio and changed in a statistically significant positive influence of banks dividend payout ratio for the period 2013 to 2019. Furthermore, the previous statistically significant positive influence of the net interest income to total assets, the significant negative influence of the risk weighted assets to total assets and the significant negative influence of the development of the STOXX 600 index are after the implementation of the CRR/CRD IV not significant. In summary, the implementation of the regulatory requirements led to a positive influence of banks capital ratio on the dividend policy and reduces shareholder dependency to banks' lending business and macroeconomic developments.

Keywords: CRR, CRD IV, dividend policy, regulatory requirements

Resumen

La crisis financiera de 2007/2008 dio lugar a varias discusiones sobre el impacto de la regulación del mercado financiero. Principalmente, tal crisis fue causada por los problemas en un sistema financiero internacional e interconectado y sus efectos a varios niveles, lo que llevó a una política para desarrollar nuevas reglas para el sistema (BCE, 2015, p. 2; Schenk, 2020, pág. 3; Claessens y Kodres, 2014, p. 8; Cappelletti et al., 2020, pág. 4). Los accionistas de los bancos europeos y de las sociedades no financieras sufrieron pérdidas sustanciales en sus posiciones de valor patrimonial (KPMG, 2016, p. 7; Admati et al., 2013, pag. I). Simultáneamente, se cerró la financiación del mercado interbancario, por lo que la capitalización de los bancos no se vio afectada por posibles incumplimientos de préstamos (Reddy, Nangia y Agrawal, 2014, p. 258 en Allen y Giovannetti, 2011, p. 2; Chen, Mrkaic y Nabar, 2019, p. 5; Cevik y Miryugin, 2020, pág. 13; Vivar, Wedow y Weistroffer, 2020, pág. 10). Para evitar el cierre del sistema, el Banco Central Europeo (BCE), con su institución de autoridad bancaria, desarrolló e introdujo un nuevo marco del sistema bancario (Maddaloni, 2018, p. 2; Khan, 2017, p. 4; BCBS, 2011, pág. 1-2). Los nuevos requisitos pueden reducir la capacidad de las instituciones de crédito para emprender negocios más arriesgados para obtener ganancias. Dado que los requisitos reglamentarios afectan a la política de dividendos, los gestores bancarios no son completamente transparentes para que los accionistas monitoricen la cartera de riesgos porque los accionistas no pueden evaluar por completo todos los riesgos asumidos. Esta investigación da respuesta a cómo los nuevos requisitos regulatorios influyen en la política de dividendos de los bancos europeos. Además, es fundamental reconocer adecuadamente los efectos a corto y largo plazo de los requisitos reglamentarios. Por lo tanto, este trabajo examina el alcance de las consecuencias de los nuevos estándares de capital, riesgo y liquidez de la política de dividendos.

Se realiza una investigación cuantitativa para investigar la relación identificada entre el CRR / CRD IV y la política de dividendos. Es necesario considerar cada efecto del componente en la política de dividendos, ya que los requisitos regulatorios tienen varios componentes. Se elige el período de 2005 a

2019 para examinar el impacto antes, durante y después de la implementación de los requisitos reglamentarios. El conjunto de datos se divide en dos marcos de datos (antes de 2013 y después de 2013) para realizar y evaluar el análisis cuantitativo. Varios instrumentos prueban el impacto del CRR y CRD IV en la política de dividendos de los bancos europeos. Para la exploración estadística, se realizan varios análisis de modelos de regresión simple y múltiple. Durante el período 2005 a 2013, el índice de capital total de los bancos tiene un valor estadísticamente significativo en el ratio de pago de dividendos bancarios, que luego cambió a una influencia positiva y significativa de la tasa de pago de dividendos de los bancos para el período 2013 a 2019. Además, la influencia positiva estadísticamente significativa previa de los ingresos netos por intereses a los activos totales, la influencia negativa significativa del riesgo activos ponderados en función de los activos totales y la influencia negativa significativa del desarrollo del índice STOXX 600 son insignificantes tras la implementación del CRR / CRD IV. En resumen, la implementación de los requisitos regulatorios conlleva una influencia positiva del coeficiente de capital de los bancos en la política de dividendos y reduce la dependencia de los accionistas de los bancos que prestan negocios y desarrollos macroeconómicos.

Palabras clave: CRR, CRD IV, política de dividendos, requisitos regulatorios

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LIST OF ACRONYMS

Cl_t	Liquidity crisis dummy variables
CAR_{t-1}	Capital-to-asset-ratio
C_{st}	Sovereign debt crisis dummy variable
$EFF_{hp,t}$	Indicator of bank efficiency
ROA_{t-1}***	Return-over-asset-ratio
ln (ASF_{t-1})	Logarithm of available stable funding
ln (NOR_{t-1})	Logarithm of net outflows
$Size_{t-1}$***	Size
ΔIR	Change in the short-term interest rate
*	Significant level 10 %
**	Significant level 5 %
***	Significant level 1 %

LIST OF ABBREVIATIONS

AIG	Accord Implementation Group
ASF	Available amount of Stable Funding
BCBS	Basle Committee on Banking Supervision
BF	Bank financing
BIS	Bank For International Settlements
bn.	billion
BP	Bank profitability
bp	Basis points
CAR	Capital to asset ratio
CCAF	Cambridge Center for Alternative Finance
CCO	Collateralized Credit Operations
CDO	Collateralized Debt Obligation
CET1	Common equity tier 1
CPM	Calibrated portfolio model
CR	Capital ratio
CRD	Capital Requirement Directive
CRE	Commercial real estate
CRR	Capital Requirements Regulation
CRM	Credit risk mitigation
CR plot	Component and residual plot
CSTM	Calibrated stress test model
CTR	Country transfer risk
CTTA	Cash to total assets
CV	Control variables
DEVSTOXX	Development of the STOXX 600

DG FISMA	Directorate-General for Financial Stability, Financial Services and Capital Markets Union
DPR	Dividend pay-out ratio
DPSE	Domestic public sector entity
DV	Dependent variables
DW	Durbin-Watson
EAD	Exposure at default
EBA	European Banking Authority
ECAI	External credit assessment institutions
ECB	European Central Bank
ECB SDW	European Central Bank Statistical Data Warehouse
ECO	Economy
EFF	Gross income over administrative and staff expenses
EL	Expected losses
ELC	Equity Liability Center
ESRB	European Systemic Risk Board
EU	European Union
FE	Fixed effect
FSB	Financial Stability Board
G1	Data frame 1
G2	Data frame 2
GDP	Gross domestic product
GMM	Generalized method of moments
GP	General provision
GLLR	General loan-loss reserves
G-SII	Global Systemically Important Institutions
HAC	Heteroscedasticity and autocorrelation consistent
H0	Null hypothesis
H1	Alternative hypothesis

HAC	heteroscedasticity and autocorrelation consistent
INCATCSTTE	Income available to common shares to total equity
IR	Interest rate
IRB	Internal ratings-based
IRRBB	Interest rate risk in the banking book
IV	Independent variables
HDCI	Hybrid debt capital instruments
LA	Lending activity
LBO	Leverage Buy Out
LCR	Liquidity coverage ratio
LGD	Loss given default
ln	Logarithm of
LS	Left skewed
LR	Leverage ratio
M&A	Mergers & Acquisitions
M	Effective maturity
MDB	Multilateral development banks
MM	Multi-modal
MR1	Multiple regression 1
MR 2	Multiple regression 2
NCGPSE	Non-central government public-sector entity
ND	Normal distribution
NETINCCOMSHARES	Net income to common shares ratio
NETINTINCTTA	Net interest income to total asset ratio
NII	Net interest income
NIOFC	Non-intermediary other financial corporates
NIITRWA	Net interest income to RWA
NIITTA	Net interest income total assets
NLTTA	Net loans to total assets

NOR	Net outflows to total assets ratio
Non-CRE	Non-commercial real estate
NPL	Non-performing loans
NPLTTA	Non-performing loans to total assets
NSFR	Net stable funding ratio
OBS	Off balance sheet
obs	Observation
OBSR	Off balance sheet activities over total assets ratio
OF	Overfitting
OLS	Ordinary least squares
O-SII	Other Systemically Important Institution
PCA	Principal component analysis
PD	Probability of default
P/E	Price earning
P/L	Profit and Loss
PNFC	Private non-financial corporates
PSE	Public sector entities
RFM	Reduced-form model
ROA	Return on assets
ROE	Return on equity
RS	Right skewed
RSF	Required amount of Stable Funding
RWA	Risk-weighted assets
RWATTA	Risk-weighted assets total assets
Sd	Standard deviation
SA	Standardized Approach
SME	Small medium enterprise
SOHQLA	Stock of High Quality Liquid Assets
SR 1	Single regression 1

SR 2	Single regression 2
SREP	Supervisory Review Process
STD	Subordinated term debt
TA	Total assets
TCR	Total Capital Ratio
TCSO	Total common shares outstanding
TETTA	Total equity to total assets
TDETTA	Total deposits to total assets
TDTTA	Total debt to total assets
Tier 1	Tier 1 ratio
TETTA	Total equity to total assets
TNCF	Total Net Cash Flow
TRE	Total Risk Exposure
TSR	Target standard ratio
UK	United Kingdom
UL	Unexpected losses
VaR	Value at risk
VAR	Vector auto regression
VIF	Variance Inflation Factor

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1 INTRODUCTION

1.1 PRACTICAL RELEVANCE

The 2007/2008 financial crisis led to several discussions regarding the impact of financial market regulation (Bergant et al., 2020, pp. 1-40; IMF, 2009, p. 9; Mueller, Yackovlev and Weisfeld, 2009, p. 15; Nier, 2009, p. 1, 4 and 5; Čihák and Tieman, 2008, pp. 1-47).[1] Primarily, such a crisis was caused by the problems in the international and interconnected financial system and their effects on several levels, which led to policy to develop new rules for the system (Schenk, 2020, p. 3; Cappelletti et al., 2020, p. 4; ECB, 2015, p. 2; Claessens and Kodres, 2014, p. 8). The inadequate equity resources of banks led to a decreasing value of assets, distress, and possible bankruptcies (Cevik and Miryugin, 2020, p. 13; Vivar, Wedow and Weistroffer, 2020, p. 10; Chen, Mrkaic and Nabar, 2019, p. 5; KPMG, 2016, p. 7; Reddy, Nangia and Agrawal, 2014, p. 258 in Allen and Giovannetti, 2011, p. 2; Admati et al., 2013, p. I). To stabilize their financial situation, banks decreased their leverage and were forced to collect liquidity by selling their assets, but the forced selling led to decreasing prices and non-optimal cash flows (Chen, Mrkaic and Nabar, 2019, p. 5; Admati et al., 2013, p. I; ECB, 2012, p. 4). The financial market and its participants were affected by this necessary sale (Admati et al., 2013, p. i), and the U.S. banking industry suffered the 2007/2008 financial crisis (Demirgüc-Kunt et al., 2015, pp. 1-3; Rao-Nicholson and Salaber, 2015, pp. 87-88; Billings and Capie, 2011, pp. 193-194; Kwan, 2010, p. 1). The affected banks tightened their lending terms and standards, according to the Federal Reserve's Senior Loan Officers Opinion Survey (Kwan, 2010, p. 1). The Basel Committee on Banking Supervision (BCBS) introduced and developed frameworks to create a stable banking sector (BCBS, 2011, pp. 1-2; Khan, 2017, p. 4). Because the 2007/2008 financial crisis affected both

[1] It is pointed out in advance that the reference to the source in this dissertation is made after each paragraph to convey a common understanding of citation. If citation occurs within the paragraph, the citation refers to the previously described statement.
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external and internal groups, such groups (for example, shareholders) must be considered for evaluating the dividend policy.

Because shareholders evaluate the business activities of a bank as a chance to generate profit, they supply them with capital and in exchange, demand a return such as dividend payouts (Millon, 2013, p. 192). Their high profit requirements led the financial institutions to adopt riskier business practices. The unregulated regulatory environment allowed banks to explore extensive business management (Martin Wolf, Unregulated Financial System, interview by IMF Survey, 2012, no page). The extension in the loan activities with low regulated financial products generally reduces transparency within the banking system (Brumm et al., 2014, p. 4). Thus, many pre-crisis phenomena led to credit defaults for single banks (Alexopoulou, Andersson and Georgescu, 2009, p. 6; Gaudêncio, Mazany and Schwarz, 2019, p. 5; Huljak et al., 2020, p. 4).

Furthermore, welfare decreased. The use of lacks in corporate governance by the credit institutions supported higher risk-taking within the banking industry (Altunbas, Gambacorta and Marqués-Ibáñez, 2010, p. 7; European Union Parliament, 2013, p. 9). This led to errors by individual banks, which caused several systemic problems. Since their capitalization was inadequate, many banks could not absorb an impairment of their loan portfolio. This resulted in a decreasing equity value and consequently, a decreasing enterprise value. Moreover, the unstable financial situation and the lost market confidence limited the credit funding for non-financial corporates (Ruckriegel, 2011, p. 109). Under this uncertainty, many investments and orders from the corporates were deferred and the dynamics of global economic growth slowed (ECB, 2011, p. 100; Ferrari, 2020, p. 4). Due to the financial crisis, the investment demand of several sectors was restrained. One result was an increase in the unemployment rate (Reinhart and Rogoff, 2009, p. 466).

Due to the high degree of globalization, European banks were particularly affected by the 2007/2008 financial crisis (Claessens and van Horen, 2014, p. 3; Cerutti and Zhou, 2017, p. 3). The shareholders of European banks and non-financial corporates suffered substantial losses in their equity value positions (KPMG, 2016, p. 7; Admati et al., 2013, p. I). Simultaneously, the funding for the interbank market was shut down, so that the capitalization of banks was not burdened by possible loan defaults (Reddy, Nangia and Agrawal, 2014, p. 258 in Allen and Giovannetti, 2011, p. 2; Chen, Mrkaic and Nabar, 2019, p. 5; Cevik and Miryugin, 2020, p. 13;

Vivar, Wedow and Weistroffer, 2020, p. 10). To prevent a system shutdown, the European Central Bank (ECB), with their banking authority institution, developed and introduced a new banking system framework (Maddaloni, 2018, p. 2; Khan, 2017, p. 4; BCBS, 2011, pp. 1-2). Furthermore, the economic environment led the ECB to make several reductions in the interest rate to stabilize the economy (Igan et al., 2019, p. 1; Medeiros and Rodríguez, 2011, p. 3; Borio and Disyatat, 2010, p. 205). These facts led to a revision of the regulatory requirements, central bank actions, and a lower interest rate environment to stabilize the financial system (Schenk, 2020, p. 3; Cappelletti et al., 2020, p. 4; Igan et al., 2019, p. 1; ECB, 2015, p. 2; Claessens and Kodres, 2014, p. 8; Medeiros and Rodríguez, 2011, p. 3; Borio and Disyatat, 2010, p. 205). The framework revision and its results reduced the banks' financial returns and many business areas of the banks were affected by the new requirements (Reusens and Croux, 2017, p. 108; Lessenich, 2014, p. 46; Kiff et al., 2010, p. 90; BCBS, 2011, pp. 1-2, 8-9, 30-51; BCBS, 2014, p. 2, 12).

Further, the shareholders' demand for dividends was another factor in the ambitious funding situation for banks. Banks had to increase their equity and liquidity to meet the regulatory requirements, combined with a sustainable reduction of risk-weighted assets (RWA) (Consolo, Malfa and Pierluigi, 2018, p. 4). All conditions directly affected the prevailing profit situation and profit development. The profit payout in the form of dividends would become more complicated (Claessens et al., 2010, p. 16). The interdependency between banks and their shareholders was affected by short-term debt and increased the challenge (Eisenbach, 2017, pp. 263-264).

With the implementation of the Capital Requirements Regulation (CRR) and Directive (CRD), the BCBS achieved the main aim (ECB, 2015, p. 2). The key driver of the new requirements is to increase the quality of lending. Ultimately, a high-quality lending business is a central component of and a prerequisite for a sustainable dividend policy (ECB, 2015, p. 2). Hence, it is necessary to examine the interdependency between the revised regulatory requirements on the one hand and banks' profitability and payout ability, on the other. Since the 2007/2008 financial crisis and the introduced regulatory requirements, many studies investigated the impacts of Capital Requirement Directive IV; for example, Bridges et al. (2014) described the loan policy's effect. Heid, Porath, and Stolz (2004) investigated whether capital regulations impact bank behavior. As a response to a consultation paper by the DG FISMA, the European Central Bank analyzed the different impacts of the CRR and CRD on funding opportunities (ECB, 2015, p. 9). The available analyses are limited because the implementation of the revised regulatory requirements is still in progress. For dividend payment studies, the moral hazard theory is the focus (Al Taleb, 2012; Prokot, 2005; Morris, 1987; Jensen and Meckling, 1976).

The new requirements may reduce the ability of credit institutions to take up riskier businesses for a profit (BCBS, 2011, p. 4, 61). Since the regulatory requirements affect the dividend policy, the banks' management is not completely transparent to shareholders to monitor the risk-portfolio because shareholders cannot wholly evaluate all taken risks. Consequently, they demand a risk-adjusted dividend for their capital provision with equity. The Capital Asset Pricing Model's financial theoretical approach is also affected by the shareholders' information asymmetries (Schulz, 2006, p. 81; Prokot, 2005, p. 77; Morris, 1987, p. 47). Since the asymmetry creates conflicts between several groups (Muneer, Bajuri, and Rehman, 2013, p. 434), there exist interest conflicts among shareholders and bondholders, major shareholders, and small shareholders (Topalov, 2011, p. 27, 30, 38). The shareholders have limited information; management decisions could not be excluded ex ante or ex post (Prokot, 2005, p. 95). The sanctioning of managers is also difficult in the aftermath (Prokot, 2005, p. 96; Tirole, 2006, p. 122). All these aspects are considered by the Capital Asset Pricing Model with its part of the return of shareholders. The research and the assessment of the impact of the dividend policy's regulatory requirements are relatively unexplored; thus, this dissertation seeks to address this research gap.

In conclusion, the analysis of the impacts of the regulatory requirements is currently at an early stage. Furthermore, previous studies' subjects were the impact of the lending growth, bank funding, or the costs of implementation (Francis and Osborne, 2009; Heid, Porath and Stolz, 2004; Borrius, 2012). The dividend policy's determination was examined in several studies (Belo, Dufresne and Goldstein, 2015, p. 1119; Jensen and Meckling, 1976, p. 305; Al Taleb, 2012, p. 234). Against this background, the dissertation investigates the impact of the revised regulatory requirements on the dividend policy. One perspective to analyze the 2007/2008 financial crisis for banks and welfare is the social cost approach, which assumes that there are social or collective costs due to the revised requirements. Banks with better capitalization are less willing to make riskier investments and can be seen by their lower funding costs (Berger, 1995a, pp. 451-454).

Consequently, shareholders and managers will benefit, at the cost of shareholders like debtholders or the government (Admati et al., 2013, pp. 2-3). The 2007/2008 financial crisis created negative externalities (Admati et al., 2013, p. i). Another fact for investors is that the debt of better-capitalized banks are safer and have fewer information asymmetries, and thus, are more useful in the provision of liquidity (Admati et al., 2013, pp. 2-3). The setting of regulatory requirements should be higher than current levels to increase the overall average for several capital ratios. Hence, previously weak institutions are forced to increase their capitalization (Mariathasan and Merrouche, 2014, p. 301). A healthier system would lead to social benefits and reduce social costs (Admati et al., 2013, pp. 2-3). There is an international consensus for a stronger focus on risk mitigation within the banking sector (BIS, accessed June 2017; BaFin, 2013, no page). Therefore, it is necessary to examine how the new regulatory requirements affect the profitability and, in the next step, the dividend policy. The banking sector has a statistically significant role in encouraging credit extension and enabling economic growth (Noss and Toffano, 2014, p. 5).

1.2 OBJECTIVES OF THE WORK

The dissertation should answer how the new regulatory requirements influence the dividend policy of the European banks. Additionally, it is essential to appropriately acknowledge the short- and long-term effects of the regulatory requirements. Hence, this work examines the extent of the consequences of the new capital, risk, and liquidity standards on the dividend policy. Therefore, the impact level of the investigation is first presented. In Chapter II, the identified scientific gap is examined through its theoretical foundations. Chapter II presents the development of the first regulatory requirement, the development to the current framework, and the existing framework. Basel I, Basel II, and Basel III are explained in detail. The impacts of the 2007/2008 financial crisis inform the implementation of the CRR and CRD IV; thus, this chapter serves as a transition of content from Basel II to Basel III. The chapter explains the capital, earning, and risk development of European banks. After presenting Basel III, a differentiation of CRR and CRD IV follows.

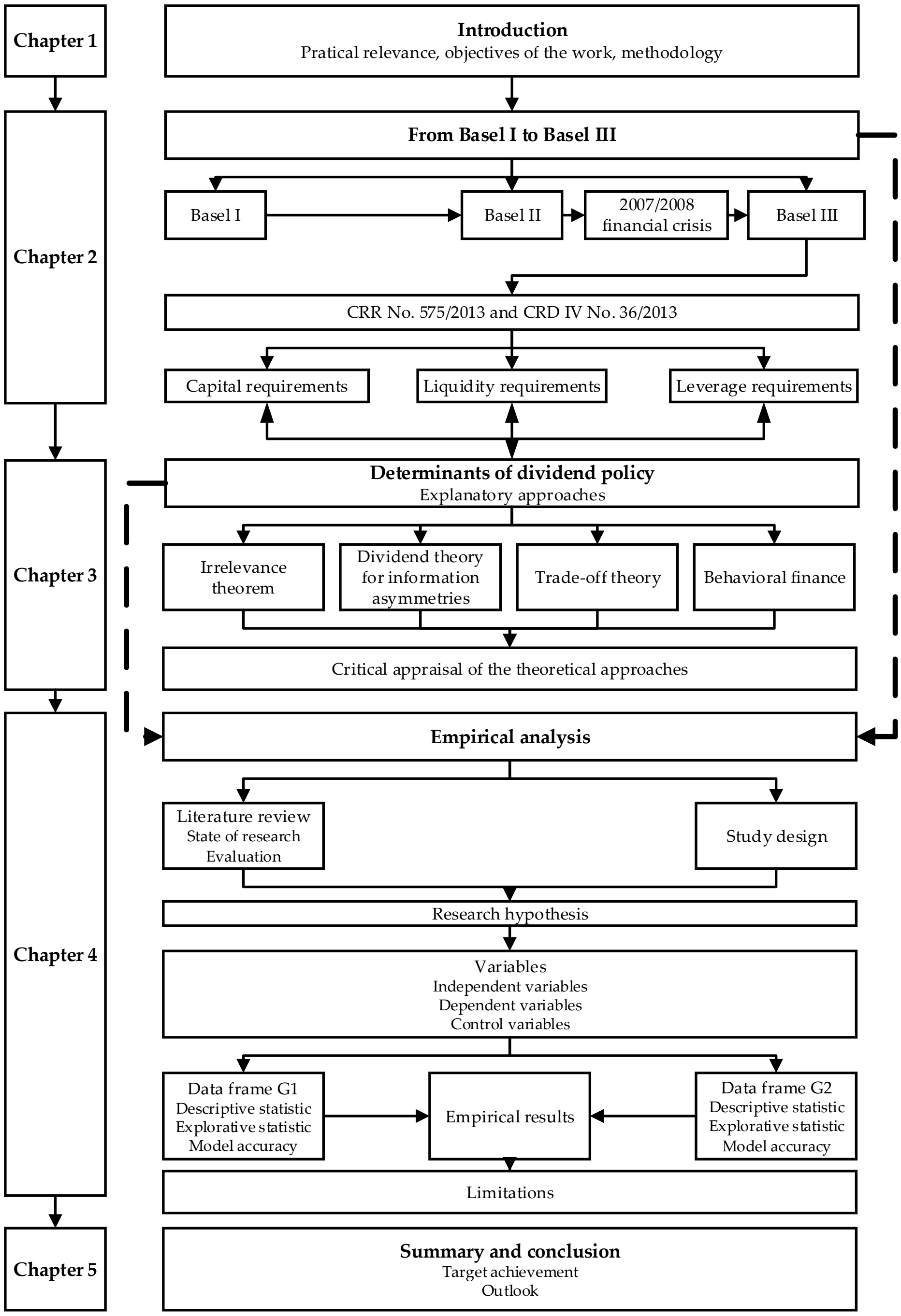
Chapter II as the theoretical framework is necessary for understanding the use of the independent variables. The Modigliani-Miller irrelevance theorem is one of the first approaches to capital structure's irrelevance to consider the dividend policy presented in chapter III. Hence, dividend payments will be described. The scientific method should show the connection between the market value, leverage-ratio, and dividend policy. Under several conditions, the approach implies that the market value and the leverage-structure are independent (compare chapter III). By contrast, the evidence from the financial market suggests that leverage-ratio and corporates' profitability are dependent and influence corporate value. The increase in the observed banks' leverage-ratio in the pre-crisis years and the profitability growth seem to confirm the theory (compare empirical evidence in chapters III and IV).

Furthermore, several theories for information asymmetries will be presented (agency theory, signaling theory, and pecking-order theory). Trade-off theory and behavioral finance theory are compared and contrasted. Chapter IV connects the previous chapter with an empirical study. The modification and the introduction of the CRR and CRD IV impact European banks at various levels. Because different bank departments are affected, the primary changes in the capital, risk, and liquidity management are presented. Chapter IV includes an examination and assessment of the CRR and CRD IV and the dividend policy. A literature review of the empirical state of the art opens the chapter. Thereafter, the study design is presented. The formulation of the research hypotheses and the research questions' operationalization by introducing the used variables will also be a part of chapter IV. The descriptive statistics, explorative statistics, model diagnostic, and research limitations are the main components of chapter IV. Chapter V summarizes the dissertation and documents the dissertation's contributions. The results are linked to the defined dissertation aims, and the outlook closes this dissertation.

1.3 METHODOLOGY

To highlight the impact of the regulatory requirements on the dividend policy, the following methodology is used. Quantitative research is performed to investigate the identified relationship between the CRR/CRD IV and the dividend policy. It is necessary to consider each component's effect on the dividend policy since the regulatory requirements have several components. The following structure has been developed.

Figure 1: Structure of the dissertation



Source: Own figure

First, the scientific and practical relevance is elaborated within the introduction, in particular the impacts of the 2007/2008 financial crisis on the banking sector are presented, which is identified as the main trigger for the developed regulatory requirements. Furthermore, the objectives of the work are defined.

Chapter 2 explains the history of the regulatory requirements, beginning with Basel I and its evolution called Basel II. Since the 2007/2008 financial crisis is the key driver of the development of Basel III, the results of the previous Basel II regulation framework on a leverage, profitability and liquidity/illiquidity perspective are presented. After that, the Basel III with its legal implementation by the CRR and CRD IV is presented.

Based on the capital, liquidity and leverage requirements and its interdependencies with the dividend policy, chapter 3 deals with the dividend policy approaches. In order to explain the interrelation of chapter 2 and 3, a section of figure 1 is shown selectively. The irrelevance theory of Modigliani and Miller (1961) represents the starting point for further academic developments of the dividend policy. Therefore, the dividend policy for information asymmetries (agency theory, signaling and pecking-order theory), the trade-off theory and the behavioral finance are explained. A critical examination of the approaches concludes chapter 4.

The relationship of the regulatory requirements and the dividend policy is analyzed in a quantitative study in chapter 4. At the beginning, the current state of research and the evaluation are presented in the sub-chapter literature review. Then, the framework of the research is presented in the context of the study design. The period from 2005 to 2019 is chosen for examining the impact before, during, and after the implementation of the regulatory requirements. The data set is divided into two data frames (before 2013 and after 2013) to perform and assess the descriptive statistics. The impact of the CRR and CRD IV on European banks' dividend policy is tested by several instruments. In order to perform an explorative statistic, research hypotheses are defined. Then, the operationalization in the form of testable variables (independent, dependent and control variables) were presented, so that the basis for explorative statistics is given. For the explorative statistic, a correlation analysis is the first step to indicate relationships between the variables. Thereafter, several single and multiple regression models are performed and assessed. Within this chapter, it is also explained why the regression analysis is chosen and executed. The assumptions of the regression are tested in the sub-chapter model accuracy. In this chapter, the developed regression models are adjusted to produce valid results. The final results are presented in the sub-chapter empirical results, in particular the comparison of the regressions results of the defined data frames G1 and G2. For a critical treatment of this study, a sub-chapter limitations section is added.

Chapter 5 includes the summary and conclusions. The key research findings are compared with the initially formulated objectives of the dissertation. With regard to the limitations, the outlook points out further research fields that open up further scientific discussions of the impacts of the regulatory requirements on the banking sector.

2 FROM BASEL I TO BASEL III

2.1 BASEL I

For an adequate analysis of the research question, the basics of the regulatory requirement are taken in an impact analysis frame. The attitudes of banks evolved under two circumstances. Risk management becomes more critical and the previous risk management was treated as a passive task. The new understanding of risk management is based on a proactive approach of "…performance measurement, risk-based pricing, portfolio management, and economic capital allocation." (Balthazar, 2006, p. 1). The latest strategies considered risk management as a constituent of the creation of shareholder value, which is the main achievement of any company's management (Balthazar, 2006, p. 1).

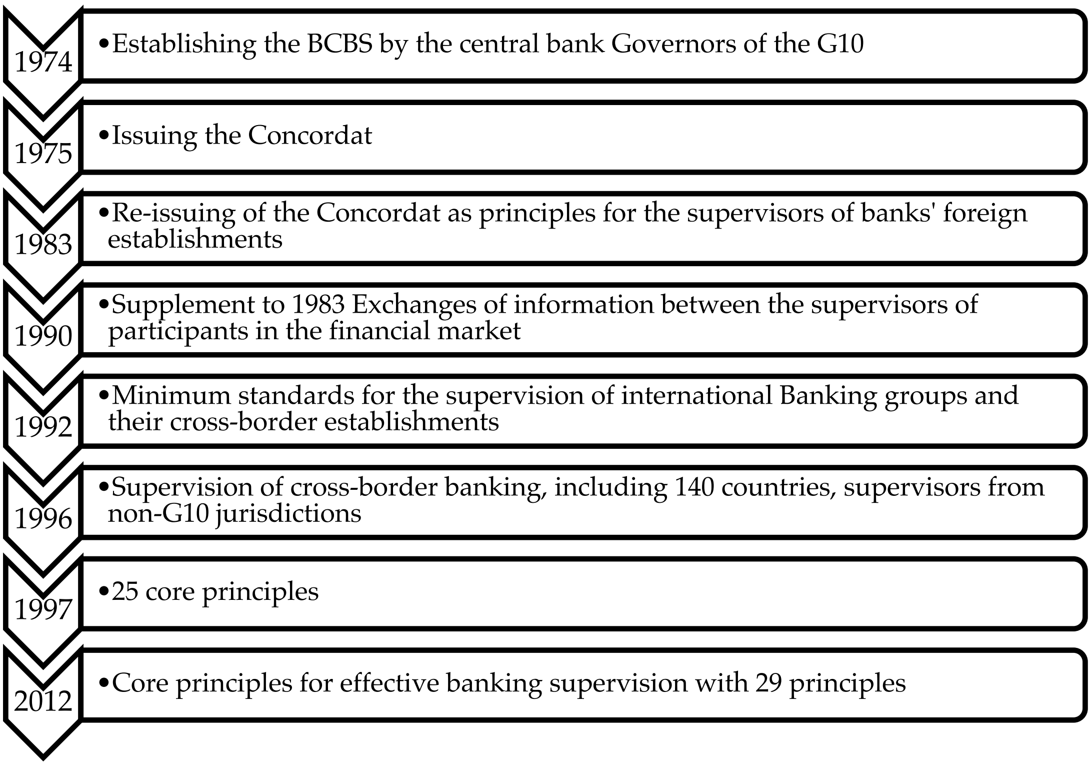
Furthermore, the attitudes of banks were affected under regulations. Hence, a short historical account of the European regulation follows to indicate the necessity of regulations for the banking sector, because historically, deregulation first took place. Implementing a regulatory framework has been the focus of several studies (Ager and Spargoli, 2013; Hasan, 2002; Calem and Rob, 1999). The economy was weak in the 1970s and the supervisory authorities were forced to revise the banking branch framework (Balthazar, 2006, p. 5). For example, the economic indicators of the worldwide inflation of 9.7 % between 1973 and 1981 or the worldwide economic growth rate of 2.4 % led to a phase of deregulation (Trumbore, 2002, accessed June 2017). The banking sector argued that regulations burden economic growth (Balthazar, 2006, p. 9). They also argued that a non-regulated financial sector promotes economic growth because an elevated level of competition within the banking industry improves their efficiency in generating competitive advantages (Balthazar, 2006, p. 9; Jayaratne and Strahan, 1996, p. 639). The banking industry saw the advantages of the branching reforms through the structure effects. Calem (1994) investigated the acquisition activities after regulatory changes and showed that many small banks are acquired and incorporated into the large banks after changes of regulations (Calem, 1994, p. 18). Amel and Liang (1992) found statistically significant entry into local markets after a reform. Simultaneously, the regulators saw competition as another driver. More competition risks could originate from more risks for different levels (institutional, systemic, and GDP growth) (Ager and Spargoli, p. 7, 29; Lange and Milesi-Ferretti, 2017, p. 5). A higher risk appetite leads to an increase in loan default probability (Ager and Spargoli, 2013, p. 29). Chava et al. (2013, p. 763) observed that deregulation and economic growth correlate positively. They used variables to measure the level of innovation (for economic development) or a dummy variable (for deregulation) (Chava et al., 2013, pp. 763-764). Furthermore, bankruptcy might have higher social costs for economic growth. Hence, different objectives are pursued with regulation of the banking sector. Other studies examined the U.S. banking sector because it was a mostly unregulated financial sector in the past (Ager and Spargoli, 2013, p. 7). However, an event highlighted the need for an internationally consistent supervisory authority and banking regulation: The Herstatt crisis, which was one trigger and had many implications for the regulatory framework (Schlenker, 2015, p. 32; Tröger, 2002, p. 117; Kossack, 2012, p. 45). Herstatt bank was founded in 1956 by Iwan Herstatt (BCBS, 2004a, p. 5). Its total assets in 1973 amounted to 2.07 billion DM (Brummer, 2014, p. 99; BCBS, 2004a, p. 5) and it was the thirty-fifth largest bank in Germany. As per the balance sheet of 31.12.1973, the bank had an equity position of 77 million DM and opened foreign exchange positions of 2 billion DM (BCBS, 2004a, p. 5). The bank speculated on a decline of the U.S. dollar (Mourlon-Druol, 2015, p. 313; Peemöller and Hofmann, 2005, p. 80; Diepen and Sauter, 1991, p. 773; Blei, 1984, p. 5). Under the Bretton Wood System, the exchange rates were fixed; the banks had relatively low risks (Kellerhoff, 2014, no page; Blei, 1984, p. 5). After the Bretton Wood System's revocation with a free-floating currency system, the bank lost 748 million DM within two days, despite a trading limit of 25 million DM (DIIR, 2008, p. 49; Blei, 1984, p. 10). In July 1973, Germany's supervisory authority received a note about speculative currency activities (Blei, 1984, p. 10). At this time, the total equity was fully consumed (Richert, 2020, no page; Blei, 1984, p. 10). In November 1973, the bank tried to equal the losses by further speculation on a rising dollar (BCBS, 2004a, p. 5; Blei, 1984, p. 10), and the losses could be reduced for a time. However, from the beginning of the year 1974, the dollar rate dropped, causing the Herstatt bank to suffer further losses (Thieme, 2020, no page; BCBS, 2004a, p. 5; Blei, 1984, p. 10). The president of Germany's supervisory authority received information about the Herstatt bank regarding their high positions in the foreign exchange market (Blei, 1984, p. 10). Remarkably, the next instruction of an examination confirmed no considerable risks of the Herstatt bank (Blei, 1984, p. 9). Furthermore, the audit ascertained no unusual complaints (BCBS, 2004a, p. 5; Blei, 1984, p. 9). The financial statement of the Herstatt bank got an unrestricted certification (Blei, 1984, p. 9). Accounting manipulations were only found by an investigation of the supervisory board's chairperson (Blei, 1984, p. 10). After the inquiry, the Herstatt bank was forced to file for bankruptcy (Penikas, 2015, p. 15; Kleinheisterkamp, 2010, pp. 12-13; ECB, 2007, p. 149; Blei, 1984, p. 10). The bank was not a systemically important global institution and did not influence the broader economy (Blei, 1984, p. 12). However, the bankruptcy showed the need for a consistent supervisory authority (Lüthje, 2013, p. 31; BCBS, 2004a, p. 5; Blei, 1984, pp. 12-15). In this context, the risk must be measured and examined by an independent authority to prevent further banking crises (BCBS, 2004a, p. 6; Blei, 1984, p. 36).

The difficulties on the financial market and the linked risks for the broader economy led the BCBS to introduce the recommendation called "International Convergence of Capital Measurement and Capital Standard" in 1988 (BIS, accessed June 2017). The 10 central bank governors developed the BCBS (BIS, accessed June 2017). The financial market distortions (especially the currency and the banking market) was the trigger for the introduction (BIS, accessed June 2017; Penikas, 2015, p. 11) and its aim was to enhance the financial system's soundness by several qualitative and quantitative measures (BIS, accessed June 2017). The participants confirmed several rules (BIS, accessed June 2017).

Furthermore, the institution sees itself as a platform to exchange information and develop and introduce further measures (BIS, accessed June 2017). Currently, the organization consists of 28 members (BIS, accessed June 2017). The BCBS introduced several uniform recommendations to regulate the banking sector internationally (BIS, accessed June 2017). Its publication on capital adequacy has high relevance for the banking activities (BIS, accessed June 2017). The recommendations are widely described as the Basel framework I to III (BIS, accessed June 2017).

The Basel I framework was the first publication of the BCBS (BIS, no year, accessed June 2017). The main element was the definition of minimum capital levels (BIS, no year, accessed June 2017). The supervisors of the BCBS member could implement more robust capital recommendations for their jurisdictions (BCBS, 2004, p. 2; BIS, no year, accessed June 2017). The BCBS saw the need to fulfill the possibility of supervising a bank without restriction like the Herstatt bank, discussed above (BIS, no year, accessed June 2017). The BCBS defined two main objectives for their initiative. First, the BCBS seeks to improve international banking supervision and second, they aim at equality in competitiveness among global banks, with standardized and harmonized supervision among the members (BIS, no year, accessed June 2017). Hence, first, an international standard was established from the Concordat. The Concordat included the recommendations for sharing the responsibility. The Concordat was developed in the last decades (BIS, accessed June 2017). The following overview shows the development of the Committee's work.

Figure 2: Evolution of the BCBS



Source: Own figure

Since the introduction of regulation standards, the reduction and prevention of the moral hazard issues and the aim of a stable financial system have been achieved. The origin of an opportunistic behavior contradicts a secondary effect of the toolbox of the banking regulators and central banks. Balthazer (2006, pp. 16-17) includes the following instruments:

Table 1: Toolbox of the regulators and central banks

Instrument	**Meaning**
Macro-prudential analysis	Monitoring the economy by various indicators (for example, the GDP-growth or the inflation rate)
Micro-prudential regulation	Individual supervision of each financial institutions
Monetary policy	For example, liquidity supply of the financial market in periods of disturbance
Communication	Adequate communication to stakeholders and shareholders to prevent panics and bank runs; support the banking sector in managing a crisis through communication
Monitoring of the payment system	In several countries
Lender of last resort measures	The bailout of individual institutions

Source: Modeled on Balthazar, 2006, pp. 16-17

The lender of last-resort measures supports opportunistic behavior (Balthazar, 2006, p. 16). The market and the individual institutions act with the expectation of a rescue by the central bank during difficulties (Balthazar, 2006, p. 16). The BCBS published their framework, called "International convergence of capital measurement and capital standards" in 1988 (BCBS, 1988). The framework aims primarily at defining the capital ratio (BCBS, 1988, p. 1). In particular, the risk from the default of counterparty is the framework's focus (BCBS, 1988, p. 2). Further, the risk of interest rate changes and securities' risk are considered (BCBS, 1988, p. 2). The first part of the framework explains the individual components of capital (BCBS, 1988, pp. 3-8). Section II describes the risk-weighting system (BCBS, 1988, pp. 8-13). Section III includes the aimed standard ratio, and the last section describes the transitional and implementing arrangements (BCBS, 1988, pp. 14-16). The framework requires banks to achieve equity above a pre-defined percentage of their RWA (Beltratti and Paladino, 2016, p. 180). The framework comprises the following constituents of capital:

Figure 3: Constituents of capital

Constituents of capital		
Core Capital (Tier 1) • Issued and fully paid ordinary shares • Common stocks • Non-cumulative perpetual preferred stocks	Supplementary Capital (Tier 2) • Undisclosed reserves • Revaluation reserves • General provisions/general loan-loss reserves • Hybrid debt capital instruments • Subordinated debt	Deductions from capital • Goodwill • Investments in subsidiaries

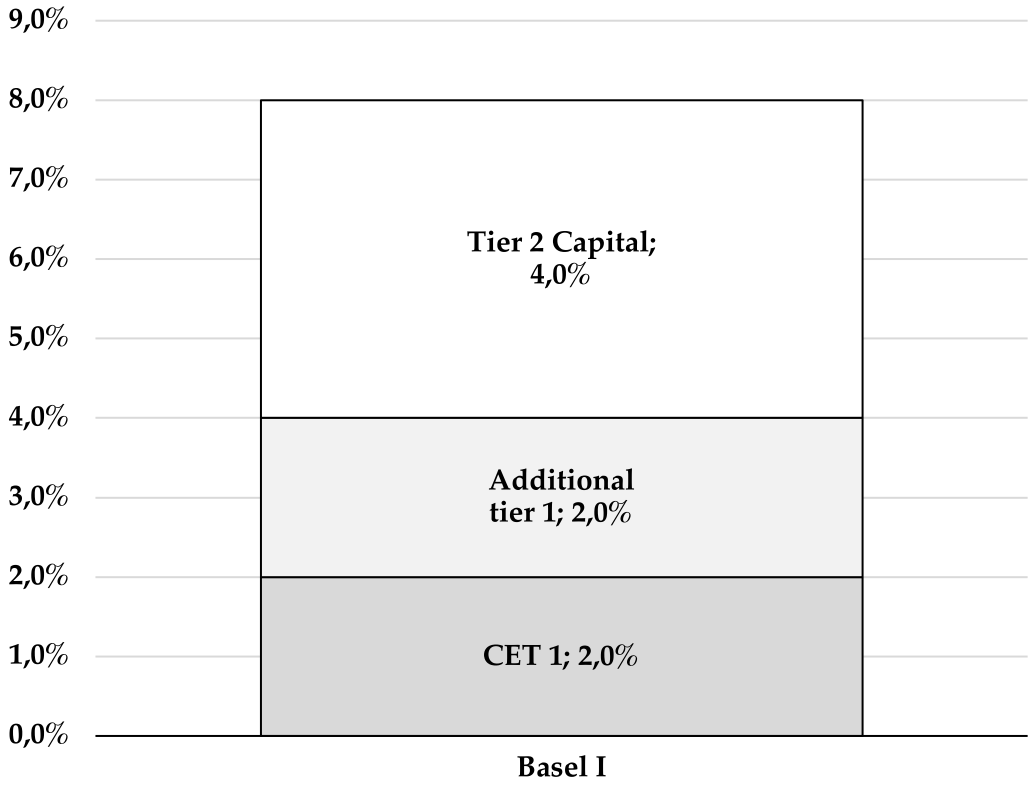
Source: Own figure, modeled on BCBS, 1988

The core capital is the main element of capital. The core capital consists of mainly two forms of capital (equity capital and revealed reserves) (BCBS, 1988, pp. 3-8).

> The Committee accepted equity capital "issued and fully paid ordinary shares, common stock, and non-cumulative perpetual preferred stocks" (BCBS, 1988, p. 3).

All countries have this substantial component of capital in common. The elements are accounted for in the financial statement. Banks' equity is a primary component of the market assessment of corporates. Since capitalization affects corporates' profitability and competition ability, the Committee also defined several components of a bank capital base that banks must consider. Therefore, the capital is defined in two tiers (BCBS, 1988, pp. 3-7). The detailed composition of the capital structure is as follows:

Figure 4: Minimum capital requirement in Basel I



Source: Own figure, modeled on BCBS, 1988, pp. 1-8, 17-20

Tier 1 contains perpetual shareholders' equity and the disclosed reserves (BCBS, 1988, p. 18). The equity consists of paid-up share capital and common stocks, and disclosed reserves (BCBS, 1988, p. 18), wherein the disclosed reserves are caused by retained earnings or other gains (BCBS, 1988, p. 18).

> "Share premiums retained profits, and general reserves and legal reserves…" (BCBS, 1988, p. 18) are also included.

The equity definition must also be applied for minority interests without considering the ownership structure (BCBS, 1988, p. 18).

The description does not contain "…revaluation reserves and cumulative preference shares." (BCBS, 1988, p. 18). The tier 1 capital stipulated that no less than 50 % of banks' equity should compose "…equity and published reserves from post-tax retained earnings" (BCBS, 1988, p. 4). Tier 2 included the "undisclosed reserves, asset revaluation reserves, general provisions/general loan-loss reserves, hybrid (debt/equity) capital instruments and subordinated debt" (BCBS, 1988, p. 17).

The undisclosed reserves are those that have their origin in unpublished or hidden reserves and are allocated to the P & L (BCBS, 1988, p. 4). The national supervisory authorities accept the application of the reserves (BCBS, 1988, p. 4). One aspect is that the undisclosed reserves may have the same capital quality and features as a disclosed reserve (BCBS, 1988, p. 17). The reserves exclude hidden values (BCBS, 1988, p. 17), which may be due to managing securities below market prices (BCBS, 1988, p. 17). The undisclosed reserves must not be burdened by any provisions or liabilities (BCBS, 1988, p. 17), and must be free and available at any time to compensate for unexpected losses (BCBS, 1988, p. 17).

Another aspect is that several countries do not account for undisclosed reserves. Additionally, against the background of a minimum cross-country standard, a lack of transparency prevents the establishments of a uniform accounting framework (BCBS, 1988, p. 4). Therefore, the BCBS excluded the undisclosed reserves from the Tier 1 capital (BCBS, 1988, p. 4, 18). Another element of Tier 2 is the revaluation reserves. The reserves result in different approaches (BCBS, 1988, p. 5). First, each country's financial institutions can revalue their assets to consider market changes sufficiently (BCBS, 1988, p. 5), which is a formal revaluation process. The surplus, which resulted from comparing the historical cost and the market value, could have accounted for capital reserves (BCBS, 1988, p. 5). The balance sheet considers these values as a revaluation reserve (BCBS, 1988, p. 5). The second approach presented a theoretical addition to the capital (BCBS, 1988, p. 5); further, the added values result from long-term holding and managing securities at historical costs (BCBS, 1988, p. 5). The added revaluation values from these methods can be included in Tier 2 (BCBS, 1988, p. 19). The inclusion prerequisites are a prudent valuation, reflecting the volatility of price changes and emergency sales (BCBS, 1988, p. 19). For adequate risk consideration, the added value has to be burdened by a discount of 55 % (BCBS, 1988, p. 19). Essentially, the credit institutions have a going-concern basis.

The general provisions (GP) and the general loan-loss reserves (GLLR) consider prospective minus' opportunity in the loan businesses. A characteristic of these reserves is the non-assignment to specific assets (BCBS, 1988, p. 6); the reserves can be considered in Tier 2 (BCBS, 1988, p. 6). The provision is limited to 1.25 % under the condition that the general requirement already includes the valuation risk by considering the balance sheet (BCBS, 1988, p. 6). In an exceptional situation, the temporary limit is 2.0 % (BCBS, 1988, p. 6). These reserves should compensate for asset value losses caused in any balance sheet position (BCBS, 1988, p. 5). If the provisions are appropriated to equal value losses of particular assets, the requirements have restrictions on their availability to compensate for unidentified losses (BCBS, 1988, p. 5). In this case, the reserves are not a component of Tier 2 (BCBS, 1988, p. 5). It is challenging to distinguish between freely available reserves and reserves appropriated against assets losses (BCBS, 1988, p. 5). This separation demonstrated the requirements and variety of accounting (BCBS, 1988, p. 5).

Furthermore, national accounting rules regarding capital definition mean that the GP and GLLR are not uniform (BCBS, 1988, pp. 5-6). To ensure consistency in the implementation, each member specifies an introduction phase (BCBS, 1988, p. 6). Before the introduction, if the members do not reach a definition, the Committee agrees that 1.25 % of risk assets is the limit of the reserves (BCBS, 1988, p. 6). This should not burden the P&L additionally.

The component hybrid debt capital instruments (HDCI) summarize capital instruments that merge specific equity and debt (BCBS, 1988, p. 6). If HDCI have many similar attributes to equity capital, especially the loss compensation character without causing liquidity problems, the BCBS will accept them for accounting as Tier 2. The Committee defined the admission requirements for using the HDCI as Tier 2 (BCBS, 1988, p. 19):

> First, the instruments must be "…unsecured, subordinated and fully paid-up" (BCBS, 1988, p. 19).

They cannot be paid back to the owner without the confirmation of the authority (BCBS, 1988, p. 19). Against conventional subordinated debts, they must have the attribute of being loss-absorbing without ceasing trading activities (BCBS, 1988, p. 19). Another requirement is that it should be allowed in low profitability to prevent the service obligations (for example, interest payments). An example of HDCI is a preference share (BCBS, 1988, pp. 19-20). The last constituent of Tier 2 is the subordinated term debt (STD). Based on their fixed maturity, the Committee has additional restrictions for considering them as Tier 2, Including a minimum duration of five years (BCBS, 1988, p. 6). Simultaneously, it is prohibited to declare more than 50 % of Tier 1 as STD for Tier 2 (BCBS, 1988, pp. 6-7), and the amount must reduce entirely in the last five years (BCBS, 1988, p. 20) to consider the STD decreasing value.

After the enumeration and explanation of the capital components, it is relevant to consider the capital deductions. The deductions have to reduce the capital base for recognizing calculated impairments in values (BCBS, 1988, p. 7). Goodwill is an asset that reduces Tier 1's value, and investment in subsidiaries, especially unconsolidated banking and financial subsidiaries, have to be considered for deductions (BCBS, 1988, p. 7). Conventionally, the investments are consolidated so that the banking group's capitalization is published (BCBS, 1988, p. 7). A dual-use of capital is not allowed so that, in particular, the deduction is necessary for a non-consolidation (BCBS, 1988, p. 7). The investments' assets are not included in total assets (BCBS, 1988, p. 7).

Initially, there was a disagreement regarding the deductibility in investments in other banks or financial corporates (BCBS, 1988, p. 7). Several supervisory authorities required this deduction to support the external capital acquisition and the financial system, to create cross-investments (BCBS, 1988, p. 7). The cross-holding activities are called double-gearing or double-leveraging (BCBS, 1988, p. 7). The interconnections within the banking system can create a more vulnerable system (BCBS, 1988, p. 7) and the BCBS intended to prevent problems and risk shifting within the banking sector (BCBS, 1988, p. 7). Therefore, some G-10 members justified the regulation of a full deduction (BCBS, 1988, p. 7). Though the members agreed with these concerns, not all members decided on a full deduction policy (BCBS, 1988, p. 7). Some members were concerned about specific significant changes in their domestic banking and financial system (BCBS, 1988, p. 7). Therefore, the Committee agreed to four commitments (BCBS, 1988, pp. 7-8):

1. The national supervisory authority can introduce a deduction policy. The authority itself can set the policy framework. The policy can be used as follows:
   a) For all equity participations
   b) For equity participations that exceed the threshold
   c) Case-by-case basis
2. If the members do not introduce the policy, the banks' equity participation capital will be charged with a weight of 100 %.
3. All members agreed that reciprocal equity participation should be prohibited to prevent investments that inflate the capital position.
4. Furthermore, BCBS can implement further restrictions in the future. Therefore, data quality for developing statistics must be ensured by the national supervisors. The Committee monitors the development of equity participation.

Furthermore, the following restrictions are established (BCBS, 1988, p. 17):

1. The amount limit of the total tier 2 components is the total of Tier 1.
2. The maximum of STD is 50 % of Tier 1 components.
3. GP and GLLR have a limitation of 1.25 % for once and limited in time 2.0 % of risk assets. This procedure must be applied for reserves of low valuation assets. Furthermore, the scope is used for non-obvious losses in the balance sheet.
4. The asset revaluation reserves have to be discounted by 55 %. The scope must be used for alleged gains on unrealized securities.

In section two, the BCBS describes the concept of risk weight. First, the Committee considered a weighted risk ratio to be the preferred method for evaluating banks' capitalization (BCBS, 1988, p. 8). The weighted risk ratio relates capital to several on-balance assets or off-balance-sheet exposure (BCBS, 1988, p. 8). Previously, the asset classes were linked to risk categories with risk weights, which depended on their relative risk (BCBS, 1988, p. 8). In principle, there exist several methods and ratios of capital measurement, but the Committee assessed that the weighted risk ratio had three main advantages (BCBS, 1988, p. 8):

1. The weighted risk ratio ensures an adequate foundation for international comparisons between banking systems with various structures.
2. The ratio includes off-balance-sheet exposures.

3. The ratio does not burden banks with high liquidity positions or assets with a low-risk status.

To use the weighted risk ratio, the BCBS defines five risk categories (0, 10, 20, 50, and 100 %) (BCBS, 1988, p. 8). Because receivables against domestic public-sector entities (DPSE) are at national discretion with a risk weight from 0 to 100 %, the literature assumes four risk categories (BCBS, 1988, p. 9).

> The risk categories should complete and not replace "…the commercial judgement for purposes of market pricing" (BCBS, 1988, p. 9). The risk categories are described in detail in Appendix 2.

Another aspect of section two is risk categorization. The framework highlights credit risk, which essentially represents the risk of a default of the counterparty. To consider the investment risk, the BCBS also concluded that further studies are necessary to evaluate and develop an acceptable measurement method for this risk (BCBS, 1988, pp. 8-9). Additionally, the framework deepened the country transfer risk (CTR). The Committee based their proposals on earlier alternative approaches.

> The first approach differentiated "…between claims on domestic institutions (for example central government, official sector, and banks) and claims on all foreign countries" (BCBS, 1988, p. 9).

Secondly, a differentiation is made between defined groups of countries that enjoy a high credit rating. During the consultative period, the Committee favored the second approach (BCBS, 1988, p. 9). In particular, three arguments supported the Committees' view (BCBS, 1988, pp. 9-10):

1. A simple differentiation between domestic and foreign ignores how the CTR can differ considerably between the members.

> Therefore, this risk has to consider a vast differentiation of "…industrialized and non-industrialized countries" (BCBS, 1988, p. 9).

2. The increasing internationalization and interdependence would not be reflected adequately by simple differentiation. A stand-alone national approach

and the concept of risk weighting for promoting sustainable and careful liquidity management are inconsistent. The banks would not invest and hold securities against their domestic currency liabilities, issued by governments of critical foreign countries.

3. A split approach would support an asymmetry treatment because seven of the G-10 countries are members of the Committee. From another perspective, the countries' treatment would not be equal because their central government liabilities would not be recognized as a high-quality risk.

Therefore, the Committee has assigned each country a weighting coefficient (BCBS, 1988, p. 10). The group member has to be a full OECD member or have a special lending arrangement with the International Monetary Fund (BCBS, 1988, p. 10). After the compilation of the groups, the Committee built a weighting structure (see appendix 2). For interbank claims, the members agreed that short-term claims against banks enjoy equal treatment and the location of the bank (whether in OECD or not) does not matter. The short-term interbank claims for liquidity supply and a lower perception of risks are not treated differently for OECD members or non-members. Since long-term interbank claims usually have more significant credit risks, these claims are treated specially (BCBS, 1988, p. 10). Another part of section two deals with claims against non-central-government public-sector entities (NCGPSE). Due to the unique character and diversification of the PSE's creditworthiness in member countries, a single standard weight for these claims was rejected (BCBS, 1988, p. 11). The national supervisory authorities have the responsibility of determining the weighting factors (BCBS, 1988, p. 11).

Nonetheless, the range of the weighting factors is from 0 to 50 % for domestic PSE (BCBS, 1988, p. 11). If the PSE is located in foreign countries, the claim has to consider a 20 % weight (BCBS, 1988, p. 11). If the public sector holds commercial corporations, a weight of 100 % has to be applied to avoid unequal competition (BCBS, 1988, p. 11). The superordinate objective of a typical ratio for assessing credit institutions' solvency makes it necessary for PSE's described agreements to be checked for further harmonization (BCBS, 1988, p. 11). Part four within section two described the collaterals and guarantees. Hence, a diversifying practice for handling collateral in the member countries, a common approach for recognizing collaterals in the weighting system, was not available before.

The constrained consideration of collaterals is only accepted to loans which are secured "…against cash or securities issued by OECD central governments" (BCBS, 1988, p. 11). The fully secured loan is treated with the lower weights and the guaranteed loans through another will be treated with the weight for "…a direct claim on the guarantor" (BCBS, 1988, p. 11).

For loans on residential properties, the Committee agreed on a factor of 50 % for loans if they are fully secured residential real estate (BCBS, 1988, p. 12). The national supervisory authority has the responsibility for applying and dealing with the risk weight (BCBS, 1988, p. 12). Different implementations could be the result of this circumstance. For example, in some jurisdictions, the risk is weighted by 50 %, but only for the first loan with a real estate charge. In other countries, the supervisory authority applies the risk weight of 50 % only if valuation rules ensure a considerable margin of additional security over the loan. Claims from risky residential loans against companies do not consider the risk weight ratio (BCBS, 1988, p. 12). Another part of the risk weight section describes the treatment of off-balance-sheet engagements. All off-balance-sheet (OBS) actions are considered regulated (BCBS, 1988, p. 12). They defined five broad categories (see appendix 3). In the last section, the BCBS described a target standard ratio of capital (TSR) in proportion to the RWA. The members set the ratio at 8 %. The core capital element has to be a minimum of 4 %. The ratio is a minimum requirement for the considered banks. The ratio must be fulfilled after the implementation phase, which extended over 54 months from the paper's date (BCBS, 1988, p. 14). The following exemplary calculation demonstrates the concept of the TSR of 8 %.

Table 2: Calculation of minimum capital requirement

Asset Class	Amount	Risk weight	RWA	TCR	Minimum capital requirement
Treasury bond	1.000,00 €	0%	- €	8%	- €
Loans to banks in OECD jurisdictions	1.000,00 €	20%	200,00 €	8%	16,00 €
Loans secured by mortgage	1.000,00 €	50%	500,00 €	8%	40,00 €
Loans to the private sector	1.000,00 €	100%	1.000,00 €	8%	80,00 €

Source: Own example

In conclusion, the framework led to a broad higher capital standard (Leventides and Donatou, 2015, p. 182; Jacques and Nigro, 1997, p. 533). The implementation of regulation standards mitigated risks (Koehn and Santomero, 1980, p. 1235). A significant achievement of the capital rules was the higher required TSR (Mongid, Tahir, and Haron, 2012, p. 60). Additionally, the primary goals were to support the banking sector's strength (Fox et al., 2003, p. 396). The Committee intended to ensure a stable capitalization for every bank within the banking system (Fox et al., 2003, pp. 395-396). However, since the implementation of the capital standards, several weaknesses have been noted. For instance, the limited differentiation of credit risk was a central point of critique (Fox et al., 2003, p. 396). There was no differentiation of risk weighting for a loan to a borrower regardless of his credit rating or for a credit to a company with an investment-grade or speculative-grade rating (Fox et al., 2003, p. 396; Ojo, 2009, p. 4). This creates incentives to shift assets off balance (Hasan, 2002, p. 4; Mongid, Tahir, and Haron, 2012, p. 60). This type of risk management encourages moral hazard (Jokipii and Milne, 2011, p. 165; Francis and Osborne, 2012, p. 811). Rochet (1992, p. 1138) stated that deposit insurance is a classic example of a moral hazard construction. Furthermore, the TSR of 8 % was not adequate to prevent failure or higher risk-taking (Mongid, Tahir, and Haron, 2012, p. 60). The risk category definition was insufficient because the regulation affected well-capitalized and weakly capitalized banks equally and led to a U-shaped relationship between capital and risk (Mongid, Tahir, and Haron, 2012, p.

61). Additionally, the summary of individual risk could lead to a preliminary assessment of risk (Hasan, 2002, p. 4; Yeh, Twaddle, and Frith, 2005, pp. 5-6). These factors led to the development of the framework as a dynamic process and led to Basel II's revised framework in 2004. Since the introduction, the capital definitions and rules have impacted the affected banks' profitability and capital structure. Therefore, it is necessary to create transparency and a foundation for the regulatory requirement.

2.2 BASEL II

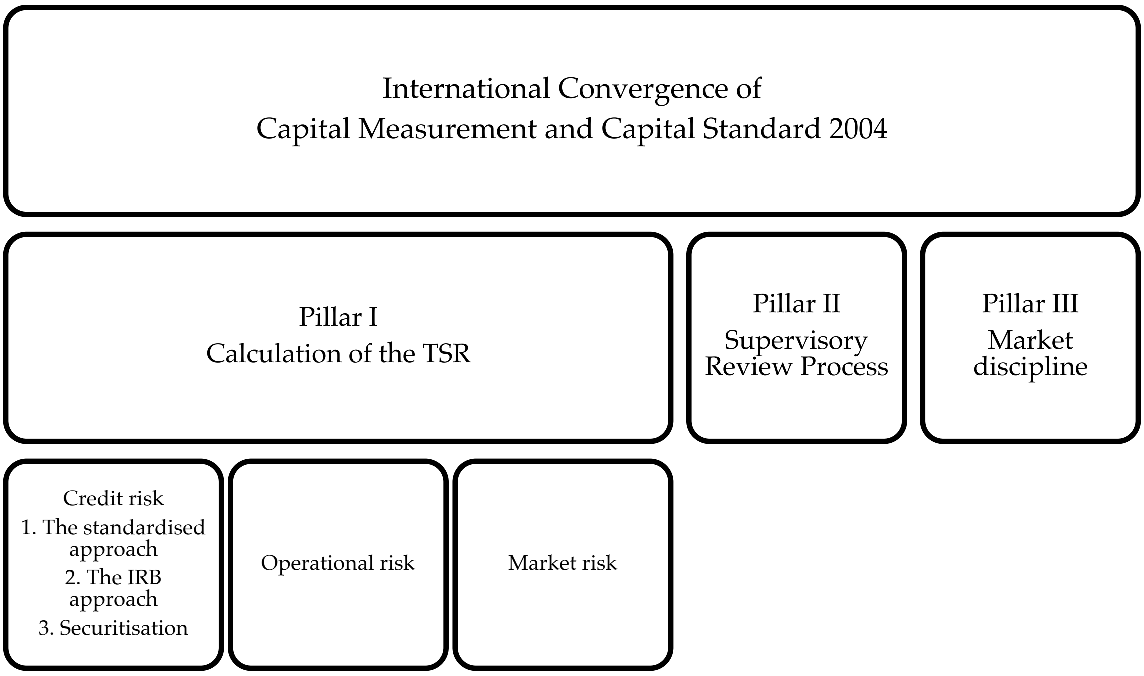
After establishing Basel I, proposals have been considered to improve the framework, justified by three reasons. Firstly, Basel I's impact on large institutions was significant, but many risks have not been considered (Navarrete and Navajas, 2006, p. 1, 7; Montes et al., 2016, p. 2). In this context, Mariathasan and Merrouche (2014, p. 301) discovered that weakly capitalized banks have a lower willingness to report their risk situation than more strongly capitalized banks. Secondly, the banking industry's risk management had evolved so that the first accord was not up-to-date regarding the international heterogeneity (Le Leslé and Avramova, 2012, p. 12). Behn et al. (2014, p. 32) find that under the IRB approach, large international banks assess their risk as low but appreciated the risk differentiation while pricing the credit. Begley (2015, p. 35) showed that banks underreported their trading books risks in low capitalization. Thirdly, the banking system's degree of concentration has increased (Fox et al., 2003, p. 396).

After several years of consulting between the BCBS and the banking branch, an evolved framework was published in 2004 by the BCBS (BCBS, 2004). Critical aspects of the first framework from 1988 are maintained, for example, the minimum TSR of 8 % or the general definition of Tier capital (BCBS, 2004, pp. 1-2). But a significant reform of the previous framework was the greater consideration of risk assessment by banks' internal systems for the capital calculation (Fadun, 2013, p. 53; Gordon, Baptista and Yan, 2013, p. 249). The BCBS has requirements for risk assessment; simultaneously, they do not intend to dictate the structure of operational details (BCBS, 2004, p. 2). The revised framework allows the supervisors to choose a good option for determining capital requirements (BCBS, 2004, p. 2). For adequate implementation, the BCBS allowed a margin of discretion for the national authorities (BCBS, 2004, p. 2). For monitoring and reviewing, the BCBS implemented an Accord Implementation Group (AIG) (BCBS, 2004, p. 2). The AIG promotes consistency in the application (BCBS, 2004, p. 2). Furthermore, the revised framework is designed as a minimum capital requirement framework. Banks are looking for instruments to lower the minimum capital requirements (Beasley, Clune, and Hermanson, 2005, p. 525). The national supervisory committees are authorized to enforce stricter capital standards regarding additional capital measures.

> Besides the previously established rules, the framework included modifications in the approach regarding "…the treatment of expected losses (EL), unexpected losses (UL) and the treatment of securitization of exposures" (BCBS, 2004, p. 3) and the changes of the components of the loss-given-default (LGD) (BCBS, 2004, p. 3).

The following part will first describe the framework in general, discuss the key components of the revised framework and highlights, and highlight the changes to the previous framework to clarify the new framework. While the first framework defined central capital requirements, the revised framework is more extensive and detailed. Although the framework is 16 years old, the Committee agreed that further work is necessary to define the additional capital. A substantial change in Basel II from Basel I are the three pillars (minimum capital requirements, supervisory review, and market discipline). The framework is structured as follows: Part 1 includes the application scope and describes the new version's scope. Part 2 provides the TSR calculation, the standardized approach of the credit risks, the IRB approach of the credit risks, the framework of securitization, the operational risk, and the trading book issues. The third and fourth parts include the second (SREP) and third pillar (Market discipline) (BCBS, 2004, no page number).

Figure 5: Structure of the evolved framework of 2004



Source: BCBS, 2004, p. 6

The first Part describes all included banks with international activities (BCBS, 2004, p. 7). The framework must be used on a consolidated level at every tier within the banking group (BCBS, 2004, p. 7). The national supervisory authorities evaluate the consolidation group to ensure the framework's implementation and use (BCBS, 2004, p. 7). One of the main objectives is the representation and protection of depositors' interests (BCBS, 2004, p. 7). Ensuring the minimum capital standards is the national authorities' responsibility (BCBS, 2004, p. 7). The other parts describe guidelines for banking, stocks and bonds and other financial affiliates, insurance entities, and minority capital share in banking, stocks, and bonds, and other financial affiliates (BCBS, 2004, pp. 7-9).

Pillar I – TSR calculation

The TSR requirement for credit, market, and operational risk is unchanged against the first framework: it must be a minimum of 8 %. Furthermore, the calculation elements (regulatory capital and RWA) are the same (BCBS, 1988, pp. 8, 14, 17-20; BCBS, 2004, pp. 12, 15-21). The definition of the regulatory capital from 1988 remains mostly unchanged (BCBS, 1988, p. 14, 17-20). Basel II changed the definition of capital concerning the deduction of capital constituents (BCBS, 2004, p. 12). The Committee agreed that RWA consists of the following parts (BCBS, 2004, p. 12):

1. Market risk requirements multiplying by a coefficient of 12.5
2. Operational risk requirements multiplying by a coefficient of 12.5
3. Adding to the RWA for credit risk

The TSR calculation for credit risks is differentiated into two approaches (Hamadi et al., 2016, p 178). The standardized approach (i) and the second approach (IRB) (ii) (BCBS, 2004, p. 12). The BCBS gives the banks a choice to decide between these two approaches for the TSR calculation for credit risks (BCBS, 2004, p. 15). The standardized system is encouraged by external credit evaluations. External credit assessments must be issued from external credit assessment institutions (ECAI) (BCBS, 2004, p. 23). For consideration by the supervisor, an ECAI must fulfill the following criteria (BCBS, 2004, p. 23):

1. Objectivity
2. Independence
3. International access/Transparency
4. Disclosure
5. Resources
6. Credibility

The supervisors must verify if the external ratings for the risk weights fulfill the requirements (BCBS, 2004, p. 23). Several studies described banks' ability to choose between the approaches as problematic because the treatment of the bank size is unequal (Hakenes and Schnabel, 2010, p. 1436; Daníelsson, Shin and Zigrand, 2004, pp. 1069-1070). Another observation of the 2007/2008 financial crisis was that the ratings of the agencies was not truthful (Ciumas, Oniga, and Popa, 2015, p. 1495). The error in the rating using the wrong models to evaluate financial instruments was one of the main reasons for the financial crisis (Salvador, Pastor and de Guevara, 2014, p. 13). In the case of several credit risk rating methods, the Committee agreed on the following guidelines:

Table 3: Guidelines of credit risk evaluations

Number of credit risk assessment by an ECAI	**Treatment**
One evaluation	Using this evaluation
Two evaluations by ECAIs	Using the evaluation with a higher risk weight
Three or more evaluations by ECAIs	Using the two evaluations with lowest risk weight and applying the assessment with the worst rating and highest risk weight

Source: Modeled on BCBS, 2004, p. 24

The external credit evaluation has a significant function for the risk-weighting and is used in the assessment. Claims on governments and their central banks are risk-weighted depending on the rating (BCBS, 2004, pp. 17-18).

Table 4: Risk-weighting of claims on government

Credit Evaluation	**AAA to AA-**	**A+ to A-**	**BBB+ to BBB-**	**BB+ to B-**	**Below B-**	**Unrated**
Risk Weight	0 %	20 %	50 %	100 %	150 %	100 %

Source: BCBS, 2004, p. 15

A detailed definition of the credit rating built on the rating agency Standard & Poor's is set out in the appendix 4. The assessment of receivables against banks can be made by two options. By choosing the first option, all banks obtain a worse risk weight category than against the country receivables. The second option considers the individual risk of a bank, which has to be rated by an external credit risk assessment (BCBS, 2004, pp. 17-18).

Table 5: Risk weighting for receivables against the bank: Option 1

Credit Evaluation of government	AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to B-	Below B-	Unrated
Risk Weight	20 %	50 %	100 %	100 %	150 %	100 %

Source: BCBS, 2004, pp. 17-18

Table 6: Risk weighting for receivables against the bank: Option 2

Credit Evaluation of banks	AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to B-	Below B-	Unrated
Risk weight	20 %	50 %	50 %	100 %	150 %	50 %
Risk weight for short-term claims	20 %	20 %	20 %	50 %	150 %	20 %

Source: BCBS, 2004, pp. 17-18

Receivables against non-central government public sector entities (PSE) can be factored simultaneously by option 1 or 2 for receivables against banks. The national supervisors take decision responsibility (BCBS, 2004, p. 16). Receivables on multilateral development banks (MDB) must be treated simultaneously by option 2 for receivables on banks, but without differentiation between short-term and long-term receivables (BCBS, 2004, p. 16). Receivables on securities firms must be evaluated as receivables on banks. The firms must be subject to supervisory and adequate regulatory requirements (BCBS, 2004, p. 18). Receivables on corporates are treated simultaneously as risk-adjusted. Table 7 shows the individual risk weights.

Table 7: Risk weighting for receivables on corporates

Credit Evaluation	AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to B-	Below B-	Unrated
Risk Weight	20 %	50 %	100 %	100 %	150 %	100 %

Source: BCBS, 2004, p. 18

If the supervisory authority judges a higher risk weight, they can modify the standard risk weight (BCBS, 2004, p. 18). Retail claims can be risk-weighted at 75 % if the following criteria are met (BCBS, 2004, pp. 19-20):

1. Type of borrower (natural person or a small trader)
2. Product criterion (Revolving credits/credit lines, personal loans, or small business loans)
3. Granularity criterion (The supervisor must be convinced that the retail portfolio is diversified.)
4. A low value of individual exposures; that is, a maximum of one million Euro to one borrower.

For residential property secured loans, the risk factor is 35 %. For real estate secured commercial, the factor is 100 % (BCBS, 2004, p. 20). Receivables with an overdue time of 90 days have to be factored with a 100 % to 150 % risk weight factor, depending on the specific provision of the outstanding sum of the loan. There is a differentiation of less than 20 %, at least 20 %, and at least 50 % (BCBS, 2004, p. 21). Furthermore, the BCBS concluded that the below-mentioned claims will be factored at 150 % or more (BCBS, 2004, p. 21):

1. Receivables against the government, PSEs, banks, and security companies which are rated worse than B-
2. Receivables against corporates which are rated worse than BB-
3. Overdue loans
4. Securitization tranches with a rating between BB+ and BB-. These tranches have to be factored in with a risk weight of 350 %.

For off-balance sheet components with the standardized approach, credit conversion factors from 0 % to 100 % are used to assess the risk weight (BCBS, 2004, p. 22). Banks have to meet increased capital requirements and can reduce the exposed credit risks through several instruments. Legal documentation has to be fulfilled for a recognition of the needs. All documentations have to be accepted and applied by all parties in their jurisdictions (BCBS, 2004, p. 27). The following techniques are allowed (BCBS, 2004, pp. 27-30):

1. Collateralized transactions
2. On-balance sheet netting
3. Guarantees and credit derivatives
4. Maturity mismatch

The second approach for the TSR calculation for the credit risk is the IRB (BCBS, 2004, p. 48). Under certain circumstances, banks can use their developed risk evaluation (BCBS, 2004, p. 48). The use of the IRB approach has to be authorized by the supervisor (BCBS, 2004, p. 48). In this case, banks can use their internal rating system to evaluate the credit risk. The approach has to consider the components PD, LGD, EAD, and maturity (M) (BCBS, 2004, p. 48). Remarkably, under the IRB approach, the PD, and thus the capital requirement for banks claims against corporates, varied across banks (Berg and Koziol, 2017, pp. 27-41). The regulators intended to improve the risk attention and implement stricter risk management systems (Cucinelli et al., 2018, p. 213). Before explaining the IRB approach, the risk components definition and asset classes definition under the approach must be described. The IRB approach categorized five classes within banking-book exposure (BCBS, 2004, p. 48). The asset classes are corporate, sovereign, bank, retail, and equity (BCBS, 2004, p. 48). The corporate asset class has five sub-classes, and the retail asset class has three sub-classes (BCBS, 2004, p. 48). The several definitions are mostly identical to the bank practice. The following part includes different descriptions (BCBS, 2004, pp. 49-53).

1. Corporate exposure

This exposure is understood as a liability of corporates, personal corporates, or properties (BCBS, 2004, p. 49). Banks have the choice to differentiate their receivables to small- and medium-sized corporates (BCBS, 2004, p. 49). Furthermore, during the above mentioned five sub-classes, several specialized lending forms are observed (BCBS, 2004, p. 49). All of them fulfill four characteristics. First, the borrower is typically an entity with a business model of financing or operating physical assets (BCBS, 2004, p. 49). Second, the borrowing corporate cannot repay the credit and depends on the financed assets' cash flows (BCBS, 2004, p. 49). Thirdly, the lender has a significant influence over the invested assets and its generated profit through obligation construction (BCBS, 2004, p. 49). Fourth, the security pay-backs' primary capacity depends on the burden asset's income and not in an independent commercial enterprise (BCBS, 2004, p. 49).

> "The five sub-classes of specialized lending are project finance, object finance, commodities finance, income-producing real estate and high-volatility commercial real estate" (BCBS, 2004, pp. 49-51).

2. Sovereign exposure

All exposures to governments in the standard approach are included in this asset class. Furthermore, exposures to the governments' central banks can be declared a sovereign exposure if they fulfill a 0 % risk weight (BCBS, 2004, p. 51).

3. Bank exposure

The asset class bank exposure includes the receivables against other banks. Furthermore, MDBs that do not fulfill the standardized approach requirement must be treated by a 0 % risk weight. The procedure can also be applied for domestic PSEs that are handled like receivable against banks (BCBS, 2004, p. 51).

4. Retail exposure

To be considered a retail exposure, certain criteria must be met. First, exposures against individuals can be classified as retail exposures (BCBS, 2004, p. 51).

Furthermore, residential mortgage loans against individuals can be considered retail exposures (BCBS, 2004, p. 51). Thirdly, exposures against small businesses can be handled as retail exposures if the bank's total receivable is less than 1 million Euro (BCBS, 2004, p. 51). The treatment of the limit has to be flexible so that individual banks are not forced to develop and implement new information systems for limit monitoring (BCBS, 2004, p. 51). The entire structure of exposures must be diversified (BCBS, 2004, p. 51). The supervisors are authorized to require a specific number of exposure and the retail asset class can be subdivided into three subclasses (BCBS, 2004, p. 51).

> The exposure is "…secured by residential properties, revolving retail exposures, and all other retail exposures" (BCBS, 2004, p. 52).

5. Equity exposure

The definition depends on the individual economic value of the equity instrument.

> "Direct or indirect ownership interests […] in assets and income of a commercial entity or a financial institution" (BCBS, 2004, p. 53) must be considered.

If an instrument fulfills the criteria, the instruments can be accepted as an equity exposure (BCBS, 2004, p. 53). The instrument cannot be canceled, and so the investment's repayment is only feasible through a forced sale (BCBS, 2004, p. 53). Secondly, it is prohibited to passivate the equity as a liability (BCBS, 2004, p. 53). Thirdly, the investor has a remaining receivable on the assets or the issuer's profits (BCBS, 2004, p. 54). To calculate the RWA, the BCBS developed formulas to calculate the correlation, then the maturity modification and the completed capital requirement (BCBS, 2004, p. 60). The procedures are more complicated than the TSR calculation, and the formula is presented in the appendix 21.

The fourth part within the first pillar includes the framework of the securitization for credit risks. The BCBS differentiated the securitization between a traditional and a synthetic securitization. For completion, it is mentioned that the part includes the definition of keywords and fundamental terms, followed by the instruction of the operational requirements for the risk transmission and the explanation of the dealing with securitization exposures (BCBS, 2004, pp. 113-136).

Part five within the first pillar considers the treatment of the operational risk of credit institutions (BCBS, 2004, pp. 137-149). The operational risk is understood as a risk of loss (BCBS, 2004, p. 137). The source of a loss can be an inappropriate or abortive internal process, a loss resulting from people, or a loss resulting from external triggers (BCBS, 2004, p. 137). Legal risks are included, and strategic and reputational risks are excluded (BCBS, 2004, p. 137). To calculate the required capital for the operational risk, the BCBS presents three methods: Basic Indicator Approach (BIA), Standardized Approach (SA), and Advanced Measurement Approaches (AMA) (BCBS, 2004, pp. 137-139). The choice of method depends on the business activity's difficulty level (e.g., international banks with investment and trading activities or a bank with a relatively conservative business model) (BCBS, 2004, p. 137). In the BIA, banks must hold 15 % of their three-year average positive annual gross income (BCBS, 2004, pp. 137-138). The calculation of the SA is differentiated. The extent of capital holding depends on the business area. The BCBS divided banks' activities into eight business areas.[2] For each business area, a capital requirement from 12 % to 18 % is required (BCBS, 2004, pp. 139-140). For implementing and using the AMA, the BCBS defines several qualitative requirements and quantitative requirements. The criteria also allow the banks to develop and apply their own approaches for the operational risk consideration (BCBS, 2004, pp. 137-149). The three methods are not further explained to focus this dissertation primarily on Basel II's actual contents.

The last part of the first pillar treated the trading book issues. The sixth part defined the trading book and financial instruments (as a replacement of the definition in the market risk amendment), provided guidance on a prudent valuation and treatment for financial instruments with possible valuation reserves (BCBS, 2004, pp. 151-157). The banks must commit that they value their financial instruments with the marking-to-market methodology (BCBS, 2004, pp. 151-152). If the mark-

[2] The eight business areas are "…corporate finance, trading & sales, retail banking, commercial banking, payment & settlement, agency services, asset management, and retail brokerage."(BCBS, 2004, p. 139).

ing-to-market approach is not applicable, a marking to model approach is permitted (BCBS, 2004, pp. 151-152). The last part is completed by describing assessment modifications, buffers, the trading book's treatment (counterparty credit risk), and handling specific risks (BCBS, 2004, pp. 153-157). The individual chapters within the trading book are not further explained to maintain the focus of this dissertation.

Pillar II – Supervisory Review Process

In the following part, the second pillar is described.

> The Supervisory Review Process (SREP) considers the "[…] key principle of supervisory review, risk management guidance and supervisory transparency and accountability […]" (BCBS, 2004, p. 158).

Three main fields are especially applicable for consideration in the second pillar (BCBS, 2004, p. 158):

1. Risks not fully considered by the first pillar (credit concentration risks).
2. Aspects not considered by the first pillar (e.g., the risk of interest rate changing, business model risks, or long-term risks regarding the business model's strategy.
3. External aspects

> Regarding the SREP, the BCBS developed "four key principles of supervisory review" (BCBS, 2004, p. 159).

The four fundamental principles supplemented the previous guidance from 1997 (BCBS, 1997, pp. 1-44; BCBS, 1999, pp. 1-55).

Principle 1: Assessing process

The principle states that banks must warrant an adequate process for capital risk profile evaluation. A strict process marks through the following elements (BCBS, 2004, p. 159):

1. Monitoring through the management board
2. Sound capital evaluation
3. Risk evaluation

4. Supervision, documentation, and reporting
5. Internal monitoring mechanisms

<u>Principle 2: Review and assessing banks capital suitability assessments through the supervisors</u>

The review can be a component of an on-site inspection, off-site monitoring, discussions with the management board, reviewing assessments by external auditors, and periodical documentation and reporting (BCBS, 2004, p. 162).

<u>Principle 3: Expectation that the banks aim to achieve more than the minimum ratios</u>

Pillar 1 contains a reserve for systemic risks. The entire system and all included banks are affected. Bank-individual risks are considered under pillar 2. The pillar 1 buffer ensures that the banks with adequate internal systems and controls and a diversified risk profile have sufficient certainty of meeting the minimum targets for solidity in pillar 1. Regarding this, the attributes of the market are considered by the supervisor's view. Therefore, supervisors force banks to act above the minimum requirements. Instruments like setting triggers, TSR, or the definition of categories above the required capital ratios can be used by the supervisors (BCBS, 2004, pp. 164-165).

<u>Principle 4: Precautionary acting</u>

To prevent the capital from not reaching the minimum requirements, the supervisors must act at an early stage. Support must be immediate if the capital cannot be maintained or if a short-term capitalization is not possible. For example, the supervisor can intensify their monitoring, limit the banks' dividend payment, and require a restoration plan to stabilize the capital adequacy (BCBS, 2004, p. 165).

In summary, the second pillar is an essential contribution to prevent moral hazard within the banking industry. The SREP, with the four fundamental principles, provides a coherent framework (BCBS, 2004, pp. 158-174). Further, the framework offers scope for individual interpretation, for example the sound capital assessment or the internal control review (BCBS, 2004, pp. 159-160, 162). For example, the first principle aims at an adequate process for evaluating the entire capital risk profile suitability (BCBS, 2004, p. 159). Simultaneously, the non-specific principle is transferred to the bank management. The management decides how extensive a risk management process should be implemented. Confirmation or rejection shall only occur during verification by the supervisory authorities (BCBS, 2004, p. 165).

Pillar III – Market Discipline

Framework completion is the goal of the third pillar to increase market discipline. Therefore, several disclosure requirements are introduced (BCBS, 2004, pp. 177-190). The information is necessary for market players to evaluate the bank through several necessary information. Particularly, the assessment of internal approaches can be ensured by the disclosure requirement. If the disclosure requirement is not implemented, the banks can be disadvantaged by using the higher risk weight factor or by the requirements of using their methodology. (BCBS, 2004, p. 175). A relevant aspect of the third pillar is the essential framework. This framework allows banks to publish information from their point of view. Information on its non-disclosure or its incorrectness is essential as it could influence the assessment by a market player. Typically, the characterization is inconclusive with the International Accounting Standards (IAS) (BCBS, 2004, p. 176). The disclosure frequency is generally semi-annual. Disclosures with qualitative content in summarizing the aim and the procedure of the risk management system are allowed to publish annually for the internal reporting system and definition. Tier 1 and the total capital adequacy ratios have to be published quarterly. Short-term changes on risk exposure have to be published as soon as possible and not later than the time limits defined by the national authorities (BCBS, 2004, p. 177).

> The scope of application obligates the banks to use the disclosure only at the "[…] top consolidated level […]" (BCBS, 2004, p. 178).

Additionally, the Committee requires the banks to disclose TCR and Tier 1 capital ratio on the top consolidated level. Furthermore, the scope of application of qualitative and quantitative information is defined for the following areas (BCBS, 2004, pp. 178-190):

1. Capital structure
2. Capital adequacy
3. Credit risk: general information for all banks
4. Credit risk: information for portfolios that apply IRB
5. Credit risk: information for portfolios subject to IRB approaches
6. Credit risk reduction: information for standardized and IRB approaches
7. Securitization: information for standardized and IRB approaches
8. Market risk: information for banks that use the standardized approach
9. Market risk: information for banks that use the IMA for trading portfolios
10. Operational risk
11. Equities: information for the position of the banking book
12. Interest rate changing risk in the banking book (IRRBB)

In conclusion, the third pillar defines relevant requirements for the disclosure. The 2007/2008 financial crisis showed that banks' disclosure policies are flawed and can be improved. The forces of a market discipline could not inform market players adequately and therefore revised the disclosure requirements (BCBS, 2015, p. 1). The BCBS itself confirmed that the previous pillar III framework failed in 2009, even though the market risk consideration improved (BCBS, 2015, p. 1). The improvement is also seen for the securitization, although the significant risk identification of banks and the overall capital adequacy comparison with other market players were not entirely possible (BCBS, 2015, p. 1).

Furthermore, the scope of application at the top consolidated level can be understood to lead to the promotion of shadow banking developments of financial and non-financial corporates, especially in transition economies (Du, Li, and Wang, 2017, p. 35; Huang, 2018, p. 125). Several studies determined regulatory arbitrage specialization as a primary trigger for the shadow banking sector (Acharya, Schnabl, and Suarez, 2012, pp. 515-536; Gorton and Metrick, A., 2010, pp. 305-306). Furthermore, Pozsar, Adrian, and Ashcraft (2010) showed that gains from specialization within the banking sector determined financial institutions' participation in the shadow banking system. The instruments were used to source risks out and operate without consideration of the capital adequacy. The disruption in 2007 to

2009 on the financial market represented a significant form of information asymmetry (Altunbas, Gambacorta and Marqués-Ibáñez, 2010, p. 7; Beltratti and Stulz, 2012, p. 5; EUR-Lex, 2013, p. 9; Rao-Nicholson and Salaber, 2014, pp. 87-88). Significantly, the securitization in the context of ABS and CDOs enhanced the information asymmetries (Kirabaeva, 2011, p. 11). Although several tranches received a high-quality rating of the ECAIs, the instruments' increasing complexity complicated the evaluation of the investment (loan portfolio of the securitized assets) for investors (Kirabaeva, 2011, p. 11, 13). By employing a Monte Carlo Simulation, Beltran and Thomas (2010) found that the CDO market before and after enhancement within the financial crisis showed adverse selection problems. The information asymmetries cause the market shutdown (Beltran and Thomas, 2010, p. 29). The following table shows the significant amendments of Basel I to Basel II.

Table 8: Overview of significant amendments from Basel I to Basel II

Component of the framework	Basel I	Basel II
Pillar I: Assessment of credit risk	One approach. The Committee previously determines the risk weight.	Standard approach (external system (ECAI) for the risk weight) IRB approach (internal assessment system for the risk weight)
Pillar I: Deductions of investments	100 % of Tier 1	50 % of Tier 1 and 50 % of Tier 2
Pillar I: Deductions of goodwill	100 % of Tier 1	100 % from Tier 1
Pillar I: Limit of Tier 2	Maximum of 100 % of Tier 1 components	Limited to a maximum of 100 % of Tier 1 components after deductions of goodwill and before deductions of investments
Pillar I: General provisions	1.25 % of RWA	Consideration in Tier 2 with a limit of 1.25 % of RWA if banks use the standardized approach
Pillar I: Risk categories	Five risk categories	Credit risk, Market risk, Operational risk
Pillar I: Claims on government	0 %	Depending on rating (0-150 %)
Pillar I: Credit risk – Calculation of risk weights	Standardized approach	Standardized approach IRB
Pillar I supplements	-	Securitization framework Operational risk Trading book issues
Pillar II	-	Supervisory Review process
Pillar III	-	Market discipline

Source: Modeled on BCBS, 1988, pp. 1-28 and BCBS, 2004, pp. 1-228

Since the dissertation examines the influence of regulatory requirements, an intensive presentation of Basel II was required for a deeper understanding of the topic. Basel II was a milestone for the financial sector. Due to the increasingly interlinked financial sector, the implementation of an extensive framework was necessary (Schenk, 2020, p. 3; Cappelletti et al., 2020, p. 4; ECB, 2015, p. 2; Claessens and Kodres, 2014, p. 8). Furthermore, the second and third pillars represent innovations because they focused on a bank's organizational and procedural aspects. The increased complexity of the framework led to effects that have been observed during the financial crisis. The banks' vulnerability to the crisis was particularly affected by their weak capital and liquidity position. Therefore, the BCBS developed tightened rules, called Basel III, which are presented below after a description of the effects of the financial crisis.

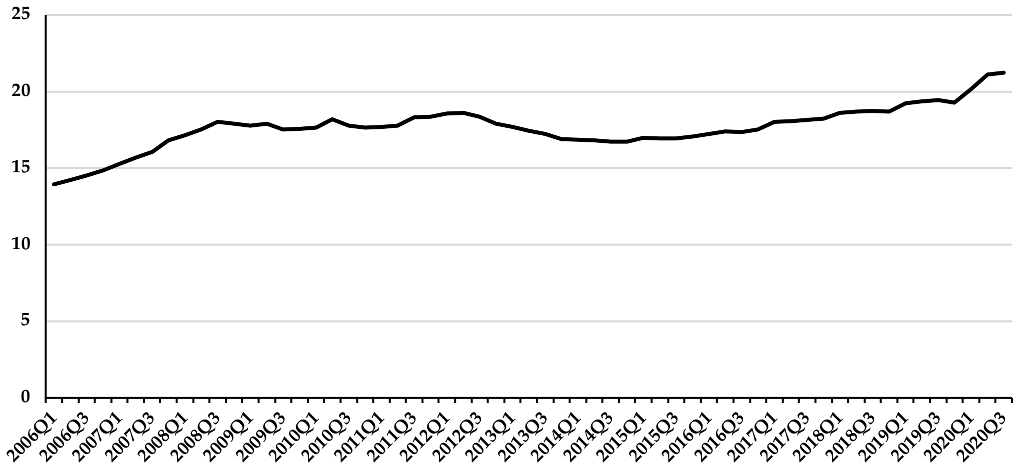
2.3 FINANCIAL CRISIS AS A TRIGGER FOR BASEL III

2.3.1 Leverage in lending

The 2007/2008 financial crisis strained the capitalization and profitability in the banking sector (Kwan, 2010, p. 1). Banks' ability and capacity to support borrowers were affected through large shocks to their funding and capital situation (Sette and Gobbi, 2015, pp. 1-3). First, the 2007/2008 crisis in the banking system affected the banks in the U.S. and spread rapidly across the world (Billings and Capie, 2011, pp. 193-194; Demirgüc-Kunt et al., 2015, pp. 1-3; Rao-Nicholson and Salaber, 2015, pp. 87-88). The bankruptcy of Lehman Brothers in 2008 led to a credit crunch and then to a global banking and financial crisis (Arezki et al., 2011, pp. 3-4; Bao, Pan, and Wang, 2011, p. 911; Pisani-Ferry and Sapir, 2010, p. 2; Rao-Nicholson and Salaber, 2015, pp. 87-88; Camba-Méndez, 2016, p. 6; Taglioni and Zavacka, 2013, p. 2, 13; Drudi, Durré, and Mongelli, 2012, pp. 7-8; Lenza, Pill, and Reichlin, 2010, p. 12). The chain reaction entered the European banking sector in 2009 (Claessens et al., 2010, p. 10) and many economic sectors were affected (Ahn et al., 2011, p. 298; Cetorelli and Goldberg, 2011, p. 1; Demirguc-Kunt et al., 2015, p. 2; Imbs, 2010, p. 1; Montagna, Torri and Covi, 2020, p. 4). The reasons for the 2007/2008 crisis can be lead back on several scientific facets. First, the banking sector's excessive lending activities triggered the financial market's development before and during the financial crisis (Brumm et al., 2014, p. 4). The lending policy was promoted through the partial ex post identified risk immunity of managers, an associated information asymmetry, tax shields for interest payments, explicit and implicit government guarantees, and a largely unregulated environment for banks (Altunbas, Gambacorta and Marqués-Ibáñez, 2010, p. 7; Beltratti and Stulz, 2012, p. 5; EUR-Lex, 2013, p. 9; Rao-Nicholson and Salaber, 2014, pp. 87-88).

Admati et al. (2013, pp. 1-70) examined several dominant opinions that the costs of equity are higher than debt financing. Furthermore, this can be related to the pecking-order theory which ranked the source of funding (Baskin, 1989, p. 27; Chirinko and Singha, 2000, p. 418; Bontempi, 2002, p. 2; Leary and Roberts, 2010, p. 332; Dong et al., 2012, p. 637, 641; Cotei and Farhat, 2009, p. 3). To show individuals' approaches, the following section primarily reflects the results of Admati et al. (2013) study. First, debt encourages disciplining-function (Morris, 1987, p. 47; Guserl and Pernsteiner, 2015, p. 42). Because debt financing is widely tradeable, and the information in the context of information asymmetry is insensitive (Prokot, 2005, p. 95; Admati et al., 2013, p. 37). As the valuation of securities presupposes data availability, the payouts to security holders show a sensitivity to the issuer's profitability and thus, this scenario is described as informationally sensitive due to agency costs for monitoring and bonding managers (Admati et al., 2013, p. 37; Jensen and Meckling, 1976, p. 308; Morris, 1987, pp. 47-48). The reaction to information is insensitive for a low probability of default (Admati et al., 2013, p. 37). The creditors will receive the cash flow of its debt, regardless of whether the bank is profiting (Admati et al., 2013, p. 37). This can produce better liquidity for the asset (Kara, Marques-Ibanez, and Ongena, 2017, p. 3). Further, there is a difference between credit claims and marketable assets for the liquidity acquisition (Tamura and Tabakis, 2013, p. 7). Furthermore, the debt as an asset class is very liquid due to its short-term nature (Admati et al., 2013, p. 37) and must be assessed in the right context. Leverage can be a function to limit bank managers' activities but the government intervention in the case of financial distress of a bank can create moral hazard (Benoît Coeuré, 2013, "Liquidity regulation and monetary policy implementation: from theory to practice," speech given at the Toulouse School of Economics, Toulouse, October 3rd, 2013). Admati et al. (2013, p. 26) differentiated between two explanatory approaches to why equity financing should be preferred to debt funding to weaken information and governance problems: First, the hard claims of creditors. If the prescribed payments do not pay, they will cause legal consequences for the issuer, for example a necessary corporate asset sale (Diamond and Dybvig, 1983, p. 402). Second, there is an existing fear of a creditor run if the managers misbehave and can lead to an interbank shut down (Allen and Carletti, 2008, p. 20). From the bank's perspective, there are four reasons for the problems in the governance intervention. First, based on their business model, banks cannot be compared to non-financial firms because they have much higher leverage than non-financial firms (Admati et al., 2013, p. 29). Second, banks' shareholders are more diversified, so that the management's supervision becomes more relevant (Admati et al., 2013, p. 29). Furthermore, the deposit insurance motivates the banks not to raise their monitoring activities and take up higher risks (Kim and Santomero, 1988, p. 1219; Aggarwal and Jacques, 2001, p. 1140; Admati et al., 2013, p. 29). Lastly, bank shareholders are indirectly protected by the government (Admati et al., 2013, p. 29; Correa-Caro et al., 2018, p. 4). During the financial 2007/2008 crisis, a debt overhang was observed (De Fiore and Uhlig, 2015, pp. 30-31). The effect is more enhanced if a bank or, in general, a corporate is heavily indebted (Admati et al., 2013, p. 24). Thus, creditors are supported by deleveraging. The debt value and existing equity are relatively immune to reductions in leverage in the case of lower leverage and when the risk charge is close to risk-free, such that the effect will be weaker (Admati et al., 2013, pp. 3-4). Figure 6 shows the increase of total loans of European.

Figure 6: Total loans and leases in trillion € of commercial banks



Source: ECB SDW, no page, 2020

But leverage builds limitations and information asymmetries. Admati et al. (2013, p. 3) showed that banks are motivated to create a structure of their financing; however, this is inefficient. Furthermore, the government guarantees and the subsidies of debt reinforced the inefficiency (Grossmann and Woll, 2014, p. 577; Bourke, 1989, pp. 65-79; Cordella and Yeyati, 1999, p. 19; Dam and Koetter, 2011, p. 32; Freixas et al., 2003, p. 26; Gale and Vives, 2002, p. 487; Panetta et al., 2009, p. 30; Rosas, 2010, pp. 10-11). The identified inefficiencies in banks' business areas include incentives to take more risk in their portfolio and invest in riskier investments and is observed by low capitalized banks (Berger, 1995a, pp. 451-454; Admati et al., 2013, p. 2). The inefficiencies caused by explicit and implicit government guarantees (Cordella and Yeyati, 1999, p. 19; Dam and Koetter, 2011, p. 32; Freixas et al., 2003, p. 26; Gale and Vives, 2002, p. 487; Panetta et al., 2009, p. 30; Rosas, 2010, pp. 10-11). It should be avoided to practice the strategy, which leads to increased probabilities of default, resulted by increased PD's in their loan portfolio (Admati et al., 2013, p. 22; Ager and Spargoli, 2013, p. 29). The banks' opportunistic strategy went to society's expense and reinforced the financial 2007/2008 crisis (Admati et al., 2013, p. 22; Berger, 1995a, pp. 451-454; Ager and Spargoli, 2013, p. 7). Equity represents a buffer because the holders of equity's claims are subsidiary, for example monitoring results or security claims (Admati et al., 2013, p. 9; Huizinga, Laeven and Nicodème, 2006, p. 2; Chatterjee, 2013, p. 2). If the banks have losses, shareholders' earnings suffer (Admati et al., 2013, p. 9; Demirgüc-Kunt et al., 2015, pp. 1-3; Rao-Nicholson and Salaber, 2015, pp. 87-88; Billings and Capie, 2011, pp. 193-194; Kwan, 2010, p. 1). Admati et al. (2013, p. 4) analyzed that a temporary prohibition of earnings and other payouts for all banks is a good possibility to strengthen the capital situation. The interpretation of holding equity was in individual cases in opposition to the classic perception.

> The CEO of the Deutsche Bank during the 2007/2008 financial crisis said that "[…] more equity might increase the stability of banks. At the same time, however, it would restrict their ability to provide loans to the rest of the economy. This reduces growth and has negative effects for all" (Ackermann, Interview, 2009 in Admati et al. 2013, p. 9).

On the other hand, Admati et al. (2013, p. 2) argued that higher requirements for capitalization are expensive because, in general, debt can help to monitor the management (Prokot, 2005, p. 103; Hansen, Kumar and Shome, 1994, p. 22). Additionally, potential shareholders might see the issue of new equity as negative and as a necessity to receive new capital (Admati et al., 2013, p. 2). The reduced leverage ratio lowers the value of the existing shareholder's claims. Since the tax-deductibility of interest payments on liabilities has become negative through a lender of last resort measurements by the government, the share price suffers by considering the tax advantages and the higher risk-taking by their capital (Admati et al., 2013, p. 23). Furthermore, the enterprise value will increase (Admati et al., 2013, pp. 23-24). The increased enterprise value strengthens thus the creditors (Admati et al., 2013, p. 24).

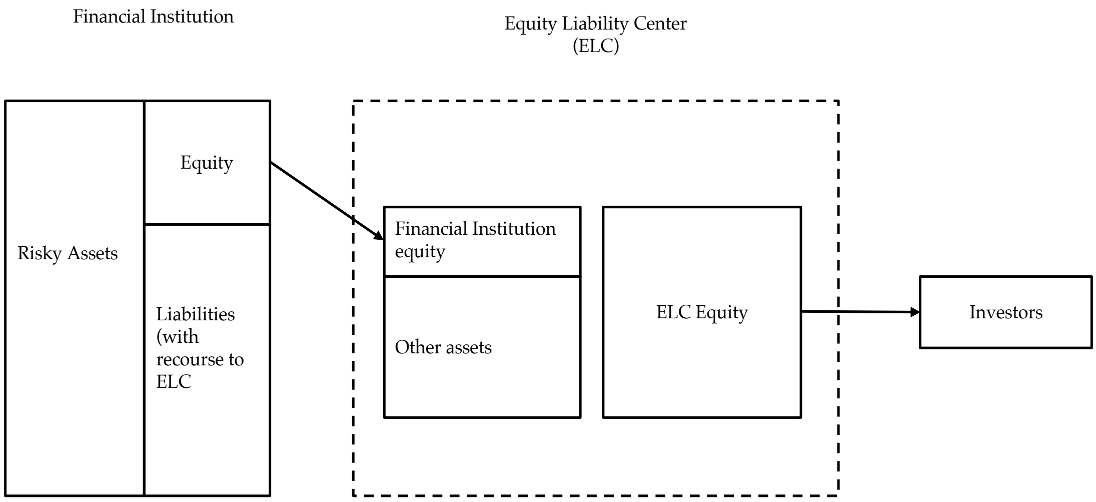
While the 2007/2008 financial crisis suffered the global economy, i.e., the participant suffered large losses in their asset portfolio. The value of different firms, with few exceptions, suffered a significant deficit. Depreciations on equity positions led to large losses for the investors (Admati et al., 2013, p. 24). As part of the interest conflict between the shareholder and the debtholder, the shareholders have several reasons to resist creditor attempts to increase capital (Admati et al., 2013, p. 2). Since companies diversify their funding situation, they use debt capital besides equity capital (Admati et al., 2013, p. 2). One advantage of the financing over the resource of debt capital is the tax deductibility / tax subsidies of the interest payments to the creditors (Admati et al., 2013, p. 2; Schepens, 2014, p. 1; Gu et al., 2012, p. 4; Beltratti and Stulz, 2012, p. 5; Rao-Nicholson and Salaber, 2014, p. 87-88). Higher equity capital requirements reduce the savings associated with debt financing (Admati et al., 2013, p. 2).

Another fact for the shareholders' resistance is the loss of bailout subsidies (Admati et al., 2013, p. 2). The government guarantees allow banks to benefit from the safety net so that their debt financing is cheaper (Schich, 2008, p. 1; Cordella and Yeyati, 1999, p. 19; Dam and Koetter, 2011, p. 32; Freixas et al., 2003, p. 26; Gale and Vives, 2002, p. 487; Panetta et al., 2009, p. 30; Rosas, 2010, pp. 10-11; Correa-Caro et al., 2018, p. 4). Banks' requirement to prefer equity financing over debt financing may raise the total cost of capital (Admati et al., 2013, p. 3). The decreasing advantage from the tax-deductibility of debt financing increases funding costs (Admati et al., 2013, p. 19) and is related to the pecking-order theory regarding ranking funding source depending on their costs (Baskin, 1989, p. 27; Chirinko and Singha, 2000, p. 418; Bontempi, 2002, p. 2; Leary and Roberts, 2010, p. 332; Dong et al., 2012, p. 637, 641; Cotei and Farhat, 2009, p. 3). Furthermore, the fact for the subordinated choice of issuing new equity was observed for the first time by Donaldson (1961) and Myers and Mailuf (1984, p. 38). Undervaluing of new equity capital causes investors to see themselves as disadvantaged regarding the information level (Leland and Pyle, 1977, p. 372). The deficit of information causes the investors to pay less for new shares (Admati et al., 2013, p. 35). The costs of asymmetric information can be mitigated if managers are more discreet, respond to the pre-specified regulatory requirements or take the information asymmetries into account with the aim to reduce the information asymmetries (Schulz, 2006, p. 79; Vieira and Raposo, 2007, p. 3; Topalov, 2011, p. 39; Admati et al., 2013, p. 35). Simultaneously, the management may be unwilling to issue new shares if they evaluate that their share value is higher than the new share (Admati et al., 2013, p. 35). This can lead to a circumstance that causes banks not to prefer new equity, which can help finance riskier investments (Shries and Dahl, 1992, p. 439; Admati et al., 2013, p. 35). A higher equity position should prevent risks resulted by financial crisis (Koehn and Santomero, 1980, p. 1235). Insofar, the enterprise value increases due to a decreased debt portfolio (Admati et al., 2013, pp. 35-36) and goes in line with the trade-off theory (Schneider, 2009, p. 14). This circumstance promotes the creditors' position at the shareholders' expense (Ager and Spargoli, 2013, p. 7; Admati et al., 2013, pp. 35-36).

Another reason for the excessive leverage is the information asymmetries between managers and investors (Admati et al., 2013, p. 3) since the information asymmetries exist between these groups (Topalov, 2011, p. 27, 30, 38; Muneer, Bajuri, and Rehman, 2013, p. 434) This promotes an aversion to issuing equity (Admati et al., 2013, p. 3). The negative signal can be diminished if the management has no scope for additional funding sources and depends on the available funding sources (Admati et al., 2013, p. 35; Guserl and Pernsteiner, 2015, p. 42). Furthermore, the disadvantages of an undervalued equity issuing could be avoided when the banks increase their capital simultaneously since the investors monitor the management and reduce the agency costs (Easterbrook, 1984, p. 653; Prokot, 2005, p. 96; Admati et al., 2013, p. 35). The principal-agent theory can be observed because managers have a better information situation over the firms' activities than their investors (Jensen and Meckling, 1976, p. 305; Morris, 1987, p. 47; Harris and Raviv, 1991, p. 300; Schulz, 2006, p. 81; Dowd, 2008, p. 2; Jokipii and Milne, 2011, p. 165; Francis and Osborne, 2012, p. 811; Strzyz, 2012, p. 16; Al Taleb, 2012, p. 234). Rational acting managers have an incentive to use the financing for their interest by taking excessive risks that do not harm them (Rosenblum et al., 2008, p. 2). The default risk of a corporate is induced through higher interest rate payments to their creditors (Prokot, 2005, p. 97; Admati et al., 2013, p. 24). Simultaneously, the entire default is not reduced by using financial instruments (for example, interest rate swaps) for reducing the default costs (Jermann and Yue, 2013, p. 29). As an alternative to higher interest payments, the creditors pay a lower price for the debt with a promised interest payment (Admati et al., 2013, p. 24). Since a decreased leverage promotes an increased enterprise value, previous creditors' claims would be strengthened (Schneider, 2009, p. 14; Admati et al., 2013, p. 24; Mariathasan and Merrouche, 2014, p. 301). The creditors' advantage is simultaneously a disadvantage for the shareholders due to information asymmetries (Topalov, 2011, p. 27, 30, 38; Admati et al., 2013, p. 24; Muneer, Bajuri, and Rehman, 2013, p. 434). It is relevant to differentiate the governance problems for financial and non-financial firms as the extent of governance problems with banks compared to non-financial firms are wider (Altunbas, Gambacorta and Marqués-Ibáñez, 2010, p. 7; European Union Parliament, 2013, p. 9; Admati et al., 2013, p. 29; Noss and Toffano, 2014,

p. 5). One reason is that the leverage level of banks is different from non-financial firms (Admati et al., 2013, p. 29). The other reason is that most financial firm shareholders are other financial firms and monitor their activities, for example by the AIG of the BCBS (BCBS, 2004, p. 2; Admati et al., 2013, p. 29). One possible instrument to solve the governance problems in lending decisions is the Equity Liability Center (ELC) approach from Admati et al. (2012, pp. 855-856). The ELC is a corporate structure that considers bank managers' disciplinary function in the context of governance problems (Hansen, Kumar and Shome, 1994, p. 22; Prokot, 2005, p. 103; Admati et al., 2013, p. 30). The monitoring responsibility lies with the ELC shareholders and the ELC vehicle has to operate with leverage level effects (Admati et al., 2013, p. 30). Simultaneously, the bank creditors have a recourse of the ELC assets, and the managers do not, so that managers can continue their operations under the discipline of high leverage, but with an opposite effect of the deposit insurance (Morris, 1987, p. 47; Kim and Santomero, 1988, p. 1219; Aggarwal and Jacques, 2001, p. 1140; Admati et al., 2013, p. 30; Guserl and Pernsteiner, 2015, p. 42). An ultimate default by the ELC is absorbed by the bank (Admati et al., 2013, p. 30). This impact on the governance problems might be less meaningful because the instrument self has an incentive for moral hazard behavior, for example with government interventions (Cordella and Yeyati, 1999, p. 19; Dam and Koetter, 2011, p. 32; Freixas et al., 2003, p. 26; Gale and Vives, 2002, p. 487; Schich, 2008, p. 1; Panetta et al., 2009, p. 30; Rosas, 2010, pp. 10-11; Admati et al., 2013, p. 30; Grossmann and Woll, 2014, p. 577).

Figure 7: Increasing cushions through a separate Equity Liability Carrier



Source: Admati et al., 2013, p. 30

Another aspect is the banks' ability to engage in future investments (Admati et al., 2013, p. 3). Properly managed banks with a high qualitative debt portfolio make better business decisions (Admati et al., 2013, p. 3; Mariathasan and Merrouche, 2014, p. 301). One approach to solve the moral hazard problem is a contract with covenants since management members can influence their renumeration contract themself (DeAngelo and DeAngelo, 1990, p. 1415; Bertrand and Mullainathan, 2002, p. 929; Bebchuk and Fried, 2004, p. 1; Bebchuk, Grinstein, and Peyer, 2006, p. 37; Admati et al., 2013, p. 22). Banks obliges completely for their risk strategy even after implementation (BCBS, 1988, p. 2; Admati et al., 2013, p. 22). Financial contracting is an instrument for efficiently dealing with information, inducement, and governance problems with shareholders and stakeholders (Schulz, 2006, p. 79; Vieira and Raposo, 2007, p. 3; Topalov, 2011, p. 39; Admati et al., 2013, p. 22). If covenants cannot be agreed upon or government guarantees exist, the moral hazard problem distorts a transparent and efficient decision process (Cordella and Yeyati, 1999, p. 19; Gale and Vives, 2002, p. 487; Freixas et al., 2003, p. 26; Panetta et al., 2009, p. 30; Rosas, 2010, pp. 10-11; Dam and Koetter, 2011, p. 32; Admati et al., 2013, p. 22). In particular, the asset composition creates a challenge in the banking sector (Admati et al., 2013, p. 26). Certain banks are not sufficiently transparent and are difficult to assess from outside (Myers and Majluf, 1984, p. 196; BCBS, 2011, p. 2; Admati et al., 2013, p. 26). This is observed in banks that have a credit portfolio of small and medium enterprise (SME) financing (Admati et al., 2013, p. 26). Based on the tradability and degree of liquidity in the financial market, other asset classes could be better assets for assessing (Nikalaou, 2009, p. 5, 14; Admati et al., 2013, p. 26). This is a situation for managers to act in the sense of maximizing their benefits (Levmore, 1982, p. 49; Topalov, 2011, p. 27, 30, 38; Muneer, Bajuri, and Rehman, 2013, p. 434; Admati et al., 2013, p. 26).

The above-mentioned largely unregulated requirements lead to the implementation of conduits and OBS financing as a vehicle to generate profits without holding equity. Through certain financial instruments, banks can increase their leverage without considering the previous capital requirements. Acharya et al. (2013, p. 2) observed that banks use financial instruments with fewer equity requirements to generate profit. Admati et al. (2013, p. 17) explained the advantage of special corporate structure and their outsourcing of debt portfolios in special vehicles to save the required 8 % by Basel II. It can be stated that debt is not the only and efficient way of supervising financial institutions. Besides establishing a regulatory authority to monitor the management, policymakers should rely on and promote market mechanisms to monitor and solve governance problems (Admati et al., 2013, p. 30).

Another explanation for the excessive leverage is the tax shield. The rising relevance of foreign direct investments and multinational firms leads to higher consideration of the tax policy. The corporate benefits through the tax-deductibility for interest payments of debt financing is a motivation for excessive leverage (Schepens, 2014, p. 1). As financing through leverage has advantages regarding the equity financing, corporates prefer debt financing (Huizinga, Laeven and Nicodème, 2006, p. 2; Chatterjee, 2013, p. 2). Companies' financial decisions are systematically affected by companies' taxation (Egger et al., 2009, p. 97; Graham, 2003, p. 57). Schepens (2014, pp. 30-31) showed by implementing a tax advantage for equity that this circumstance supports capital building (Schepens, 2014, p. 31). Furthermore, Schepens (2014, p. 31) illustrated that banks' credit risk with a low capitalization decrease. Based on the tax recognition of interest payments, the tax advantage is called debt bias of taxation (Gu et al., 2012, p. 3). It is undisputed that the debt bias of taxation has not been the only reason for creating the 2007/2008 financial crisis (Gu et al., 2012, p. 3). The consequences of the bias might have corporates more vulnerable to negative impacts (Gu et al., 2012, pp. 3-4). Several empirical studies tested the debt bias (Graham, 2003, p. 10; de Mooij, 2011, p. 22; Feld et al., 2011, pp. 50-52). However, further studies of the debt bias investigation are not available. The particularities of the banking industry were not considered. They made no differentiation between financial and non-financial corporates. The study from Keen and de Mooij (2012, p. 28) investigated a debt bias in the banking sector, especially large banks with a systemic function. The authors pointed to two bank-specific characteristics of the debt bias. First, banks' lending capacity is limited through capital requirements (Keen and de Mooij, 2012, p. 28). Second, there exist different agency costs associated with the regulation (Keen and de Mooij, 2012, p. 28). For example, the agency costs differentiate to deposit insurance or implicit and explicit government guarantees (Keen and de Mooij, 2012, p. 28). Their key message is that the sensitivity of debt to taxation between banks and non-financial corporates is equal (Keen and de Mooij, 2012, p. 28).

Due to the significant externalities, which are related to excessive leverage, the results are relevant. The extent and the wide of the 2007/2008 financial crisis were tightened through different tax locations. There are several ways to minimize the taxation burden (Buettner and Wamser, 2013, p. 63). Through instruments like international debt shifting with subsidiaries, it is attractive for corporates to use debt financing in a high-tax country (Gu et al., 2012, p. 3). In contrast to the high-tax location, equity financing is attractive in low-tax locations because the corporates' profits would be a burden at a smaller tax rate (Gu et al., 2012, p. 4). The debt payment is deductible (Gu et al., 2012, p. 4). Therefore, subsidiaries' financing in countries with a higher tax rate is more attractive against financing in low-tax countries. Within a company structure, the liquidity can be forwarded to the holding company by an intra-company debt (Gu et al., 2012, p. 5). The return for the holding is mostly tax-free when they forwarded it back to the holding (Gu et al., 2012, p. 3). Insofar there is another motivation to repatriate dividends from subsidiaries to the holding (Gu et al., 2012, p. 3). This description can be summarized as a tax-minimizing strategy in high-tax jurisdictions (Gu et al., 2012, pp. 3-5).

Several studies for the U.S. and European corporate sector with subsidiaries in other countries found out that the leverage level of the subsidiaries reacts similarly (Gu et al., 2012, p. 17; Hines and Hubbard, 1990, p. 32; Collins and Shackelford, 1992, pp. 103-124; Grubert, 1998, pp. 269-290; Altshuler and Grubert, 2002, pp. 73-

107; Mills and Newberry, 2004, pp. 89-107; Moore and Ruane, 2005, pp. 4-31; Huizinga et al., 2008 pp. 80-118; Buettner and Wamser, 2009, pp. 63-96; Egger et al., 2010, pp. 96-107). All the studies identified debt shifting and measured the extent of debt shifting between low and high-tax jurisdictions. The empirical results are relevant because debt shifting decreases the tax bases in high-tax countries. Therefore, several high-tax countries implemented measures to prevent tax base erosion (Buettner and Wamser, 2009, p. 67). Gu et al. (2012, pp. 3-17) exploited the debt bias in multinational banks. Based on the study results, the motivation of acting, the impact of the financial crisis in 2007/2008, and the relevance of the interest deductibility can be better understood. They measured the response of multinational and systemically important banks to taxation. Their results are relevant for the tax policy in the banking sector, which promotes spill-over measures by multinational banks (Gu et al., 2012, p. 17). The tax-induced advantage of increases in debt is irrespective of companies' ownership structure (Egger et al., 2009, p. 97). They investigated the influence of corporate taxation on the debt-to-asset ratio of national and international firms in Europe. The taxation extent of profit and debt shifting has relevant implications for the general business tax structure. High-tax countries suffer on several levels from the instruments. First, they have an adverse revenue effect. Furthermore, they suffer from discrimination against domestic firms without access to intra-company debt shifting (Buettner and Wamser, 2013, p. 63). In conclusion, the role of taxation influences the capital structure of international acting firms. Several empirical studies examined the sensitivity of the capital structure regarding the role of tax (Jog and Tang, 2001, pp. 5-25; Mills and Newberry, 2004, pp. 89-107; Huizinga et al., 2008a, pp. 80-118; Huizinga and Laeven, 2008b, pp. 1164-1182; Egger et al., 2010, pp. 96-107; Møen et al., 2008, pp. 1-15; de Mooij, 2011, pp. 1-22).

Another observation is that lower interest rates promote an increase in debt financing (Kraus and Litzenberger, 1973, p. 911; Borio and Disyatat, 2010, p. 205; Medeiros and Rodríguez, 2011, p. 3; Claessens and Kodres, 2014, p. 8; ECB, 2015, p. 2; Igan et al., 2019, p. 1; Schenk, 2020, p. 3; Cappelletti et al., 2020, p. 4). A higher indebtedness creates additional risks for the business cycle and the economy (Shambaugh, 2012, p. 2). A higher level of leverage increases the probability of default (Admati et al., 2013, p. 20). Furthermore, this led to higher systemic risk (Admati et al., 2013, p. 20). The worst scenario is bankruptcy and the inability to service its debt (Shambaugh, 2012, p. 2). During the financial crisis in 2007/2008, the government was forced to strengthen the financial system through several recovery measures (Admati et al., 2013, p. i). One measure to strengthen the financial system is the bailout through the government. Grossmann and Woll (2014, p. 577) defined a bailout as a form of active intervention through the government into the event. The intervention can be in the form of a guarantee or a capital injection of the government in favor of a bank (Panetta et al., 2010, p. 2; Fratzscher and Rieth, 2015, p. 5; Allen et al., 2017, p. 4). The largest bailouts were the bailout (capital injection) of the US investment bank Bear Stearns, the bailout (capital injection) of the insurer AIG, the bailout of the mortgage lender Freddie Mac (capital injection) or the bailout of the lender Fannie Mae (capital injection) (Laeven and Valencia, 2010, p. 5; Panetta et al., 2010, p. 2). A current form of bailouts can be seen in the measures to mitigate the Covid-19 impacts on non-financial corporates: The EU agreed a 2.364,3 bn. € recovery fund which includes a 25 bn. € pan-European guarantee fund to stabilize the economy (EU council, 2020, no page). Grossmann and Woll (2014, p. 577) described that the intervention influenced redistribution. The government intervention creates moral hazard in the sense that corporates management do not have a risk aversion resulted by the lender of last resort in form of a bailout or a deposit insurance for depositors (Rochet, 1992, p. 1138; Jokipii and Milne, 2011, p. 165; Francis and Osborne, 2012, p. 811; Grossmann and Woll, 2014, p. 577). Furthermore, welfare is affected negatively (Grossmann and Woll, 2014, p. 577). Financially troubled institutions and strained markets are supported by governments (Rosas, 2009, p. 6). It is relevant to link government color with their aid (Cioffi and Höpner, 2006, p. 463). Liberal-oriented countries tend to solve market problems themselves through market mechanisms (Grossmann and Woll, p. 577). By contrast, countries with a high extent of government intervention tend to interfere more (Grossmann and Woll, 2014, p. 577).

> Societies with a "corporatist tradition" (Grossmann and Woll, 2014, p. 577) promotes collaborative approaches. (Grossmann and Woll, 2014, p. 577).

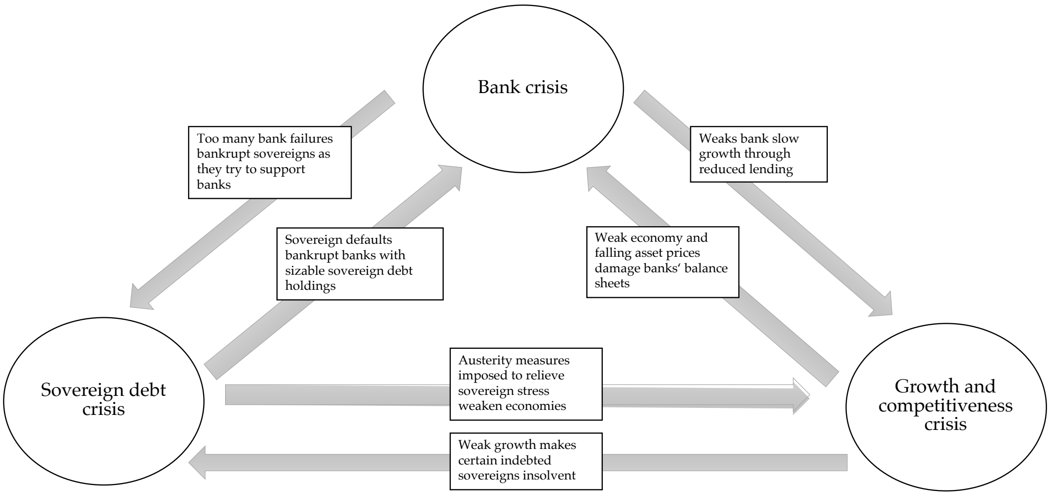
The introduction of safety measures (for example, deposit insurance, improve the previous deposit insurance and government statements to the deposit insurance) for the banking sector through the jurisdictions has been the main achievement as a reaction to the 2007/2008 financial crisis (Schich, 2008, p. 1, 3).

The deposit insurance is required to avoid an error in the financial system. Lehman Brothers' bankruptcy showed that deposit insurance is only as strong as its weakest component (Schich, 2008, p. 3). The policymakers decided the following measures for the deposit insurance to mitigate the lowest component of the insurances (Schich, 2008, p. 3):

1. Introduction of deposit insurance, if the OECD Committee on Financial Markets (CMF) members had a non-explicit deposit insurance scheme.
2. If the CMF members already had deposit insurance, they were forced to examine the insurance's magnitude. The maximum deposit insurance coverage is insufficient to support and strengthen the financial system in financially challenging times.
3. In some countries, the policymakers suggested that they bail out financial institutions under stress and guaranteed unlimited government insurance coverage for the depositors.

The existing trust deficit of the financial market attendees after the breakout of the 2007/2008 financial crisis could be decreased through government measures (Schich, 2008, p. 1). The reverse side of the measures is an arising moral hazard behavior, particularly in the case of a total safety net (Schich, 2008, p. 1). The CMF reviewed different instruments to rescue the financial market in 2007/2008 in the short term and to develop a sustainable and healthy financial sector (Gordon and Tash, 2008, pp. 4-6). During the Tour d'horizon, it was agreed that the government should notify any critical decisions, reasons, and new rules for investment transactions (Gordon and Tash, 2008, p. 4). The government's required safety net was an event for the OECD to perform more empirical investigations (Schich, 2008, p. 2). To investigate the conflict area related to possible revised requirements, the OECD invited experts (Gordon and Tash, 2008, p. 5). One of the measures is deposit insurance (Schich, 2008, p. 3). The deposit insurance serves to preserve deposits against a bank's default (Dam and Koetter, 2011, p. 1). The deposit insurance instrument can protect an unexpected urge to withdraw all deposits (the bank run) because the bank customers have a higher sense of security about their deposits (Diamond and Dybvig, 1983, p. 401). The first bank run was a multiple bank run and is detected during the great depression in 1930 in the USA (History, 2020, no page). Well-known cases of a bank run during the 2007/2008 financial crisis are the Northern Rock in February 2008, the bank run on securities of Bear Stearns, the case of Wachovia in USA in September 2008 or the Roskilde bank in Denmark in September 2010 (Rosas, 2010, p. 1; Grossmann and Woll, 2014, p. 589-590). In a bank run scenario, depositors want to quickly dispose of their deposits (Diamond and Dybvig, 1983, p. 401). The depositors expect that there will be a default of the bank (Diamond and Dybvig, 1983, p. 401). Therefore, it is necessary to stabilize the market with confidence (Diamond and Dybvig, 1983, p. 402; Schich, 2008, p. 4). To hold the required liquidity, the banks must sell their assets (Diamond and Dybvig, 1983, p. 402); however, the sale under pressure negatively influences their assets' value (Diamond and Dybvig, 1983, p. 402). That, in turn, increases banks' default probability (Diamond and Dybvig, 1983, p. 402). A bank run does not only affect an individual bank; furthermore, in the acute situation, many banks are illiquid (Diamond and Dybvig, 1983, p. 402). The economic and social welfare decreases (Diamond and Dybvig, 1983, p. 403). Several studies explain the several impacts of bank runs (Tian, Zhao, and Gong, 2019, pp. 53-72; Gertler, Kiyotaki, 2015, pp. 2011-2043; Vodová, 2015, pp. 91-107). Diamond and Dybvig (1983, p. 402) developed a model for analyzing the bank run's liquidity demand. An uninsured deposit can help generate liquidity (Diamond and Dybvig, 1983, p. 402). In contrast, the uninsured deposit leads to less stability of the banks (Diamond and Dybvig, 1983, p. 402). The weakness arises through several equilibria, combined with various degrees of confidence, responsible for a possible bank run (Diamond and Dybvig, 1983, p. 402). In the context of multiple discussions, some elements of the government guarantees, such as deposit insurance, have been redrawn (Schich, 2008, pp. 2-3). Before the financial crisis broke out, jurisdictions had guaranteed certain financial market areas (Leonello, 2017, p. 4). There is a sizable empirical field of the observation of the government guarantees, so that it is necessary to investigate whether government guarantees have been exacerbated or mitigated the extent of the financial crisis in 2007 and 2008 (Leonello, 2017, p. 4; Allen et al., 2017, p. 2). A bank error threat could be reduced through the policy actions so that depositors and creditors continue their supply with capital. Thus, the financial system's failure could be prevented preventively (Grossmann and Woll, 2014, p. 575). In this context, the banking crisis is integrated into interlocking problems (Shambaugh, 2012, p. 157). The following figure shows how several levels of concern interact.

Figure 8: Bank crisis in several ways



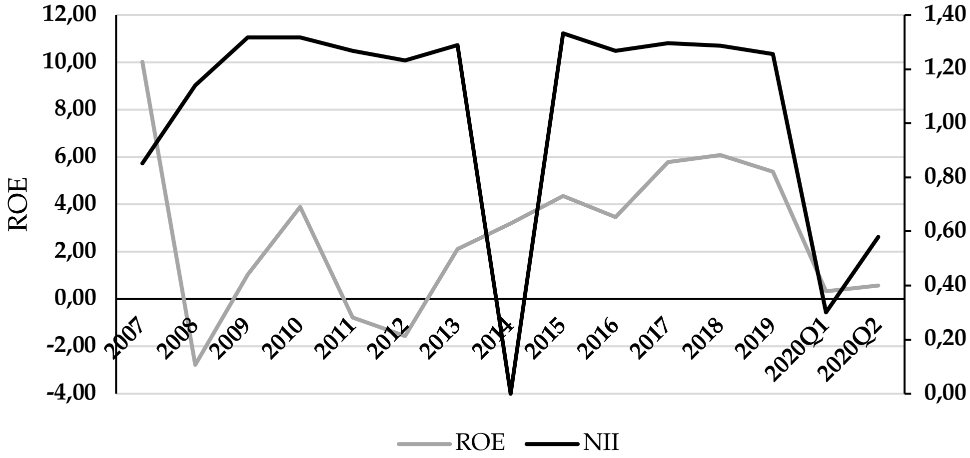
Source: Shambaugh, 2012, p. 159

The need for intervention will be higher if the banking system has a system relevant size (Laeven and Valencia, 2010, p. 12, 19; Grossmann and Woll, 2014, p. 577). The government tends to bail out domestic credit institutions with high lending activities in their jurisdiction to avoid straining the economy (Grossmann and Woll, 2014, p. 577). The banking sector and its function play an essential role within the economic system. This circumstance promotes using the government's safety net and simultaneously, generating profit for the shareholder (Admati et al., 2013, p. 22). In conclusion, the subsidized effect cannot be eliminated. The safety net leads to less sensitivity of bank shareholders and management (Rochet, 1992, p. 1138; Jokipii and Milne, 2011, p. 165; Francis and Osborne, 2012, p. 811; Admati et al., 2013, p. 21). Furthermore, the financial benefit resulting from the lower probability of default and the decreasing costs of financing promotes the shareholder (Berger, 1995a, pp. 451-454; Schneider, 2009, p. 14; Admati et al., 2013, p. 21).

2.3.2 Profitability of the European banking sector

Since the financial crisis in 2007/2008, the profitability of EU banks has suffered (Constâncio, 2016, p. 5; KPMG, 2016, p. 3; Jouida, Bouzgarrou and Louhichi, 2016, p. 21). Several factors led to this development (Bordeleau and Graham, 2010, p. 4; Raddatz, 2010, p. 7; Vazquez and Federico, 2012, p. 6; Trujillo-Ponce, 2012, pp. 561; Amba and Almukharreq, 2013, p. 84; KPMG, 2016, p. 3). Depending on the countries' bank structure and market structure, the earnings situation varied greatly (KPMG, 2016, p. 3). The Central bank of Germany stated in their monthly report 09/2016 that the share of the interest income amounts to nearly 75 % of the total revenue (Deutsche Bundesbank, 2016, p. 71). This fact linked the loan activity's relevance and regulatory requirements with European banks' profitability, including the dividend policy. The financial crisis led to a weaker economy and a significant decrease in profitability, created by an increasing portfolio of non-performing loans in Europe (Alexopoulou, Andersson and Georgescu, 2009, p. 6; Brumm et al., 2014, p. 4; KPMG, 2016, p. 3; Gaudêncio, Mazany and Schwarz, 2019, p. 5; Huljak et al., 2020, p. 4). Through a high NPL level and a debt overhang, the affected banks' interest income decreased (Mian, Sufi, and Trebbi, 2012, p. 16; Kobayashi, 2015, p. 250; KPMG, 2016, p. 7). Simultaneously, there was a high cost to income ratio through low-pressure costs (KPMG, 2016, p. 7). Another circumstance is the business model's weaknesses, overdue loans, and increased provisions against depreciated assets (Alexopoulou, Andersson and Georgescu, 2009, p. 6; KPMG, 2016, p. 7; Gaudêncio, Mazany and Schwarz, 2019, p. 5; Huljak et al., 2020, p. 4). Decline and low profitability have several impacts. First, it limits the extent of the retained earnings' ability and funding (KPMG, 2016, p. 4). Second, it limits issuing new equity or debt (KPMG, 2016, p. 4). Furthermore, allocating new capital is more difficult and expensive (KPMG, 2016, p. 4). The broader economy is also affected so that government intervention was necessary (Panetta et al., 2009, p. 30; Rosas, 2010, pp. 10-11; Dam and Koetter, 2011, p. 32; KPMG, 2016, p. 4). The lending portfolio value decreased by an increase of NPL (KPMG, 2016, p. 7). The KPMG (2016, p. 4) reported in their study that the ROE and the NII of European banks decreased. The following figures show the weak ROE and NII in Europe.

Figure 9: Development of ROE and NII in Europe

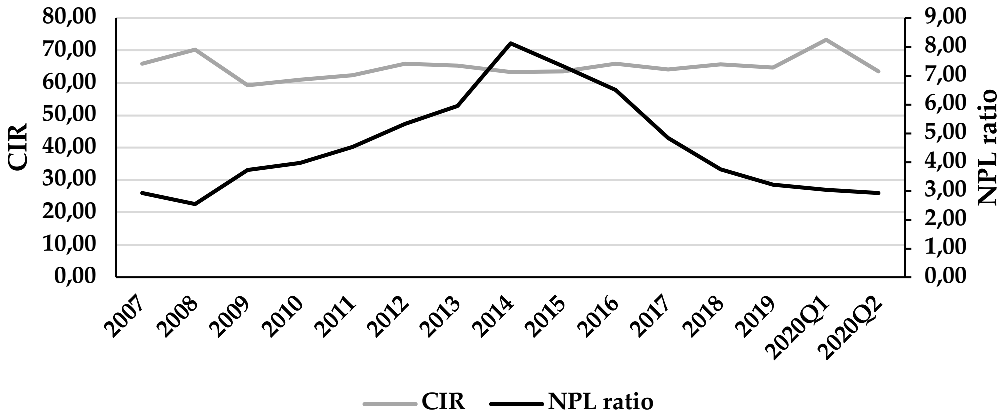


Source: ECB SDW, no page, 2020

The figure above matches with the following data of the ECB data warehouse. The ROE decreased during the financial crisis in 2007/2008. One reason for the decreasing development during the financial crisis is the NPL level (see figure 10). Through a high level of NPL, borrowers were could not pay their debt obligations. Remarkably, the net interest income (NII) remains constant. This confirms that banks had to make high impairments on their asset portfolio during the financial crisis. At the same time, the number of liquid assets increased. The banks hold their liquidity without an extensive engagement in the interbank business (Chen, Mrkaic and Nabar, 2019, p. 5; Cevik and Miryugin, 2020, p. 13; Vivar, Wedow and Weistroffer, 2020, p. 10). These aspects led to a decreasing in the ROE. Since the financial crisis in 2007/2008, the European economy suffered from adverse developments (KPMG, 2016, p. 6). The ROE decreased significantly in 2007 and 2008 (KPMG, 2016, p. 4). The interest income to total asset ratio was nearly constant because the NII and the total assets decreased, and as a result, the rate was constant. The profitability of EU banks is typically lower than elsewhere (KPMG, 2016, p. 7). For example, the net interest margins of total assets were 1.2 % lower than U.S. banks (3 %) or Canada (2 %) (KPMG, 2016, p. 7). Their reasons could be different. For example, the banking sector is highly competitive. Already before the 2007 and 2008, there exist studies of banks ROE. For instance, Berger (1995a) investigated the relationship between the profitability and capital of U.S. banks from 1983 to 1989.

Berger stated a strong positive connection between banks' earnings and capital (Berger, 1995a, pp. 451-454). Banks with a better capitalization enjoys lower funding costs (Berger, 1995a, pp. 451-454), and the lower costs of funding promote compensation of issuing new capital (Berger, 1995a, pp. 451-454). Due to the financial crisis, the profitability of European banks decreased. The fact is examined by careful bank lending activities, lower economic growth, and an increase of NPL (KPMG, 2016, p. 4). The following figure shows the development.

Figure 10: Development of non-performing loans in Europe



Source: ECB SDW, no page, 2020

The figure describes that the cost to income ratio before and during the financial crisis increased. Simultaneously, the NPL level recorded a significant increase since the outbreak of the financial crisis. The simultaneous rise of NPL and the decrease of the cost to income ratio confirm that European banks' earning situation decreased by increasing NPL. This led to a regressive development of the NII. The decreasing effect of profitability was partly compensated with higher efficiency. This explained the decrease of the cost to income ratio immediately during the financial crisis in 2007/2008. The impact of Covid-19 on the NPL level can only be seen a few quarters later, as loan losses and risk provisions are taken in the second half of the 2020 and the data are at this time not available. Complete compensation of the declining income is not possible because there are fixed costs for the banks.

Furthermore, a high level of NPL has a long-time impact on banks' profitability. Regarding the literature, the profitability determinants are differentiated between two factors (internal and external) (Amba and Almukharreq, 2013, p. 85). The internal factors are corporate-related, for instance, the liability structure, the liquidity structure, or the bank size (Amba and Almukharreq, 2013, p. 85). External factors are economic ratios such as the GDP, the inflation, or country-specific framework (Amba and Almukharreq, 2013, p. 85). The following simple illustration of banks' profitability drivers is used in demonstrating internal and external factors' impacts. The table focuses on the drivers' net interest margin, NPL, the cost-to-income ratio, and relationship to an exemplary balance sheet.

Table 9: Example for illustration of drivers of banks profitability

Assets		Equity/Liabilities	
Other assets	20	Equity	5
Loans	80	Liabilities	95
Total	**100**	**Total**	**100**

Source: Own figure, based on KPMG, 2016, p. 9

The above showed table could be added by a presumption that the profit is 0.5 (KPMG, 2016, p. 9). Therefore, an ROE is 10 results. A further assumption is that the NII amounts to 1.2 and a reduction in NII reduction of 0.1 would reduce the ROE to the same extent (KPMG, 2016, p. 9). The ROE decreases from 10 % to 8 %, and the new profitability amounts to 0.4. There are primary determinants, which influence the net interest margins. The central bank decisions, the interest rate, and the intensified competitive situation with a government intervention affected the net interest margin (Bourke, 1989, p. 65-79; Molyneux and Thornton, 1992, pp. 1173-1178; KPMG, 2016, p. 7). Thereby that the drivers of profitability are interrelated, the driver business model, and its impact on the driver NII have to be considered. Specific business models may generate a higher proportion of non-interest income so that these banks are less severe faced during a financial crisis (KPMG, 2016, p. 10) but it should be noted that the loan growth influences the profitability positively (Jouida, Bouzgarrou and Louhichi, 2016, p. 18). The next scenario considers the NPL. Based on the example, the profit will decrease to 0.24 due to an increased risk provision (by a 1-percentage increase of NPL) (KPMG, 2016, p. 9). The depreciation amounts to 30 % and if there is a 5-percentage increase of NPL, and the depreciation amounts to 50 %, the profit would burn for the next four years (KPMG, 2016, p. 9). This simple example shows the relevance and the interrelation of the loan activities and the banking industry's earning return. The NPL ratio in Europe increased since 2008 from 1.5 % to above 5 % since 2013; thus, European banks' profitability is improvable (KPMG, 2016, p. 7; ECB SDW, 2020, no page). Figure 10 shows that the NPL ratio decreased after the peak in 2013/2014 and it took 13 years (end 2007 to 2020) to reach the pre-crisis NPL level. The impact on profitability is determined by several perspectives (Short, 1979, pp. 209-219; Bourke, 1989, p. 65-79; Molyneux and Thornton, 1992, pp. 1173-1178; KPMG, 2016, p. 7). In times of a high NPL level, the borrowers cannot pay the interest on loans (KPMG, 2016, p. 7). Simultaneously, the banks increase their provision to compensate for depreciation on their assets (KPMG, 2016, p. 7). Furthermore, the profitability suffers through regressive profits or realized losses if assets are sold or restructured (Alexopoulou, Andersson and Georgescu, 2009, p. 6; Mian, Sufi, and Trebbi, 2012, p. 16; Kobayashi, 2015, p. 250; Brumm et al., 2014, p. 4; KPMG, 2016, p. 7; Gaudêncio, Mazany and Schwarz, 2019, p. 5; Huljak et al., 2020, p. 4). The revised regulatory requirements are aimed at improving the amounts of NPL. The driver of profitability is linked with RWA investigation in this dissertation and confirmed through the explained study of KPMG. The last driver of profitability is the cost to income ratio; based on the example, the net income is 1.5 and the costs of the operating business is 1 and a s a result, the profit is 0.5 and the cost-income ratio is 67 % (KPMG, 2016, p. 9). Furthermore, a cost reduction of 10 % would increase the profit to 0.6 and the new ROE is 12 % (KPMG, 2016, p. 9). Due to the attacked economy, the above-explained weak interest margin (Panetta et al., 2009, p. 30; Rosas, 2010, pp. 10-11; Dam and Koetter, 2011, p. 32). As a result, it has become more challenging to generate profits, but an efficient cost structure can improve the profitability through data upgrades and new technologies (KPMG, 2016, p. 8). One revolution and therefore key determinant of the financial sector and their profitability is the fintech sector with its technology based delivering of financial services and represents a competitor of the traditional financial sector (Desai et al., 2019, p. 41).

> The Financial Stability Board (FSB) defines a fintech "…as technologically enabled innovation in financial services that could result in new business models, applications, processes or products with an associated material effect on financial markets and institutions and the provision of financial services. FinTech innovations are affecting many different areas of financial services." (FSB, 2020, no page).

> Another definition of a fintech is provided by the Cambridge Center for Alternative Finance, World Bank Group and the World Economic Forum: "FinTech is defined as encompassing advances in technology and changes in business models that have the potential to transform the provision of financial services through the development of innovative instruments, channels and systems." (CCAF, 2020, p. 16).

Fintechs are already well established in the payment service sector or fintech credits (Ziegler and Shneor, 2020, p. 31; Restoy, 2021, p. 1; Cornelli et al., 2020, p. 2) and can disrupt the long-time existing banking industry (Philippon, 2020, p. 2). Despite the pandemic Covid-19, the fintech sector has grown, measured by the transaction volume (+11 %), identified with a survey of the CCAF with 1,385 fintechs in 169 countries (CCAF, 2020, p. 16, 28). For banks without a technology-based business model like fintechs, a profit decrease is concerned due to the less expensive execution of payments and higher competition costs in form of higher funding costs which is resulted by a deposit shifting from the traditional banks to the e-wallet system of the fintechs (Monetary Authority of Singapure, 2020, pp. 280-281). PayPal with its 377 mn. Customer (Statista, 2021, no page) or the 507 mn. installations on iPhones (Payment & Banking, 2021, no page) compared to 660 mn. customers of the largest bank in the world (by total assets) Industrial and Commercial Bank of China (ICBC, 2020, no page) shows the influence of the fintechs on the banking sector well.

In addition to the potential negative impact of fintechs, traditional banks resist higher capital requirements because they fear higher costs and declining profitability (BCBS, 2011, p. 4, 61; Admati et al., 2013, p. 1). Since equity is riskier (De Jong, Verbeek and Verwijmeren, 2011, p. 1312; Admati et al., 2013, p. 1), investors have a higher expectation of their return of equity return against debt (Millon, 2013, p. 192; Admati et al., 2013, p. 1). However, Admati et al. (2013, p. 16) stated that the influence of modifications in ROE components is more extensive than equity issuing changes (Admati et al., 2013, p. 16). The tax advantage in debt financing penalizes equity financing (Huizinga, Laeven and Nicodème, 2006, p. 2; Gu et al., 2012, p. 4; Beltratti and Stulz, 2012, p. 5; Chatterjee, 2013, p. 2; Admati et al., 2013, p. 19, 23; Schepens, 2014, p. 1; Rao-Nicholson and Salaber, 2014, p. 87-88). Banks use more debt financing than other companies so that they benefit stronger from tax subsidies (Elliott, 2013, no page). Admati et al. (2013, pp. 15-16) argue that adjusted capital requirements do not cause an increase in the ROE. The consideration of further equity matches a higher demanded return for the shareholders (Admati et al., 2013, p. 15). On the other side, the ROE includes a risk premium. In the case of holding more equity, the ROE has to decrease because adequate capitalization reduces the probability of default (Kahane, 1997, p. 207; Admati et al., 2013, p. 16; Barth and Miller, 2018, p. 37). More equity mitigates the banks' risk structure (Shries and Dahl, 1992, p. 439; Berger, 1995a, pp. 451-454; Schneider, 2009, p. 14; Admati et al., 2013, p. 16). The lower probability of default leads to reduced funding costs (Berger, 1995a, pp. 451-454; Schneider, 2009, p. 14; Babihuga and Spaltro, 2014, p. 2; Admati et al., 2013, p. 16). It is relevant to consider that firms' funding costs depend on their funding situation and other factors (size, tradability, liquidity) (Admati et al., 2013, p. 1).

Several studies investigated the relationship between bank profitability and selected determinants: Short (1979, pp. 209-219) investigated the relationship between bank profitability and government ownership as an independent variable. The study observed a significant impact of the dummy variable government ownership (Short, 1979, p. 212). Bourke (1989, pp. 65-79) analyzed 90 banks in North America, Europe, and Australia between 1972 and 1989. The used variables were a loan to deposit ratio, capital ratio, liquidity ratio, staff expenses, and for external factors the variables competition, extent of economies of scale, regulation, concentration, government ownership, growth in the market, interest rate, and the market power (Bourke, 1989, p. 65-79). The study confirmed the relationship between low profitability and higher government ownership (Bourke, 1989, pp. 65-79). The variables concentration and interest rate correlate positively with the profitability (Bourke, 1989, pp. 65-79). Additionally, Bourke (1989, pp. 74-75) observed that well-capitalized banks have cheaper access to funding sources than less capitalized banks, but it should be noted that government intervention (capital injection or guarantee) distorts the funding costs but seems to be necessary regarding the too-big-to-fail phenomena (Buch, 2020, no page, "Too-big-to-fail Evaluierung." Speech given at FSB-Evaluierung der Too-big-to-fail-Reformen, Frankfurt am Main, June 26, 2020). Molyneux and Thornton (1992, pp. 1173-1178) observed this between

1986 and 1989 for European banks. The independent variables were internal and external determinants. They found a positive relationship between government ownership and profitability, which was operationalized by returning on the capital ratio (Molyneux and Thornton, 1992, pp. 1173-1178).

2.3.3 Illiquidity

It is necessary to research the liquidity side as another relevant determinant of the profitability of EU banks, which was a pertinent factor during the financial crisis (Bordeleau and Graham, 2010, p. 4), when banks had not completely taken the relevance of liquidity risk and mismanagement into account (Bordeleau and Graham, 2010, p. 4; Taylor and Williams, 2009, p. 58; Adrian and Shin, 2010, p. 1 in Chudik and Fratzscher, 2012, p. 4; Borio, 2009, p. 3 in Chudik and Fratzscher, 2012, p. 4; Tirole, 2010, p. 1 in Chudik and Fratzscher, 2012, p. 4). Some financial institutions failed or were forced to evaluate exit-options like mergers or bailout through the government (Bordeleau and Graham, 2010, p. 4). Therefore, the ECB provided high amounts of liquidity to support the financial system (Bernanke, 2008, "Liquidity Provision by the Federal Reserve." Speech given at Risk Transfer Mechanism and Financial Stability Workshop, Basel, May 13, 2008; Longworth, 2010, no page number). The balance sheet of the Eurosystem extended from September 2008 of 1441,0 bn. Euro (September 2008) to 2004,4 bn. Euro in December 2010 (Ruckriegel, 2011, p. 112). Liquidity has an importance for a workable financial system (Nikalaou, 2009, p. 5). The literature relates the notion of liquidity to the ability to exchange an existing good for other assets (Cunningham et al., 2008, p. 337). Banks' liquidity can be defined as the ability to supply the economy with capital (Nikalaou, 2009, p. 11). Several liquidity perspectives are used to assess different issues (Nikalaou, 2009, p. 8). For instance, in monetary policy, central bank liquidity is often examined (Nikalaou, 2009, p. 8, 11). By contrast, market liquidity is usually the object of investigation of asset pricing and funding liquidity studies (Nikalaou, 2009, p. 8; Miralles-Quirós, Miralles-Quirós, and Oliveira, 2017, pp. 191-206; Bongaerts, de Jong, and Driessen, 2017, pp. 1229-1269). Brunnermeier and Pederson (2005, pp. 1825-1864) examined another perspective of liquidity: the effects of liquidity through unilaterally beneficial trading.

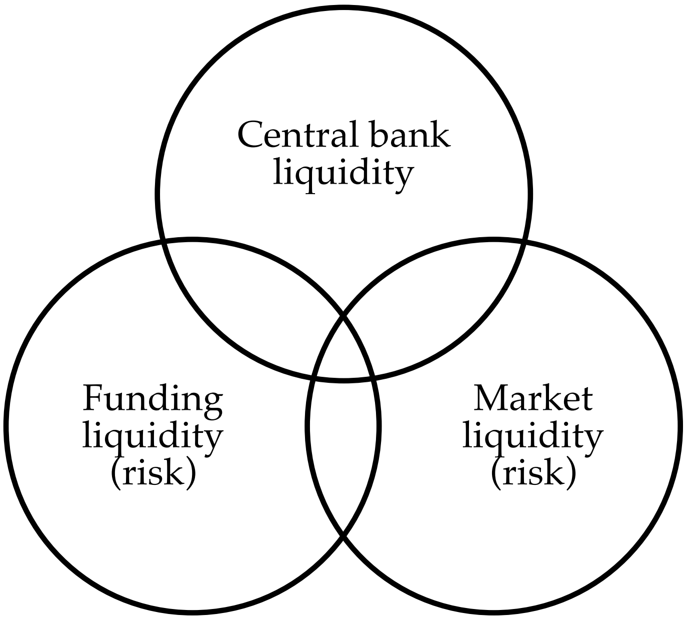
> Nikalaou (2009, p. 5) differentiated between the "…central bank liquidity, the market liquidity, and the funding liquidity" (Nikalaou, 2009, p. 5).

To set the several liquidity terms correctly, a definition of the several terms follows. The central bank liquidity can be defined as the central bank's ability to deliver liquidity to the financial system. The central bank issues banknotes and provide them to banks through Collateralized Credit Operations (CCO) (Bindseil and Jablecki, 2013, p. 7). The BCBS definition can be used to define funding liquidity.

> The BCBS (2000, p. 1) described the "[funding] liquidity as the bank's ability to fund increases in assets" (BCBS, 2000, p. 1).

Several studies defined market liquidity as the competence to trade an asset under certain conditions (Brunnermeier and Pedersen, 2007, p. 2; Nikalaou, 2009, p. 5; ESRB, 2016, p. 2; Shin, 2016, no page, "Market liquidity and bank capital." Speech given at Perspectives 2016: Liquidity Policy and Practice conference, London, April 26, 2016). These conditions are the low-cost, short-term tradability and impact the asset price (Nikolaou, 2009, p. 14). Brunnermeier and Pedersen (2008, pp. 1-38) examined a relationship between market liquidity and the funding liquidity of assets and traders. The European Systemic Risk Board (ESRB) (2016, pp. 1-25) examined liquidity availability during the financial crisis. It stated that the gross and the net stock of corporate bonds decreased. Johnson (2009, pp. 1374-1404) dealt with how liquidity capital influences asset liquidity and the asset market. In particular, Johnson (2009, p. 1376) defined liquidity using its availability and all-time exchange. Shin (2016, p. 2) argued that the conclusion of the failed market liquidity compensation could be understood through mitigation of capital and leverage standards. Nikalaou (2009, p. 15) observed that the covariance of the market liquidity and the stock market liquidity is positive. The relationship between the various liquidity aspects in the financial system is ascertaining in the following figure.

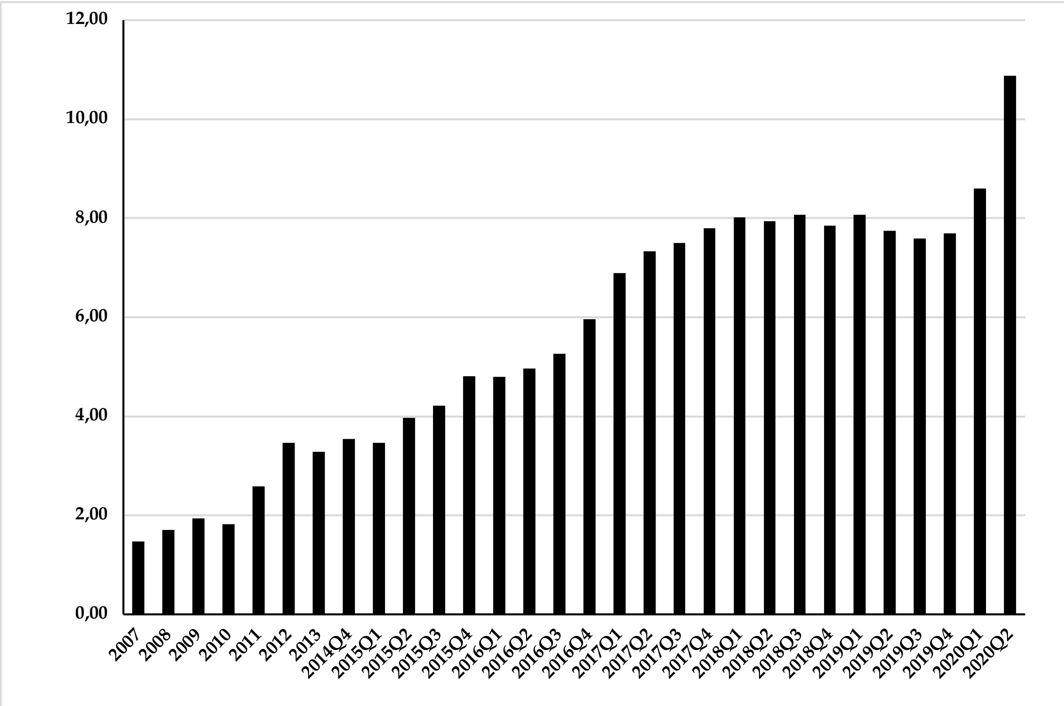
Figure 11: Relationship between the three types of liquidity



Source: Nikolaou, 2009, p. 22

Another perspective is the trade-off between excessive amounts of liquidity assets with a relatively low return and higher opportunity cost for a bank and low amounts of liquidity (Bordeleau and Grahman, 2010, p. iii). Through a minimum basis of liquidity, banks can invest their capital in high-yield assets and, in consequence, generate revenues and profits (Bordeleau and Grahman, 2010, p. 4). Following the risk-return-pattern of the capital market theory, the high yield assets are related to higher risks (Sharpe, 1964, p. 442). Therefore, less liquidity increases the bank's risk situation through the maintaining of high yield assets. Furthermore, there is evidence that additional liquidity encumbered banks' profitability (Bordeleau and Grahman, 2010, p. 4). A different reason might be the free cash flow problem (Jensen, 1986, p. 328; Richardson, 2006, p. 159; Stulz, 1990, p. 4). This problem describes the ability of management to withhold cash flows from shareholders (Jensen, 1986, p. 328; Richardson, 2006, p. 159; Stulz, 1990, p. 4). The withhold cash flows are engaged in uneconomical investments (Jensen, 1986, p. 328; Richardson, 2006, p. 159; Stulz, 1990, p. 4). The regulatory authority requires a higher minimum level of liquidity. The following figure can ascertain the development.

Figure 12: Liquid assets of total assets

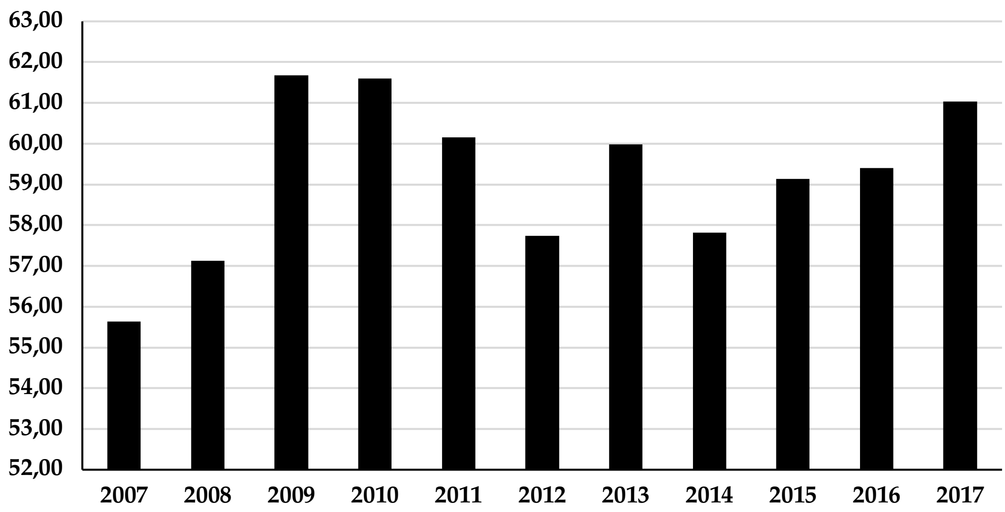


Source: ECB SDW, 2020, no page

The amount of liquidity includes all cash and cash balances with central bank liquidity (ECB SDW, 2017, no page). The data consists of all stand-alone banks and domestic banking groups of the Euro area (ECB SDW, 2017, no page); the sum of money and cash balances with central bank liquidity increases predominantly every year. In 2007 the portion amounted to 1.47 % of total assets, and in 2013 3.29 % of total assets. Due to a low-interest-rate environment since the financial crisis, the financial institutions have no intention to hold higher liquid assets (Bernanke and Gertlerin, 1995, p. 27 in Altavilla, Boucinha, and Peydró, 2017, p. 3; Bordeleau and Graham, 2010, p. 4; Bernanke, 2007, "The Financial Accelerator and the Credit Channel." Speech given at the Credit Channel of Monetary Policy in the Twenty-first Century Conference, Federal Reserve Bank of Atlanta, Atlanta, Georgia, June 15, 2007 in Altavilla, Boucinha, and Peydró, 2017, p. 3; Gertler and Karadi, 2009, p. 2 in Altavilla, Boucinha, and Peydró, 2017, p. 3). This development and observation confirm the above mentioned previous empirical investigations.

Nevertheless, the banks hold more liquidity (Yehoue, 2009, p. 17; Caruana, 2009, p. 14; d'Avernas, Vandeweyer and Pariès, 2020, no page). The increase in liquidity has several causes. On the one hand, risks from the primary business activity are increased so that the banks form a higher liquidity base for absorbing potential risks (Calimani, Susanna, Hałaj, and Żochowski, 2020, p. 4; Ahnert, 2014, pp. 5-6, 33; Grandia et al., 2019, p. 5). Another cause is the pressure of the revised liquidity requirement (Grandia et al., 2019, p. 5; BCBS, 2013, p. 2, 7). Through several ratios, the European Banking Authority (EBA) forces the banks to hold more liquidity for stabilizing the bank situation and, from a comprehensive perspective, the financial system (LCR and NSFR, cp. BCBS, 2013, p. 2, 7). The 2007/2008 financial crisis on the liquidity has other effects on the banks' relevant business activities. The regulatory requirement for higher amounts of liquidity can be solved from several approaches (BCBS, 2013, p. 2, 7). The statistical data bank from the ECB points that the banks have reduced their loans since the financial crisis in 2007/2008 (ECB SDW, 2020, no page). One lesson from the financial crisis is maintaining increased liquidity stocks (Bordeleau and Graham, 2010, p. 5). In addition to increased liquidity, there was also an increase in loans and receivables during and after the financial crisis (ECB SDW, 2020, no page). The following figure shows the development of loans and receivables (data available until 2017).

Figure 13: Loans and receivables to total assets since the financial crisis



Source: ECB SDW, 2020, no page

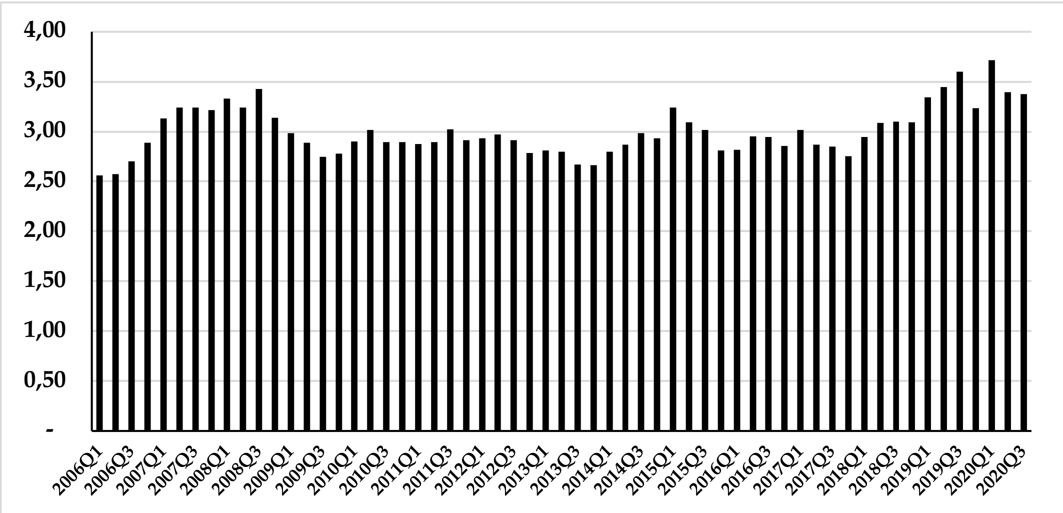
The figure includes all domestic banking groups and stand-alone banks in the European Union. The loans and receivables include finance leases too. It can be ascertained that the financial crisis leaves her tracks also years after the crisis's eruption. The figure shows an increase in loans and receivables before and during the financial crisis to 61.7 % in January 2009 and then decreased to 57.7 % of total assets in July 2012. The figure gives careful consideration. Individual branches, which react sensitively to economic growth, have stronger felt the decrease of lending activity (Bpb, 2016, no page; Papaioannou et al., 2013, p. 4; di Bella, 2011, p. 6.). The loan and receivable decrease is one indicator of the lending business's return as banks' primary business activity (Ongena and Popov, 2010, p. 7; Worms, 2001, p. 7; Porcellacchia, 2020, p. 3). These circumstances led to several empirical investigations.

> Alper, Hulgu, and Kele (2012, p. 29) stated that "unexpected liquidity and volatility shocks are positively and significantly correlated across stock and bond markets."

Gambacorta (2005, p. 1755), Gambacorta and Marques-Ibanez (2011, p. 8), Kishan and Opiela (2000, p. 132), Van den Heuvel (2001, p. 1) discovered a decreased diversity in the monetary policy of the lending activities and a simultaneously fall of the deposits. Even before the financial crisis in 2007/2008, Kashyap and Stein (2000, p. 425) stated that a new framework in the monetary policy hit smaller banks with lower liquidity ratios harder. Kashyap, Rajan, and Stein (2002, p. 33) argued that the liquidity supply mission has two approaches—the lending activity and the receiving and management of deposits. A further examination by Peek and Rosengren (1995, p. 688) showed that decreases in capital ratios caused by the revision of new capital rules could be created through liquidity issues. Already Stein (1998, p. 466) confirmed the statement in his empirical study that reinforcing regulatory requirements negatively affected the credit supply and correlated negatively with the bond market's interest rate. Due to the relationship between the credit institutions' supply of credit and the liquidity situation, this investigation contributes a further exploration of the liquidity structure impact. During the primary time of the financial crisis in 2007/2008, the extent of loans to key accounts decreased by 47 % by comparison to the prior-year period (Ivashina and Scharfstein, 2010, p. 319). A more considerable decline was observed in the period

04/2007 to 06/2007 (79 %) (Ivashina and Scharfstein, 2010, p. 319). The lending volume fell across several credit sectors, such as new lending to corporates, working capital loans, LBOs, or M & A financing (Ivashina and Scharfstein, 2010, p. 319). The development led to further issues regarding financial institutions' liquidity and stability (Ivashina and Scharfstein, 2010, p. 319). The concerns could not be stopped, although the government intervened (Ivashina and Scharfstein, 2010, p. 319). The following figure shows the decrease of the total loans in the EU.

Figure 14: Total loan issuance from 2006 to 2020 in trillion €



Source: ECB SDW, 2020, no page

The Euro volume of bank loans fell from 3.430 billion Euro in the third quarter of 2008, the primary time of the credit boom, to 2.748 billion Euro in the third quarter of 2009. The decline in October 2008 was incredibly steep. The lending amount decreased than one-fourth of its level one year later (from July 2008 to July 2009). The financial crisis stressed the liquidity relevance for the financial system since August 2007 (Ivashina and Scharfstein, 2010, p. 319; Reddy, Nangia and Agrawal, 2014, p. 258 in Allen and Giovannetti, 2011, p. 2; Chen, Mrkaic and Nabar, 2019, p. 5; Cevik and Miryugin, 2020, p. 13; Vivar, Wedow and Weistroffer, 2020, p. 10). Lehman Brothers' insolvency reduced the confidence of actors in the financial market (Lenza, Pill, and Reichlin, 2010, p. 12; Pisani-Ferry and Sapir, 2010, p. 2; Ivashina and Scharfstein, 2010, p. 319; Arezki et al., 2011, pp. 3-4; Bao, Pan, and

Wang, 2011, p. 911; Drudi, Durré, and Mongelli, 2012, pp. 7-8; Taglioni and Zavacka, 2013, p. 2, 13; Rao-Nicholson and Salaber, 2015, pp. 87-88; Camba-Méndez, 2016, p. 6). Therefore, the interbank market shut down (Allen and Carletti, 2008, p. 20; Chen, Mrkaic and Nabar, 2019, p. 5; Cevik and Miryugin, 2020, p. 13; Vivar, Wedow and Weistroffer, 2020, p. 10). The banking sector has no mutual trust in the payback ability of their exposure (Allen et al., 2020, p. 4; Cœuré, 2012, no page; Draghi, 2016, no page). The interbank market financing has lost its necessary liquidity (Vento and La Ganga, 2009, p. 13). With a view to lending risks, the Bank's liquidity was hoarded and not passed on (Vento and La Ganga, 2009, p. 13). The central banks injected liquidity into the market to restart the interbank lending (Vento and La Ganga, 2009, p. 3). The liquidity of marketable structured assets declined significantly (Allen and Carletti, 2008, p. 20; Brunnermeier, 2009, p. 85; Cañón and Margaretic, 2014, p. 515; Heider, Hoerva and Holthausen, 2009, p. 7). The following figure shows the money market decline.

Figure 15: Money market liquidity in bn. € during the financial crisis

Source: Nikolaou, 2009, p. 8

Several studies identified the interbank market's breakdown by observing the interbank spreads' determinants (Furfine, 2001, p. 1; Bai, Krishnamurthy and

Weymuller, 2014, p. 2; Dubecq et al., 2016, p. 30; Allen et al., 2020, p. 4). The term structure of interbank risk was followed by Filipovic and Trolle (2013, p. 707). The interbank rate fixings effects were observed by Gyntelberg and Wooldridge (2008, p. 65). The determinants of interbank rates with a focus on credit and liquidity were followed by Michaud and Upper (2008, p. 47). The observation of the counterparty risk was the focus of the study of Taylor and Williams (2009, p. 58). Schwarz (2009, p. 1) confirmed in a survey that the liquidity influenced the interbank market. The liquidity was observed in several ways by the academic community. Chordia, Roll, and Subrahmanyam (2000, p. 26) investigated the existence of commonality in liquidity. Furthermore, they showed that asymmetric information affects the liquidity situation of an individual bank (Chordia, Roll, and Subrahmanyam, 2000, p. 26). Brunnermeier and Pedersen (2005, p. 1825) studied predatory trading in the context of market liquidity and showed that the asset liquidity and the liquidation value correlate with the trading behavior. A negative relation between the asset price and the liquidity was stated by Acharya and Pedersen (2005, p. 405).

2.3.4 Interim summary

The 2007/2008 financial crisis showed that individual credit institutions and the banking sector were not able to absorb more significant losses as in chapter 2.3.1 described. The risk for an individual and the European banking system have not entirely been considered. The financial crisis impacts involved the earning structure, the liquidity situation, the banking sector's capitalization and the competitive situation (for example the described fintech development in chapter 2.3.2). Banks' ability and capacity to support borrowers were affected through large shocks to their funding and capital situation (Sette and Gobbi, 2015, pp. 1-3). During the financial crisis, a debt overhang was observed (Mian, Sufi, and Trebbi, 2012, p. 16; Kobayashi, 2015, p. 250). Furthermore, there is evidence for decreased demand and slower economic growth (Lo and Rogoff, 2015, p. 10). Leverage builds governance problems and significant discrepancies (Agha, 2013, p. 1). There is an inefficient funding mix of banks (Raddatz, 2010, p. 7; Vazquez and Federico, 2012, p. 6). Furthermore, the guarantees of the government and the subsidies of debt reinforced the inefficiency (cp. bailout of several institutions described in chapter 2.3.1). The findings regarding deficits in banks' business divisions include a motivation to ignore a higher risk level. The result was that the banks, invest in riskier loans. As a result of NPL, the anyway weak capitalization was decreased furthermore. Besides the excessive leverage, other determinants for the vulnerable equity situation of EU banks were identified and explained. For example, the tax shield encouraged leveraging as an explanatory determinant for the equity decrease. Several academic investigations investigated the tax shield effect (see the previous chapter). Furthermore, the explicit and implicit guarantees of governments create and support moral hazard problems and reduce the impact on the welfare (Cordella and Yeyati, 1999, p. 19; Dam and Koetter, 2011, p. 32; Freixas et al., 2003, p. 26; Gale and Vives, 2002, p. 487; Panetta et al., 2009, p. 30; Rosas, 2010, pp. 10-11). The low profitability of many European banks has become a constant situation since the financial crisis (KPMG, 2016, p. 3). The range of determining factors is wide. The factors depend on the countries. Already before the financial crisis in 2007/2008, the profitability of banks was investigated (Athanasoglou, Brissimis and Delis, 2008, pp. 134-135; Berger, 1995b, p. 429; Bruno and Hauswald, 2014, pp. 1712-1713; Claessens, Demirgüc-Kunt and Huizinga, 2001, p. 4; Demirguc-Kunt and Huizinga, 1999, p. 379; García-Herrero, Gavíla, Santabárbara, 2009, p. 2092; Pasiouras and Kosmidou, 2007, p. 234; Trujillo-Ponce, 2012, pp. 575-578). During the supervisory authority investigation, deficits were ascertained and led to a consistent standard to monitor and improve the bank capital and liquidity and has been worked out in Basel III, which is described in the following chapter.

2.4 BASEL III

2.4.1 Requirements for the banks

2.4.1.1 Capital requirements

The financial crisis accentuated that several causes are responsible for its emergence. The excessive on- and off-balance leverage with the internal models to forecasts the daily value at risk was discovered a significant reason (McAleer, Jimenez-Martin and Perez-Amaral, 2013, p. 251). Furthermore, adequate risk management and governance for strengthening the transparency and disclosures failed. Therefore, an amendment of the previous framework was necessary. The reforms aim to maintain the macro-prudential level. This should support to increase the resistance against a crisis of an individual bank. Furthermore, the reforms aim to consider system-wide risks at the macro-prudential level, affecting the banking sector (BCBS, 2011, p. 1-2). The revision of the framework is based on the last pillars of Basel II. In particular, the following areas have been revised.

Definition of capital

The crisis showed that the assessment and comparison of the capital quality between different institutions were not possible in an acceptable way. Therefore, the committee aimed to eliminate the capital definition's inconsistency across all areas of responsibility and information disclosure deficit (BCBS, 2011, p. 2). The BCBS defined new capital requirements with a greater scope on common equity and edited the set of criteria for an acceptance of capital into the category (BCBS, 2011, p. 2). The BCBS revised the minimum thresholds and requirements regarding the capital components as follows. The common equity tier 1 ratio (CET 1) must be a minimum of 4.5 % of the RWA at all times (BCBS, 2011, p. 12). The tier 1 capital ratio must be a minimum of 6.0 % of the RWA at all times. The TSR must be minimum at 8.0 % of RWA anytime. (BCBS, 2011, p. 12).

Risk Coverage

The error of capturing direct and indirect interactions (on- and off-balance sheet risks) during the financial crisis was a weakening factor (Borio and Drehmann, 2009, p. 11; Barucci and Milani, 2018, p 47). Furthermore, several studies exist that banks take more risk if their risk management and decision are not open to the public (Cordella and Yeyati, 1998, p. 110; Matutes and Vives, 2000, p. 27; Blum, 2002, pp. 1427, 1439-1440). To improve the capturing, the committee introduced mainly five reforms (BCBS, 2011, pp. 30-51):

1. Modified version for a more adequate counterparty credit risk consideration, credit assessment adjustments, and misbehavior (BCBS, 2011, pp. 30-39)
2. Asset value correlation multiplier for large financial institutions (BCBS, 2011, pp. 39-40)
3. Collateralized counterparties and margin period of risk (BCBS, 2011, pp. 40-46)
4. Central counterparties (BCBS, 2011, p. 46)

5. Developed counterparty credit risk management requirements (BCBS, 2011, pp. 46-51).

A further focus was placed on improving the dependency of the rating agencies. The agencies were criticized for their business model, their lower rating criteria during economic growth, and their lack of transparency (Salvador, de Guevara, and Pastor, 2018, p. 289). The lack of transparency can be noticed in rating agencies and their different rating factors, which failed to take the changed macroeconomic circumstances into account (Kiff et al., 2010, p. 90; Reusens and Croux, 2017, p. 108). Wojtowicz (2014, pp. 1-13) found that credit ratings are not sufficient for Collateralized Debt Obligations (CDO) pricing. In addition to the reforms, several measures have been adopted to mitigate external ratings' trust (BCBS, 2011, pp. 51-54).

Capital conservation buffer

Further capital buffers for improving the capitalization are established to implement the revised capital requirements. The BCBS defined a capital conservation buffer (CCB). Banks are faced with a regulatory paradoxon. The paradoxon describes the fact that the increased capital ratio does not cover the losses fully, although the capital ratio increases (Lessenich, 2014, p. 46). For improving the crisis resistance, the CCB will be activated in a loss scenario and must then be refilled (Lessenich, 2014, p. 46). Simultaneously, this is intended to prevent the credit institutions from distributing dividends despite losses to demonstrate economic strength (Lessenich, 2014, p. 46). The CCB was developed to ensure that banks maintain a buffer beyond the phases of stress. The additional component should prevent disruptions of the set capital requirements. The BCBS established a buffer of 2.5%, which has to comprise CET 1. If the capital level is not reached, the banks will be sanctioned with a constraint on capital distribution. In the worst case, the bank can be sanctioned to fully constrain for capital distribution. The ratio of a capital distribution depends on CET 1 and is shown in Table 10 (BCBS, 2011, pp. 54-55):

Table 10: Minimum capital conservation standards

CET 1	Minimum capital conservation ratios (in percentage of earnings)
4.5% - 5.125%	100%
>5.125% - 5.75%	80%
>5.75% - 6.375%	60%
>6.375% - 7.0%	40%
>7.0%	0%

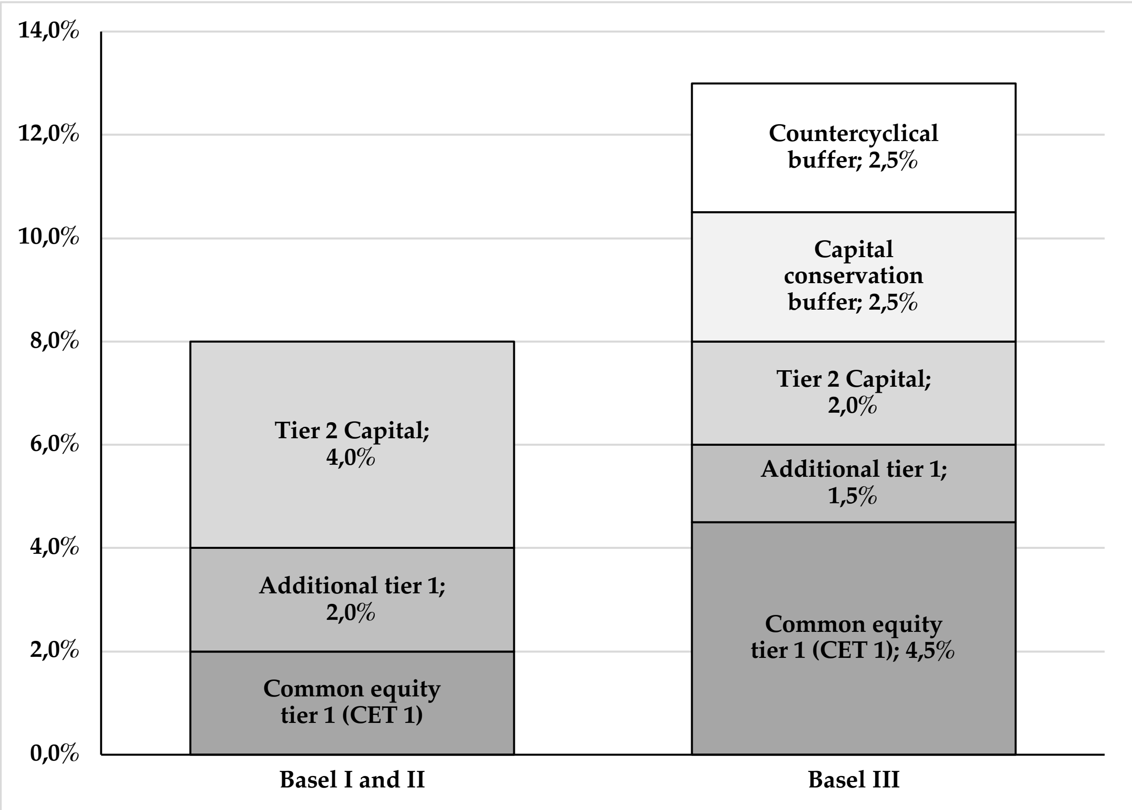
Source: BCBS, 2011, p. 56

In total, a bank has to own CET 1 capital of 7 % (4.5 % for the minimum capital level and 2.5 % as CCB) and the other components of capital must be considered. For instance, a credit institution with a CET 1 of 6 % has to constrain its earning distribution at 60 %. The following example shows another view of the effects of an incorrect capitalization. A credit institution with a CET 1 of 8 % and no additional of tier 1 or tier 2 would face all minimum capital requirements but have no conservation buffer. Therefore, this bank must consider the constrain ratio of 100 % (BCBS, 2011, p. 56).

Countercyclical buffer

An additional capital buffer to solve the regulatory paradox is the countercyclical buffer. The countercyclical buffer captures the risk of a slowdown after a vital credit growth phase where the banking sector can be affected with high losses by an economic downturn. The destabilized banking sector can transmit their losses in the real economy. The BCBS aims these interactions with the countercyclical buffer. The countercyclical buffer varies between 0 % and 2.5 % of RWA and depends on the BCBS member's national authority. The buffer must contain CET 1 capital. Just like the capital conservation buffer, a capital distribution constrain is a sanction measure if a bank does not consider the buffer (BCBS, 2011, pp. 58-60). The revised capitalization is as the following figure.

Figure 16: Minimum capital in Basel III



Source: Own figure, modeled on BCBS, 2011, pp. 12, 17-19, 54-61

A minimum level of 3 % was introduced and based on the "[…] monthly leverage ratio over the quarter based […]" (BCBS, 2011, p. 61).

The implementation's authorization is mostly due to the financial risk ratio valuation regarding the value at risk (VaR) as a risk indicator. Jarrow (2013, pp. 973-976) examined if leverage ratios are better for comparing the banks and found that VaR estimates are not normalized and not comparable without adjustments (Jarrow, R., 2013, p. 976). Barth and Miller (2018, p. 37) found that an increased leverage ratio (measured by the total book value of equity to total book value of assets) reduces the probability of causing a crisis while the higher ratio induces higher costs in the form of reduced loans and the transmission of higher equity costs to the borrower. Allahrakha, Cetina, and Munyan (2018, pp. 3-16) confirmed this effect for banks' activities on the U.S. triparty repo market. Regarding Barth and Seckinger (2018 p. 463), the committed leverage ratio could affect the financial sector by further competitors (results from an oversupply of debt) by a lower engagement of banks in high-risk projects. Another impact was measured by D'Mello, Gruskin, and Kulchania (2018). They observed that the leverage ratio influences the cost-benefit trade-off to shareholders (D'Mello, Gruskin, and Kulchania, 2018, p. 352). The investigation suggests that corporates are more motivated to reduce leverage regarding the higher cost of debt and a connection of the annual debt change and the net costs to shareholders (D'Mello, Gruskin and Kulchania, 2018, p. 371).

2.4.1.2 Liquidity requirements

Complementing measures to improve banks' capitalization, the consequences of the 2007/2008 financial crisis led to a need for stabilizing and improving the liquidity basic and structure (Schenk, 2020, p. 3; Cappelletti et al., 2020, p. 4; ECB, 2015, p. 2; Claessens and Kodres, 2014, p. 8). Therefore, the BCBS implemented internationally coordinated liquidity ratios: Net Stable Funding Ratio (NSFR) and the Liquidity Coverage Ratio (LCR) (BCBS, 2011, p. 8). The LCR aims at avoiding liquidity problems over 30 days (BCBS, 2011, p. 9). The LCR is a ratio that simulated a short-term stress scenario (BCBS, 2011, p. 9). Banks have to ensure that they hold sufficient and unencumbered high-quality liquid assets (BCBS, 2011, p. 9). The calculation of the LCR is described as follows:

Equation 1: LCR

$$\text{LCR}= \frac{\text{Stock of HQLA}}{\text{TNCF over the next 30 calendar days}} \geq 100\ \%$$

Source: BCBS, 2013, p. 7

<u>Net Stable Funding Ratio</u>

The 2007/2008 financial crisis highlighted the deficits in the banking sector (Ashraf, Rizwan, and L'Huillier, 2016, p. 47). The weak liquidity situation on the financial market and individual banks led to a rethink to non-existent liquidity requirements (Rösch and Kaserer, 2014, p. 152; Chiu et al., 2018, p. 21; BCBS, 2011, p. 8). The evidence of Vazquez and Federico (2012, pp. 1-14) showed that banks with a weaker liquidity structure are more vulnerable to failure. Therefore, the central bank intervened and provided liquidity for the financial market (Baig and Winters, 2018, p. 3). Thus, the BCBS introduced the NSFR. The NSFR calculation is described in Equation 2:

Equation 2: NSFR

$$\text{NSFR} = \frac{\text{Available amount of Stable funding (ASF)}}{\text{Required amount of Stable funding (RSF)}} \geq 100\ \%$$

Source: BCBS, 2014, p. 2

The ratio shows that the bank capital and liabilities are related to categories with individual ASF and RSF factors (BCBS, 2014, p. 3). Then the amount is multiplied with the ASF or RSF factor. The sum of the weighted amounts determines the ASF and the RSF and the ratio has to be fulfilled from 2018 (BIS, 2018, p. 1). Roulet (2018, p. 34) investigated the impact of liquidity ratios on lending growth and found that the NSFR influences the European bank commercial-lending-growth significantly and positively, while the same ratio influences the European bank retail-lending-growth negatively. Furthermore, the ratio has no negative impact on systemic risks, but the speed of adjustment impacts (Ly et al., 2017, p. 169). The cost-effective strategies to fulfill the NSFR requirement are to increase the stock of high-rated securities and to prolong the maturity of wholesale funding (King, 2013, p. 4144, 4155). Simultaneously, banks with an NSFR > 100 % are better capitalized on average than banks with an NSFR < 100 % (Dietrich, Hess, and Wanzenried, 2014, p. 14). Another aspect is that the achievement of the NSFR burdens banks' profitability through the reduced use of short-term-financing, but simultaneously reduces the PD of banks (Wei, Gong, and Wu, 2017, p. 229). In addition to building up and improving existing capital standards, a leverage ratio is implemented for limiting the balance sheet volume and off-balance sheet volume concerning the capital (BmFi, 2013, no page).

2.4.1.3 Leverage requirements

The objectives for introducing a leverage ratio are to constrain the leverage and simultaneously successive mitigation of a deleveraging process (BCBS, 2011, p. 4, 61). Second, an introduction of further safety precautions against model risk and default risk of each credit risk measurement (BCBS, 2011, p. 4, 61). The calculation of the LR is described as follows:

Equation 3: Leverage ratio

$$LR = \frac{\text{Tier 1 Capital}}{\begin{array}{c}\text{Total on-balance sheet exposure+total derivative expsoure+} \\ \text{total securities financing transaction expsoure+off-balance sheet items}\end{array}}$$

Source: BCBS, 2014, p. 12

The ratio has to be at a minimum of 3.0 % (BCBS, 2011, p. 61). With its additional indicators, Basel III represents a revised framework for banking regulation. Since the first introduction in 1988, the framework has been further developed (BCBS, 1999; BCBS, 2000; BCBS, 2004; BCBS, 2004a; BCBS, 2008; BCBS, 2011; BCBS, 2013; BCBS, 2014). A significant development was presented with Basel II as a framework (BCBS, 2004). The changes published between Basel I, Basel II, and Basel III represent changes of several rules, but not a complete revision of the framework. In addition to capital ratio changes, Basel II's existing risk weight has been changed in selected rating categories (BCBS, 2017, p. 3). The impact and intended improvements of Basel III have been investigated in various studies. For example, Mohanty et al. (2018) found that the total risk, market risk, and the idiosyncratic risk for Global Systemically Important Institutions (G-SIIs) increased from June 2006 – July 2007 to January 2010 – December 2015. But the results are also limited because at the mentioned period, and the European debt crisis has its peak. Thus, the results are distorted (Mohany et al., 2018, p. 105). At the same time, Naceur, Marton, and Roulet (2018, p. 17) examined that U.S. banks strengthen their capital as a risk absorption capacity when they increase their credit activities. Furthermore, they found that capital ratios negatively influence retail and other lending growth (Naceur, Marton and Roulet, 2018, p. 17).

2.4.2 CRD IV packet as an implementation instrument

2.4.2.1 CRR No. 575/2013

Basel I and II's previous BCBS frameworks are not directly legally binding for credit institutions and represent a BCBS recommendation (BmFi, 2019, no page). The recommendations only affect if they have been lawfully implemented into national rules (BmFi, 2019, no page). Since Basel I and II are regulations in the form of a recommendation, they had to be transferred into national law. The respective banks were always affected by the directive (BmFi, 2019, no page). With the previous directives, the EU has adopted binding targets, but the choice of form and means was shifted to the member states (Hölscher, 2016, p. 53). Based on the extent of the financial crisis, the European Parliament had adopted several legislative packages to improve the financial system. Two legal acts have implemented the framework Basel III described in the previous chapter called the CRD-IV packet. The first legal action was the Capital Requirement Regulation (CRR) and is documented in the official journal of the European Union No. 575/2013 as a regulation and not a directive (EUR-Lex, 2013a, no page). With the CRR, essential capital requirements are implemented. The CRR is valid from the 2014-01-01 (EUR-Lex, 2013a, article 8, paragraph 1). The definition of the concerned credit institutions and other investment firms are placed in article 4 of the CRR (EUR-Lex, 2013a, article 4, paragraph 1-8). The scope of the CRR concerns the respective banks directly. The CRR deals with the requirements to credit institutions and investment firms (EUR-Lex, 2013a, article 6). It includes quantitative requirements and disclosure obligations following Basel III (BaFin, 2013, no page). To introduce and apply joint banking supervision, a single rulebook was implemented. The single rulebook is a directly applicable rule (BmFi, 2013, no page). Thus, the CRR contains all recommendations from the BCBS framework Basel III (BmFi, 2013, no page). Essentially, the CRR and the CRD IV obligated the involved banks and investment firms to own the required supervisory capital (EUR-Lex, 2013a, article 25). The national laws had to be amended and partly newly introduced by the CRR.

2.4.2.2 CRD No. 36/2013

The Capital Requirements Directive (CRD) serves the member states in the CRR introduction and is a directive that must be transferred into national law (BmFi, 2019, no page). Due to a view of the extensive and partly overlapping contents of Basel III (BmFi, 2019, no page), the most important contents for this dissertation are presented. Based on Basel III, the CRD exists in its fourth edition and is called CRD IV. The previous CRD are from 2006 (CRD I), 2009 (CRD II) and 2010 (CRD III) (EUR-Lex, 2006a, no page; EUR-Lex, 2006b, no page; EUR-Lex, 2009a, no page; 2009b, no page; EUR-Lex, 2010, no page). The first CRD No. 48/2006 and No. 49/2006 transposed Basel II into European law (EUR-Lex, 2006a, article 1-160; EUR-Lex, 2006b, article 1-54). CRD II from 2009 and CRD III from 2010 have already provided initial reactions to the financial crisis, particularly CRD II aims at tighter capital requirements for several counterparty credit risks, the trading book risks, and stricter requirements for the resecuritization (BmFi, 2013, no page). CRD III implemented further developments from the BCBS into European directives. The CRD III requirements for the remuneration policy were defined for the first time to prevent disincentives (BmFi, 2013, no page). In 2013 the CRD IV was introduced. The CRD IV is placed in the European Union's official journal as the directive No. 2013/36 (EUR-Lex, 2013b, article 1-165). The CRD IV packet aims to ensure higher quantitative and qualitative equity rules of the credit institutions (BaFin, 2013, no page). The corporate governance principles were defined in article 88 (EUR-Lex, 2013b, article 1, paragraph 1-2). The CRD IV obligated the concerned institutions to implement a nomination committee for the management board members' adequate qualification level for their control function (EUR-Lex, 2013b, article 1, paragraph 1). Another aspect of the CRD IV is the introduction of a limitation in the remuneration policy. In particular, article 94 g defined limits for the remuneration variable (EUR-Lex, 2013b, article 94, paragraph g). The variable part has not been greater than 100 % of the fixed part (EUR-Lex, 2013b, article 94, paragraph g, i). An upgrade of the fixed part's maximum 200 % is only possible if the member states approved it (EUR-Lex, 2013b, article 94, paragraph g, ii). In addition to the capital requirements in Basel III and CRR, the CRD IV obligated the banks to have several capital buffers. The capital buffers were oriented to systemic risks, while the capital composition changes were geared toward individual institutions' solvency (Hölscher, 2016, p. 160). The CRD IV requires several additional capital buffers. At first, the

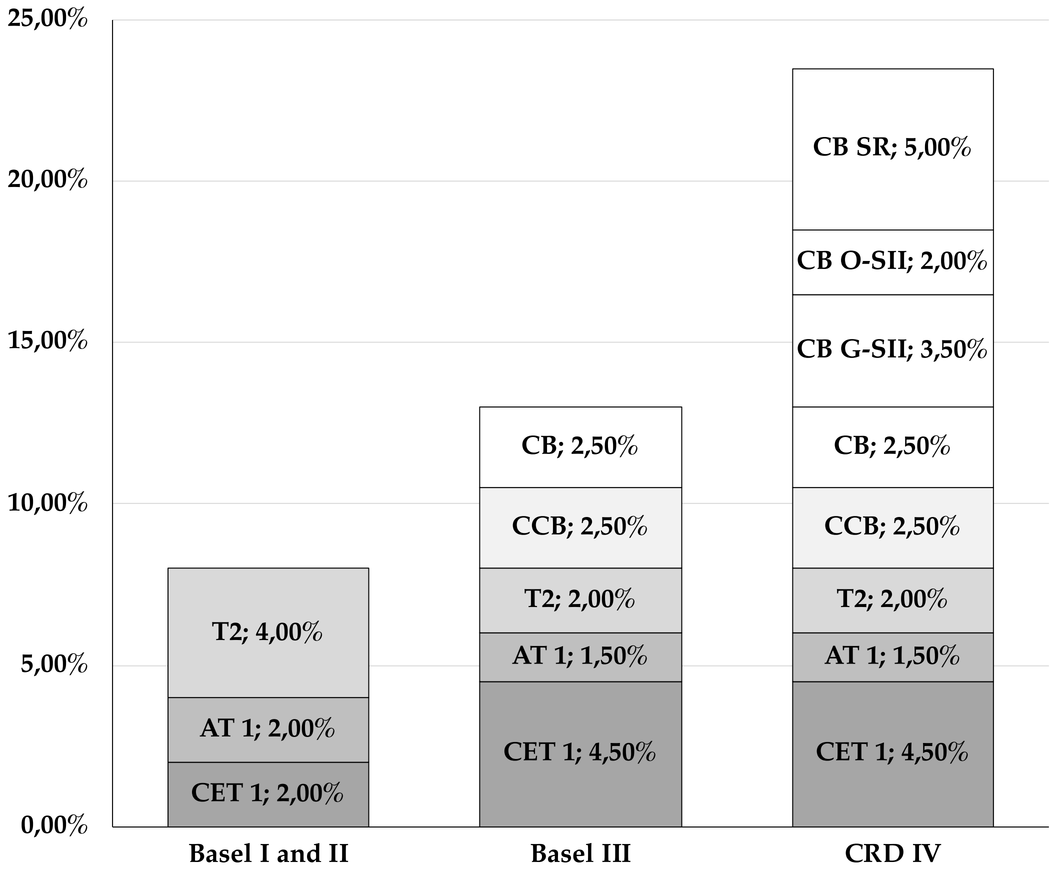
CRD IV includes the CCB of 2.5 % and the countercyclical capital buffer of 2.5 % of their total risk exposure from Basel III and made a recommendation. The national authorities can decide on an exemption of implementing the countercyclical capital buffer if the exemption does not burden the financial system stability (EUR-Lex, 2013b, article 129, paragraph 1). Not included in Basel III but developed in the CRD IV implementation process is the capital buffer for Global Systemically Important Institutions (G-SIIs) of up to 3.5 % of the total risk exposure (EUR-Lex, 2013b, article 131, paragraph 9). This buffer depends on the bank size and its relevance to the financial system (BmFi, 2013, no page). The member states are responsible for designating the authority for identifying a G-SII (EUR-Lex, 2013b, article 131, paragraph 1-2).

The definition of a G-SII based on the following criteria (EUR-Lex, 2013b, article 131, paragraph 2):

i. "Size of the group
ii. The interconnectedness of the group with the financial system
iii. Substitutability of the services or the financial infrastructure provided by the group
iv. The complexity of the group
v. The cross-border activity of the group."

If an institution is not identified as a G-SII, further examination is necessary to test if the credit institution is another Systemically Important Institution (O-SII). The CRD IV obliges the credit institution to build a capital buffer for O-SII up to 2.0 % of the total risk exposure (EUR-Lex, 2013b, article 131, paragraph 5). A further requirement of the CRD IV is that a systemic risk buffer must be introduced if the supervisory authorities recognize risk for the total financial system, which is not influenced by the previous regulatory requirement. The buffer range is at a minimum of 1 % and a maximum of 5 % (EUR-Lex, 2013b, article 133, paragraph 3, 14). In summary, the following figure shows the capital requirement under Basel III and CRD IV.

Figure 17: Capital requirement under Basel III and CRD IV

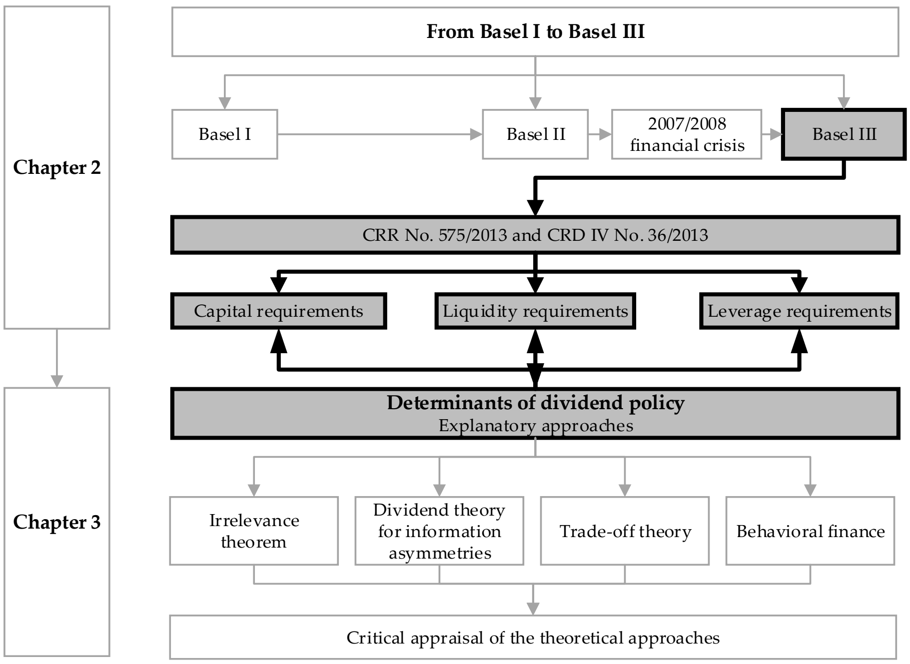


Source: Own figure, modeled on BCBS, 2011, pp. 12, 17-19, 54-61; EUR-Lex, 2013b, article 128-133

The capital amount and components increased considerably. The capitalization only grows if the supervisory authorities identified high risks. It should not be surprising that banks should be held more equity in the phase of high risks.

Chapter 2 has shown the emergence and successive development of the Basel accords (cp. chapter 2.1 to 2.4). Within the framework of Basel III, the CRR No. 575/2013 and CRD No. 36/2013 has been developed (cp. chapter 2.4.2.1 and 2.4.2.2), in particular the capital, liquidity and leverage requirements, which directly and indirectly influence overall bank management and thus also dividend policy (for example the sanctioning of a capital distribution constraint if the defined capital requirements are not met, cp. chapter 2.4.1.1). The following figure shows interdependence of the regulatory requirements (chapter 2) with the dividend policy (chapter 3).

Figure 18: Relationship between chapter 2 and 3



Source: Own figure

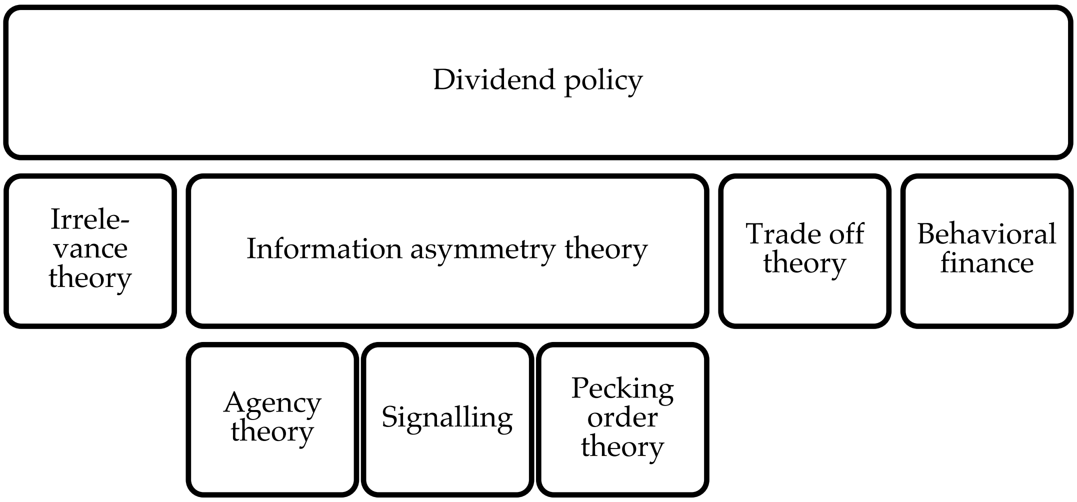
Therefore, its necessary to address the various approaches of the dividend policy, which is explained in the following chapter.

3 DETERMINANTS OF DIVIDEND POLICY

3.1 EXPLANATORY APPROACHES

As the influence of the regulatory requirement on the dividend policy will be examined in this dissertation, it is necessary to present the theoretical framework of dividend policy. In this context, companies compare the dividend payout with the reinvesting policy into the company (CFI, 2020, no page; Tekin and Polat, 2020, pp. 2-3; Omerhodžić, 2014, p. 42; Livoreka et al., 2014, p. 388). Simultaneously, it is not understandable that dividends are paid, and the capital is raised by new capital or new capital acquisition in the form of debt (Easterbrook, 1984, p. 650). Therefore, it is necessary to deal with the dividend policy. The decision-making and determination of corporates about their earning distribution in the form of dividends describe the dividend policy (Meyer, 2018, p. 4; Copeland, Weston and Shastri, 2008, p. 55; Schulz, 2006, p. 18). Since the theory of the irrelevance of a dividend policy was developed by Miller and Modigliani (1961), different approaches were developed. The further developed strategies were created from the elimination of individual assumptions of the irrelevance theory. In principle, the theories for the dividend policy can be categorized as follows explained.

Figure 19: Categorization of the dividend policy theories



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3.2 IRRELEVANCE THEOREM

Merton Miller and Franco Modigliani developed the theory of irrelevance of dividends in 1961 (Miller and Modigliani, 1961). The missing consistency on the optimal dividend policy was due to the lack of a complete theoretical approach (Miller and Modigliani, 1961, p. 411). Based on a mathematical model, they examined the influence of dividend distribution on the share price performance (Meyer, 2018, p. 9). For the theory development, the following assumptions have been made (Miller and Modigliani, 1961, p. 412):

- No influence on price changes through a buyer or seller
- No information asymmetries and costless access to information
- No transaction costs
- No taxes
- Rational behavior: Investors are benefit maximizer, and it does not matter in which form the value of their stock portfolio increase (via dividend or an expansion of the market value)

– Perfect certainty: Investors have absolute assurance regarding the investment program and the future gains of companies. Therefore, there is no differentiation between stocks and bonds as a funding source (assumption of one type of financial instrument)

They found that the influence of a dividend policy on the enterprise value is irrelevant (Meyer, 2018, p. 9; Topalov, 2011, p. 3). There is no advantageous or disadvantageous dividend policy (Meyer, 2018, p. 10). The enterprise value is independent of profit retention or dividend payout, with a simultaneous capital increase (Prokot, 2006, p. 59; Meyer, 2018, p. 9; Grullon and Michaely, 2002, p. 1652). All forms of the dividend policy are equal (Prokot, 2006, p. 59). An explicit dividend policy does not lead to an increase in shareholder value (Prokot, 2006, p. 59). The model is coherent in itself, but the underlying premises are regularly criticized. The stronger focus on model premises was the basis for new theoretical approaches for identifying the determinants of dividends (Jensen and Meckling, 1976, p. 305; Akerlof, 1970, p. 489; Myers and Majluf, 1984, p. 196; Kraus and Litzenberger, 1973, pp. 911-922; Shiller, 1981, p. 434; Shiller, 1986, p. 503). Since in reality, the irrationality of investors or transaction costs are detected in principal-agent-conflicts, the theory is regularly criticized in this regard (Ahmeti and Prenaj, 2015, p. 922; Titman, 2002, p. 101; Glickman, 1997, p. 272; Gordon, 1989, p. 26, Ross, 1988, p. 127; Miller, 1988, p. 100; Gottardi, 1995, p. 192).

3.3 DIVIDEND THEORY FOR INFORMATION ASYMMETRIES

3.3.1 Agency theory

It is a challenge for investors to be fully informed and have valid information at their disposal (Prokot, 2005, p. 77). One way of differentiating companies between their quality and profitability is the dividend policy (Prokot, 2005, p. 77, Topalov, 2011, p. 39). In reality, information is not freely available for all participants to the same extent (Strzyz, 2012, p. 16). Therefore, the examination of the theoretical framework of dividend policy concerning information asymmetries is necessary. Jensen and Meckling (1976) agency theory is based on the knowledge that within a corporate, incentive problems and interest conflicts exist (Jensen and Meckling, 1976, p. 305; Al Taleb, 2012, p. 234). The theory engaged with information asymmetries between the shareholders and a firm's management (Schulz, 2006, p. 81; Morris, 1987, p. 47; Harris and Raviv, 1991, p. 300).

The asymmetry creates conflicts between several groups (Muneer, Bajuri, and Rehman, 2013, p. 434). Topalov (2011, p. 27, 30, 38) enhances the interest conflicts among shareholders and bondholders, major shareholders, and small shareholders. The shareholders have limited information; management decisions could not be excluded ex ante or ex post (Prokot, 2005, p. 95). The sanctioning of managers is also difficult in the aftermath (Prokot, 2005, p. 96; Tirole, 2006, p. 122). Measures to reduce negative effects (for example, securities for credit or stronger monitoring of the management board) before management acting and after management acting exist (Guserl and Pernsteiner, 2015, p. 42). Agency theory presents an explanatory approach for the valuation and regulation policy for accounting, the voluntary disclosure, and auditing processes (Morris, 1987, p. 47). The mitigation of agency costs is agency theory's aim (Morris, 1987, p. 47). Agency costs are defined as reducing corporates' market value, as the shareholders assume that their interests are not fully represented by the managers (Jensen and Meckling, 1976, p. 308, Prokot, 2005, p. 95, Tirole, 2006, p. 79). Other agency costs are costs caused by monitoring and bonding managers to perceive shareholders' interest (Jensen and Meckling, 1976, p. 308; Morris, 1987, pp. 47-48).

Two approaches for reducing agency costs were presented by Easterbrook (1984). Dividends are seen as an instrument for reducing agency costs (Prokot, 2005, p. 96; Topalov, 2011, p. 31). In particular, the ownership and management split is relevant (Prokot, 2005, p. 96). At first, the free-riding-problem describes the cost and benefit-sharing of managers' monitoring (Levmore, 1982, p. 49). While the shareholders have to bear the monitoring costs fully themselves, the profit is only limited according to their share (Prokot, 2005, p. 96). Thus, shareholders are interested that other actors take on monitoring tasks (Easterbrook, 1984, p. 653; Prokot, 2005, p. 96). With a view of the monitoring activities, the external raising of capital becomes more important. The managers are evaluated by the investors and their analysts (Easterbrook, 1984, p. 653; Prokot, 2005, p. 96). There is only a willingness to invest if there is adequate compensation in the form of a lower price for the take-over of agency costs (Prokot, 2005, pp. 96-97). Managers are interested in the maximum price, and thus information asymmetries exist, and agency costs arise (Prokot, 2005, p. 97). Put another way, a dividend payout or a share repurchase as an outflow of liquidity increases the demand for external financing, and thus, the associated monitoring activities (Grullon and Michaely, 2002, 1652). Therefore, an optimal dividend policy consists of the trade-off between raising external capital and reducing agency costs (Rozeff, 1982, 249). An optimal dividend policy aims to minimize these costs (Rozeff, 1982, p. 249). Second, managers' risk aversion contributes to reducing entire corporate risks to avoid the threat to their jobs (Easterbrook, 1984, p. 653; Prokot, 2005, p. 97). Through profit retention, managers could positively reduce the leverage, which positively influences corporate risk (Easterbrook, 1984, p. 653; Prokot, 2005, p. 97; Topalov, 2011, p. 27; Poledna et al., 2014, p. 199). This means that an asset shifts to external credit investors and benefits them (Prokot, 2005, p. 97, Topalov, 2011, p. 27). Dividend payments add continuous external capital raising, increasing the probability of a consensus of interests between the shareholders and the management (Prokot, 2005, p. 97; Topalov, 2011, p. 31). To investigate the influence of the interest and interest differences between the management and the shareholders, approaches of bond price reaction, leverage, dividends, and management remuneration can be used. One approach is the bond price reaction to dividends changes (Topalov, 2011, p. 28). Based on the wealth redistribution theory, bond prices decrease in a dividend increase (Dhillon and Kalay, 1994, p. 281). Dhillon and Johnson (1994) confirmed the theoretical framework and found a significant negative bond price reaction (Dhillon and Johnson, 1994, p. 288). These theoretical considerations were not confirmed by Handjinicolaou and Kalay (1984, p. 59). Their evidence was that bond prices are negative influenced by dividend reductions (Handjinicolaou and Kalay, 1984, p. 59).

Another approach for the evidence and the reduction of the agency theory effect is leverage. Since leverage involves a payback of the debt, the management is responsible for fulfilling this obligation (Prokot, 2005, p. 100; Byrd, 2010, p. 1, Hauck, 2008, p. 35). Debt can lead to interest differences between shareholders and bondholders (Hauck, 2008, p. 35; Guserl and Pernsteiner, 2015, p. 42, Glover and Hambusch, 2016, p. 2). Hence, the dividend payouts and the leverage have a negative relationship (Prokot, 2005, p. 100). But the signal of a dividend change is weaker than the signal of nonpayment of liabilities (Berk and DeMarzo, 2019, p.

622). Debt motivates managers to act in the shareholders' interests (Okoye et al., 2016, p. 123). The amount of debt to support corporate success was the research objective of Belo, Dufresne, and Goldstein (2015). They determined that a constant leverage ratio would lead to a volatile dividend policy in the short term (Belo, Dufresne, and Goldstein, 2015, p. 1119). Furthermore, DeAngelo and DeAngelo (1990) found that debt covenants influence dividend policies through contract clauses. Furthermore, dividends are another instrument to reduce agency costs (Prokot, 2005, p. 96; Topalov, 2011, p. 31). Based on higher payout ratios, corporates have to require new external capital (Prokot, 2005, p. 103). External financing can reduce agency costs through its monitoring function (Prokot, 2005, p. 103). Hansen, Kumar, and Shome (1994) also explained that dividends could reduce agency costs through the capital market's control. They showed that monitoring provided by capital market pressure to electric utility corporates increases profitability (Hansen, Kumar and Shome, 1994, p. 22). Guserl and Pernsteiner (2015, p. 43) described the management's remuneration as an instrument to incentivize the management to act to increase shareholder value. The idea is to reduce the agency conflicts and costs between the shareholders and the management by the management participation of profits (Garen, 1994, p. 1175). Due to a wide area of influence of the management and short-term corporate orientation, management remuneration has been criticized in various studies because management can influence their remuneration contract (Bebchuk and Fried, 2004, p. 1; Bebchuk, Grinstein, and Peyer, 2006, p. 37; Bertrand and Mullainathan, 2002, p. 929). Since the management can influence the design of their contract, especially the remuneration, the degree of monitoring and control over agency conflicts and costs are weaker.

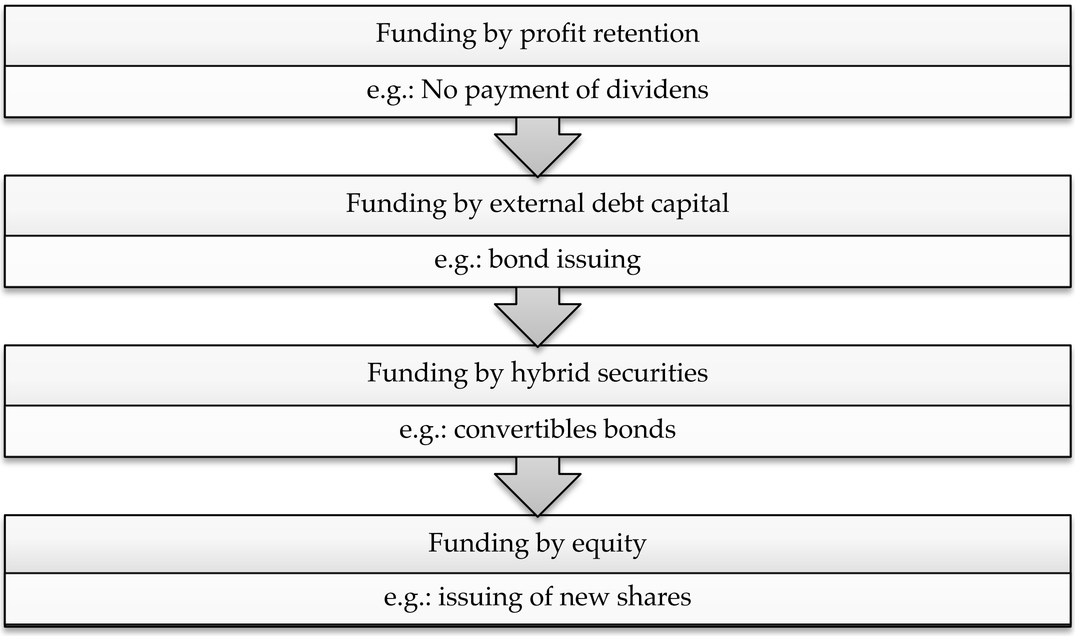
3.3.2 Signaling

Like the agency cost approach, the signaling system is based on an information asymmetry between the shareholder and management (Meyer, 2018, p. 12). The difference is that the signaling approach assumed a consensus of interest and opportunistic behavior of the management while the agency theory supposes a conflict-of-interest conflict (Meyer, 2018, p. 12). The company management has an information advantage over the owners (Topalov, 2011, p. 39). Therefore, the management sends signals to the shareholders to convey information asymmetries in the context of a non-matching of interest (Schulz, 2006, p. 79; Topalov, 2011, p. 39; Vieira and Raposo, 2007, p. 3). The first signaling model was developed by Akerlof (1970) for the automobile market. He showed that demanders could not sufficiently differentiate the quality of a good and thus do not demand high-priced goods (Akerlof, 1970, p. 489). This process displaces the suppliers of the right products so that in the end, only the suppliers of the wrong products ("lemons") remain (Akerlof, 1970, p. 489). In transferring the management–ownership relation, the management strives to provide information to signal the business's actual state (Topalov, 2011, p. 40). However, the signal must be so expensive that other companies are discouraged from copying it (Topalov, 2011, p. 40). Bhattacharya modeled the first signaling function of dividends in 1979. The model is based on disclosing the quality of investment (Bhattacharya, 1979, p. 260). For this purpose, the management pays high dividends because they are not covered by the underlying investment (Bhattacharya, 1979, p. 261). Therefore, additional capital is necessary. The related transaction costs are costs for the dividend signaling and the prices are lower for corporates with profitable investments (Bhattacharya, 1979, p. 269). According to the model, companies without positive prospects cannot announce dividend increases (Meyer, 2018, p. 11). Therefore, in contrast to Modigliani and Miller, an optimal dividend policy is possible (Meyer, 2018, p. 12). Further studies examined the effect of the signaling theory through other forms of signaling costs: The study of John and Williams (1985, p. 1053, 1065) showed signaling costs through dividends and the higher taxation of cash dividends for a signal of future cash flow. Miller and Rock (1985, pp. 1031, 1047-1048) have operationalized the signaling costs in the form of a non-executing of future investments to pay the dividends. Since the stock price of a corporate reacts after a dividend decision, several studies confirmed an interdependency of the stock price increase and a dividend increase (Pettit, 1972, p. 1006; Woolridge, 1983, p. 1614; Dielman and Oppenheimer, 1984, p. 214, Asquith and Mullins, 1983, pp. 93-94).

3.3.3 Pecking-order theory

The pecking-order theory was developed because investors cannot thoroughly assess a corporate (Myers and Majluf, 1984, p. 196). In 1961, Donaldson formulated the first approach, which deals with the pecking-order theory (Donaldson, 1961). The theory was further developed and modified by Myers and Majluf (Myers and Majluf, 1984). They created a model based on the discrepancy between the empirical evidence and the corporates' financial policy as a trade-off of the benefits and the handicaps of market imperfections, tax shields, agency costs, and bankruptcy costs (Sánchez-Vidal and Martín-Ugedo, 2005, p. 341). They considered an information asymmetry since the managers of a company have an information advantage (Myers and Majluf, 1984, p. 189). At the core, the problem is based on the state, which implies that goods' quality is assessed with discounts resulting from information asymmetries (Akerlof, 1970, p. 489). Additionally, Leland and Pyle developed a capital structure model (Leland and Pyle, 1977, p. 372). In their model, entrepreneurs are looking for funding projects with information asymmetries to their favor (Leland and Pyle, 1977, p. 372). The entrepreneur's willingness to be considered in their project is perceived as a positive signal (Leland and Pyle, 1977, p. 372). A defined target debt-equity ratio does not exist (de Jong, Verbeek, and Verwijmeren, 2010, p. 733). Regarding financing policy, Myers and Majluf suggest considering if managers are shareholders too in their issue-invest decision model (Myers and Majluf, 1984, p. 197, 219). By taking the managers' simultaneous shareholder role, the extent of the information asymmetry can be assessed by the managers' intention to buy new shares in a scenario of issuing new shares (Myers and Majluf, 1984, p. 197). This resulted in a prioritization of funding sources which depend on information costs (Baskin, 1989, p. 27; Chirinko and Singha, 2000, p. 418; Bontempi, 2002, p. 2; Leary and Roberts, 2010, p. 332; Dong et al., 2012, p. 637, 641; Cotei and Farhat, 2009, p. 3). The following figure presents the pecking-order of funding sources in a top-down view.

Figure 20: Pecking-order of funding sources



Source: Based on Myers and Majluf, 1984, pp. 219-220

Since the pecking-order theory contrasts with the preferred leverage financing, its necessary to deal with this issue; the empirical evidence is not consistent. The following table shows the most important findings of some empirical investigations.

Table 11: Additional summary of dividend policy studies

Author (year, page)	Key findings
Shyam-Sunder and Myers (1999, p. 242)	- Confirmed the pecking-order theory as a good decision instrument - A sample size of 157 firms
Lemmon and Zender (2010, p. 1184)	- Modification of the Shyam-Sunder and Myers model - Confirmed the modified model of the pecking-order theory
Frank and Goyal (2003, p. 217, 241)	- Tested the pecking-order theory - Sample: publicly traded U.S. firms from 1971-1998 - The key finding is that internal funding (for example, through profit retention) is not sufficient to supply the capital demand of corporates for their investments
De Jong, Verbeek and Verwijmeren (2011, p. 1312)	- Confirmed the pecking-order theory - For repurchase decisions and depending on the debt ratio to the target ratio, the observations did not confirm the pecking-order theory since firms repurchase equity and not debt
Atiyet (2012, p. 2)	- Firms with large information asymmetry should prefer debt to equity issuing - This implies that debtholders instead tend to accept the information asymmetries than shareholders.

Source: Own table

Exceptionally, the testing of the pecking-order theory by Shyam-Sunder and Myers was executed by considering 157 firms (de Jong, Verbeek, and Verwijmeren, 2011, p. 1304; Frank and Goyal, 2003, p. 231). As a consequence, there is a financial necessity to cover capital demand with other funding sources (Myers and Majluf, 1984, pp. 219-220). But there are common trade-offs in the implementation of the pecking-order theory. Several funding sources influence the dividend policy and led to a prioritization of these funding sources (Baskin, 1989, p. 27; Chirinko and Singha, 2000, p. 418; Bontempi, 2002, p. 2; Leary and Roberts, 2010, p. 332; Dong et al., 2012, p. 637, 641; Cotei and Farhat, 2009, p. 3). No dividends should be distributed for fulfilling the pecking-order theory starting with the first recommendation (cp. above mentioned figure and Myers and Majluf, 1984, pp. 219-220). On the other side, equity funding results in more shares and, therefore, to a higher payout amount of the dividend (Blundell-Wignall and Roulet, 2013, p. 2).

3.4 TRADE-OFF THEORY

The central idea of the trade-off theory is that an optimal degree of leverage exists, bankruptcy costs and an optimal tax shield regarding the leverage (Stiglitz, 1972, p. 458; Kraus and Litzenberger, 1973, p. 918; Berens and Cuny, 1995, p. 1185; Fama and French, 2002, p. 1; Sarkar and Zapatero, 2003, p. 834; Ju et al., 2005, p. 259; Hackbarth, Hennessy and Leland, 2007, p. 1390; Hovakimian, Kayhan and Titman, 2012, p. 315; Serrasqueiro and Caetano, 2015, p. 446). The critical examination of market conditions (perfect capital market, no taxes, no difference between debt and equity in corporate funding) of the Modigliani and Miller has been performed in several studies (Baxter, 1967, p. 395; Stiglitz, 1969, p. 784; Kraus and Litzenberger, 1973, p. 911; Robichek and Myers, 1966, p. 4, 16; Baumol and Malkiel, 1967, p. 567). Kraus and Litzenberger developed a formal state-preference approach for the trade-off theory (Kraus and Litzenberger, 1973, pp. 911-922). After other studies followed, the process was called the trade-off theory (Scott, 1976, pp. 33-54; Kim, 1978, pp. 45-63; Schneider, 2009, p. 14). The trade-off theory promotes an optimal, value-maximizing debt-equity ratio (Schneider, 2009, p. 14). The maximum enterprise value depends on the debt-equity ratio and is reached if the tax shield of leverage still covered the expected bankruptcy costs (Schneider, 2009, p. 14). Remarkably, within the trade-off theory, a hierarchy between the funding sources can be identified (Hackbarth, Hennessy, and Leland, 2007, p. 1392). Within the debt funding, bank debt is preferred to public debt (Hackbarth, Hennessy, and Leland, 2007, p. 1392). Myers linked further impact factors to the trade-off theory (Myers, 1989, p. 82).

Table 12: Further determinants of the trade-off theory

Determinants	**Influence on the tax shield**	**Influence on the bankruptcy costs**
Profitability	+	-
Tangible assets	+	-
Corporate risk	+/-	-

Source: Schneider, 2009, pp. 14-15; Myers, 1989, pp. 82-83

With increasing profitability, the tax shield (i.e., the tax benefit of interest payments on debt) becomes more attractive (Schneider, 2009, p. 14). Furthermore, higher profitability reduces the default probability and, therefore, the bankruptcy costs (Schneider, 2009, p. 14). When the amount of tangible assets increases or the corporate risk is lower, the bankruptcy costs decrease (Schneider, 2009, p. 14). More tangible assets increase the tax shield through higher interest payments for the asset funding or depreciations.

3.5 BEHAVIORAL FINANCE

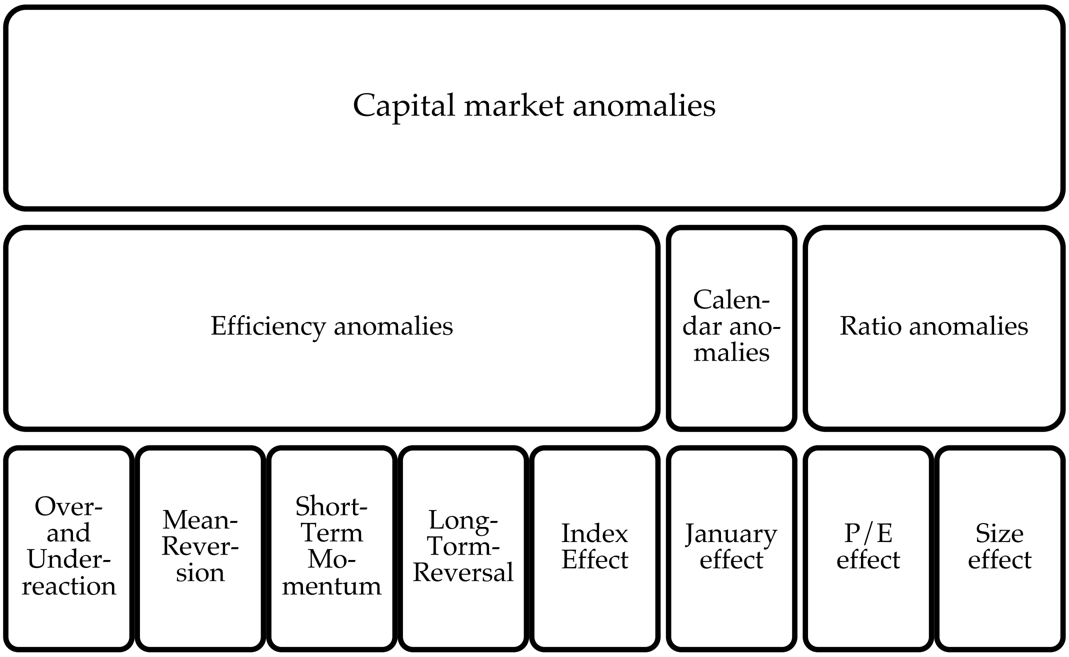
Behavioral finance was placed for the first time by Shiller in 1981 (Shiller, 1981).[3] Because the market efficiency could not explain return patterns on the stock price indexes or other evidence, behavioral approaches are considered and developed (Shiller, 1981, p. 434; Shiller, 1986, p. 503). In general, behavioral finance can be described as follow (Fuller, 2000, p. 1):

- The human decision-making behavior, psychology findings, the previous capital market theory, and the economic principles are integrated into behavioral finance.
- The behavioral finance attempt to determine the observed anomalies.
- Behavioral finance attempts to study the behavioral error and investors' expectation error for adding the behavioral finance scope.

[3] The contents in chapter 3.5 and 3.6 have been developed based on the quoted sources and my unpublished M.Sc. thesis in 2015. The M.Sc. thesis was written in German and has the title "Behavioral Finance—Empirische Untersuchung der Risikoaversion zur Antizipation der Marktentwicklung des deutschen Aktienmarktes".

Behavioral finance adjusts two main assumptions of the capital market theory. First of all, irrational investors are considered behavioral finance (Rapp, 1997, p. 82). The second adjustment is that arbitrage gains are only limited possible (Barberis and Thaler, 2002, pp. 1059-1061). Both adjustments do not confirm the market efficiency hypothesis and are the foundation for long-term differences of an asset's market value from its fundamental value (Lamberti, 2009, p. 7). The increasing number of anomalies on the financial markets leads to behavioral knowledge for explaining the anomalies (Shiller, 1986, p. 503). Thus, an anomaly is understood as a significant difference in behavior, already postulated in a previous theory (Roßbach, 2001, p. 7). The abnormalities can be structured as follows.

Figure 21: Capital market anomalies



Source: Roßbach, 2001, p. 8

First of all, the empirically observed return development is described as price anomalies or capital market anomalies (Eustermann, 2010, p. 97). The observation does not confirm the previous neoclassical theory (Eustermann, 2010, p. 97). Furthermore, the capital market anomalies can be differentiated into efficiency anomalies, calendar anomalies, and ratio anomalies. The systematic deviations of assets from their fundamental value are known as efficiency anomalies and have different forms (Eustermann, 2010, pp. 97-98). The differences could not be explained through the market efficiency theory (Eustermann, 2010, pp. 97-98). One form of the efficiency anomalies is the over-reaction and under-reaction, which describes investors' preference not to consider relevant information into their asset valuation and instead consider the historical asset performance (DeBondt and Thaler, 1985, p. 804; Barberis, Shleifer and Vishny, 1998, pp. 307-308). Furthermore, the mean-reversion is an empirical finding that a share price on the long-term is performed in a cyclic pattern, based on autocorrelation observation (Fama and French, 1988, p. 265; Poterba and Summers, 1988, p. 20). Additionally, the short-term-momentum summarizes the empirical finding that the share prices' positive performance follows after a positive performance on short to mid-term (Daniel, 2001, pp. 532-533; Jagadeesh and Titman, 1993, p. 65; Rouwenhorst, 1998, p. 267, 283). Just like the short-term-momentum, the long-term-reversal does not confirm the random-walk assumption and describes a long-term positive asset price performance return afterward into a negative performance (Chopra, Lakonishok and Ritter, 1992, p. 261; Fama and French, 1988, p. 247, 265; Richards, 1997, pp. 2142-2143). The last anomaly within the efficiency anomalies is the index effect. The index effect describes the observation that asset prices enjoy a not explained price increase when a share is listed in an index (Harris and Gurel, 1986, p. 828). The statistically significant correlation of price anomalies with a certain period/point in time is called calendar anomaly and were observed in several studies (French, 1980, pp. 55-69; Haugen and Jorion, 1996, pp. 27-31; Agrawal and Tandon, 1994, pp. 83-106; Yakob, Beal and Delpachitra, 2005, pp. 298-315). Another group of anomalies is the ratio anomalies. The ratio anomalies include mainly the P/E ratio effect and the size effect. The P/E ratio effect as a ratio anomaly describes the negative relationship between the P/E ratio and the profit (Basu, 1977, p. 680; Basu, 1982, p. 129). Beside the P/E ratio effect, the size effect describes the observation that -on average- the profit of corporates with a low market capitalization is higher than the profit of corporates with a high market capitalization (Banz, 1981, p. 3; Fama and French, 1992, p. 427; Stock, 2002, p. 119). The foundations of decision-making in behavioral finance are given in Kahnemann and Tversky's prospect theory and not in the expected utility theory (Kahnemann and Tversky, 1979). The prospect theory is a decision model considering uncertainty (Daxhammer and Fascar, 2017, p. 179). The prospect theory's main difference against the expected utility theory is that the prospect theory is a descriptive approach to explain human behavior (Daxhammer and Fascar, 2017, p. 180). Kahnemann and Tversky differentiated the decision making into two phases: editing and evaluation (Kahnemann and Tversky, 1979, pp. 274, 277-278). The editing phase contains six sub-processes. With the sub-phases, the decision- making alternatives can be analyzed (Kahnemann and Tversky, 1979, p. 274). The following table describes the sub-phases.

Table 13: 6 sub-phases of the editing phase

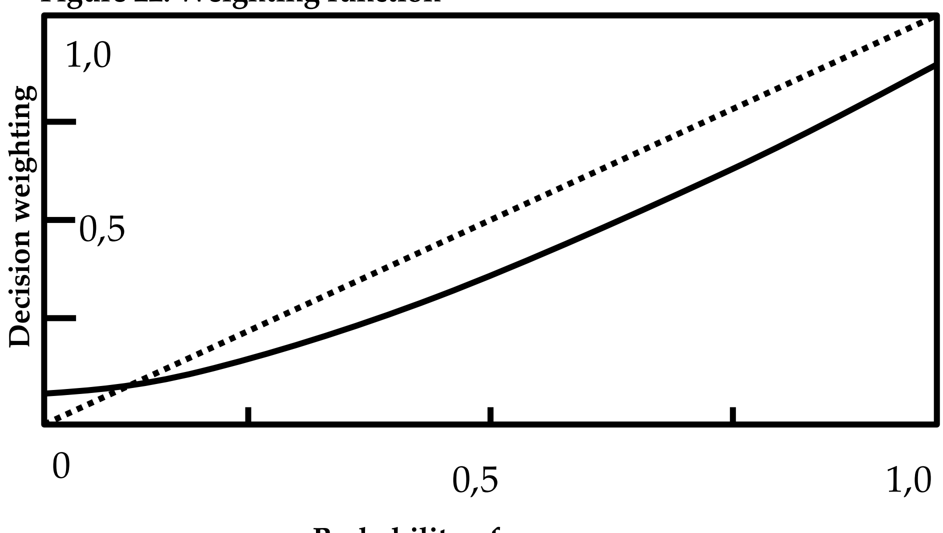
Phase	Description
Coding	Decision-makers code the consequences of their decision into wins and losses. Therefore, a neutral reference point is necessary.
Combination	The decision alternatives with equal probabilities of occurrence are summarized and are evaluated in a summarized form.
Segregation	A separation of risk and risk-free components: Safe wins are isolated, and the risky alternatives are in the scope.
The sub-phases coding, combination, and segregation are implemented for each decision alternative. The following sub-phases refer to a set of decision alternatives.	
Cancelation	The cancelation describes the adjustment of decision alternatives from identical and significantly unlikely components.
Simplification	Round up and round down of the probability of occurrence.
Detection of dominance	In the last sub-phase stochastically, dominant alternatives are eliminated.

Source: Modeled on Kahnemann and Tversky, 1979, pp. 274-275

After disassembling and preparing the decision opportunities in the editing phase, the decision opportunities with their components will be evaluated in the evaluation phase (Kahnemann and Tversky, 1979, p. 2797). The evaluation is performed in two functions. The first function is the value function, which consists of 3 characteristics (Laux, Gillenkirch and Schenk-Mathes, 2018, pp. 167-168). First of all, the valuation depends on a reference point and is subjective (Kahnemann and

Tversky, 1979, p. 277, 279). Second, the valuation is a relative concept (Kahnemann and Tversky, 1979, p. 278). A win's value is lower than the equal value of a loss (Kahnemann and Tversky, 1979, p. 278). Therefore, and third, the value function has a convex curve for losses and a concave curve for gains (Kahnemann and Tversky, 1979, p. 279). As a result, decision-makers tend to act more risk-averse in the gain area (Kahnemann and Tversky, 1979, p. 278). In the loss area, the curve's convexity means that the behavior is more risk-averse (Kahnemann and Tversky, 1979, p. 278). The second function of the evaluation phase is the weighting function. In this function, the decision-makers modify the objective probabilities of occurrence in their decision making (Kahnemann and Tversky, 1979, pp. 280-281). The probabilities of occurrence are misevaluated due to subjective influences. This leads to over-reaction and under-reaction and impacts investors' risk aversion (Daxhammer and Fascar, 2012, p. 170). The following figure shows the misevaluation of individuals.

Figure 22: Weighting function



Source: Kahnemann and Tversky, 1979, p. 283

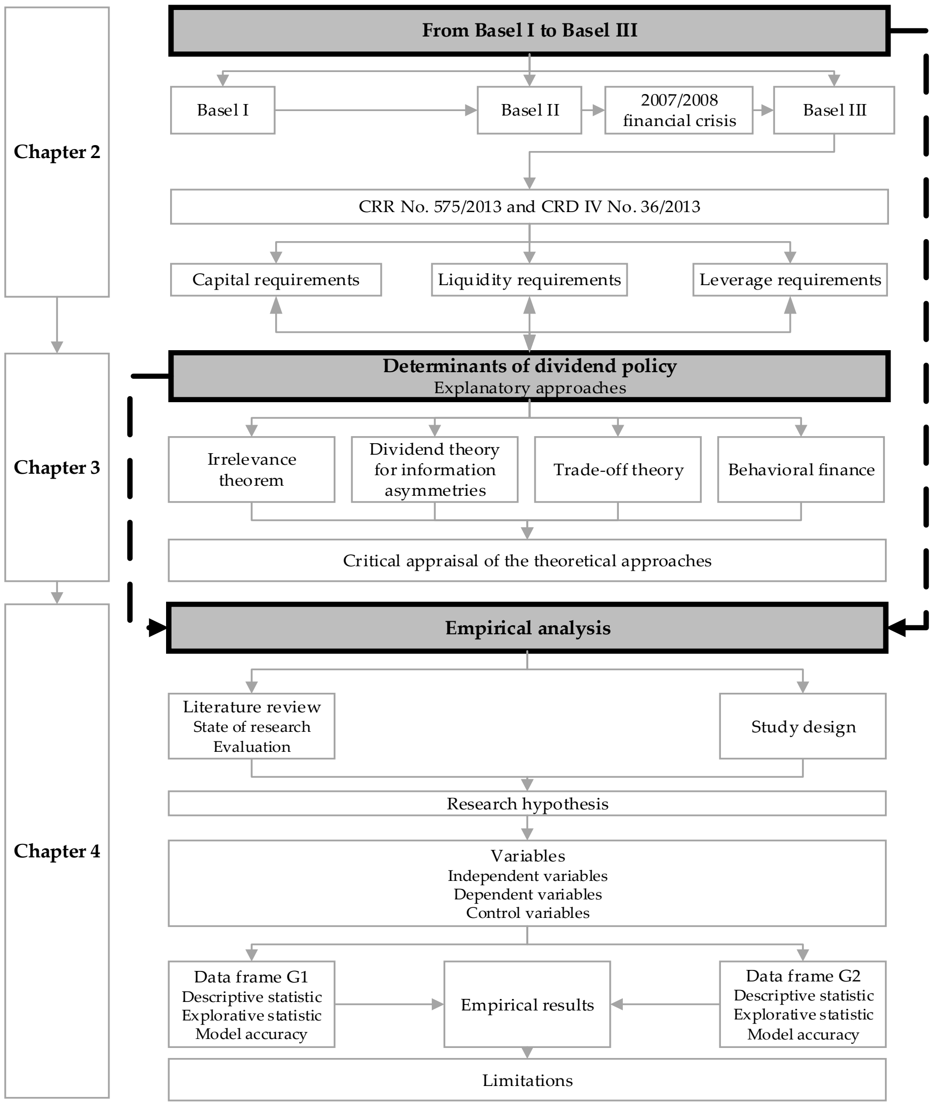
The objective probability is shown as a dotted line, while the subjective decision weight is shown as a solid line (Kahnemann and Tversky, 1979, p. 282). Lower probabilities are overweighted, and higher probabilities are underweighted. Adopted on the dividend policy, the prospect theory directly affected the decision making of investors. The perception of bias and heuristics influence the market evaluation of investors. The payment of dividends is generally uncertain and entails several risks regarding the level of information asymmetries.

3.6 CRITICAL APPRAISAL OF THEORETICAL APPROACHES

Miller and Modigliani developed the first approach to explain the structure of capital and the dividend policy and that any forms of a dividend policy are equal (Meyer, 2018, pp. 9-10; Topalov, 2011, p. 3; Prokot, 2006, p. 59; Grullon and Michaely, 2002, p. 1652). Especially the assumptions of no information asymmetries, costless access to information, no transactions costs, and a rational behavior were criticized in this regard (Ahmeti and Prenaj, 2015, p. 922; Titman, 2002, p. 101; Glickman, 1997, p. 272; Gordon, 1989, p. 26, Ross, 1988, p. 127; Miller, 1988, p. 100; Gottardi, 1995, p. 192). The assumptions of no information asymmetries were a trigger for further theoretical developments so that, for example, an agency theory, signaling theory, or a pecking order theory were developed. There are information conflicts and asymmetry between shareholders and corporates management (Strzyz, 2012, p. 16; Schulz, 2006, p. 81; Morris, 1987, p. 47, Harris and Raviv, 1991, p. 300; Prokot, 2005, p. 95). Therefore, the theories of information asymmetries fit adequately to the information asymmetries. But the theories have mostly examined partial aspects (for example, agency costs and monitoring of managers within the agency theory). Only behavioral finance is considered irrational behavior of individuals (Rapp, 1997, p. 82). The observed capital market anomalies supported behavioral finance because the anomalies were not explained through the previous classical theory of dividends (Shiller, 1981, p. 434; Shiller, 1986, p. 503). Remarkably, misevaluation and mispricing within the perfect capital market are advantageous, but the theoretical framework is not doubted. The assumptions changed over time. The assumptions fit more and more to reality so that the theory development become more descriptive. The CRD IV prohibits non-conformity of the CCB as a capital distribution (BCBS, 2011, pp. 54-55). Therefore, a direct link between the CRR and the dividend policy exists and its theoretical frameworks. Within this dissertation's empirical investigation, the considered banks' dividend policy will be classified at an aggregate level to relate the observed dividend policy with the presented theories.

After explaining the regulatory framework in chapter 2, the various scientific approaches to dividend policy in chapter 3, and also the relationship between these areas (cp. figure 18 and its explanations at the end of chapter 2), the next step is to examine this relationship empirically in a quantitative study. In particular, it is examined whether and to what extent the regulatory requirements influence the dividend policy. The following figure shows the relationship of chapter 2, 3 and 4.

Figure 23: Relationship and joining of chapter 2 and 3 to chapter 4



Source: Own figure

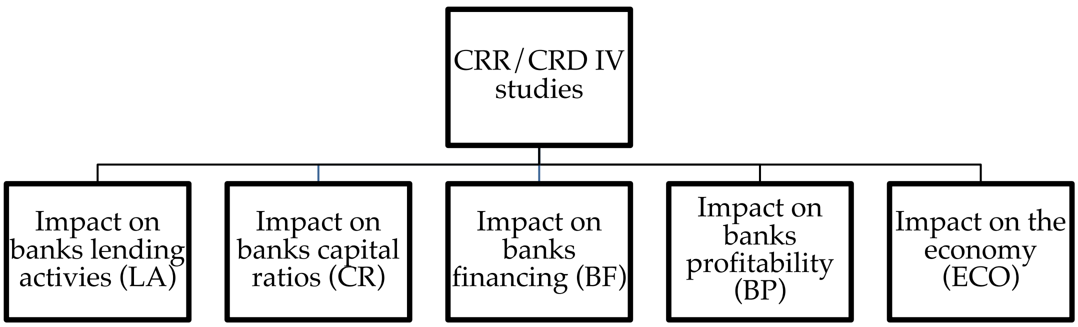
Therefore, the empirical analysis includes the regulatory requirements (cp. chapter 2) and the dividend policy (cp. chapter 3) in terms of measurable variables in order to perform the quantitative study. Hence, the following chapter 4 empirical analysis follows.

4 EMPIRICAL ANALYSIS

4.1 LITERATURE REVIEW

Several studies investigated the impact of CRR/CRD IV. The ECB, EBA, IMF, and the national authorities have regularly investigated the CRR/CRD IV package's impact. But in each study, they investigated partial areas so that a research area structure is not established up to now. The previous studies can be structured as follows to create transparency in the literature review:

Figure 24: Structure of the previous CRR/CRD IV studies



Source: Own figure

4.1.1 State of research

For an introduction of the literature research, the Basel III Monitoring Report in its highlights is presented (BCBS, 2019). Afterward, a summary of several scientific studies is presented. The Basel III Monitoring report is a semi-annual descriptive report published by the BCBS and consists of data of 181 banks, provided by the individual banks and their national supervisors (BCBS, 2019, p. 1, 15). The report has the following main results for the fully phased-in initial Basel III framework (BCBS, 2019, pp. 2-3):

1. The average CET 1 ratio remained at 12.7 % for large internationally acted banks (group 1) and 15.4 % for other banks (group 2) on 31 December 2018.

2. The LR on 31 December 2018 for group 1 banks was 6.0 %, and for group 2 banks 5.3 %. It is already visible that large institutions have a higher LR and, therefore, more vulnerable to the financial crisis.

3. The LCR as a newly developed ratio from Basel III was at 136.2 % for group 1 banks and 177.2 % for group 2 banks on 31 December 2018. It can be seen that larger institutions have a lower liquidity buffer compared to smaller institutions.

4. The NSFR as a further new developed ratio from Basel III was at 116.3 % for group 1 banks and 120.0 % for group 2 banks on 31 December 2018. It can be seen that larger institutions have a lower stable funding ratio compared to smaller institutions.

5. Remarkable are the determinants of Tier 1 ratio changes. Since 2014, the determinants of the changes shift in favor of an immediate increase of the Tier 1 capital. The change in the RWA is considerably lower than the difference in the Tier 1 capital. The change suggests that the banks have not reduced their business activity but maintain their extent and increase their Tier 1 capital basic.

In addition to the descriptive statistic, several CRR/CRD IV impact studies were performed and related to the research structure and described as follows:

Table 14: Summary of CRR/CRD IV impact studies

	BIS (2010)	**Smith, Grill, and Lang (2017)**	**Fender and Lewrick (2016)**	**Cosimano and Hakura (2011)**	**Slovik and Counéde (2011)**
Research area	ECO	CR	ECO	LA	CR/LA/BF/ECO
Dataset	10.718 banks worldwide (73.662 obs.)	655 obs. of EU banks	70 banks worldwide (420 obs.)	100 largest banks worldwide, commercial banks that experienced a crisis between 2007-2009, commercial banks that experienced not a crisis between 2007-2009	No information about the number of obs. Period: 2006-2009; 2015, 2019
Research technique	RFM CPM CSTM	OLS regression	OLS regression	GMM regression	Descriptive statistic

Significant variables *** **at 1 %** ** **at 5 %** * **at 10 %**	Economic net benefits Capital ratio LCR NSFR	Tier 1 capital ratio*** Log of Total assets** Total loans/Total assets** ROA* Loan to deposit ratio*** Leverage ratio proxy*** Dummy (LR < 3)** GDP growth** Government debt to GDP*	Customer loans*** Bank loans and deposits with banks** Held-to-maturity securities***	Interest expense ratio*** Interest expense ratio*initial equity-to-asset ratio*** Non-interest expense ratio*** Non-interest expense ratio* initial equity-to-asset ratio*** Non-performing loans ratio* initial equity-to-asset ratio*** Logarithm of assets**	-
Findings	Net benefits for capital ratios result from a reduced probability of a banking crisis.	Banks have an incentive to increase their risk-taking to fulfill the liquidity requirement, but the simultaneous increase of bank capital will compensate for more than the effect.	Basel III leads to macroeconomic benefits. The related costs are overestimated.	The largest banks have to increase their loan rates by 16 bp to fulfill their equity to asset ratio by 130 bp.	A 100 bp increase in bank capital leads to a rise of 14.4 bp in lending spreads.

	Boora and Kavita (2018)	**Giordana and Schumacher (2017)**	**King (2013)**	**Bahaj et al. (2016)**	**Bridges et al. (2014)**	**Galiay and Maurin (2015)**
Research area	BP	BP/CR	BP	LA	LA/CR	BF/ECO
Dataset	21 Indian banks for 10 years	50 largest banks in Luxembourg from 2003 to 2011	549 banks from 15 countries	18 UK banks period 1989 to 2007 (589 obs.)	53 UK banking groups over the period from 1990 to 2011 (1.590 obs.)	31 EU banks from 10 countries period 2005 to 2013
Research technique	ANOVA	OLS/FE/GMM regression	Balance sheet and P/L simulation	The linear local projection model	Panel regression	PCA/OLS
Significant variables ***** at 1 %** **** at 5 %** *** at 10 %**	Pre-Basel III (2007-2012) to Post-Basel III (2013-2017)***	GMM Regression: ROA_{t-1}***, CAR_{t-1}* ln (NOR_{t-1})*, ln (ASF_{t-1})*, $Size_{t-1}$***, $EFF_{hp,t}$***, ΔIR*** Cl_t***, C_{st}**	-	Credit growth RWA growth Capital ratio Capital requirement	Trigger ratio (1-4)**/* Capital (1-4)*** Tier 1 ratio Leverage ratio	Spread to the loan sovereign of the closest maturity**/* Spread to 3M-Euribor**

Findings	The implementation of Basel III leads to a decrease in the ROE and ROA.	The liquidity regulations (LCR and NSFR) lead to a decrease in the probability of default. Basel III's impact on banks' profitability is not mainly determined but influenced by their funding structure.	The fulfillment of the NSFR (based on 2009 values) lead to a 70-88 bp reduction of the net interest margin.	A 25 bp increase of the capital requirements leads to a lending cut of 60 bp than banks without capital regulations.	A rebuilding of buffers follows an increase in capital requirements.	A 1 sd increase of the capital and leverage index reduces one sd economic risk by 20 bp.

	Noss and Toffano (2014)	**Maurin and Toivanen (2012)**	**Mésonnier and Monks (2015)**	**Dermine (2015)**
Research area	LA/ECO	CR/LA	LA/ECO	ECO
Dataset	UK banks period 1986 to 2010	51 EU banks period 2005 to 2011	198 European banks for 09/2011, 12/2012, and 06/2012	na
Research technique	VAR	GMM regression	Multivariate regression	Confidence level (99 %)
Significant variables ***** at 1 %** **** at 5 %** *** at 10 %**	PNFC*** CRE*** Non-CRE *** Households*** NIOFC**	Lagged capital ratio*** Provisioning over total assets*** Expected default frequency*** Log-odds EDFs***	Shortfall/RWA*/**, Stressed**, Unemployment** $\frac{Sov.Bonds}{Assets}^{***}$ $\frac{Dom.Sov.Bonds}{Assets \times Stressed\ Country}^{***}$	na
Findings	The coefficient of the lending growth is for all sectors positive during a shock in capital ratio.	Banks with a lower capitalization have a more significant challenge to fulfill the capital requirements and therefore restrict their lending activity.	A decrease in the shortfall/RWA ratio leads to a lower loan growth rate (120 bp lower than in the control group).	There are several causes for a lending portfolio with different correlation coefficients and PDs. If the loan portfolio is diversified, the capital requirements decrease, but the bank run's PD increases due to a lower capitalization.

Source: Own table

4.1.2 Evaluation

Section 4.1.1 shows that several impact studies for the research area of the capital requirements exist. Most of the investigations used regression models to estimate the influence of the CRR/CRD IV (Smith, Grill, and Lang, 2017; Fender and Lewrick, 2016; Cosimano and Hakura, 2011; Giordana and Schumacher, 2017; Bridges et al., 2014; Galiay and Maurin, 2015). The BIS study used economic models to assess the benefits and costs for the economy and derive recommendations for dealing with the CRR/CRD IV (BIS, 2010, no page). King (2013) is a noteworthy study: a balance sheet and P/L simulation were performed, and afterward, the impact of the CRR/CRD IV package was assessed, especially the LCR and the NSFR for the liquidity requirements were the focus (King, 2013, pp. 4147, 4149-4151). The study cannot claim their results as significant. Compared to the other studies in table 14, King considered the NSFR and LCR and the related balance sheet and P/L changes on factual previous financial statements and simulated direct balance sheet changes. The other works used statistical modeling. Boora and Kavita (2018) should be considered as well. It is notable that the study compared the ROE and ROA before (2007-2012) and after (2013-2017) the Basel III implementation (Boora and Kavita, 2018, pp. 55-56). The ROE and ROA after the Basel III implementation were lower than before the performance (Boora and Kavita, 2018, p. 55-56). The study of Giordana and Schumacher stated in essence that the liquidity framework (LCR and NSFR) encumbers the profitability (Giordana and Schumacher, 2017, p. 11). The results confirm the basic principle of this dissertation that the CRR/CRD IV package's implementation is at the expense of banks' profitability. The study of Dermine showed an interesting phenomenon (Dermine, 2015). A loan portfolio with a defined PD was simulated with different correlation coefficients (Dermine, 2015, p. 272). A lower correlation leads to a lower capital requirement, but the lower capitalization leads, in turn, to a higher probability for a bank run (Dermine, 2015, pp. 272, 274-275). The study examined a partial area of the CRR/CRD IV. Other determinants for bank stability are not considered (for example, profitability, bank size, etc.). Since most of the studies aimed to identify and explain the CRR/CRD IV influence on other financial ratios, the regression model (OLS, fixed effect regression GMM, multivariate regression) was used. Several studies in the CRR/CRD IV research area impact profitability (Smith, Grill, and Lang, 2017; Cosimano and

Hakura, 2011; Boora and Kavita, 2018; King, 2013). But the research area of the impact on the dividend policy based on intact profitability is unexplored and presents the research gap in this dissertation.

4.2 STUDY DESIGN

To address the research question, information about CRR/CRD IV participated banks are necessary. Furthermore, data for the period is needed because the changes before and after implementing the CRR/CRD IV and the financial crisis should be considered. Therefore, the 2005 to 2019 period is chosen. In principle, there are several sources of information available. However, only a few of them are applicable because only the Bloomberg and Thomson Reuter data are complete (see table 15). The most known and largest data sources were compared in the following table.

Table 15: Comparison of several sources of data

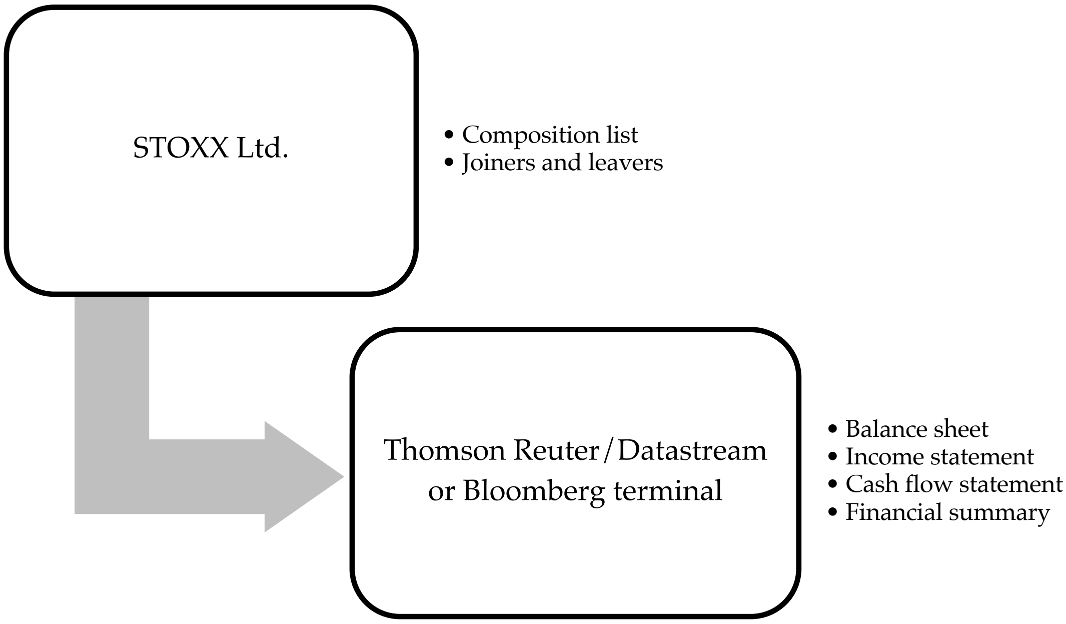
	ECB SDW	EBA risk analysis and data	Thomson Reuter/Datastream	Bloomberg terminal
Extent of data	All CRR/CRD IV affected banks	All CRR/CRD IV affected banks	All capital market listed bank	All capital market listed bank
Available variables	Aggregated balance sheet composition and profitability, capital adequacy, leverage, asset quality, and funding	Bank by bank data on capital positions, risk exposure amounts, leverage exposures, and asset quality	Bank by bank data on the balance sheet and income statement	Bank by bank data on the balance sheet and income statement
Available period	Since Q2 2015	Since Q3 2018	Since 2004	Since 2004
Advantages	- Already summarized - Data set includes only CRR/CRD IV affected banks	- Bank by bank data - Data set includes only CRR/CRD IV affected banks	- Bank by bank data - Data includes CRR/CRD IV affected banks (capital market listed banks are too big to be not considered by CRR/CRD IV) - Data available since 2004	- Bank by bank data - Data includes CRR/CRD IV affected banks (capital market listed banks are too big to be not considered by CRR/CRD IV) - Data available since 2004

Disadvantages	- Data available since Q2 2015 - Aggregated data does not allow statements about the distribution	- Data available since Q3 2018 - No detailed balance sheet and income statement information - The database includes banks that are not capital market listed	- Data are not standardized (balance sheet and income statement have not the same structure)	- Data are standardized - Supervisory information (CET 1) is not available

Source: Own table

In ensuring a high-quality database for the empirical investigation, the information is acquired from three sources to achieve a possible complete database.

Figure 25: Phases and sources of data collection



Source: Own figure, 2020

The banks of the index STOXX Europe 600 banks were considered. Due to the broader database, the STOXX Europe 600 banks' information, the Bloomberg terminal, and the Thomson Reuter/Datastream were used. In providing a short overview of the STOXX Europe 600 banks, the essential facts of the STOXX Europe 600 banks are listed below:

- Provider of the index is STOXX Ltd., a subsidiary of Qontigo (STOXX, "Company overview," https://www.stoxx.com/about-us, accessed 28th February 2020).
- Qontigo is a joint venture of Axioma, DAX, and STOXX and is part of the firm Deutsche Börse (STOXX, "Company overview," https://www.stoxx.com/about-us, accessed 28th February 2020).

- On the 28th February 2020, STOXX Ltd. has more than 10.000 indices (STOXX, "Company overview," https://www.stoxx.com/about-us, accessed 28th February 2020).
- STOXX Ltd. was founded in 1997 (STOXX, "History," https://www.stoxx.com/history, accessed 28th February 2020).
- One of the best-known indices is the EURO STOXX 50, established in 1998 (STOXX, "History," https://www.stoxx.com/history, accessed 28th February 2020).
- STOXX understands itself as a global index provider and has a base of more than 500 clients (STOXX, "Global footprint," https://www.stoxx.com/global-footprint, accessed 28th February 2020).
- The STOXX has 19 supersectors (STOXX, 2020, p. 1).
- The categorization of a company into an index is determined by its primary revenue source (STOXX, 2020, p. 1).
- The inclusion or exclusion of banks in the index is determined by their free-float and market capitalization (STOXX, 2020, p. 2; STOXX, 2019, p. 13).

Table 16 overviews the critical facts of the STOXX Europe 600 banks.

Table 16: Key-facts of the STOXX Europe 600 banks on 31st January 2020

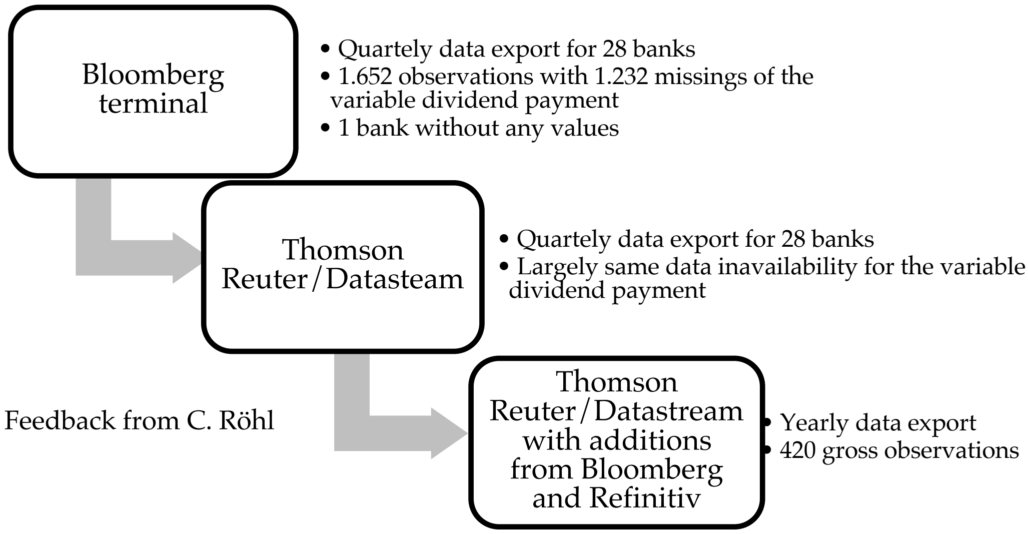
Key-fact	
Market capitalization	975.2EUR bn.
Free float	830.2 EUR bn.
Mean	18.4 EUR bn.
Median	10.4 EUR bn.
Largest	135.1 EUR bn. (16.3 %)
Smallest	1.9 EUR bn. (0.2 %)
Turnover last 12 months	2.1 %
Return 1Y	3.6 %
Return 3Y	-9.8 %
Return 5Y	-9.6 %
Volatility 1Y	18.7 %
Volatility 3Y	16.9 %
Volatility 5Y	22.8 %

Source: STOXX, 2020, p. 1

First, general information about the STOXX Europe 600 banks are obtained from the STOXX Ltd. website. Significantly, the composition of the index is relevant and needed to ensure a continuous data set. The STOXX Europe 600 banks include 45 banks with a total market capitalization of 1.065 EUR bn per 31st January (STOXX, 2020, p. 1). Since the STOXX Europe 600 banks introduction in 1998, 282 records in the leavers and joiners list were recorded (Thomson Reuter/Datastream, accessed 14th February 2020). The amount includes the first-time inclusion into the index. Since 2005, 17 banks joined the STOXX Europe 600 banks. Therefore, the used data set consists of 28 banks. The number of joiners since 2005 agreed with the volatility of the index in general. But the movement can be relativized, as the remaining 28 banks have a market capitalization of 845 billion EUR and can be seen as representative (Thomson Reuter, 2020, accessed 14th February 2020). The largest European banks also showed changes in their market capitalization and their free float, but their value is higher than that of other banks. Therefore, an adjustment of

17 banks resulted in a decrease of the market capitalization from 1.065 EUR bn. to 845 EUR bn. of the adjusted index. Several steps and considerations were necessary to obtain the data. The following figure is created to create transparency of the steps of data collection:

Figure 26: Steps of data obtaining



Source: Own figure

The first idea was to obtain the quarterly data for the period 2005 to 2019 from Bloomberg. The quarterly rhythm should ensure the highest possible number of observations. The gross number of 1.652 gross observations has many quarterlies based on missing values and led to a sharp reduction of observations. For example, the variable dividend payment has 1.232 missing values and represent 74,6 % of the total observations. Furthermore, one bank (Bank of Ireland) has no values across all variables. A nearly similar result of data reduction for quarterly data was found at the Thomson Reuter/Datastream. The high degree of quarterly data unavailability is caused by different dividend frequencies (Röhl, 2020, see appendix 7). Therefore, a yearly based data set is necessary (Röhl, 2020, see appendix 7). Hence, the first idea was rejected, and Thomson Reuter/Datastream requested an annual based data set. The data set contains 28 banks with the balance sheet and P/L data so that the number of gross observations is 420 (yearly based). The following table shows the key facts of the data set.

Table 17: Key facts of the used data

The gross number of banks	**45**
-Banks that joined the index since 2005	-17
= Net number of banks	**28**
= Gross number of observations (15 years for each bank)	420
-Missing values	-129
= Net number of observations	**291**

Source: Own table, based on Thomson Reuter/Datastream and Bloomberg terminal, accessed 28th February 2020

The data set contains six observations collected afterward with seven values from Bloomberg and 22 observations collected with 22 values from Refinitiv. Refinitiv is a sub-source from Thomson Reuter/Datastream. Alternatively, a value imputation could be used to compensate for the missing values. To avoid a value adjustment in the raw data and create bias in the empirical study's early stage, no value imputation was applied (Cleff, 2008, pp. 25-26). Additional information for the data corrections is given in the appendix 5.

Furthermore, it should be noted that the variables NSFR, LCR, and LR are limited, as the binding requirement starts in 2018 (BIS, 2018, p. 2). There are 15 observations with an NSFR, 88 observations with an LCR, and 90 observations with an LR. The inference statistic considers the available observations for the LCR and LR to ensure a resilient sample. The NSFR is not used because the sample size for the variable is not valid enough. In giving an overview, the following term sheet is created:

Table 18: Term sheet for the data collection

Data sources	STOXX Ltd. Thomson Reuter/Datastream incl. Refinitiv Bloomberg terminal
Data export Thomson Reuter/Datastream incl. Refinitiv	14th February 2020 28th February 2020
Data export Bloomberg	20th February 2020
Period	2015 to 2019
Time interval	Yearly
Data basis	STOXX Europe 600 banks
The gross number of banks	45
Net number of banks	28
The gross number of observations	420
The net number of observations	291

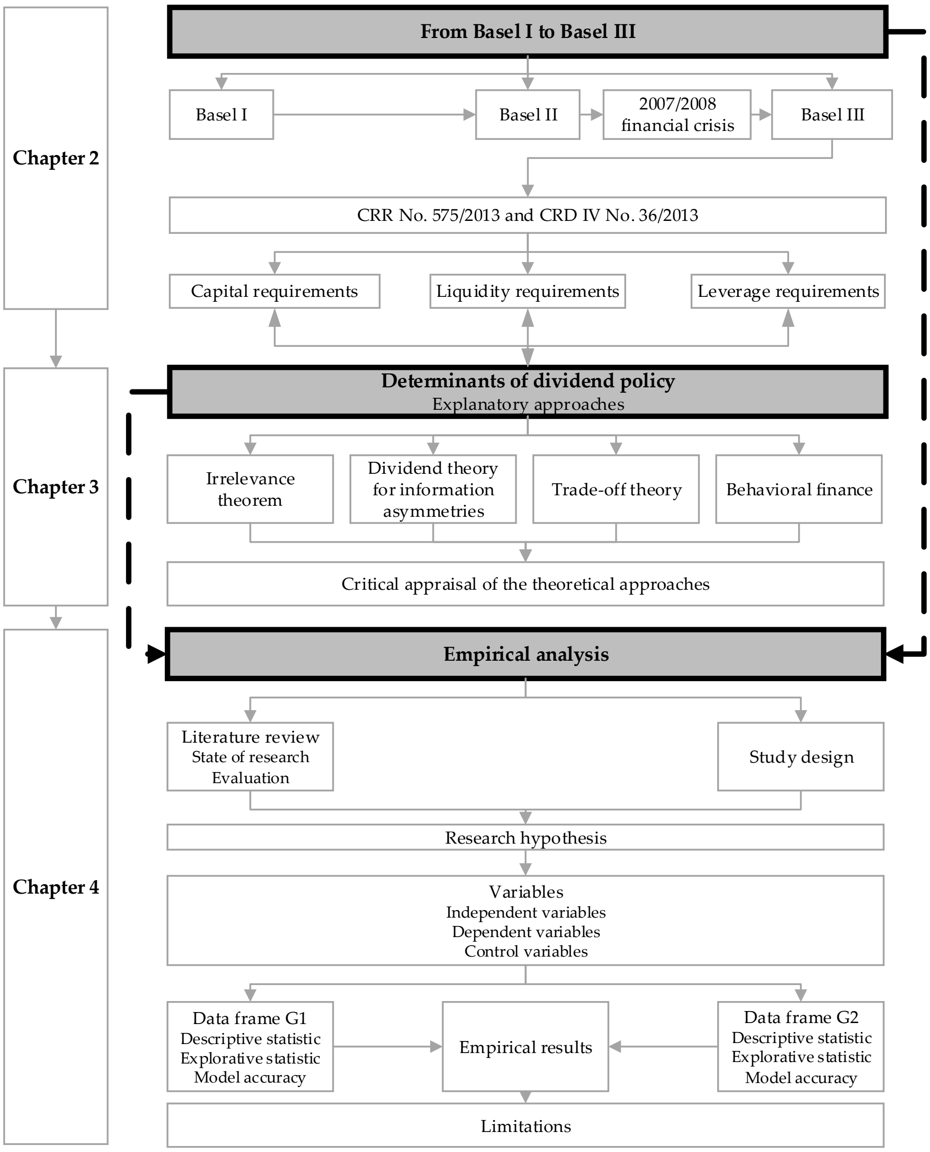
Source: Own table

Since the new relationship between the CRR/CRD IV and the dividend policy is the focus of this dissertation and is based on a quantitative investigation with statistical tests, it is necessary to formulate the research hypothesis, which is done in the next chapter.

4.3 RESEARCH HYPOTHESIS

Since the previous chapters explained the regulatory requirements, the dividend policy, and shown an evidence of the interdependencies between the CRR/CRD IV and the dividend policy, its necessary to define a research hypothesis. The following figure shows the described relationships.

Figure 27: Derivation of the empirical study



Source: Own figure

In particular, the interdependency of the regulatory requirements and the dividend policy (for example the previous mentioned example of the sanctioning of a capital distribution constraint if the defined capital requirements are not met, cp. chapter 2.4.1.1) and the current state of research (several examinations of the impact of the regulatory requirements (cp. chapter 4.1.1 and 4.1.2), but no examination of the regulatory requirements on the dividend policy, led to the following central research hypothesis:

The CRR/CRD IV, with its liquidity, capital, and risk requirements, influences European banks' dividend payout ratio. Statistically significant, the influence of higher capital, liquidity, and risk requirements on the dividend payment will focus on the empirical study.

Furthermore, several earnings ratios are considered because they are a prerequisite for a dividend payment. The dividend payout ratio covers the dividend policy for the observed banks. Furthermore, several variables for the capital, liquidity, and risk area are considered.

Therefore, the generated hypothesis based on the findings of chapter 2, 3 and 4.1, but also consider the knowledge of Popper and Sedláček. The critical rationalism postulates that any scientific theory is fundamentally unprovable and that only the verification of possible errors of the theory is relevant and based on these foundations the derivation of a hypothesis has not to follow a logical reasoning and reconstruction (Schurz, 2004, p. 27-28; Sedláček, 2012, p. 373).

In the further course of the work, the hypothesis is divided into several test hypotheses (H0 and H1). It is necessary to define measurable variables to test the formulated hypothesis, which are presented in the next chapter.

4.4 VARIABLES

In the following chapter, the considered variables are presented with their formulas for operationalizing the variables. The variables are differentiated into independent, dependent, and control variables. After variables definition, a variable categorization follows for providing the basis for selecting the statistical instruments.

4.4.1 Independent variables

The independent variables with their measurement and their related research area are described in table 19. The assigned research area was based on the underlying revision of the regulatory requirements, especially the capital, risk, and liquidity prerequisites (cp. chapter 2.4). For the capital area, the variables TCR, TIER1, and LR coefficients are used. These variables are suitable for statements on the capital and leverage the structure of the banks. Furthermore, the reason for using these variables is that the variables are legally required. For the liquidity area, the variables LCR and the NSFR, the cash to total assets ratio (CTTA), the total debt to total assets ratio (TDTTA), and the full deposit to total assets ratio (TDETTA) are used. These variables NSFR and LCR are legally required. The variables NSFR, LCR, and LR, are limited, as the binding requirement starts in 2018 (BIS, 2020, p. 2). There are 15 observations with an NSFR, 88 observations with an LCR, and 90 observations with an LR. In ensuring a resilient sample, the processing does not consider the NSFR but all other variables. Owing to LCR's relation to the liquidity area, this variable is used instead of the NSFR.

Furthermore, the CTTA, TDTTA, and TDETTA are used to measure a liquidity impact for the entire period. For the profit area, the variables return on assets (ROA), the income available to common shares to total equity ratio (INCATCSTTE), the net income to common shares ratio (NETINCCOMSHARES), the net interest income to total assets ratio (NETINTINCTTA) are used, since the several profit ratios represent a connection between the various areas (capital, liquidity, and risk). They are therefore well suited for examining the influence on the dividend policy. For the risk area, the variables net loans to total assets ratio (NLTTA), the non-performing loans to total assets ratio (NPLTTA), and the RWA to total assets ratio (RWATTA) are used. The variables are considered because risk management, especially loan activity, is a crucial driver of banks' profitability.

Moreover, lending activity is a primary trigger for the financial crisis (cp. chapter 2.3.1). Therefore, the ratios are well suitable indicators for the risk area. Table 19 summarizes the used variables.

Table 19: Independent variables

Independent variable	Research area	Measurement
Total capital ratio (TCR)	Capital	$\frac{\text{Tier 1 capital+Tier 2 capital+Tier 3 capital}}{\text{RWA}} \times 100 > 8\,\%$
Tier 1 capital ratio (TIER1)	Capital	$\frac{\text{Tier 1 capital}}{\text{RWA}} \times 100 > 6\,\%$
Leverage ratio (LR)	Capital	$\frac{\text{Tier 1}}{\text{Total on-balance sheet exposure+total derivative expsoure+ total securities financing transaction expsoure+off-balance sheet items}} \times 100$
Total equity to total assets (TETTA)	Capital	$\frac{\text{Total equity}}{\text{Total assets}} \times 100$
Liquidity coverage ratio (LCR)	Liquidity	$\frac{\text{Stock of HQLA}}{\text{TNCF over the next 30 calendar days}}$
Cash to total assets (CTTA)	Liquidity	$\frac{Cash \,\&\, due\ from\ banks}{\text{Total assets}} \times 100$
Total debt to total assets (TDTTA)	Liquidity	$\frac{\text{Total debt}}{\text{Total assets}} \times 100$
Total deposit to total assets (TDETTA)	Liquidity	$\frac{\text{Total deposit}}{\text{Total assets}} \times 100$
Return on assets (ROA)	Profit	$\frac{\text{Net income}}{\text{Total assets}} \times 100$
Income available to common shares to total equity (INCATCSTTE)	Profit	$\frac{\text{Income available to common shares}}{\text{Total equity}} \times 100$

Net income to common shares (NETINCCOMSHARES)	Profit	$\frac{\text{Net income}}{\text{Common shares}} \times 100$
Net interest income to total assets (NETINTINCTTA)	Profit	$\frac{\text{Net interest income}}{\text{Total assets}} \times 100$
Net loans to total assets (NLTTA)	Risk	$\frac{\text{Net loans}}{\text{Total assets}} \times 100$
Non-performing loans to total assets (NPLTTA)	Risk	$\frac{\text{Non-performing loans}}{\text{Total assets}} \times 100$
Risk-weighted assets to total assets (RWATTA)	Risk	$\frac{\text{Risk-weighted assets}}{\text{Total assets}} \times 100$

Source: Own table

After the variable description, it is necessary to classify each variable regarding their scaling as a precondition for the statistical instruments. Most of the variables are related to the total assets so that the variable type is a percentage value. All variables are metrically scaled.

Table 20: Variable scaling for the independent variables

Variable	Type	Scale
TCR	%	Metric
TIER 1	%	Metric
LR	%	Metric
TETTA	%	Metric
LCR	%	Metric
CTTA	%	Metric
TDTTA	%	Metric
TDETTA	%	Metric
ROA	%	Metric
INCATCSTTE	%	Metric
NETINCCOMSHARES	%	Metric
NETINTINCTTA	%	Metric
NLTTA	%	Metric
NPLTTA	%	Metric
RWATTA	%	Metric

Source: Own table

4.4.2 Dependent variables

Since this dissertation examines the influence of the CRR/CRD IV package on the dividend policy with a quantitative investigation, variables that adequately operationalize the dividend policy are necessary. The dividend payout ratio is well suited to operationalize the dividend policy and is therefore used. The dependent variable, the assigned research area, and the measurement of the variable are presented as follows:

Table 21: Dependent variable

Dependent variable	Research area	Measurement
Dividend payout ratio (DPR)	Profit	$\frac{\text{Dividend paid}}{\text{Income available to common shares}} \times 100$

Source: Own table

After the variable description, it is necessary to classify each variable based on their scaling as a precondition for the statistical instruments. The variable is metrically scaled and, therefore, useful to perform the necessary descriptive and explorative statistics.

4.4.3 Control variables

The bank size and the development of the index STOXX Europe 600 banks (yearly based) are used as control variables for considering different explanatory variables. The number of total assets in billions € (TA), the number of employees (EMPLOYEES), and the number of outstanding common shares in millions (TCSO) are used for the bank size. The following table shows the measurement of these variables.

Table 22: Control variables

Control variable	Measurement
Total assets (TA)	Sum of total assets
Employees (EMPLOYEES)	Number of employees
Total common shares outstanding (TCSO)	Number of outstanding common shares
Development of the STOXX 600 Europe Banks (DEVSTOXX)	Change compared to the previous year

Source: Own table

The scaling of the control variables can be seen in table 23.

Table 23: Variable scaling for the control variables

Variable	Type	Scale
TA	bn €	Metric
EMPLOYEES	number	Metric
TCSO	number (in bn)	Metric
DEVSTOXX	%	Metric

Source: Own table

4.5 DATA FRAME G1

4.5.1 Descriptive statistic

The results presented in the following are calculated and analyzed by using the statistical program R. The first data frame consists of 20 variables. Before the descriptive and inference statistic takes place, the data set is split into two groups. For measuring the impact of the regulatory requirements on the dividend policy, the year 2013 was identified as the criterion to form two groups. Therefore, the data set with 291 observations were divided as follows:

Table 24: Subgroups of the data set

Data set	Number of variables	Number of observations
G1 (< 2013)	18	144
G2 (> 2013)	20	75

Source: Own table

Since before 2013, the ratios LCR and LR were not existent, the subgroup G1 does not consider these variables and contains therefore 18 variables. G2 includes 20 variables. G2 was eliminated by all zero values of the variables LCR and LR so that the total sum of observations is not 291 as described above. The following descriptive analysis refers to the data set G1.

Outlier analysis is performed in the first step. Boxplots are created to get a first overview and an early indication. The boxplots (with and without outliers) are included in the appendix 8. In addition to the visualization, a static outlier analysis based on the IQR is performed. An outlier analysis and data adjustment with the IQR is a well-established method (Rey, 2017, p. 103; Silva et al., 2019, p. 680; Schendera, 2008, pp. 133-134). First, an outlier identification was performed with the given data set. A total of 12 variables have outliers. The dependent variable DPR contains 12 outliers, and the key independent variables TCR and TIER 1 have 4 and 1 outliers, respectively. The following table summarizes the outlier identification for the independent variables (IV), dependent variable (DV), and the control variables (CV). A + means that outliers are identified and a – means that outliers are not identified. The identified outliers are eliminated from the data frame to use a fully adjusted data set.

Table 25: Overview of the outlier identification

	Variable	**Outliers**	**Number of outliers**
IV	TCR	+	4
	TIER 1	+	1
	TETTA	+	4
	CTTA	-	0
	TDTTA	-	0
	TDETTA	-	0
	ROA	+	3
	INCATCSTTE	+	1
	NETINCCOMSHARES	+	20
	NETINTINCTTA	+	1
	NLTTA	-	0
	NPLTTA	+	14
	RWATTA	-	0
DV	DPR	+	12
CV	TA	+	1
	EMPLOYEES	+	0
	TCSO	+	24
	DEVSTOXX	-	0
		Total	**85**

Source: Own table

After the outlier elimination, the data set G1 is reduced from 144 to 59 observations. The data set with the eliminated values is called G1NEW. A descriptive analysis is performed and compared with the descriptive statistic of the uneliminated data set. At first, a descriptive statistic for G1 follows.

Table 26: Descriptive statistic G1

Variable	N	Mean	Sd	Median	Min	Max	Skew	Kurtosis
TCR	144	13.18	2.73	12.75	8.87	21.90	0.85	0.44
TIER1	144	9.95	2.57	9.40	6.30	17.21	0.67	-0.30
TETTA	144	5.25	2.28	4.95	1.39	15.09	1.47	3.72
CTTA	144	6.62	4.37	6.11	0.27	20.33	0.67	0.12
TDTTA	144	21.45	13.73	22.17	1.06	55.31	0.22	-0.90
TDETTA	144	46.14	12.57	46.73	17.96	71.33	0.01	-0.89
ROA	144	0.49	0.60	0.49	-1.68	4.06	0.65	9.22
INCATCSTTE	144	9.51	11.67	11.47	-49.46	68.49	-0.65	8.20
NETINC-COMSHARES	144	1.54	4.69	0.80	-7.72	36.58	4.89	32.58
NETINTINCTTA	144	1.36	0.78	1.22	0.23	8.10	4.58	36.76
NLTTA	144	51.85	18.06	53.86	12.23	81.85	-0.33	-0.95
NPLTTA	144	1.92	5.57	0.80	0.04	64.51	9.92	107.89
RWATTA	144	45.12	18.96	44.96	0.05	87.45	0.23	-0.54
DPR	144	200.51	1877.58	35.61	-376.89	22526.28	11.67	135.83
EMPLOYEES	144	74,470.95	75,998.51	47,700.00	1,716.00	315,520.00	1.38	1.39
TCSO	144	3.87	4.81	1.63	0.05	18.48	1.50	0.91
TA	144	685.99	676.70	336.35	38.23	2513.00	1.01	-0.42
DEVSTOXX	144	-5.21	34.55	-11.57	-64.76	48.49	-0.18	-0.78

Source: Own table

It's necessary to take the dependent variable DPR into account. The descriptive statistic shows that the mean of DPR is 200.51 %, while the median is 35.61 %. It can be indicated that extreme values influence the descriptive statistic of this variable. The maximum value of 22,526.28 % can confirm this expectation. The high value is probably an extraordinary dividend payment and considerably higher than the generated profits. The minimum value is -376.89 % for estimating the type of distribution; it is necessary to take the skewness and the kurtosis into account. Both indicators should be considered for distributions with only one peak (Kuckartz et al., 2013, p. 46). The skew value of 11.67 is greater than 0 and suggests that the distribution is right-skewed. The skewness is commonly known as the third moment of a distribution and is > 0 for a right-skewed distribution and < 0 for a left-skewed distribution and = 0 for a normal distribution (Ausloos and Cerqueti, 2018, p. 2203, Fahrmeir et al., 2007, p. 75). The kurtosis value is 135.83, much greater than three, and indicates that the distribution has an acute shape and fat ends of the distribution. The kurtosis is the fourth moment of a distribution (Ausloos and Cerqueti, 2018, p. 2203). The kurtosis value of 3 is commonly known for a normal distribution, > 3 for distributions with fat ends, and < 3 for thin ends.

By considering the independent variables TCR and TIER 1 from the capital area variables, it is noticeable that the mean of the TCR is 13.18 %, with a range from 8.87 % to 21.9 %. On average, the sample of 144 observations fulfills the capital requirements of a 13 % TCR. But there is a minimum value of 8.87 % that indicates that not all banks satisfy the capital requirements. The median of 12.75 % as a distribution middle value shows that it is close to the mean of 13.18 %, indicating a normal distribution. It should be mention that the testing of a normal distribution follows in the further process of this work. TIER 1 has a mean value of 9.95 %, a median of 9.4 %, a minimum of 6.3 %, and a maximum of 17.21 %. Since the minimum of 6.3 % is greater than the capital requirement of TIER 1, it can be stated that all banks fulfill the capital requirement regarding the TIER 1 requirement of 6 % (cp. chapter 2.4.1.1). The skew value of the TCR is 0.85, the skew of TIER 1 is 0.67, and both are greater than 0 and suggest that the variables are right-skewed with thin ends because the kurtosis is 0.44 for TCR and -0.30 for TIER 1 and < 3. The descriptive of the other independent variables can be taken from table 26.

The control variables EMPLOYEES, TCSO, TA, and DEVSTOXX, can be characterized as follows: The sub-sample G1 includes relatively large banks. The number of variable EMPLOYEES is a well-suited indicator for the bank size. The dataset has a mean of 74,470.95 for the variable EMPLOYEES and a median of 47,700.00. The range is from a minimum value of 1,716.00 to a maximum weight of 315,520.00. The skew is 1.38 and greater than 0 and indicates a right-skewed distribution of a variable. Furthermore, the kurtosis with 1.39 is > 0 and < 3 and shows thin ends. The variable EMPLOYEES ratios confirm the intention to consider capital market listed European banks, as these banks are more considerable than banks not listed in the capital market. The next control variable is the TCSO. On average, the 144 observations in the sample G1 have 3.87 bn. outstanding shares with a minimum value of 0.05 bn. and a maximum of 18.48 bn. outstanding shares. The skew of 1.50 indicates a right-skewed distribution. The kurtosis of 0.91 indicates thin ends of the distribution. The high number of outstanding shares (on average) goes along with the variable EMPLOYEES and TA structure as other size variables. Another size variable is TA and describes the total amount of assets of the sample G1. With a mean of 685.99 bn. € and a median of 336.35 bn. €, this variable confirms the previous statement of considering relatively large banks. But the standard deviation of 676.70 bn. € implies that the distance of all measured observations from its meaning is far from the average and therefore a high spread can be implied (Fahrmeir et al., 2007, p. 70; Müller and Poguntke, 2010, p. 208, Sachs, 1984, p. 57; Eckstein, 2006, p. 51). The skew is 1.01 and identifies a right-skewed distribution. The kurtosis is negative with -0.42 and indicates thin ends of the distribution. The variable DEVSTOXX has an average of -5.21 % with a relatively high standard deviation of 34.55 % but is understandable regarding a volatile index development. A descriptive statistic for the newly created data frame G1NEW, which excludes the outliers, follows. Table 27 shows the descriptive statistic of G1NEW.

Table 27: Descriptive statistic G1NEW

Variable	N	Mean	Sd	Median	Min	Max	Skew	Kurtosis
TCR	59	12.02	2.23	11.60	8.87	18.40	0.95	0.42
TIER1	59	8.82	1.98	8.19	6.50	14.00	0.83	-0.29
TETTA	59	5.03	1.73	4.57	1.89	9.72	0.62	0.35
CTTA	59	6.57	5.39	5.03	0.27	20.33	0.91	-0.25
TDTTA	59	21.21	13.82	25.09	1.07	48.36	0.02	-1.09
TDETTA	59	47.83	10.43	46.29	28.02	66.35	0.20	-0.98
ROA	59	0.67	0.25	0.71	0.09	1.25	-0.09	-0.34
INCATCSTTE	59	13.96	5.23	14.05	2.32	23.31	-0.19	-0.73
NETINC-COMSHARES	59	0.96	0.47	0.88	0.24	2.16	0.88	0.25
NETINTINCTTA	59	1.32	0.54	1.18	0.23	2.59	0.48	-0.76
NLTTA	59	59.43	15.06	62.71	21.40	81.85	-0.65	-0.38
NPLTTA	59	0.78	0.69	0.61	0.04	3.21	1.69	2.84
RWATTA	59	47.86	18.70	47.44	0.05	83.49	-0.03	-0.39
DPR	59	35.04	13.94	35.39	0.17	69.38	0.04	0.23
EMPLOYEES	59	41,177.00	39,323.30	20,536.00	3,242.00	134,900.00	1.05	-0.43
TCSO	59	2.35	1.67	1.87	0.12	7.34	1.37	1.55
TA	59	369.79	385.41	229.97	52.32	1905.63	2.41	5.60
DEVSTOXX	59	-4.92	31.59	-11.57	-64.76	48.49	-0.19	-0.38

Source: Own table

The adjusted data frame G1NEW is presented and compared to the previous variables to ensure a transparent analysis of the descriptive statistic. The elimination of outliers influences the new data frame. The variable DPR previously had a 200.51 % mean and 35.61 % median; after outlier elimination, the mean is reduced to 35.04 % with a median of 35.39 %. The minimum value is 0.12 %, and the maximum value is 69.38 %. Due to the outlier analysis and elimination, the descriptive statistic is much more understandable. It fits into the latest ECB analysis, where the DPR median is between 30 % and 40 % (Gardó, Grodzicki, and Wendelborn/ECB, no page, accessed on 27.07.2020). The DPR has a skew of 0.04 and a kurtosis of 0.23. The skew is nearly 0 and indicates a normal distribution (Ausloos and Cerqueti, 2018, p. 2203, Fahrmeir et al., 2007, p. 75). The kurtosis is nearly 0 too and < 3 and indicates thin ends of the distribution. The independent variables TCR and TIER 1 of the adjusted data frame are analyzed in the next step. TCR has a mean of 12.02 %, and a median of 11.60 %, which differs slightly from the non-outliers eliminated data frame G1 (mean of 13.18 % and a median of 12.75 %). The median of 11.60 % as a distribution middle value shows it is close to the mean of 12.02 %, indicating a normal distribution. The exact distribution is tested in the next step with a Shapiro-Wilk-test. The minimum of 8.87 % is the same as in G1. The minimum is in the calculated tolerance range. The maximum is after adjustment of 18.40 %. Based on the outlier analysis, all values above, 19.40 %, are eliminated. It can be seen that G1NEW includes observations that do not fulfill the capital requirements of a 13 % TCR. The skew is 0.95 and is > 0 and a kurtosis of 0.42 and is < 3. The distribution can be characterized as a right-skewed distribution with thin ends. TIER 1 has a mean of 8.82 % and a median of 8.19 %. Both ratios are closed together and indicate a normal distribution. The values differ marginally from the mean and median of G1 (mean of 9.95 % and median of 9.40 %). The minimum increases from 6.30 % to 6.50 %, while the maximum decreases from 17.21 % to 14.00 %. The determined threshold is 17.20 %. Due to actual statistical work, even a slight difference in the old maximum of 0.01 % from the threshold leads to removing the observation from the data set. Since the minimum of 6.50 % is greater than the capital requirement of TIER 1, it can be stated that all banks fulfill the capital requirement regarding the TIER 1 requirement of 6 % (cp. chapter 2.4.1.1). The skew is 0.83 and > 0, which implies a right-skewed distribution. The kurtosis is -0.29 and nearly on the old level of -0.30 and is < 3, indicating a distribution with thin ends.

The control variables EMPLOYEES, TCSO, TA, and DEVSTOXX, are characterized as follows: G1NEW includes relatively large banks and can be seen by variable number EMPLOYEES. The variable EMPLOYEES has a mean of 41,177 and a median of 20,536. The unadjusted mean is 74,470.95, and the unadjusted median is 47,700.00. The smaller values result from eliminating the identified outliers (compare the minimum of EMPLOYEES in G1 of 1,716.00 and the maximum of 315,520.00 with a minimum of 3,242.00 and a maximum 134,900.00 in EMPLOYEES in G1NEW). The skew is 1.05 and > 0 and indicates a right-skewed distribution of a variable. Furthermore, the kurtosis with -0.43 and < 3 and indicates thin ends. The variable EMPLOYEES includes after outlier elimination capital market listed European banks and outliers of relatively small and big banks. In the adjusted data frame G1NEW, the control variable TCSO has a mean of 2.35 bn. outstanding shares with a minimum of 0.12 bn. and a maximum of 7.34 bn. outstanding shares (before adjustment a minimum of 0.05 bn. and a maximum of 18.48 bn.). The skew of 1.37 indicates a right-skewed distribution. The kurtosis of 1.55 indicates thin ends of the distribution. The high number of outstanding shares (on average) goes along with the variable EMPLOYEES and TA structure as other size variables. The TA structure changed as follows: The mean reduces by 46.1 % from 685.99 bn. € to 369.79 bn. €. The median reduces by 31.6 % from 336.35 bn. € to 229.97 bn. €. Even after the outlier elimination, the data frame G1NEW includes large banks. Nevertheless, the new mean and new median distance is 37.8 %, and the sd is 385.41 bn. € (before 676.7 bn. €) so that a high spread can be implied (Fahrmeir et al., 2007, p. 70; Müller and Poguntke, 2010, p. 208, Sachs, 1984, p. 57; Eckstein, 2006, p. 51). The skew is 2.41 and identifies a right-skewed distribution. The kurtosis is 5.6 and indicates fat ends of the distribution. The variable DEVSTOXX has an average of -4.92 % with a relatively high standard deviation of 31.59 % and is understandable due to a volatile index development. The outlier analysis is well suited to eliminate extreme values. But the general direction of the variables has not changed (for example, the control variables EMPLOYEES, TA, TCSO, and DEVSTOXX). Further, comparing the independent variables TCR and TIER1 shows the same direction with a TCR mean of 13.18 % in G1 and 12.02 % in G1NEW. A look at the DPR shows the most adjustment. The DPR has changed from 200.51 % in G1 to 35.04 % in G1NEW and seems much more understandable.

The next step is to create a table for the distribution structure for the uneliminated data frame G1, and the outlier eliminated data frame G1NEW based on their histograms and their descriptive statistic (significantly skew and kurtosis). Since the skew and kurtosis describe a left- or right-skewed distribution with thin or fat ends, it is necessary to summarize a first visual indication of the distribution structure. Some skew or kurtosis values are beyond the defined value ranges. The table is structured as follows: The first column contains the 18 variables. The second column is split into three different columns. The first sub-column describes the distribution structure of the outlier uneliminated data frame G1 with 144 observations. The second sub-column describes the distribution structure of the outlier eliminated data frame G1NEW with 59 observations. The third sub-column describes the distribution structure of the transformed variables of the data frame G1NEW.

Regarding the variable transformation, the variables CTTA, NPLTTA, TDETTA, TETTA, TCSO, NETINTINCTTA, and NETINCCOMSHARES are transformed with their square root, and the variables TA, TCR, TIER1, and EMPLOYEES are changed with their logarithm. For variables with a slightly right-skewed distribution, the square root and variables with a more substantial right-skewed distribution, the logarithm are adequate instruments to generate a normal distribution (Keller, 2020, no page; Mangiafico, 2020, no page; Ofungwu, 2014, p. 358; Amitava, 2016, p. 240; Woodward, 1999, p. 82; Leong and Austin, 2016, p. 249). For left-skewed distributions, the square transformation is applicable (Woodward, 1999, p. 82; Leong and Austin, 2016, p. 249). The data frame contains one variable (NLTTA), which is left-skewed and transformed with the square. The following table summarizes the variable transformation.

Table 28: Variable transformation G1NEW

Variable	Transformation
TCR	log
TIER1	log
TETTA	sqrt
CTTA	sqrt
TDTTA	-
TDETTA	sqrt
ROA	-
INCATCSTTE	-
NETINCCOMSHARES	sqrt
NETINTINCTTA	sqrt
NLTTA	^2
NPLTTA	sqrt
RWATTA	-
DPR	-
EMPLOYEES	log
TCSO	sqrt
TA	log
DEVSTOXX	-

Source: Own table

For a better understanding, the abbreviations RS = right-skewed, LS = left-skewed, ND = normal distributed, and MM = multi-modal distributed are used. The histograms for all variables (compared with and without outliers) are included in the appendix 9. Table 29 gives an overview of the distribution structure for G1 and G1NEW.

Table 29: Visual distribution indication for G1 and G1NEW

Variable	Distribution structure		
	1st run (144 obs.)	**2nd run (59 obs.)**	**3rd run (59 obs.)**
TCR	RS	RS	ND
TIER1	RS	RS	RS
TETTA	RS	ND	ND
CTTA	RS	RS	ND
TDTTA	MM	MM	MM
TDETTA	MM	MM	MM
ROA	ND	ND	ND
INCATCSTTE	ND	ND	ND
NETINCCOMSHARES	RS	RS	ND
NETINTINCTTA	RS	ND	ND
NLTTA	LS	LS	ND
NPLTTA	RS	RS	ND
RWATTA	ND	ND	ND
DPR	RS	ND	ND
EMPLOYEES	RS	RS	MM
TCSO	RS	RS	ND
TA	RS	RS	ND
DEVSTOXX	MM	MM	MM

Source: Own table

The visual distribution structures based on their histograms are briefly presented here to explain the previously highlighted variables. The independent variables TCR and TIER1 have in their first and second run a right-skewed distribution. These distribution structures relate to the fact that the median and the mean of these variables are close together. Simultaneously, the range (minimum to maximum) of these variables is wide. The independent variables ROA, INCATCSTTE, and RWATTA, have in their first run a normal visual distribution. Only the independent variable NLTTA is left-skewed. The other independent variables (TDTTA, TDETTA) have a multi-modal distribution structure. The dependent variable DPR has in its first run a right-skewed distribution structure. After the outlier elimination, the distribution structure is typically distributed and fulfills regression analysis requirements (STATISTIK-Peter, 2020, no page). The explorative statistic contains a notice of the effect of an outlier analysis on the regression analysis.

Further explanations are included in the appendix 10. The outlier elimination reduced the wide range of observations. The control variables EMPLOYEES, TCSO, and TA are right-skewed, while the variable DEVSTOXX has a multi-modal distribution structure that displays the volatile index development. The histograms confirm the descriptive statistic and are included in the appendix 9. Since the normal distribution is an assumption for parametric tests, its necessary to test the variables of normal distribution (Billeter, 1972, p. 30; Freidlin, Miao and Gastwirth, 2003, p. 887; Thadewald and Büning, 2007, p. 87; MESOSworld, 2020, no page). Therefore, the Shapiro-Wilk-test is used for testing a normal distribution (Shapiro and Wilk, 1965, p. 610, Ghasemi and Zahediasl, 2012, p. 487). The significance codes are described as follows:

Table 30: Description and meaning of the significance codes

Significance code	Meaning
***	p-value < 0.001
**	p-value < 0.01
*	p-value < 0.05
.	p-value < 0.1
	p-value < 1

Source: Own table

The following table includes the results of the Shapiro-Wilk-test. The following test hypothesis is formulated:

H0: The values are normally distributed

H1: The values are not normally distributed

If the p-value is < than the alpha level, the H0 is rejected, and the H1 is temporarily accepted so that the values are not normally distributed (Rothman, Greenland and Lash, 2008, p. 153; Black, 2009, p. 302). The p-values should be greater than the alpha level. An alpha level of 5 % is assumed.

On this occasion, it should be noted that the p-value is generally known as a standard to avoid the type 1 error, which means that a true null hypothesis is rejected (Dahiru, 2008, p. 22; Kim and Bang, 2016, p. 73; McLeod, 2019, no page; Dirnagl, 2019, p. 2421). Results are marked as statistically significant if the p-value is below certain thresholds and this circumstance leads to the targeted search for evaluations (called p-hacking) and creates bias in form of a false discovery rate (Kim and Ban, 2016, p. 78; Hirschauer et al., 2016, p.557; Vidgen and Yasseri, 2016, p. 1). In order to avoid a false discovery rate, a statistical study should consider several methods, in particular, an examination of the content of the research question, which is the foundation of the formed test hypothesis (Nature, 2019, no page; Dirnagl, 2019, p. 2423). Also relevant is that the p-value is meaningless if the tested hypothesis is meaningless (Ranstam, 2012, p. 806). But the critic will not lead to a replacement of the p-value relevance, despite its limitations (Kim and Bang, 2016, p. 73). The p-value ensures a cross-content and cross-test comparison due to its single number (Halsey, 2019, p. 2) and furthermore, the consideration of graphics for a first indication of the data structure is recommended, regardless of their results (Halsey, 2019, p. 2). The using of the p-value is relevant for an adequate interpretation. For example, data assessment and inspection should be after the definition of test hypothesis and not vice versa (Ranstam, 2012, p. 806) and it should be noted that most data analysis based on a sample and not the population, so that a statistically significant or insignificant effect not always lead to an implication from the sample to the population (Ranstam, 2012, p. 806). A mindful treatment with the p-value is important: a statistically not significant result is no evidence for a hypothesis rejection (Illinger, 2019, no page). The assessment of the results has to consider uncertainty (Verhagen, Ostelo and Rademaker, 2004, p. 262). Other statistical approaches are the using of confidence intervals instead or beside the p-value using (Dahiru, 2008, p. 24).

In order to exclude the possibility of misinterpretation regarding the p-value, this dissertation has explained the regulatory requirements in chapter 2, the several approaches of the dividend policy in chapter 3, and theoretical relationship at the end of chapter 3. Furthermore, this dissertation includes an extensive descriptive statistic and an explorative statistic with a multi-level model accuracy (cp. chapter 4.5.3, chapter 4.6.3 and the limitations of the empirical investigation in chapter 4.8). Furthermore, the explorative statistic declares the results as significant in a context of a statistically significance and not a significance in the area of important (as recommended in Hirschauer et al., 2016, p.560 or Wasserstein, Schirm and Lazar, 2019, p. 2). Furthermore, the previous research for impact analysis of the regulatory requirements are still using the p-value (cp. chapter 4.1.1). Although, the using of a confidence interval is discussed by Dahiru (2008, p. 24) or Vidgen and Yasseri (2016, p. 4), the using of a confidence interval in this dissertation seems to be not appropriate due to the closed observed capital and leverage ratios to the regulatory requirements (cp. chapter 4.5.3 and chapter 4.6.3) and an expected result bias.

In the first run only one variable (RWATTA) shows a normal distribution, because the p-value is < 1 but > 0.1 (and therefore also > 0.05). The variable TDETTA is rejected at an alpha level of 5 %.

Table 31: SW results for G1, G1NEW, and G1NEW transformed

Variable	Result					
	1st run (144 obs.)		2nd run (59 obs.)		3rd run (59 obs.)	
	W-value	Signif. code	W-value	Signif. code	W-value	Signif. code
TCR	0.94502	***	0.92439	**	0.96204	.
TIER1	0.94064	***	0.89647	***	0.92537	**
TETTA	0.90166	***	0.9596	*	0.97938	
CTTA	0.95009	***	0.88957	***	0.96444	.
TDTTA	0.95992	***	0.92888	**	0.92888	*
TDETTA	0.97725	*	0.95442	*	0.96252	.
ROA	0.85213	***	0.97766		0.97766	
INCATCSTTE	0.84704	***	0.97774		0.97774	
NETINC-COMSHARES	0.50242	***	0.93129	*	0.98586	
NETINTINCTTA	0.68523	***	0.94593	**	0.96399	.
NLTTA	0.95991	***	0.943	**	0.96767	
NPLTTA	0.23925	***	0.82368	***	0.96054	.
RWATTA	0.98205	.	0.97331		0.97331	
DPR	0.07857	***	0.98405		0.98405	
EMPLOYEES	0.8231	***	0.78063	***	0.92767	*
TCSO	0.71265	***	0.85799	***	0.96024	.
TA	0.81171	***	0.67479	***	0.96297	.
DEVSTOXX	0.92667	***	0.92625	*	0.92625	*

Source: Own table

To give a summary of the Shapiro-Wilk test results for the relevant 3rd run with an assumed alpha level of 5 %, the following table summarizes the results:

Table 32: SW results for the 3rd run for G1NEW

Variable	Result
TCR	Normal distributed
TIER1	Not normal distributed
TETTA	Normal distributed
CTTA	Normal distributed
TDTTA	Not normal distributed
TDETTA	Normal distributed
ROA	Normal distributed
INCATCSTTE	Normal distributed
NETINCCOMSHARES	Normal distributed
NETINTINCTTA	Normal distributed
NLTTA	Normal distributed
NPLTTA	Normal distributed
RWATTA	Normal distributed
DPR	Normal distributed
EMPLOYEES	Not normal distributed
TCSO	Normal distributed
TA	Normal distributed
DEVSTOXX	Not normal distributed

Source: Own table

4.5.2 Explorative statistic

Based on the descriptive statistic, an explorative statistic is performed for estimating the CRR/CRD IV impact on the dividend policy. First of all, a correlation analysis is performed. This study uses the commonly used Pearson correlation since the Pearson correlation is suitable to measure a linear relationship between two metrically scaled variables (Gravetter and Wallnau, 2008, p. 440; David and Sutton, 2004, p. 303; Weinberg and Knapp, 2008, p. 135). The following table summarizes the correlation coefficients of the variables.

Table 33: Correlation matrix for G1NEW

	Same variables as in the columns																	
LOGTCR	1.00																	
LOGTIER1	0.83	1.00																
SQRTTETTA	0.33	0.31	1.00															
SQRTCTTA	0.63	0.51	0.26	1.00														
TDTTA	-0.23	-0.06	0.32	-0.28	1.00													
SQRTTDETTA	0.28	0.02	0.36	0.35	-0.35	1.00												
ROA	-0.01	-0.29	0.38	-0.01	0.16	0.57	1.00											
INCATCSTTE	-0.32	-0.59	-0.41	-0.24	-0.02	0.16	0.62	1.00										
LOGNETINCCOMSHARES	0.07	-0.07	-0.01	0.10	-0.07	0.14	0.07	0.05	1.00									
SQRTNETINTINCTTA	0.27	0.00	0.68	0.14	0.26	0.60	0.67	0.11	0.08	1.00								
NLTTA^2	-0.48	-0.42	0.32	-0.44	0.39	0.05	0.44	0.20	-0.18	0.29	1.00							
SQRTNPLTTA	0.24	0.28	0.29	0.20	0.08	0.43	-0.06	-0.34	-0.02	0.39	-0.07	1.00						
RWATTA	-0.26	-0.23	0.62	-0.11	0.37	0.15	0.36	-0.10	-0.17	0.49	0.44	0.09	1.00					
DPR	-0.53	-0.58	-0.32	-0.28	0.05	-0.05	0.03	0.33	-0.13	0.05	0.24	-0.08	0.06	1.00				
LOGEMPLOYEES	0.36	0.14	-0.30	0.11	-0.31	0.37	-0.01	0.15	0.46	0.13	-0.55	0.35	-0.49	0.01	1.00			
SQRTTCSO	0.16	0.06	-0.42	-0.13	-0.09	0.02	0.07	0.45	-0.26	0.01	-0.30	0.14	-0.40	0.18	0.56	1.00		
LOGTA	0.22	0.21	-0.61	-0.05	-0.30	-0.14	-0.40	0.07	0.30	-0.36	-0.65	0.11	-0.70	0.02	0.79	0.66	1.00	
DEVSTOXX	0.07	0.06	0.10	-0.03	0.01	0.05	-0.03	-0.09	0.00	0.06	0.01	0.10	0.06	-0.28	0.00	0.01	-0.02	1.00

Source: Own table

Table 34: P-values for table 33

	Same variables as in the columns																	
LOGTCR	*NA*																	
LOGTIER1	0	*NA*																
SQRTTETTA	0.01	0.017	*NA*															
SQRTCTTA	0	0	0.046	*NA*														
TDTTA	0.077	0.648	0.013	0.033	*NA*													
SQRTTDETTA	0.031	0.881	0.005	0.006	0.006	*NA*												
ROA	0.941	0.028	0.003	0.922	0.221	0	*NA*											
INCATCSTTE	0.012	0	0.001	0.064	0.867	0.228	0	*NA*										
LOGNETINCCOMSHARES	0.577	0.598	0.931	0.467	0.613	0.274	0.58	0.727	*NA*									
SQRTNETINTINCTTA	0.04	0.996	0	0.276	0.05	0	0	0.427	0.537	*NA*								
NLTTA^2	0	0.001	0.013	0	0.002	0.709	0	0.139	0.171	0.024	*NA*							
SQRTNPLTTA	0.063	0.034	0.025	0.131	0.553	0.001	0.676	0.009	0.905	0.002	0.584	*NA*						
RWATTA	0.049	0.086	0	0.415	0.004	0.242	0.005	0.449	0.187	0	0	0.49	*NA*					
DPR	0	0	0.015	0.034	0.718	0.73	0.822	0.012	0.313	0.712	0.071	0.534	0.65	*NA*				
LOGEMPLOYEES	0.005	0.299	0.023	0.389	0.015	0.004	0.917	0.27	0	0.328	0	0.007	0	0.95	*NA*			
SQRTTCSO	0.235	0.656	0.001	0.333	0.51	0.866	0.61	0	0.047	0.935	0.019	0.295	0.002	0.173	0	*NA*		
LOGTA	0.088	0.112	0	0.703	0.02	0.28	0.002	0.614	0.022	0.005	0	0.404	0	0.876	0	0	*NA*	
DEVSTOXX	0.62	0.647	0.43	0.849	0.948	0.71	0.819	0.517	0.991	0.637	0.92	0.459	0.658	0.032	0.993	0.932	0.851	*NA*

Source: Own table

The variables LOGTCR and LOGTIER1 correlate with -0.53 (p-value < 0.001) and -0.58 (p-value < 0.001) with the DPR. This indicates a linear relationship between LOGTCR and DPR, respectively, LOGTIER1 and DPR. Furthermore, the correlation indicates that DPR increases if the capital ratios decrease. Since the p-value in both relationships is < 0.001, the relationship is determined as statistically significant.

For the risk area, the variables NLTTA, NPLTTA, and RWATTA are used. The transformed variable NLTTA^2 correlates positive with 0.24 (p-value > 0.05 and < 0.1) with the DPR. The correlation is statistically significant at a level of 10 % (0.1). The variable SQRTNPLTTA correlates negative with -0.08 (p-value > 0.1) and is not statistically significant, while the RWATTA correlates positive with 0.06 (p-value > 0.1) and is not significant too. In general, the risk variables correlate weakly and are not statistically significant. Only the variable NLTTA^2 correlates slightly stronger with 0.24 (p-value > 0.05 and < 0.1) and indicates that a higher amount of NLTTA^2 goes along with a higher DPR. This implies that higher risks correlate with a higher DPR and is investigated in the previous literature (cp. previous chapter).

For the liquidity area, the CTTA, TDTTA, and TDETTA are used. The SQRTCTTA correlates negatively with -0.28 with the DPR. The relationship is statistically significant at a significance level of 5 % (p-value < 0.05). The TDTTA has a weak correlation of 0.05 and is not statistically significant (p-value > 0.1) with the DPR, while the SQRTTDETTA correlates weak negatively with -0.05 and is not statistically significant (p-value > 0.1) with the DPR. The key variable CTTA, respectively, the square root (SQRTCTTA) shows a remarkable negative correlation with -0.28 and implies that lower liquidity goes along with a higher DPR. This relationship is statistically significant. A lower liquidity level supports a higher risk-taking (correlation of -0.44 between SQRTCTTA and NLTTA^2 and a p-value < 0.001). This theoretical setting of the negative relationship between risk and liquidity is noted in chapter 2.3.3.

ROA, INCATCSTTE, NETINCCOMSHARES, NETINTINCTTA are used for the profit area. Only the variable INCATCSTTE shows a remarkable correlation to the DPR with 0.33 and a p-value < 0.05 but > 0.01. This is understandable because INCATCSTTE operationalizes the available income to common shares concerning total equity. If the amount of available income increases, the DPR increases too since more profit is for the shareholder. The other variables have no remarkable correlation with the DPR and are not statistically significant at a level of 10 % (ROA 0.03 with a p-value > 0.1, LOGNETINCCOMSHARES -0.13 with a p-value > 0.1 and SQRTNETINTINCTTA 0.05 with a p-value > 0.1).

Since there are several linear relationships with the DPR, regression models are performed. Due to a limited panel data (not all observations for each time, the regulatory variables LC, LCR and NSFR are implemented in 2013 for the first time and the regulatory requirements for the capital ratios has been changed for several times), a perfect panel data set is not available (Stein and Bekalarczyk, 2020, p. 3). In order to ensure a regression model with an available and consistent data set, several OLS regressions are performed and compared to each other. In the first run, regressions of the LOGTCR/LOGTIER1 to the DPR are modeled. The test hypotheses are:

H0: The variables LOGTCR/LOGTIER1 and DPR are independent.

H1: The variables LOGTCR/LOGTIER1 and DPR are dependent.

Table 35 represents the results. The first sub-column in the column DPR represents the LOGTCR's influence on the DPR and the second sub-column represents the influence of the LOGTIER1 on the DPR. The values in the row of the variables are the coefficient of the influence. Below this value, the standard error is given in brackets.

Table 35: Results for regression 1 and 2

	Dependent variable:	
	DPR	
	(1)	(2)
LOGTCR	-42.062^{***}	
	(8.897)	
LOGTIER1		-37.676^{***}
		(7.087)
Constant	138.969^{***}	116.178^{***}
	(22.039)	(15.336)
Observations	59	59
R^2	0.282	0.331
Adjusted R^2	0.269	0.320
Residual Std. Error (df = 57)	11.914	11.494
F Statistic (df = 1; 57)	22.351^{***}	28.264^{***}
$.p < 0.1$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$		

Source: Own table

The models show that the LOGTCR influences the DPR with -42.062, and the LOGTIER1 influences the DPR with -37.676. The formulated H0 that the coefficient is zero, respectively that the LOGTCR/LOGTIER1 does not influence the DPR can be rejected. The t-test for the regression coefficients is statistically significant with a p-value < 0.001, and the R^2 for LOGTCR is 0.282 and represents the approximation quality of the data by the developed regression. The R^2 for LOGTIER1 has a value of 0.331 and represents the regression model even slightly better than the first regression. The R^2 is the squared correlation coefficient between LOGTCR/LOGTIER1 and DPR and therefore shows the proportion of the total variation determined by the regression model (Gordon, 2015, p. 199). As previously announced, the same regression was performed with the data frame, which includes the outlier and no variable transformations. In this case, the TCR has a negative influence but is not statistically significant. The p-value is 0.573 and much greater than the greatest usual accepted p-value of 0.10. The R^2 has a value of 0.002 and indicates that the model is not adequate to describe the research hypothesis into a regression model.

Furthermore, the F-test for the R^2 is not statistically significant and has a p-value of 0.57. The considerable difference of the results between the model without and with outliers clarifies and supports the previously chosen approach to eliminate outliers in the complete data set. In the further course, especially in the multiple regressions, a comparison of the results with the regression results with a data frame with outliers is unnecessary (because the simple regression shows remarkable differences and non- statistically significant results). All regression information with outliers can be taken in the appendix 11 (for TCR and TIER1). Between the LOGTCR/LOGTIER1 and DPR exist a statistically significant linear relationship, which is described by the regression equation. Based on table 35, the following regression equations are formulated:

Equation 4: Regression 1 of G1NEW

$$\boxed{DPR = 138.969 - 42.062 \times LOGTCR}$$

Source: Own equation

Equation 5: Regression 2 of G1NEW

$$\boxed{DPR = 116.178 - 37.676 \times LOGTIER1}$$

Source: Own equation

After the regression equations 4 and 5 determined a statistically significant influence of the independent variables on the DPR, it is useful to examine the different influences of Basel III. Therefore, two multiple regression models are modeled. All independent variables and control variables are considered and are modeled in the following table. The first sub-column (regression 3) in the column DPR represents the regression with the LOGTCR and the other variables. The second sub-column represents the regression with the LOGTIER1 (regression 4) and the other variables.

Table 36: Results for regression 3 and 4

	Dependent variable:	
	DPR	
	(3)	(4)
LOGTCR	-64.515*** (15.323)	
LOGTIER1		-45.308*** (11.984)
SQRTTETTA	0.040 (14.923)	-11.401 (14.796)
SQRTCTTA	5.522** (2.202)	4.199* (2.161)
TDTTA	0.027 (0.159)	0.228 (0.161)
SQRTTDETTA	2.116 (4.899)	7.040 (4.906)
ROA	-37.146* (18.595)	-32.388 (19.495)
INCATCSTTE	1.329 (1.354)	0.096 (1.439)
LOGNETINCCOMSHARES	-19.011* (11.284)	-11.782 (11.375)
SQRTNETINTINCTTA	60.844*** (14.272)	45.015*** (14.269)
NLTTA^2	0.003* (0.002)	0.003** (0.002)
SQRTNPLTTA	-11.971* (5.934)	-10.629* (6.093)
RWATTA	-0.004 (0.126)	0.071 (0.124)
LOGEMPLOYEES	0.905 (5.131)	-5.567 (5.346)
SQRTTCSO	-17.970 (16.714)	-7.517 (17.098)
LOGTA	20.023 (12.463)	18.971 (12.820)
DEVSTOXX	-0.089** (0.041)	-0.102** (0.042)
Constant	4.612 (97.984)	16.851 (101.826)
Observations	59	59
R^2	0.670	0.649
Adjusted R^2	0.544	0.516
Residual Std. Error (df = 42)	9.413	9.696
F Statistic (df = 16; 42)	5.320***	4.863***
.p < 0.1; *p <0.05; **p <0.01; ***p < 0.001		

Source: Own table

The first multiple regression (regression 3) shows LOGTCR, SQRTCTTA, ROA, LOGNETINCCOMSHARES, SQRTNETINTINCTTA, NLTTA^2, SQRTNPLTTA, AND DEVSTOXX influence the DPR with different significance level. Based on a significance level of 5 % in this study, only the variables LOGTCR (estimate: -64.515), SQRTCTTA (estimate: 5.522), NETINTINCTTA (estimate: 60.844) and DEVSTOXX (estimate: -0.089) can be considered at a p-value level of 5 %. The other variables mentioned above can be considered only at a level of 10 %. All other considered variables in the regression model have a not statistically significant influence on the DPR. The capital side (with the LOGTCR) influences the DPR negatively. The liquidity side with the SQRTCTTA influences the DPR positively. The profitability side with the NETINTINCTTA influences the DPR positively. All relationships go in line with the theoretical setting of this dissertation (cp. previous chapter). The constant value of 4.612 is the first point of the regression line. The R^2 for regression has a value of 0.67 and represents the data's approximation quality by the regression line. Since a multiple regression is performed, it is necessary to take the adjusted R^2 into account because the R^2 would increase by considering additional explanatory variables (Groß, 2010, p. 208). The adjusted R^2 is 0.544. The adjusted R^2 is lower than the R^2 if other independent variables are considered in the regression model (Komlos and Süssmuth, 2010, p. 72; Schuster and Liesen, 2017, p. 228). For multiple regression models, the adjusted R^2 is more suitable as the R^2, since the calculation of the R^2 is extended by a coefficient of the residual sum of squares and the total sum of squares (Hackl, 2005, p. 76). The adjusted R^2 in this model shows that the model has a good explanation of power. However, the effect of further variable consideration penalizes. Further, it is relatively large due to the difference of 0.126 between the R^2 of 0.670 and the adjusted R^2 of 0.544. The penalty of the R^2 to the adjusted R^2 shall prevent overfitting problems. Overfitting can be understood as considering too many explanatory variables to explain the response variable concerning the number of observations (Ciaburro, 2018, p. 208). Furthermore, the F-statistic of the R^2 and adjusted R^2 is statistically significant (p-value < 0.001). The adjusted R^2 indicates a good explanation of the DPR in this model.

The second multiple regression (regression 4) shows that LOGTIER1, SQRTCTTA, SQRTNETINTINCTTA, NLTTA^2, SQRTNPLTTA, and DEVSTOXX have a statistically significant influence on the DPR. However, the significance level varies as in the first multiple regression model. Based on a 5 % significance level, the variables LOGTIER1 (estimate: -45.308), SQRTNETINTINCTTA (estimate: 45.015), NLTTA^2 (estimate: 0.003) and DEVSTOXX (-0.102) influence the DPR statistically significant. Due to the marginal estimate value of 0.003 of the variable NLTTA^2, the impact is marginal. The variables SQRTCTTA and SQRTNPLTTA are statistically significant at a 10 % level since their p-value is greater than 5 % but lower than 10 %. All other variables are not significant because their p-values are greater than 10 %. The capital side (with the LOGTIER1) influences the DPR negatively. The liquidity side with the SQRTCTTA influences the DPR positively, but the impact is not statistically significant at a 5 % level. The profitability side with the NETINTINCTTA influences the DPR positively. The risk side with the NLTTA^2 influences the DPR positively, but with its value nearly zero, the impact can be described as marginally. As in the first multiple regression, the relationships go in line with the theoretical setting of this dissertation (cp. previous chapter).

The constant value of 16.851 is the first point of the regression line and is remarkably higher than the constant value of 4.612 in the first model. The R^2 of 0.649 is nearly similar to the R^2 of the first multiple regression. The adjusted R^2 with 0.516 is 0.133 lower than the R^2 and shows a similar penalty for taking additional variables into the regression. In the first model, the size of the adjusted R^2 indicates that the model has a good power explanation. Furthermore, the F-statistic of the R^2 and adjusted R^2 is statistically significant (p-value < 0.001). Due to the amount of the adjusted R^2, the DPR can be explained well in this model. Further, in the second multiple regression model, overfitting indications can be seen (due to the gap between R^2 and adjusted R^2). The overfitting problem is discussed and treated in the regression diagnostic in the further course of this study.

4.5.3 Model accuracy

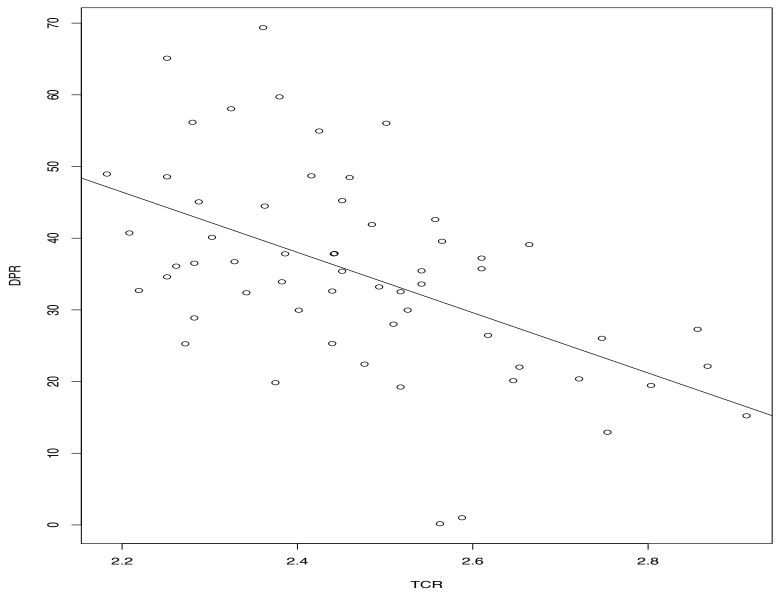
Since a regression model based on several assumptions, it's necessary to test if the assumptions are fulfilled. The assumptions are tested for all regressions (1 to 4), focusing on the multiple regressions (regression 3 and 4).

Linearity of the parameters

The relationship between dependent and independent variables must be linear. The following aspects can verify the linearity assumption: The linear relationship can already be seen by the single regression 1 and 2. The influence of LOGTCR on DPR is negative with -42.062 and statistically significant (***), and the influence of LOGTIER1 on DPR is -37.676 and statistically significant (***). This indicates linearity between these variables. Furthermore, the linear relationship can be detected by the correlation coefficient (cor = -0.53*** for LOGTCR/DPR).

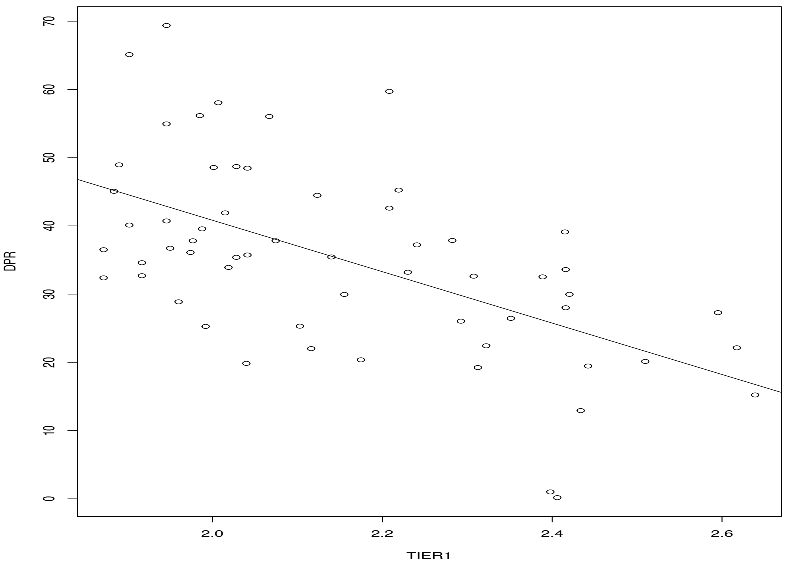
Further, here, the relationship is negative and statistically significant. The influence of the LOGTCR on the DPR is negative and influential in the single regression model and the multiple regression. The correlation between LOGTIER1 and DPR is -0.58 and statistically significant (***). The next step is to create linearity plots: The negative relationship between LOGTCR/LOGTIER1 and DPR can be seen well in the following figures.

Figure 28: Plot for LOGTCR DPR for G1NEW



Source: Own figure

Figure 29: Plot for LOGTIER1 DPR for G1NEW



Source: Own figure

For the single regression, linearity is confirmed. Since the multiple regression model includes the aspect that the independent variables affect each independent variable's impact on the dependent variables, the assumption of linearity is assessed with a cr plot (component and residual plots). The dotted line shows the OLS fit, and the smoother line shows the real shape of data (StackExchange, 2020, no page). The cr plots for regression 3 and 4 are in the appendix 12. The cr plots show that most of the variables fulfill the assumption of linearity. For the variables TETTA and EMPLOYEES, the linearity is not given since the lines are not run in the same way.

Completeness of the model

For evaluating the regressions' completeness, the R^2 and the adjusted R^2 are adequate indicators and are considered. For the single regression 1, the R^2 is 0.282 (28.2 %). As already assess, the regression line describes the model well and is useful for modeling the relationship between the explanatory and explained variable. The R^2 for the single regression 2 has a value of 0.331 (33.1 %) and is higher than the R^2 from the other regression. Furthermore, the R2 in both regressions is based on only one independent variable. Therefore, the representing of the relationship by the regression model is suitable. In both single regressions, the F-test for the R^2 is statistically significant (***).

For regression 3, the R^2 is 0.670 (67.0 %) and is 2.37 larger than the R^2 for the single regression 1. The F-statistic is statistically significant (***) with the H0 that the R^2 is 0. The H0 can be rejected since the p-value is < 0.001 (0.01 %). Nevertheless, it should be noted that multiple regression 1 includes 15 further (independent and control) variables, while single regression 1 includes one independent variable. The increase of the R^2 is good but has to be placed in considering 15 different variables. This aspect is also reflected in the adjusted R^2 of 0.544 (54.4 %) and the difference of 0.126 (12.6 %) between the R^2 and the adjusted R^2. The difference is 18.8 % of the R^2 and relatively high and indicates that other variables' consideration is strongly penalized. An overfitting problem can already be expected and is analyzed in the further course.

For regression 4, most similar values for the R^2 and adjusted R^2 can be seen. The R^2 is 0.650 (65 %) and is good. The F-statistic is statistically significant (***). The explanatory power of the multiple regression 2 is reduced because 15 additional explanatory variables are considered. The adjusted R^2 is 0.516 (51.6 %) and 0.134 (13.4 %) lower than the R^2. Further, the reduction is relatively high and indicates overfitting problems, discussed in the further course.

Expectation value of the error term = 0

The residuals should have an expected value of 0. Therefore, a descriptive statistic for the residuals follows in the following table.

Table 37: Descriptive statistic for the residuals of the regression models

	Mi	**1Q**	**Median**	**3Q**	**Max**
Regression 1	-31.0098	-6.9990	-0.7915	7.7471	29.7082
Regression 2	-25.357	-6.226	-1.144	8.046	26.735
Regression 3	-22.0693	-5.1197	0.5443	4.8084	19.1097
Regression 4	-21.4663	-4.2830	0.8466	4.2819	20.2647

Source: Own table

It can be seen that the residuals of the regression models 1 and 2 have a negative median. Ideally, the median is 0, which means that 50 % of the residuals are greater than 0, and the other 50 % are lower than 0, which finally implies that the residuals are normally distributed. The median for regression 3 has the lowest value with 0.5443. Furthermore, a Tukey-Anscombe-plot is used to visualize the fitted vs. the residuals (Stahel, 1999, p. 278). The plots are included in the appendix 14. Tukey-Anscombe-plots show that the expectation value is nearly 0 for all regression models so that the expectation of a value of 0 is fulfilled.

Normal distribution of the residuals

The normal distribution of the residuals is not only answered visually; it is also checked with a statistical method. For this, the Shapiro-Wilk-test and the Jarque-Bera-test are performed and are summarized as follows:

The following test hypothesis is formulated:

H0: The values of the residuals are normally distributed

H1: The values of the residuals are not normally distributed

Table 38: SW and JB results for the regressions 1 to 4 in G1NEW

Regression model	**Shapiro-Wilk test**		**Jarque-Bera test**	
	W-value	p-value	JB-value	p-value
Regression 1	0.98751	0.806	0.46579	0.7795
Regression 2	0.99001	0.9103	0.19154	0.9005
Regression 3	0.99421	0.9941	0.19103	0.9125
Regression 4	0.98268	0.5633	0.55275	0.731

Source: Own table

Since all results have a greater p-value than the given alpha-level of 5 %, the H0 is accepted. The residuals of all variables are normally distributed. Additionally, to the statistic, Q-Q-Plots are created to visualize the residuals in the context of a normal distribution. A Q-Q-Plot ensures a visual verification of a characteristic's normal distribution assumption (Eckstein, 1997, p. 87). A small difference of the residuals to the straight line in the Q-Q-Plot indicates that the residuals are normally distributed.

Autocorrelation

The autocorrelation test is intended to check if a correlation between two consecutive residual residuals exists (Durbin and Watson, 1950, p. 409-428; Bajpai, 2010, p. 481). For testing the autocorrelation, a Durbin-Watson-test is performed. The hypotheses are:

H0: There is no autocorrelation

H1: There is an autocorrelation

Table 39 summarizes the results of the Durbin-Watson-test.

Table 39: DW results for the regression models 1 to 6 of G1NEW

Regression model	Durbin-Watson-test	
	DW-value	p-value
Regression 1	1.5014	0.021
Regression 2	1.5978	0.05191
Regression 3	1.9995	0.1161
Regression 4	1.9629	0.09379

Source: Own table

By using an alpha level of 5 %, an autocorrelation is detected for regression 1. There is no autocorrelation in all other regression models because the p-value is greater than the alpha level of 0.05, such that in the result, the H0 cannot be rejected. Furthermore, it is necessary to interpret DW-value. A value of 0 shows that the autocorrelation is entirely positive; a DW-value of 2 indicates no autocorrelation. Further, a DW-value of 4 means that there is an entirely positive autocorrelation.

(Wooldridge, 2009, p. 415; Marktforschung fandom, 2020, no page). Regression 3 and 4 have a DW-value of nearly 2, while regression 1 and 2 have a value of 1.5014 and 1.5978. The difference to the DW-value of 2 (no autocorrelation) is also reflected in the p-value because the p-value gets smaller, leading to H0 rejection.

Homoscedasticity

Now it must be checked for the regression quality if the dispersion of the disturbance variables is systematic. The variances of the residuals have to be equal. In this case, homoscedasticity would be present (Bühner and Ziegler, 2009, p. 669; Regorz Statistik, 2020, no page). In the case of no homoscedasticity (or in other words: heteroscedasticity is given), the OLS expectation is true and consistent, but not efficient (Hackl, 2005, p. 174, Wegener, 2019, p. 237). The opposite of homoscedasticity is heteroscedasticity. For testing the homoscedasticity, the Breusch-Pagan-test is used. The Breusch-Pagan-test examined if heteroscedasticity is given. If heteroscedasticity is not provided, homoscedasticity is given implicitly. The following test hypothesis is formulated:

H0: Heteroscedasticity is not given

H1: Heteroscedasticity is given.

Table 40 documents the results of the Breusch-Pagan-test.

Table 40: BP results for the regression models 1 to 4 for G1NEW

Regression model	**Breusch-Pagan-test**	
	BP-value	p-value
Regression 1	0.64186	0.423
Regression 2	0.20902	0.6475
Regression 3	31.359	0.01211
Regression 4	32.1	0.009704

Source: Own table

In regression 1 and 2, heteroscedasticity is not given, so that homoscedasticity is given. In contrast to single regressions, heteroscedasticity is given for regressions 3 and 4 since the p-value in both regressions is smaller than the alpha level of 5 %. In considering heteroscedasticity, the heteroscedasticity and autocorrelation consistent (HAC) standard error is used to create an efficient regression model with robust standard errors (Wegener, 2019, p. 237). The results of the HAC application are summarized and compared with the previous OLS in the following table.

Table 41: HAC application for regression 3 and 4 of G2NEW

	Dependent variable:			
	DPR			
	(3)		(4)	
	OLS	HAC	OLS	HAC
LOGTCR	-64.515***	-64.515**		
	(15.323)	(27.794)		
LOGTIER1			-45.308***	-45.308*
			(11.984)	(22.662)
SQRTTETTA	0.040	0.040	-11.401	-11.401
	(14.923)	(26.611)	(14.796)	(26.758)
SQRTCTTA	5.522**	5.522*	4.199*	4.199
	(2.202)	(2.938)	(2.161)	(2.725)
TDTTA	0.027	0.027	0.228	0.228
	(0.159)	(0.218)	(0.161)	(0.240)
SQRTTDETTA	2.116	2.116	7.040	7.040
	(4.899)	(5.786)	(4.906)	(6.896)
ROA	-37.146*	-37.146	-32.388	-32.388
	(18.595)	(30.880)	(19.495)	(32.823)
INCATCSTTE	1.329	1.329	0.096	0.096
	(1.354)	(2.072)	(1.439)	(2.339)
LOGNETINC-COMSHARES	-19.011*	-19.011	-11.782	-11.782
	(11.284)	(21.326)	(11.375)	(19.474)
SQRTNETINTINCTTA	60.844***	60.844*	45.015***	45.015
	(14.272)	(35.898)	(14.269)	(31.419)
NLTTA^2	0.003*	0.003	0.003**	0.003
	(0.002)	(0.003)	(0.002)	(0.003)
SQRTNPLTTA	-11.971*	-11.971	-10.629*	-10.629
	(5.934)	(8.454)	(6.093)	(9.855)
RWATTA	-0.004	-0.004	0.071	0.071
	(0.126)	(0.130)	(0.124)	(0.123)
LOGEMPLOYEES	0.905	0.905	-5.567	-5.567
	(5.131)	(7.876)	(5.346)	(7.777)
SQRTTCSO	-17.970	-17.970	-7.517	-7.517
	(16.714)	(36.758)	(17.098)	(31.803)
LOGTA	20.023	20.023	18.971	18.971
	(12.463)	(25.436)	(12.820)	(21.590)
DEVSTOXX	-0.089**	-0.089*	-0.102**	-0.102*
	(0.041)	(0.052)	(0.042)	(0.052)
Constant	4.612	4.612	16.851	16.851
	(97.984)	(141.500)	(101.826)	(152.597)
Observations	59	59	59	59
R^2	0.670	0.670	0.649	0.649

Adjusted R^2	0.544	0.544	0.516	0.516
Residual Std. Error	9.413 (df = 42)	9.413 (df = 42)	9.696 (df = 42)	9.696 (df = 42)
F Statistic	5.320*** (df = 16; 42)	5.320*** (df = 16; 42)	4.863*** (df = 16; 42)	4.863*** (df = 16; 42)
.p < 0.1; *p <0.05; **p <0.01; ***p < 0.001				

Source: Own table

Due to the HAC application's consideration, the variable's standard error increases (which leads to a decrease of the T-value) and finally reduces the P-value since the regression model gets more efficient. The regression coefficient is unchanged, while the standard error, T-value, and P-value are adjusted. The variables LOGTCR, ROA, LOGNETINCCOMSHARES, SQRTNETINTINCTTA, NLTTA^2, SQRTNPLTTA, and DEVSTOXX the P-value decreases and leads from a previous significance to a now insignificance for ROA, LOGNETINCCOMSHARES, NLTTA^2, and SQRTNPLTTA. The same procedure was performed for the second multiple regression (regression 4).

Further, in regression 4, the HAC application's consideration leads to an increased standard error and a decreased T-value with a decreased p-value. By considering the HAC, the regression model gets more efficient. It can be seen that the constant value is unchanged, while the standard error, T-value, and P-value are adjusted. For the variables LOGTIER1, SQRTCTTA, SQRTNETINTINCTTA, NLTTA^2, SQRTNPLTTA, and DEVSTOXX, the P-value decreases and leads from a previous significance to a now insignificance for SQRTCTTA, SQRTNETINTINCTTA, NLTTA^2, and SQRTNPLTTA. The influence of LOGTIER1 and DEVSTOXX are still statistically significant.

Multicollinearity

Another assumption of the regression analysis is that the independent variables should not correlate with each other since the independent variables' variance share overlaps (Schneider, 2009, p. 222; Eckey, Kosfeld and Dreger, 2004, p. 83; Fromm, 2008, p. 351). The first indication of multicollinearity can be seen on the correlation coefficient since the coefficient represent the linear relationship between two variables (see table 33). But the correlation coefficient does not contain a piece of information about the share of variance explanation of the independent variable. Therefore, the Variance Inflation Factor (VIF) is used. The VIF shows how much each independent variable's variance increases when all other variables do not correlate with each other (Riesenhuber, 2007, p. 127). A VIF of 10 (or greater) indicates strong multicollinearity, while a VIF smaller than five shows weak multicollinearity. The following table summarizes the VIF for the multiple regressions.

Table 42: VIF analysis for the multiple regressions

Variable	**VIF regression 3**	**VIF regression 4**
LOGTCR	4.752038	
LOGTIER1		4.018193
SQRTTETTA	21.683277	20.091375
SQRTCTTA	3.557016	3.226863
TDTTA	3.175840	3.066312
SQRTTDETTA	8.983305	8.492228
ROA	13.982570	14.485393
INCATCSTTE	32.809918	34.955145
LOGNETINCCOMSHARES	20.809318	19.931034
SQRTNETINTINCTTA	7.441794	7.011397
NLTTA^2	4.395611	4.354037
SQRTNPLTTA	3.029465	3.009826
RWATTA	3.619564	3.307946
LOGEMPLOYEES	15.809290	16.175377
SQRTTCSO	48.536109	47.873015
LOGTA	68.362670	68.184537
DEVSTOXX	1.118075	1.102831

Source: Own table

Based on the VIF, all variables with a VIF greater than 10 are removed from the regression models since their explanation power is not essential but leads to overfitting problems. For regression 3, the number of variables reduces from 16 to 9 because the VIF of 7 variables is > 10 and are eliminated from the regression model. Further, for regression 4, 7 variables are eliminated from the regression model. Since regression 3 and 4 differs by the capital area variable (LOGTCR and LOGTIER1), the same VIF detected variables are identified.

Overfitting

The identified variables were eliminated based on the VIF analysis, and a new regression model is performed. Table 43 compares the previous regression models with the adjusted regression models to consider and assess overfitting in the regression models. The regression models already include the HAC application.

Table 43: Regression 3 and 4 comparison with the previous regression

	Dependent variable:			
	DPR			
	(3)		(4)	
	OLS HAC adj.	OLS OF adj.	OLS HAC adj.	OLS OF adj.
LOGTCR	-64.515** (27.794)	-70.200*** (16.837)		
LOGTIER1			-45.308* (22.662)	-41.951*** (9.758)
SQRTTETTA	0.040 (26.611)	eliminated	-11.401 (26.758)	eliminated
SQRTCTTA	5.522* (2.938)	1.924 (2.010)	4.199 (2.725)	0.683 (1.862)
TDTTA	0.027 (0.218)	-0.264 (0.212)	0.228 (0.240)	-0.117 (0.218)
SQRTTDETTA	2.116 (5.786)	-5.593 (4.675)	7.040 (6.896)	-5.061 (4.791)
ROA	-37.146 (30.880)	eliminated	-32.388 (32.823)	eliminated
INCATCSTTE	1.329 (2.072)		0.096 (2.339)	
LOGNETINC-COMSHARES	-19.011 (21.326)		-11.782 (19.474)	
SQRTNETINTINCTTA	60.844* (35.898)	40.330** (15.541)	45.015 (31.419)	14.128 (12.432)
NLTTA^2	0.003 (0.003)	-0.001 (0.002)	0.003 (0.003)	0.0004 (0.002)
SQRTNPLTTA	-11.971 (8.454)	1.431 (7.743)	-10.629 (9.855)	6.160 (9.212)
RWATTA	-0.004 (0.130)	-0.228** (0.107)	0.071 (0.123)	-0.100 (0.117)
LOGEMPLOYEES	0.905 (7.876)	eliminated	-5.567 (7.777)	eliminated
SQRTTCSO	-17.970 (36.758)		-7.517 (31.803)	
LOGTA	20.023 (25.436)		18.971 (21.590)	
DEVSTOXX	-0.089* (0.052)	-0.100* (0.056)	-0.102* (0.052)	-0.109* (0.058)
Constant	4.612 (141.500)	213.992*** (44.937)	16.851 (152.597)	142.807*** (33.437)
Observations	59	59	59	59

R^2	0.670	0.491	0.649	0.434
Adjusted R^2	0.544	0.398	0.516	0.330
Residual Std. Error	9.413 (df = 42)	10.813 (df=49)	9.696 (df = 42)	11.408 (df = 49)
F Statistic	5.320*** (df = 16; 42)	5.259*** (df = 9; 49)	4.863*** (df = 16; 42)	4.172*** (df = 9; 49)
.p < 0.1; *p <0.05; **p <0.01; ***p < 0.001				

Source: Own table

Although 7 out of 16 variables (elimination of 43.75 % of the previous variable setting) are eliminated, the R^2 of 0.491 and the adjusted R^2 of 0.398 have a relatively well explanation power. Due to a variable elimination of 43.75 %, the adjusted R^2 reduction of 22.87 % to 0.398 can be accepted well. The F-Fest of the R^2 is statistically significant (p-value < 0.001). The variable LOGTCR is unchanged statistically significant (p-value < 0.001) while the regression coefficient increases. The p-value of the variable SQRTNETINTINCTTA is smaller than 0.05 (as before in the first model). Remarkable is that the regression coefficient of the variable RWATTA is after the VIF and HAC adjustment statistically significant (p-value < 0.001). The regression coefficient of the variable DEVSTOXX changed from -0.089* to -0.1*. In summary, the final regression model has the same fundamental message (nearly the same regression coefficients, but with adjusted p-values). Therefore, the adjusted regression 3 is more reliable and efficient and suitable to explain the CRR/CRD IV's influence on the dividend policy.

For regression 4, although 7 out of 16 variables (elimination of 43.75 % of the previous variable setting) are eliminated, the R^2 of 0.434 and the adjusted R^2 of 0.330 has already a relatively well explanation power. Due to a variable elimination of 43.75 %, the adjusted R^2 reduction of 36.05 % from 0.434 to 0.330 can be accepted well. The F-Fest of the R^2 is statistically significant (p-value < 0.001). Furthermore, the variable LOGTIER1 is unchanged statistically significant (p-value < 0.001) while the regression coefficient decreases. The regression coefficient of the variable DEVSTOXX changed from -0.102** to -0.109 (p-value < 0.05). In summary, the final regression model has the same key message (nearly the same regression coefficients, but with adjusted p-values). Therefore, the adjusted regression multiple model-2 is more reliable and efficient and suitable to explain the CRR/CRD IV's influence on the dividend policy.

4.6 DATA FRAME G2

4.6.1 Descriptive statistic

The following analysis is based on the mentioned data frame G2, which includes 20 variables in total with 75 observations (since 2013, all variables as in G1 and additionally the variables LCR and LR). First of all, an outlier analysis is performed with boxplots for a first visual indication; boxplots with and without outliers are included in appendix 15. The results of the outlier analysis are summarized in the following table.

Table 44: Overview of the outlier identification

	Variable	Outliers	Number of outliers
IV	TCR	+	3
	TIER 1	-	0
	TETTA	+	1
	CTTA	+	4
	TDTTA	-	0
	TDETTA		
	ROA	+	1
	INCATCSTTE	+	1
	NETINCCOMSHARES	+	7
	NETINTINCTTA	+	3
	NLTTA	-	0
	NPLTTA	+	5
	RWATTA	+	2
	LCR	+	1
	LR	-	0
DV	DPR	+	8
CV	TA	-	0
	EMPLOYEES	-	0
	TCSO	+	3
	DEVSTOXX	-	0
		Total	**39**

Source: Own table

After the outlier elimination, the data set G2 was reduced from 75 to 36 observations. The data set with the eliminated values is called G2NEW. A descriptive analysis is performed and compared with the descriptive statistic of the uneliminated data set in this context. At first, a descriptive statistic for G2 follows.

Table 45: Descriptive statistic G2

Variable	N	Mean	Sd	Median	Min	Max	Skew	Kurtosis
TCR	75	18.85	3.95	18.50	11.70	31.80	1.20	2.06
TIER1	75	16.03	3.72	15.40	10.80	28.70	1.41	2.23
TETTA	75	6.27	1.74	6.03	3.62	13.34	1.97	5.63
CTTA	75	10.32	4.36	9.81	1.17	29.23	1.11	3.41
TDTTA	75	20.24	12.08	16.88	4.04	49.29	0.79	-0.48
TDETTA	75	49.87	12.11	47.33	28.28	78.56	0.26	-1.12
ROA	75	0.35	0.48	0.45	-1.58	1.19	-1.53	3.88
INCATCSTTE	75	4.82	7.53	6.73	-24.13	15.40	-1.62	3.58
NETINCCOMSHARES	75	0.83	1.88	0.53	-4.55	6.04	0.88	2.61
NETINTINCTTA	75	1.31	0.52	1.14	0.70	2.61	1.09	0.19
NLTTA	75	48.47	15.04	49.80	22.55	74.69	0.00	-1.28
NPLTTA	75	2.13	3.03	1.14	0.24	17.86	3.87	16.41
RWATTA	75	33.81	11.25	31.90	17.46	77.14	1.20	2.02
DPR	75	-11.93	332.12	46.00	-2248.19	704.93	-4.97	28.92
EMPLOYEES	75	83,165.53	72,430.99	67,000.00	4,036.00	255,203.00	0.76	-0.64
TCSO	75	8.49	14.45	2.07	0.42	71.97	3.24	11.17
TA	75	884.12	668.91	698.69	69.82	2422.08	0.57	-0.86
DEVSTOXX	75	-6.79	14.58	-3.25	-28.04	8.66	-0.47	-1.32
LCR	75	142.85	26.27	139.00	100.00	244.00	1.24	2.22
LR	75	5.27	1.17	5.10	3.50	9.52	1.21	2.13

Source: Own table

For ensuring an adequate comparison, the variables are analyzed in the same order as in G1. The DPR has a mean of -11.93 %, while the median is 46.00 %. The difference indicates that the variable is influenced by outliers, relating to the fact that G2 included outliers and the outlier adjusted data frame follows. Furthermore, the DPR range confirms the outlier inclusion because there is a minimum value of -2248.10 % and a maximum value of 704.93 %. These values are probably originated due to extraordinary dividend distributions (higher than the generated earnings). The skew is -4.97 and indicates a left-skewed distribution (Ausloos and Cerqueti, 2018, p. 2203, Fahrmeir et al., 2007, p. 75). The kurtosis of 28.92 is much greater than 3 and indicates that the distribution has an acute shape and fat ends of the distribution. The kurtosis is the fourth moment of a distribution (Ausloos and Cerqueti, 2018, p. 2203). The kurtosis value of 3 is commonly known for a normal distribution, > 3 for distributions with fat ends, and < 3 for thin ends.

The variables TCR and TIER1 from the capital area variables are mostly equal. TCR has a mean of 18.85 % and TIER1 a mean of 16.03 %. Even the standard deviation is similar to 3.95 for TCR and 3.72 for TIER1. On average, the 75 observations fulfill regulatory requirements regarding capital ratios of a TCR of 13 % (due to the mean of 18.85 %). Considering minimum values, both for TCR and TIER1, the regulatory requirements are not fulfilled by all observations (minimum of 11.70 % for TCR and 10.80 % for TIER1). The median of TCR is 18.50 % as a value of the middle distribution and is close to the mean of 18.85 %, indicating a normal distribution. The TIER1 has a median of 15.40 % and is close to the mean, showing a normal distribution.

In contrast to G1, where the capital requirements regarding TIER1 (minimum 6.00 %, compare chapter 2.4.1.1) were not met for some observations, the capital requirements are now fulfilled because there is a minimum value TIER1 of 10.80 %. The skew value of the TCR is 1.20, the skew of TIER 1 is 1.41, and both are greater than 0 and suggest that the variables are right-skewed with thin ends because the kurtosis is 2.06 for TCR and 2.23 for TIER 1 and < 3. The descriptive of the other independent variables can be taken from table 45.

The variable LCR is from the research is liquidity and now included for the first time. The LCR has a mean of 142.85 % with a median of 139.00 %. The minimum value is 100 %, which is understandable because the LCR should be greater than 100 %. In this case, the banks hold more high-quality liquid assets than their total net cash outflows over their next 30 days. The maximum value is 244.00 %. All banks fulfill the requirement of 100 %. The skew is 1.24, and the kurtosis is 2.22 (a right-skewed distribution with thin ends).

The variable LR is also included for the first time. The LR has a mean of 5.27 % with a median of 5.10 %. Since the median and mean are closed together, a normal distribution can be indicated. The minimum value is 3.50 %, and the maximum value is 9.52 %. The skew is 1.21, and the kurtosis is 2.13. The distribution description is the same as for LCR (a right-skewed distribution with thin ends).

The control variables EMPLOYEES, TCSO, TA, and DEVSTOXX, can be characterized as follows: The sub-sample G2 includes relatively large banks and can be seen by the number of the variable EMPLOYEES. The dataset has a mean of 83,165.53 for the variable EMPLOYEES with a median of 67,000.00. The range is from a minimum value of 4,036.00 to a maximum of 255,203.00, and the skew is 0.76 and greater than 0, indicating a right-skewed variable distribution. Furthermore, the kurtosis with -0.64 is < 3 and shows thin ends. The variable EMPLOYEES ratios confirm the intention to consider capital market listed European banks, as these banks are more extensive than banks not listed capital market. The next control variable is the TCSO. On average, the 75 observations in the sample G2 have 8.49 bn. outstanding shares (in G1: 3.87 bn. outstanding shares) with a minimum of 0.42 bn. and a maximum of 71.97 bn. outstanding shares (in G1: 18.48 bn. outstanding shares). The comparison with the G1 descriptive statistic shows that the number of outstanding shares increased since 2013. The skew of 3.24 indicates a right-skewed distribution; the kurtosis of 11.17 indicates fat ends of the distribution. The high number of outstanding shares (on average) goes along with the variable EMPLOYEES and TA structure as other size variables. The variable TA is structured as follows: With a mean of 884.12 bn. € and a median of 698.69 bn. €, this variable confirms the previous statement of considering relatively large banks. However, it should be noted that the standard deviation of 668.91 bn. € implies that the distance of all measured observations from its meaning is far from the average; therefore, a high spread can be implied (Fahrmeir et al., 2007, p. 70; Müller and Poguntke, 2010, p. 208, Sachs, 1984, p. 57; Eckstein, 2006, p. 51). The skew is 0.57 and identifies a right-skewed distribution. The kurtosis is negative with -0.86 and indicates thin ends of the distribution. The variable DEVSTOXX has an average of -6.79 % with a sd of 14.58 % but is understandable due to a volatile index development. The next step is to analyze the descriptive statistic for the newly created data frame G2NEW, which excludes the outliers. The following table shows the descriptive statistic of G2NEW.

Table 46: Descriptive statistic G2NEW

Variable	N	Mean	Sd	Median	Min	Max	Skew	Kurtosis
TCR	36	19.41	3.34	19.90	13.30	28.30	0.09	-0.15
TIER1	36	16.74	3.03	16.90	12.20	25.00	0.39	-0.18
TETTA	36	6.23	1.12	6.07	4.06	8.50	0.09	-0.93
CTTA	36	11.09	3.05	10.98	4.81	17.54	0.28	-0.45
TDTTA	36	23.66	11.67	17.38	8.57	48.54	0.67	-0.90
TDETTA	36	49.71	12.80	45.81	28.28	78.56	0.21	-1.16
ROA	36	0.44	0.28	0.47	-0.37	0.93	-0.59	0.77
INCATCSTTE	36	6.68	4.71	6.88	-6.80	15.40	-0.56	0.61
NETINCCOMSHARES	36	0.60	0.75	0.51	-1.37	2.24	-0.06	0.76
NETINTINCTTA	36	1.32	0.54	1.13	0.74	2.45	1.00	-0.37
NLTTA	36	50.64	14.36	54.10	25.71	74.69	-0.12	-1.16
NPLTTA	36	1.39	1.08	1.07	0.24	4.66	1.17	0.63
RWATTA	36	33.00	8.89	34.19	18.40	53.12	0.17	-1.08
DPR	36	51.05	34.91	51.38	-37.37	103.82	-0.66	-0.22
EMPLOYEES	36	82,306.78	78,599.12	55,555.00	9,561.00	255,203.00	0.82	-0.78
TCSO	36	7.38	7.06	3.30	0.85	20.04	0.62	-1.40
TA	36	845.50	622.18	641.84	122.55	2230.48	0.71	-0.67
DEVSTOXX	36	-8.13	16.13	-5.01	-28.04	8.66	-0.25	-1.73
LCR	36	144.86	19.85	146.00	100.00	185.00	0.05	-0.16
LR	36	5.27	0.90	5.10	3.50	7.50	0.61	0.46

Source: Own table

Table 46 excludes 39 outliers so that the sample size was reduced to 36 observations. The impact of an outlier elimination is also visible here. The variable DPR had a mean of -11.93 % and a median of 46.00 % with a standard deviation of 332.12 %. After outlier elimination, the mean is 51.05 %, the median is 51.38 %, with a standard deviation of 34.91 %. The minimum value is -37.37 %, and the maximum value is 103.82 %. Due to the outlier analysis and elimination, the descriptive statistic is much more understandable. It fits into the latest ECB analysis, where the DPR median is between 30 % and 40 % (Gardó, Grodzicki, and Wendelborn/ECB, no page, accessed on 27.07.2020). The DPR has a skew of -0.66 and kurtosis of -0.22. The skew smaller than 0 and indicates a left-skewed distribution (Ausloos and Cerqueti, 2018, p. 2203, Fahrmeir et al., 2007, p. 75). The kurtosis is nearly 0 too and < 3 and indicates thin ends of the distribution. In the next step, the independent variables TCR and TIER 1 of G2NEW are analyzed. The TCR has a mean of 19.41 % and a median of 19.90 %, which differs slightly from the not outliers eliminated data frame G2 (mean of 18.85 % and a median of 18.50 %). The median of 19.90 % as a value of the middle distribution is close to a mean of 19.41 %, which indicates a normal distribution. The exact distribution will be tested in the next step with a Shapiro-Wilk-test. After the outlier elimination, the minimum is 13.30 %, and the maximum is 25.30 %. The data frame G2NEW fulfill the capital requirements of a 13 % TCR. The skew is 0.09, nearly 0 and a kurtosis of -0.15 and is < 3, and the distribution can be characterized as a normal distribution (regarding the skew coefficient) and a distribution with thin ends (regarding the kurtosis coefficient); TIER 1 has a mean of 16.74 % and a median of 16.90 %. Both ratios are closed together and indicate a normal distribution. The mean increases from 16.03 % in G2 to 16.74 % in G2NEW. The minimum increases from 10.80 % in G2 to 12.20 % in G2NEW. The maximum value is nearly unchanged (28.70 % in G2 to 25.00 % in G2NEW). Since the minimum of 10.80 % is greater than the capital requirement of TIER 1, it can be stated that all banks fulfill the capital requirement regarding the TIER 1 requirement of 6 % (cp. chapter 2.4.1.1). The skew is 0.39 and > 0, which implies a right-skewed distribution. The kurtosis is -0.18 and is < 3, which indicates a distribution with thin ends. The LCR has, after outlier elimination, a mean of 144.86 % and a median of 146.00 %. The minimum value is 100.00 %, and the maximum value is 185.00 %. The skew coefficient is 0.05, and the kurtosis coefficient is -0.16. Therefore, the LCR in G2NEW is normally distributed (based on the skew) with thin ends (based on the kurtosis). After outlier elimination, the LR has a mean of 5.27 % and a median of 5.10 %. The minimum value is 3.50 %, the maximum value is 7.50 %; the minimum value is unchanged to LR in G2, but the maximum value is reduced from 9.52 % to 7.50 %. The skew is 0.61, and the kurtosis is 0.46. Based on these coefficients, the distribution is a nearly normal distribution with thin ends.

A look at the control variables shows the following description. Further, G2NEW includes relatively large banks and can be understood by the number of variable EMPLOYEES. The variable EMPLOYEES has a mean of 82,306.78 and a median of 55,555.00. The skew is 0.82 and greater than 0 and indicates a right-skewed distribution of a variable. Furthermore, the kurtosis with -0.78 is < 3 and shows thin ends. The general distribution of EMPLOYEES has not been changed. The variable EMPLOYEES ratios confirm the intention to consider capital market listed European banks, as these banks are more considerable than banks not listed in the capital market. The next control variable TCSO has an average of 7.38 bn. outstanding shares (before outlier elimination: 8.49 bn.) with a median of 3.30 bn. outstanding shares (before outlier elimination: 2.07 bn.). The minimum value is 0.85 bn. and the maximum value is 20.04 bn. The outlier elimination reduces the maximum value from 71.97 bn. to 20.04 bn.

Nevertheless, the number of outstanding shares goes in line with the number of employees (compare variable EMPLOYEES) or total assets (compare variable TA). TCSO has a skew coefficient of 0.62, describing a right-skewed distribution. The kurtosis coefficient is -1.40 and describes thin ends of the distribution; the variable TA's average is 845.50 bn. € and the median is 641.84 bn. €. In G2, the mean was 884.12 bn. € and the median of 698.69 bn. €. In general, the values have not been changed because G2NEW considers large banks as G2. The sd is 622.18 bn. € and unchanged relatively high (as in G2: 668.91 bn. €). This implies that the distance of all measured observations from its meaning is far from the average; therefore, a high spread can be implied (Fahrmeir et al., 2007, p. 70; Müller and Poguntke, 2010, p. 208, Sachs, 1984, p. 57; Eckstein, 2006, p. 51). The skew is 0.71 and identifies a right-skewed distribution. The kurtosis is negative with -0.67 and indicates thin ends of the distribution. The variable DEVSTOXX has an average of -8.13 % with a standard deviation of 16.13 % but is understandable due to a volatile index development. The skew is -0.25, and the kurtosis is -1.73. In summary and as in G1NEW, the outlier eliminated data frame G2NEW is useful to display a data set without extreme values (for example, DPR with a mean of -11.93 % to now 51.05 % with a standard deviation of 34.91 % (before outlier elimination: 332.12 %). The capital ratios TCR and TIER1 show the same direction. Furthermore, the control variables have the same critical statement (data set contains relatively large European banks).

In the next step, histograms for G2 and G2NEW were created. The histogram comparison is included in the appendix 16. As for G1 and G1NEW applied, a first visual indication of the distribution structure follows. Furthermore, variables without a normal distribution are transformed with their square, square root, or logarithm (compare transformation description in chapter 4.5.1). Table 48 was created to give an overall view. The following table summarizes the distribution structure and their changes caused by an outlier elimination and a transformation.

Table 47: Visual distribution indication for G2 and G2NEW

Variable	Distribution structure		
	1st run (75 obs.)	2nd run (36 obs.)	3rd run (36 obs.)
TCR	ND	ND	ND
TIER1	RS	RS	ND
TETTA	RS	ND	ND
CTTA	RS	ND	ND
TDTTA	RS	RS	RS
TDETTA	MM	MM	ND
ROA	LS	LS	ND
INCATCSTTE	LS	ND	ND
NETINCCOMSHARES	ND	LS	ND
NETINTINCTTA	RS	RS	RS
NLTTA	MM	MM	MM
NPLTTA	RS	RS	ND
RWATTA	RS	ND	ND
DPR	LS	LS	ND
EMPLOYEES	RS	RS	RS
TCSO	RS	RS	RS
TA	RS	RS	RS
DEVSTOXX	MM	MM	MM
LCR	RS	ND	ND
LR	RS	ND	ND

Source: Own table

A total of 2 out of 20 variables (TCR and NETINCCOMSHARES) show a normal distribution in the first run (based on their histograms). In the second run (G2 without outliers), 7 out of 20 variables show a normal distribution. 3 of 20 variables have a multi-modal structure. The left-skewed variables (3 of 20 in the second run) and the right-skewed variables (7 out of 20) are transformed. In the third run, 13 out of 20 variables are normally distributed, caused by an outlier elimination and variable transformations. The following table shows the chosen change in each variable.

Table 48: Variable transformation G2NEW

Variable	Transformation
TDTTA	log
TDETTA	log
NETINTINCTTA	log
NPLTTA	log
EMPLOYEES	log
TCSO	log
TA	log
LR	log

Source: Own table

All variables are tested by the Shapiro-Wilk test to fulfill the normal distribution requirement for the following parametric tests. The following table summarizes the Shapiro-Wilk test results for the variables and each stage of the variable (1st run: variables with outliers, 2nd run: variables without outliers, and 3rd run: transformed variables). The following test hypothesis is formulated:

H0: The values are normally distributed

H1: The values are not normally distributed

Table 49: SW results for G2, G2NEW, and G2NEW transformed

Variable	Result					
	1st run (75 obs.)		**2nd run (36 obs.)**		**3rd run (36 obs.)**	
	W-value	Signif. Code	W-value	Signif. Code	W-value	Signif. Code
TCR	0.90303	***	0.95825		0.95825	
TIER1	0.86124	***	0.95683		0.95683	
TETTA	0.82023	***	0.97732		0.97732	
CTTA	0.93477	***	0.9779		0.9779	
TDTTA	0.89583	***	0.8794	***	0.93219	*
TDETTA	0.94709	***	0.93541	*	0.94307	.
ROA	0.88578	***	0.94343	.	0.94343	.
INCATCSTTE	0.86391	***	0.96043		0.96043	
NETINC-COMSHARES	0.82774	***	0.93573	*	0.93573	*
NETINTINCTTA	0.86652	***	0.82638	***	0.90248	**
NLTTA	0.94542	***	0.9498		0.9498	
NPLTTA	0.51998	***	0.85536	***	0.95453	
RWATTA	0.92072	***	0.95777		0.95777	
DPR	0.3566	***	0.94916	.	0.94916	.
EMPLOYEES	0.88124	***	0.83302	***	0.90214	**
TCSO	0.54136	***	0.78763	***	0.87572	***
TA	0.90939	***	0.88413	**	0.93876	*
DEVSTOXX	0.79714	***	0.76403	***	0.76403	***
LCR	0.91907	***	0.97613		0.97613	
LR	0.91157	***	0.9301	*	0.94891	.

Source: Own table

The results of the Shapiro-Wilk-test with an alpha level of 5 % are collected in the following table.

Table 50: SW results for the 3rd run of G2NEW

Variable	Result
TCR	Normal distributed
TIER1	Normal distributed
TETTA	Normal distributed
CTTA	Normal distributed
TDTTA	Not normal distributed
TDETTA	Normal distributed
ROA	Normal distributed
INCATCSTTE	Normal distributed
NETINCCOMSHARES	Normal distributed
NETINTINCTTA	Not normal distributed
NLTTA	Normal distributed
NPLTTA	Normal distributed
RWATTA	Normal distributed
DPR	Normal distributed
EMPLOYEES	Not normal distributed
TCSO	Not normal distributed
TA	Not normal distributed
DEVSTOXX	Not normal distributed
LCR	Normal distributed
LR	Normal distributed

Source: Own table

It should be noted that the variable DEVSTOXX has not been transformed since the observations of this variable have negative values. The other variables with negative values are already normally distributed through outlier elimination. Through the outlier elimination and variable transformation, most of the variables (14 of 20) show a normal distribution (by an alpha level of 5 %) and well-suited for the parametric statistical tests.

4.6.2 Explorative statistic

The explorative statistic is performed to estimate the impact of the CRR/CRD IV on the dividend policy. First of all, a correlation analysis is performed. This study uses the commonly used Pearson correlation since the Pearson correlation is suitable to measure a linear relationship between two metrically scaled variables (Gravetter and Wallnau, 2008, p. 440; David and Sutton, 2004, p. 303; Weinberg and Knapp, 2008, p. 135). The following table summarizes the correlation coefficients between the variables.

Table 51: Correlation matrix for G2NEW

	Same variables as in the columns																			
TCR	1																			
TIER1	0.96	1																		
TETTA	-0.27	-0.3	1																	
CTTA	0.22	0.08	0.13	1																
LOGTDTTA	0.58	0.7	-0.39	-0.05	1															
LOGTDETTA	-0.61	-0.64	0.61	-0.05	-0.63	1														
ROA	0.12	0.24	0.4	-0.3	0.26	0.09	1													
INCATCSTTE	0.22	0.36	0.13	-0.38	0.42	-0.04	0.95	1												
NETINCCOM-SHARES	0.28	0.42	0.12	-0.4	0.46	-0.26	0.78	0.83	1											
LOGNETINTINCTTA	-0.72	-0.68	0.52	-0.25	-0.44	0.79	0.17	0.05	-0.12	1										
NLTTA	0.06	0.2	0.1	-0.43	0.36	0.2	0.72	0.8	0.56	0.38	1									
LOGNPLTTA	-0.64	-0.65	0.38	-0.29	-0.74	0.56	0	-0.11	-0.06	0.66	0.01	1								
RWATTA	-0.73	-0.73	0.72	-0.01	-0.47	0.73	0.08	-0.11	-0.14	0.8	0.05	0.54	1							
DPR	0.47	0.46	0.12	0.17	0.21	-0.17	0.39	0.41	0.4	-0.32	0.06	-0.17	-0.25	1						
LOGEMPLOYEES	-0.54	-0.61	0.08	0.09	-0.5	0.37	-0.45	-0.5	-0.52	0.32	-0.57	0.36	0.4	-0.02	1					
LOGTCSO	-0.41	-0.45	0.22	0.12	-0.52	0.43	-0.16	-0.23	-0.4	0.33	-0.34	0.37	0.36	0.29	0.83	1				
LOGTA	-0.36	-0.41	-0.07	0.13	-0.31	0.06	-0.48	-0.52	-0.48	0.06	-0.68	0.15	0.16	0.04	0.93	0.77	1			
DEVSTOXX	0.03	0.04	-0.06	-0.06	-0.11	0.04	-0.14	-0.13	-0.14	0.09	0	0.11	-0.03	-0.23	0.06	0.04	0.06	1		
LCR	0.04	0.05	-0.21	0.17	0.11	0.03	-0.07	0.04	-0.07	-0.21	-0.01	-0.13	-0.22	0.23	0.01	0.14	-0.01	-0.16	1	
LOGLR	0.06	0.07	0.77	0.15	-0.1	0.25	0.43	0.23	0.31	0.24	0.19	0.15	0.45	0.23	-0.31	-0.12	-0.39	-0.08	-0.24	1

Source: Own table

Table 52: P-values for table 51

	Same variables as in the columns																			
TCR	*NA*																			
TIER1	0	*NA*																		
TETTA	0.11	0.08	*NA*																	
CTTA	0.19	0.64	0.45	*NA*																
LOGTDTTA	0	0	0.02	0.77	*NA*															
LOGTDETTA	0	0	0	0.78	0	*NA*														
ROA	0.5	0.16	0.02	0.08	0.13	0.62	*NA*													
INCATCSTTE	0.2	0.03	0.45	0.02	0.01	0.82	0	*NA*												
NETINCCOM-SHARES	0.1	0.01	0.49	0.02	0.01	0.12	0	0	*NA*											
LOGNETINTINCTTA	0	0	0	0.14	0.01	0	0.33	0.78	0.5	*NA*										
NLTTA	0.74	0.24	0.56	0.01	0.03	0.25	0	0	0	0.02	*NA*									
LOGNPLTTA	0	0	0.02	0.09	0	0	0.99	0.52	0.73	0	0.97	*NA*								
RWATTA	0	0	0	0.95	0	0	0.64	0.53	0.4	0	0.79	0	*NA*							
DPR	0	0	0.49	0.32	0.23	0.31	0.02	0.01	0.02	0.06	0.73	0.32	0.13	*NA*						
LOGEMPLOYEES	0	0	0.63	0.62	0	0.02	0.01	0	0	0.06	0	0.03	0.02	0.92	*NA*					
LOGTCSO	0.01	0.01	0.19	0.47	0	0.01	0.35	0.17	0.02	0.05	0.04	0.03	0.03	0.08	0	*NA*				
LOGTA	0.03	0.01	0.69	0.44	0.07	0.73	0	0	0	0.71	0	0.4	0.34	0.81	0	0	*NA*			
DEVSTOXX	0.87	0.83	0.73	0.74	0.54	0.81	0.4	0.46	0.41	0.62	0.99	0.53	0.87	0.17	0.74	0.81	0.74	*NA*		
LCR	0.83	0.78	0.23	0.32	0.53	0.86	0.7	0.84	0.71	0.23	0.96	0.43	0.19	0.17	0.93	0.4	0.96	0.36	*NA*	
LOGLR	0.73	0.7	0	0.4	0.58	0.14	0.01	0.18	0.07	0.15	0.26	0.39	0.01	0.18	0.06	0.49	0.02	0.64	0.16	*NA*

Source: Own table

In contrast to G1NEW, the variable TCR correlates positive with the DPR with 0.47 (p-value < 0.01), while TIER1 correlates with 0.46 (p-value < 0.01). Since the p-value in both relationships is < 0.001, the relationship can be described as statistically significant. In G1NEW, the relationship between these variables is negative. Since this study assumed a positive long-term effect of the capital ratios on the DPR, the negative relationship is understandable. G1NEW represents the period from 2005 to 2013, while G2NEW represents the period 2014 to 2019. Another capital ratio is LR. The correlation between the LR and the DPR is positive with 0.23, but not statistically significant (p-value > 0.05).

For the risk area, the variables NLTTA, LOGNPLTTA, and RWATTA are used. NLTTA correlates with DPR with 0.06 and is not statistically significant (p-value > 0.05). The variable LOGNPLTTA correlates negative with -0.17 and is not significant too (p-value > 0.05). The RWATTA has a correlation coefficient of -0.25 and a p-value > 0.05. Since the p-value of 0.13 is not less far from the accepted alpha of 0.05, the correlation should be considered in thought. In general, the correlation between the risk variables and the DPR is negative but statistically insignificant. This fact goes in line with the regulatory authorities' long-term approach that a sustainable and risk-averse corporate management leads to rising DPR.

For the liquidity area, the variables CTTA, LOGTDTTA, LOGTDETTA, and the LCR are used. The CTTA has a positive correlation coefficient of 0.17. But also here the correlation is not statistically significant (p-value > 0.05). The variable LOGTDTTA has the same result in general (correlation of 0.21 with a p-value > 0.05). The variable LOGTDETTA correlates with -0.17 with a p-value > 0.05, so that the linear relationship is not statistically significant. The variable LCR has a correlation coefficient of 0.23 with a p-value > 0.18. However, the difference between the p-value of 0.18 and the accepted alpha level of 0.05 is not great; the relationship should be considered in thought.

For the profit area, the variables ROA, INCATCSTTE, LOGNETINCCOMSHARES, and LOGNETINTINCTTA are used. The ROA correlates strongly with 0.39 and is statistically significant (p-value < 0.05). The INCATCSTTE correlates with 0.41 and is statistically significant too (p-value < 0.05). The same main result is given with the relationship between LOGNETINCCOMSHARES and DPR. The coefficient of correlation is 0.4 and statistically significant (p-value < 0.05). Remarkable is that the variable LOGNETINTINCTTA has a negative correlation coefficient (-0.32) with a p-value of 0.06 and is unless far from the alpha level of 0.05. Since the variable LOGNETINTINCTTA represents the sample's interest income and can be understood as an indicator for risk-taking (because loan activities generate interest incomes), the negative correlation is understandable. It goes in line with the negative relationship between the risk area variables and DPR.

Since there are several linear relationships with the DPR, regression models are performed. The TCR, TIER1, LCR, and LR regressions to the DPR are modeled in the first run. The test hypotheses are:

H0: The variables TCR/TIER1/LCR/LR and DPR are independent.

H1: The variables TCR/TIER1/LCR/LR and DPR are dependent. There is a relationship.

Therefore four single regressions are performed. The regression results are presented in the following table. The first sub-column in the column DPR represents the influence of TCR on DPR. The second sub-column represents the influence of TIER1 on DPR, the third sub-column represents the influence of the LCR on the DPR, and the fourth sub-column represents the influence of the LR on the DPR. The values in the row of the variables are the coefficients of the influence. Below this value, the standard error is given in brackets.

Table 53: Results for single regression 1 to 4

	Dependent variable:			
	DPR			
	(1)	(2)	(3)	(4)
TCR	4.929*** (1.579)			
TIER1		5.332*** (1.753)		
LCR			0.412 (0.293)	
LOGLR				47.480 (34.546)
Constant	-44.644 (31.100)	-38.197 (29.796)	-8.625 (42.868)	-27.215 (57.233)
Observations	36	36	36	36
R^2	0.223	0.214	0.055	0.053
Adjusted R^2	0.200	0.191	0.027	0.025
Residual Std. Error (df = 34)	31.231	31.405	34.438	34.478
F Statistic (df = 1; 34)	9.740***	9.257***	1.973	1.889
.p < 0.1; *p <0.05; **p <0.01; ***p < 0.001				

Source: Own table

Regression 1 shows that TCR influences DPR with 4.929. The H0 that the coefficient is zero and that the TCR has no influence on the DPR can be rejected. The T-test for the regression coefficient is statistically significant with a p-value < 0.001. The R^2 for regression 1 has a value of 0.223 and represents the data's approximation quality by the regression line. Because this regression includes only one independent variable, the R^2 can be understood as well. The results of regression 2 do not surprise. TIER1 influences the DPR with 5.332. The influence is due to the p-value < 0.001 statistically significant. The R^2 for regression 2 has a value of 0.214 and represents the data's approximation quality by the regression line. Since this regression includes only one independent variable, the R^2 can be understood as well. Regression 3 shows the influence of the LCR on the DPR. The regression coefficient is 0.412 and not statistically significant (p-value > 0.05). Furthermore, the R^2 is 0.055. This regression's explanation power is not relevant and especially not statistically significant because the F-test for the R^2 has a p-value of 0.1692, greater than the accepted alpha level of 0.05. The H0 is zero cannot be rejected. The relationship between LCR and DPR is not well represented by regression line 3. A similar result is given by regression 4. The LOGLR influences the DPR with 47.480. The influence is not statistically significant (p-value of 0.178). The R^2 is 0.053, and with a p-value of 0.1783, the effect is approximation by the regression line is not statistically significant. As previously announced, the same regression was performed with the data frame G2, which includes the outlier and no variable transformations. The results of the regressions are in the appendix 17. In these regressions, the influence of TCR and TIER1 is statistically significant. However, the R^2 is considerably lower (for regression 1: 0.063 instead 0.223 or for regression 2: 0.056 instead 0.214). Due to this fact, the outlier elimination and variable transformation seem to be useful and suitable. Based on table 55, the following regression equations are formulated:

Equation 6: Regression 1 of G2NEW

$$DPR = -44.644 + 4.929 \times TCR$$

Source: Own equation

Equation 7: Regression 2 of G2NEW

$$DPR = -38.197 + 5.332 \times TIER1$$

Source: Own equation

Equation 8: Regression 3 of G2NEW

$$DPR = -8.625 + 0.412 \times LCR$$

Source: Own equation

Equation 9: Regression 4 of G2NEW

$$DPR = -27.215 + 47.480 \times LR$$

Source: Own equation

After regressions 1 and 2 determined a statistically significant influence on the DPR, it is necessary to consider Basel III's further influences. Therefore, two multiple regression models were modeled. All independent variables and control variables are considered and are modeled in the following table. The first sub-column in the column DPR represents the regression with the TCR and the other variables (called regression 5). The second sub-column represents the regression with TIER1 and the other variables (called regression 6).

Table 54: Results for multiple regression 5 and 6

	Dependent variable:	
	DPR	
	(5)	(6)
TCR	-2.878	
	(3.332)	
TIER1		-2.458
		(3.655)
TETTA	23.734*	20.735*
	(13.002)	(11.854)
CTTA	1.705	1.554
	(1.276)	(1.292)
LOGTDTTA	21.779	21.197
	(25.449)	(27.532)
LOGTDETTA	-91.542*	-76.435
	(46.696)	(43.973)
ROA	-117.977	-118.734
	(123.247)	(128.080)
INCATCSTTE	5.805	6.107
	(8.704)	(9.070)
NETINCCOMSHARES	14.034	14.724
	(11.595)	(11.705)
LOGNETINTINCTTA	-30.442	-29.618
	(40.414)	(41.623)
NLTTA	0.450	0.454
	(1.536)	(1.608)
LOGNPLTTA	-4.357	-2.654
	(9.897)	(9.620)
RWATTA	-3.623**	-3.258**
	(1.607)	(1.481)
LOGEMPLOYEES	64.449**	54.547**
	(23.140)	(20.065)
LOGTCSO	36.038***	34.090***
	(11.688)	(11.267)
LOGTA	-91.149**	-76.074**
	(39.851)	(31.622)
DEVSTOXX	-0.277	-0.280
	(0.183)	(0.188)

LCR	-0.258 (0.257)	-0.206 (0.240)
LOGLR	68.875* (39.462)	73.666* (39.756)
Constant	98.921 (286.100)	30.250 (258.560)
Observations	36	36
R^2	0.905	0.903
Adjusted R^2	0.804	0.801
Residual Std. Error (df = 17)	15.456	15.585
F Statistic (df = 18; 17)	8.977***	8.813***
.p < 0.1; *p <0.05; **p <0.01; ***p < 0.001		

Source: Own table

Regression 5 shows that TETTA, LOGTDETTA, RWATTA, LOGEMPLOYEES, LOGTCSO, LOGTA, and LOGLR statistically significant influence the DPR. However, the significance level varies, but all variables fulfill the requirement of an alpha level of 5 %. The capital area variables only the variable TETTA influences with 23.734 with a statistically significance (p-value < 0.05). Furthermore, the variable LOGLR influences with 68.875 the DPR (p-value < 0.05). The other variable, TCR, has no statistically significant influence on the DPR. For liquidity-based variables, only the variable LOGTDETTA influences the DPR with -91.542 statistically significant (p-value < 0.05). The other liquidity-based variables CTTA, LOGTDTTA, and LOGLCR do not influence the DPR with a p-value < 0.05. For the profit variables, it can be seen that no variable has a statistically significant impact on DPR. In contrast the risk-based variable RWATTA influences the DPR with -3.623 (p-value < 0.01). The other risk-based variables NLTTA and LOGNPLTTA have no statistically significant influence on DPR. Remarkable is that 3 of 4 control variables influence the DPR as follows: The size variable LOGEMPLOYEES influence the DPR with 64.449 (p-value < 0.01), and the LOGTCSO influences 36.038 (p-value < 0.001) what goes in line with the size effect that large banks are more able to payout dividends. On the other side, the size variable LOGTA negatively influences DPR with -91.149 (p-value < 0.01). The other variables have no statistically significant influence on the DPR. The constant value of 98.921 is the beginning of the regression line. The R^2 for regression 5 has a value of 0.905 and is very high. Due to the multiple regression, it is necessary to take the adjusted R^2 into account.

The adjusted R^2 is 0.804. The adjusted R^2 is lower than the R^2 if other independent variables are taken into account in the regression model (Komlos and Süssmuth, 2010, p. 72; Schuster and Liesen, 2017, p. 228).

Nevertheless, the adjusted R^2 is very high, at 0.804. The adjusted R^2 in this model shows that the model has an excellent explanation of power. However, the effect of further variable consideration penalizes. Further, it is relatively large due to the 0.101 difference between the R^2 of 0.905 and the adjusted R^2 of 0.804. The penalty of the R^2 to the adjusted R^2 shall prevent overfitting problems. Regression 5 seems to be including overfitting characteristics because only seven variables have a statistically significant influence on the DPR. The other 11 variables have no statistically significant influence on DPR. The overfitting problem is identified and treated in the following chapter. Furthermore, the F-statistic of the R^2 and adjusted R^2 is substantial (p-value < 0.001). Due to the adjusted R^2, the DPR can be explained very well in this model.

The second multiple regression (regression 6) shows similar results as regression 5. Except for the variable LOGTDETTA, the same variables as regression 5 have a significant influence on DPR. The capital area variables only the variable TETTA influence with 20.735 with a significance (p-value < 0.05). Furthermore, the variable LOGLR influence with 73.666 the DPR (p-value < 0.05). The variable TIER1 has no statistically significant influence on the DPR. The liquidity-based variables CTTA, LOGTDTTA, LOGTDETTA and LOGLCR do not influence the DPR with a p-value < 0.05. For the profit variables, it can be seen that no variable has a statistically significant impact on DPR. As in regression 5 the risk-based variable RWATTA influences the DPR with -3.258 (p-value < 0.01). The other risk-based variables NLTTA and LOGNPLTTA have no statistically significant influence on DPR. Remarkable is that 3 of 4 control variables influence the DPR as follows: The size variable LOGEMPLOYEES influence the DPR with 54.547 (p-value < 0.01), and the LOGTCSO influences 34.090 (p-value < 0.001) what goes in line with the size effect that large banks are more able to payout dividends (as in regression 5). On the other side, the size variable LOGTA negatively influences DPR with -76.074 (p-value < 0.01). The other variables have no statistically significant influence on the DPR. The constant value of 30.250 is the beginning of the regression line and much smaller than the constant value in regression 5. The R^2 for regression 6 shows mostly the same key statement as in regression 5. The R^2 has a value of 0.903 and is very high. The adjusted R^2 is 0.801. The adjusted R^2 is lower than the R^2 if other independent variables are considered in the regression model (Komlos and Süssmuth, 2010, p. 72; Schuster and Liesen, 2017, p. 228).

Nevertheless, the adjusted R^2 is very high, at 0.801. The adjusted R^2 in this model shows that the model has an excellent explanation of power. However, the effect of further variable consideration penalizes. Further, it is relatively large due to the difference of 0.102 between the R^2 of 0.903 and the adjusted R^2 of 0.801. The penalty of the R^2 to the adjusted R^2 shall prevent overfitting problems. Regression 6 seems to be including overfitting characteristics because only six variables have a statistically significant influence on the DPR. The other 12 variables have no statistically significant influence on DPR. The overfitting problem is identified and treated in the following chapter. Furthermore, the F-statistic of the R^2 and adjusted R^2 is substantial (p-value < 0.001). Due to the adjusted R^2, the DPR can be explained very well in regression 6.

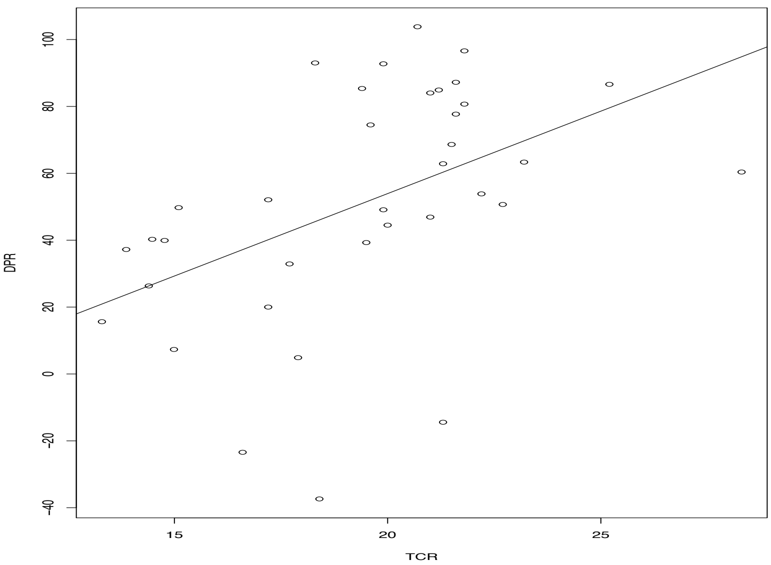
4.6.3 Model accuracy

Like chapter 4.5.3, it is necessary to test the regression assumptions' fulfillment; the testing is performed for regression 5 and 6.

<u>Linearity of the parameters</u>

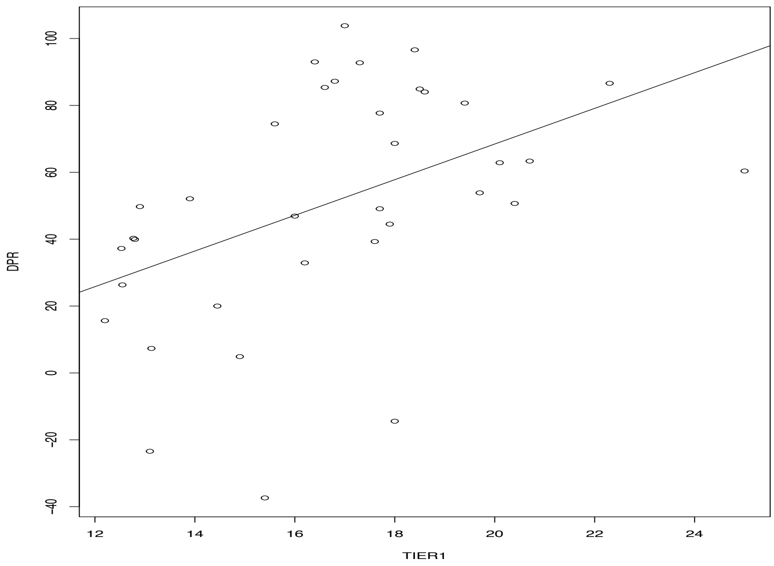
The relationship between dependent and independent variables must be linear. The following aspects can verify the linearity assumption: The evaluation already sees the linear relationship of the single regression 1 and 2. The influence of TCR on DPR is positive with 4.929 and statistically significant (***), and the influence of TIER1 on DPR is 5.332 and statistically significant (***). This indicates linearity between these variables. Furthermore, the linear relationship is indicated by the correlation coefficient (cor = 0.47 (***) for TCR/DPR). Further, the relationship is negative and statistically significant. The influence of the LOGTCR on the DPR is negative and statistically significant in the single regression model and the multiple regression. The correlation between TIER1 and DPR is 0.46 and statistically significant (***). In regression 3 the correlation coefficient is 0.23, but the p-value of 0.17 is > 0.05 (alpha) so that the correlation is not statistically significant. The same result is given for regression 4, where the correlation coefficient is 0.23, with a p-value of 0.18. The next step is to create linearity plots: The positive relationship between TCR or TIER1 and DPR can be seen in the following figure.

Figure 30: Plot TCR DPR for G2NEW



Source: Own figure

Figure 31: Plot TIER1 DPR for G2NEW

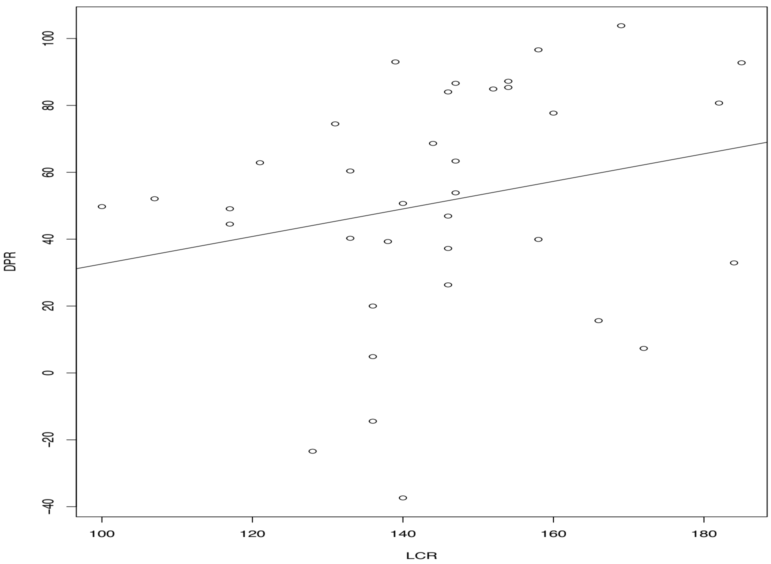


Source: Own figure

In contrast to the negative relationship between LOGTCR and LOGTIER1 and G1NEW, the actual relationship is positive (even if the variables in G1NEW are transformed with the logarithm).

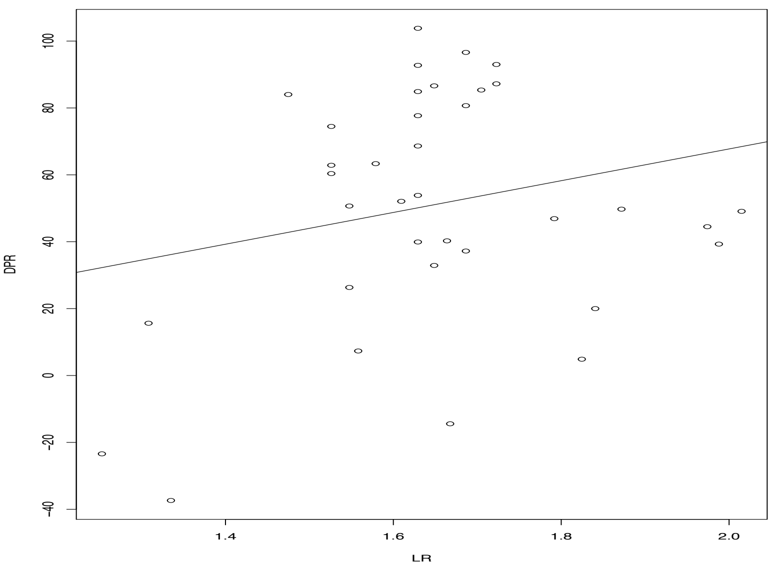
For LCR and LOGLR to DPR, a non-linear relationship is detected (due to the weak and not statistically significant correlation and not statistically significant influencing the regression models 3 and 4). The following figures illustrate the relationships.

Figure 32: Plot LCR DPR for G2NEW



Source: Own figure

Figure 33: Plot LOGLR DPR for G2NEW



Source: Own figure

For regression 1 and 2, the assumption of linearity can be fulfilled; for regression 3 and 4, the assumption of linearity is not given. Due to the performed multiple regressions (5 and 6) and the fact that the regression models include several variables, cr plots are created. The cr plots are included in the appendix 18.

Completeness of the model

For evaluating the regression models' completeness, the R^2 and the adjusted R^2 are adequate indicators and are taken into account. For the single regression 1, the R^2 is 0.223 (22.3 %). As already assess, the regression line describes the model well and is useful for modeling the relationship between the independent and dependent variables. The R^2 for the single regression 2 has a value of 0.214 (21.4 %) and is higher than the R^2 of regression 2. Regression 3 and 4 have a relatively small R^2 of 0.055 (5.5 %) and 0.053 (5.3 %). It should be noted that the R2 in both regressions is based on only one independent variable. For regression 1 and 2, the representing of the relationship by the regression model is well suitable. In both single regressions, the F-test for the R^2 is statistically significant (***), while for regression 3 and 4, the F-test is not statistically significant, which goes in line with the small explanation power of these regression models.

For the multiple regression (regression 5 and 6), the R^2 are very high with 0.905 (90.5 %) for regression 5 and 0.903 (90.3 %) for regression 6. However, the high values have to be relativized because there is a remarkable difference between the R^2 and the adjusted R^2 in both regressions (difference of 0.101 in regression 5 and 0.102 in regression 6), indicating a relatively great penalty of the explanation power of the regressions. Furthermore, both regressions include several statistically insignificant variables considered due to multicollinearity effects (treatment follows). An overfitting problem can already be expected and is analyzed in the further course. In summary, the R^2 and adjusted R^2 of both regressions are very high, but the explained framework conditions should be considered.

Expectation value of the error term = 0

The residuals should have an expected value of 0. Therefore, a descriptive statistic for the residuals follows in the following table.

Table 55: Descriptive statistic for G2NEW regression residuals

	Mi	**1Q**	**Median**	**3Q**	**Max**
Regression 1	83.417	-12.018	4.778	20.592	47.442
Regression 2	-81.287	-15.549	2.838	21.892	51.370
Regression 3	-86.41	18.70	10.47	26.15	44.37
Regression 4	-73.540	19.504	3.297	29.830	53.678
Regression 5	-24.459	-7.625	-1.602	8.181	17.172
Regression 6	-24.242	8.153	-2.094	9.303	17.224

Source: Own table

Except for regression 5 and 6, the regressions have their median, not nearly 0. Additionally, a Tukey-Anscombe-plot is used to visualize the fitted vs. the residuals (Stahel, 1999, p. 278). The plots are included in the appendix 19. Tukey-Anscombe-plots show that the expectation value is nearly 0 for all regression models so that the assumption of a value of 0 is fulfilled.

Normal distribution of the residuals

The statement for a normal distribution of the residuals is answered visually and checked with a statistical method. For this, the Shapiro-Wilk-test and the Jarque-Bera-test are performed and are summarized in the following table:

The following test hypothesis is formulated:

H0: The values of the residuals are normally distributed

H1: The values of the residuals are not normally distributed

The test results are given in the following table.

Table 56: SW and JB results for the regressions 1 to 6 in G2NEW

Regression model	Shapiro-Wilk-test		Jarque-Bera-test	
	W-value	p-value	JB-value	p-value
Regression 1	0.93531	0.03636	5.7924	0.0375
Regression 2	0.95686	0.1718	3.11	0.085
Regression 3	0.9222	0.01461	4.1957	0.0565
Regression 4	0.95168	0.1182	1.8288	0.2155
Regression 5	0.96255	0.2574	0.53719	0.728
Regression 6	0.96045	0.2219	0.76159	0.6155

Source: Own table

For the Shapiro-Wilk test, the residuals of regression 1 and 3 have no normal distribution. The residuals of regression 2, 4, 5, and 6 are normally distributed. By using the Jarque-Bera test, only the residuals of regression 1 are not normally distributed. Because regression 5 and 6 are in focus, the not given normal distribution in regression 1 can be neglected. Additionally, to the statistic, Q-Q-Plots are created to visualize the residuals in the context of a normal distribution. A Q-Q-Plot ensures a visual verification of a characteristic's normal distribution assumption (Eckstein, 1997, p. 87). A small difference of the residuals to the straight line in the Q-Q-Plot indicates that the residuals are normally distributed. The Q-Q-Plots are attached in the appendix 20.

Autocorrelation

The autocorrelation test is intended to check if a correlation between two consecutive residual residuals exists (Durbin and Watson, 1950, pp. 409-428; Bajpai, 2010, p. 481). For testing the autocorrelation, a Durbin-Watson-test is performed. The following hypotheses are formulated:

H0: There is no autocorrelation

H1: There is an autocorrelation

The following table summarizes the results of the Durbin-Watson-test.

Table 57: DW results for the regression models 1 to 6 of G2NEW

Regression model	**Durbin-Watson-test**	
	DW-value	p-value
Regression 1	1.3179	0.01173
Regression 2	1.2818	0.009003
Regression 3	0.94269	0.000231
Regression 4	0.86358	0.00007041
Regression 5	2.2806	0.1531
Regression 6	2.3079	0.1689

Source: Own table

The H0 that there is no autocorrelation can be rejected for the regression 1 to 4. For regression 3 and 4, the result does not surprise because the regression models have no strong explanation power. Regression 3 and 4 has a relatively small R^2 of 0.055 (5.5 %) and 0.053 (5.3 %). The autocorrelation in regression 1 to 4 is positive. Regressions 1 and 2 can be neglected due to the focus on the multiple regressions 5 and 6. In these models, the H0 cannot be rejected because the p-value is > 0.05. Therefore, there is no autocorrelation for the relevant regression models. The DW-value of 2.2806 for regression 5 and 2.3079 indicates no autocorrelation (Wooldridge, 2009, p. 415; Marktforschung fandom, 2020, no page).

Homoscedasticity

The next step is to test if homoscedasticity is given. The variances of the residuals have to be equal. The theoretical foundations of homoscedasticity are given in chapter 4.5.3. For testing the homoscedasticity, the Breusch-Pagan-test is used. The Breusch-Pagan-test examines if heteroscedasticity is presented. If heteroscedasticity is not provided, implicit homoscedasticity is given. The following test hypothesis is formulated:

H0: Heteroscedasticity is not given

H1: Heteroscedasticity is given.

The results are in table 58.

Table 58: BP results for the regression models 1 to 6 for G2NEW

Regression model	Breusch-Pagan-test	
	BP-value	p-value
Regression 1	0.019993	0.8876
Regression 2	0.029007	0.8648
Regression 3	0.16798	0.6819
Regression 4	2.476	0.1156
Regression 5	27.242	0.07457
Regression 6	27.472	0.07055

Source: Own table

In all regression models, the p-value is > 0.05, so that H0 cannot be rejected. Heteroscedasticity is not given, and homoscedasticity is given. Remarkable is that in regression 5 and 6, the p-value is remarkably lower than the p-values in the single regressions (1 to 4). As for the results of G1NEW used, the heteroscedasticity and autocorrelation consistent (HAC) standard error is used to create an efficient regression model with robust standard errors (Wegener, 2019, p. 237). The HAC application results for regression 5 and 6 compared to the previous OLS are summarized in the following table.

Table 59: HAC application for regression 5 and 6

	Dependent variable:			
	DPR			
	(5)		(6)	
	OLS	HAC	OLS	HAC
TCR	-2.878	-2.878		
	(3.332)	(5.389)		
TIER1			-2.458	-2.458
			(3.655)	(8.050)
TETTA	23.734*	23.734	20.735*	20.735
	(13.002)	(40.137)	(11.854)	(41.875)
CTTA	1.705	1.705	1.554	1.554
	(1.276)	(2.545)	(1.292)	(2.694)
LOGTDTTA	21.779	21.779	21.197	21.197
	(25.449)	(32.220)	(27.532)	(41.778)
LOGTDETTA	-91.542*	-91.542	-76.435	-76.435
	(46.696)	(85.331)	(43.973)	(78.266)
ROA	-117.977	-117.977	-118.734	-118.734
	(123.247)	(267.413)	(128.080)	(311.267)
INCATCSTTE	5.805	5.805	6.107	6.107
	(8.704)	(17.400)	(9.070)	(20.000)
NETINCCOMSHARES	14.034	14.034	14.724	14.724
	(11.595)	(18.179)	(11.705)	(18.443)
LOGNETINTINCTTA	-30.442	-30.442	-29.618	-29.618
	(40.414)	(77.129)	(41.623)	(85.549)
NLTTA	0.450	0.450	0.454	0.454
	(1.536)	(2.458)	(1.608)	(2.780)
LOGNPLTTA	-4.357	-4.357	-2.654	-2.654
	(9.897)	(18.024)	(9.620)	(17.442)
RWATTA	-3.623**	-3.623	-3.258**	-3.258
	(1.607)	(3.312)	(1.481)	(3.832)
LOGEMPLOYEES	64.449**	64.449*	54.547**	54.547
	(23.140)	(35.829)	(20.065)	(38.645)
LOGTCSO	36.038***	36.038*	34.090***	34.090
	(11.688)	(20.107)	(11.267)	(21.528)
LOGTA	-91.149**	-91.149	-76.074**	-76.074
	(39.851)	(61.750)	(31.622)	(55.484)
DEVSTOXX	-0.277	-0.277	-0.280	-0.280
	(0.183)	(0.292)	(0.188)	(0.316)
LCR	-0.258	-0.258	-0.206	-0.206
	(0.257)	(0.467)	(0.240)	(0.512)
LOGLR	68.875*	68.875	73.666*	73.666
	(39.462)	(101.434)	(39.756)	(110.898)
Constant	98.921	98.921	30.250	30.250

	(286.100)	(598.912)	(258.560)	(599.018)
Observations	36	36	36	36
R^2	0.905	0.905	0.903	0.903
Adjusted R^2	0.804	0.804	0.801	0.801
Residual Std. Error	15.456 (df = 17)	15.456 (df = 17)	15.585 (df = 17)	15.585 (df = 17)
F Statistic	8.977*** (df = 18; 17)	8.977*** (df = 18; 17)	8.813*** (df = 18; 17)	8.813*** (df = 18; 17)
.p < 0.1; *p <0.05; **p <0.01; ***p < 0.001				

Source: Own table

The HAC application leads to adjustments of the standard error, t-value, and the p-value. The regression model gets more efficient. The regression coefficient has not changed, while the standard error increases, and the t-value and p-value decreases. After the HAC application, only the LOGEMPLOYEES and LOGTCSO variables statistically significant influence DPR (p-value < 0.05). The same procedure was performed for regression 6. The results of the HAC application in regression 6 are more remarkable. The adjustments lead to an utterly statistically insignificant influence of all DPR variables and indicate overfitting characteristics (which is treated in the further course).

Multicollinearity

It is necessary to test multicollinearity to test if the independent variables correlate and if the variance overlaps with another independent variable's variance. Therefore, the VIF analysis is used. The following table summarizes the VIF for regressions 5 and 6.

Table 60: VIF analysis for regression 5 and 6 for G2NEW

Variable	VIF regression 5	VIF regression 6
TCR	18.176993	
TIER1		17.655967
TETTA	31.187548	25.494022
CTTA	2.211074	2.231179
LOGTDTTA	22.685356	26.112180
LOGTDETTA	22.083193	19.259204
ROA	168.517694	178.984104
INCATCSTTE	245.833822	262.529254
NETINCCOMSHARES	11.218291	11.244620
LOGNETINTINCTTA	32.958502	34.382430
NLTTA	71.287261	76.851382
LOGNPLTTA	9.430504	8.761630
RWATTA	29.894349	24.965675
LOGEMPLOYEES	102.267010	75.624255
LOGTCSO	24.954042	22.804949
LOGTA	163.028458	100.956089
DEVSTOXX	1.278620	1.320840
LCR	3.803230	3.276208
LOGLR	6.493111	6.481487

Source: Own table

Based on the VIF, all variables with a VIF value greater than 10 are removed from the regression model since their explanation power is not essential but leads to overfitting problems. For regression 5, the number of explanatory variables reduces from 18 to 5 variables. The variables CTTA, LOGNPLTTA, LOGTA, DEVSTOXX, and LOGLR remain; for regression 6, the number of explanatory variables reduces from 18 to 5 variables. The remaining variables are the same as in regression 5.

Overfitting

The identified variables are eliminated based on the VIF analysis, and new regression models are performed. The following table compares the previous regression models with the new regression models to consider and assess overfitting in the regression models. All regression models already include the HAC application.

Table 61: Regression 5 and 6 comparison with the previous regressions

	Dependent variable:			
	DPR			
	(5)		(6)	
	OLS HAC adj.	OLS OF and HAC adj.	OLS HAC adj.	OLS OF and HAC adj.
TCR	-2.878 (5.389)	6.515*** (2.017)		
TIER1			-2.458 (8.050)	7.580*** (2.236)
TETTA	23.734 (40.137)	eliminated	20.735 (41.875)	eliminated
CTTA	1.705 (2.545)	0.263 (1.937)	1.554 (2.694)	1.603 (1.985)
LOGTDTTA	21.779 (32.220)	eliminated	21.197 (41.778)	eliminated
LOGTDETTA	-91.542 (85.331)	eliminated	-76.435 (78.266)	eliminated
ROA	-117.977 (267.413)	eliminated	-118.734 (311.267)	eliminated
INCATCSTTE	5.805 (17.400)	eliminated	6.107 (20.000)	eliminated
NETINCCOMSHARES	14.034 (18.179)	eliminated	14.724 (18.443)	eliminated
LOGNETINTINCTTA	-30.442 (77.129)	eliminated	-29.618 (85.549)	eliminated
NLTTA	0.450 (2.458)	eliminated	0.454 (2.780)	eliminated
LOGNPLTTA	-4.357 (18.024)	11.487 (12.527)	-2.654 (17.442)	14.371 (12.401)

RWATTA	-3.623 (3.312)	eliminated	-3.258 (3.832)	eliminated
LOGEMPLOYEES	64.449* (35.829)		54.547 (38.645)	
LOGTCSO	36.038* (20.107)		34.090 (21.528)	
LOGTA	-91.149 (61.750)		-76.074 (55.484)	
DEVSTOXX	-0.277 (0.292)	-0.486 (0.372)	-0.280 (0.316)	-0.519 (0.356)
LCR	-0.258 (0.467)	0.447 (0.277)	-0.206 (0.512)	0.389 (0.289)
LOGLR	68.875 (101.434)	39.956 (42.449)	73.666 (110.898)	31.163 (43.817)
Constant	98.921 (598.912)	-213.252** (98.954)	30.250 (599.018)	-206.081** (99.382)
Observations	36	36	36	36
R^2	0.905	0.409	0.903	0.414
Adjusted R^2	0.804	0.287	0.801	0.292
Residual Std. Error	15.456 (df = 17)	29.486 (df = 29)	15.585 (df = 17)	29.373 (df = 29)
F Statistic	8.977*** (df = 18; 7)	3.345*** (df = 6; 29)	8.813*** (df = 18; 7)	3.408*** (df = 6; 29)
.p < 0.1; *p <0.05; **p <0.01; ***p < 0.001				

Source: Own table

The final regression 5 shows fewer variables are included in the regression (6 variables against 18). By using the HAC adjustment, the standard error is constant, and the model gets more efficient. Furthermore, the variable TCR is in the new regression model 5 statistically significant (p-value < 0.001). The other variables have no significant influence on the DPR. The R^2 is already well with 0.409. The adjusted R^2 is 0.287 and considers the penalty in the regression by taking additional explanatory variables in the regression model. Nevertheless, the adjusted R^2 has a sufficient size and is related in this case, with the number variables' reduction share (variable reduction of 66.67 % by an adjusted R^2 reduction of 64.3 %). The F-statistic of the R^2 is statistically significant (p-value < 0.001).

The final regression 6 shows a similar result. The number of variables was reduced from 18 to 6 variables. The new model includes the HAC adjustment with a constant standard error and statistically significant influences DPR with 7.580 (p-value < 0001). The R^2 is already well with 0.414. The adjusted R^2 is 0.292, and regarding the model reduction well too. The adjusted R^2 has sufficient size. The F-statistic of the R^2 is statistically significant (p-value < 0.001).

4.7 EMPIRICAL RESULTS

In the following, the key findings of the previous statistic performance are presented. Regression 3 of G1NEW is compared with regression 5 of G2NEW, and regression 4 of G1NEW is compared with regression 6 of G2NEW. Table 62 shows the results.

Table 62: Comparison of regression 3 with 5 and 4 with 6

	Dependent variable:			
	DPR			
	(3)	(5)	(4)	(6)
LOGTCR/TCR	-70.200*** (16.837)	6.515*** (2.017)		
LOGTIER1/TIER1			-41.951*** (9.758)	7.580*** (2.236)
SQRTTETTA/TETTA	eliminated	eliminated	eliminated	eliminated
SQRTCTTA/CTTA	1.924 (2.010)	0.263 (1.937)	0.683 (1.862)	1.603 (1.985)
TDTTA/LOGTDTTA	-0.264 (0.212)	eliminated	-0.117 (0.218)	eliminated
SQRTTDETTA/LOGTDETTA	-5.593 (4.675)		-5.061 (4.791)	
ROA	eliminated		eliminated	
INCATCSTTE				
LOGNETINCCOMSHARES/ NETINCCOMSHARES				
SQRTNETINTINCTTA/ LOGNETINTINCTTA	40.330** (15.541)		14.128 (12.432)	
NLTTA^2/NLTTA	-0.001 (0.002)		0.0004 (0.002)	

SQRTNPLTTA/LOGNPLTTA	1.431 (7.743)	11.487 (12.527)	6.160 (9.212)	14.371 (12.401)
RWATTA/RWATTA	-0.228** (0.107)		-0.100 (0.117)	
LOGEMPLOYEES/ LOGEMPLOYEES		eliminated		eliminated
SQRTTCSO/LOGTCSO	eliminated		eliminated	
LOGTA/ LOGTA				
DEVSTOXX/DEVSTOXX	-0.100* (0.056)	-0.486 (0.372)	-0.109* (0.058)	-0.519 (0.356)
LCR		0.447 (0.277)		0.389 (0.289)
LOGLR		39.956 (42.449)		31.163 (43.817)
Constant	213.992*** (44.937)	-213.252** (98.954)	142.807*** (33.437)	-206.081** (99.382)
Observations	59	36	59	36
R^2	0.491	0.409	0.434	0.414
Adjusted R^2	0.398	0.287	0.330	0.292
Residual Std. Error	10.813 (df=49)	29.486 (df = 29)	11.408 (df = 49)	29.373 (df = 29)
F Statistic	5.259*** (df = 9; 49)	3.345*** (df = 6; 29)	4.172*** (df = 9; 49)	3.408*** (df = 6; 29)
.p < 0.1; *p <0.05; **p <0.01; ***p < 0.001				

Source: Own table

First of all, in regression 3 and 5, TCR statistically significant influences the DPR (both regressions with a p-value < 0.001). Because the type of variable is not the same for all variables, a direct comparison of the influence's strength is impossible. However, a statement about the general direction of the influence is possible. While in regression 3, the influence is negative, and the influence in regression 5 is positive. Furthermore, the constant value in both regressions is statistically significant (p-value < 0.001). It should be noted that the G1NEW contains the period 2005 to 2013 and G2NEW the period 2014 to 2019 so that the implementation of new regulatory requirements (regarding capital) has no negative influence on the dividend policy (especially DPR). The influence is positive and statistically significant.

Furthermore, all eliminated variables in regression 3 are eliminated in regression 5 too. They eliminated variables in both regressions: ROA, INCATCSTTE, LOGNET-INCCOMSHARES, LOGEMPLOYEES, SQRTTCSO/LOGTCSO, and LOGTA. The variables TDTTA/LOGTDTTA, SQRTTDETTA/LOGTDETTA, SQRTNET-INTINCTTA/LOGNETINTINCTTA, and RWA, are eliminated in regression 5. The overlapping of the eliminated and remaining variables shows that the dividend payout determination's general concept has not changed during the observation period. In regression 3 the variables SQRTNETINTINCTTA, RWATTA and DEVSTOXX have a statistically significant influence on DPR (SQRTNET-INTINCTTA with 40.330 and a p-value < 0.01, the RWATTA with -0.228 and a p-value < 0.01 and DEVSTOXX with -0.100 and a p-value < 0.05). In regression 5, there is no other variable with a statistically significant influence on DPR except the TCR (as mentioned before). Remarkable is that both regressions have a well-accepted adjusted R^2 (in regression 3: 0.398 and in regression 5: 0.287). Both models are suitable to explain the DPR.

The comparison of regression 4 and 6 shows that TIER1 statistically significant influences both regressions (p-value in both regressions < 0.001). However, the direction of the influence has changed. While in regression 4, the influence was negative, the influence in regression 6 is positive, which is an indicator that increasing capital ratios does not burden the dividend policy. The variable DEVSTOXX in regression 4 has a statistically significant influence (p-value < 0.05). The constant value of 142.807 in regression 4 and -206.081 is statistically significant (p-value < 0.001 in both regressions). The other variables in regression 4 and 6 have no statistically significant influence on the DPR. A look at the explanation power shows that the adjusted R^2 are in both regressions relatively well. The adjusted R^2 in regression 4 is 0.33, while the adjusted R in regression 6 is 0.292. Both regressions explained the DPR well. The model accuracy criteria make another regression comparison. Therefore, the following table shows a summary of the results.

Table 63: Overview of regression diagnostic for regression 3 to 6

	Regression 3	Regression 5	Regression 4	Regression 6
Linearity	Given	Given	Given	Given
Completeness	Given	Given	Given*	Given
Error term = 0	Given	Given	Given	Given
Normal distribution of the residuals	Given	Given	Given	Given
No Autocorrelation	Given	Not given	Given	Not given
Homoscedasticity	Not given	Given	Not given	Given
Multicollinearity	Given	Given	Given	Given
Overfitting	-	Given	-	Given

Source: Own table

In summary, the regressions fulfill most of the regression requirements. The linearity in regression 3 and 4 between the LOGTCR/LOGTIER1 and DPR is given. In regression 5 and 6 (multiple regression), the linearity is shown for all variables' relationships, except that the linearity's strength is different. Regarding the model completeness, regression 3 and 4 have a meaningfully adjusted R2 (0.398 and 0.33) despite the single regression, which indicates a good regression explanation. In multiple regressions 5 and 6, R^2 and adjusted R^2 were in the first round very high (adjusted R^2 in regression 5 and 0.801 in regression 6). After the variable elimination, the adjusted R^2 is 0.287 for regression 5 and 0.292 for regression 6 and still a satisfied coefficient. The error term is in all regression models nearly 0, so that this requirement can be seen as fulfilled. The requirement of the normal distribution of the residuals was tested by two tests (Shapiro-Wilk-test and Jarque-Bera-test). In both tests, the results confirmed the normal distribution. In contrast, the results of the homoscedasticity test are different. In regression 3 and 4, homoscedasticity is not given, and heteroscedasticity is given. The regression bias was treated with the HAC adjustment to get an efficient regression coefficient with unbiased p-values to create an efficient regression model. Therefore, not given homoscedasticity was treated acceptably. The multicollinearity was detected with the VIF values; many variables were deleted based on their VIF value (> 10). The last step was to treat the overfitting aspect. Based on the VIF results, new (reduced) regression models were modeled. To consider constant standard errors for an efficient regression model, the new models include the HAC adjustments. In summary, the regressions fulfill the BLUE characteristics (best linear unbiased estimator, Wooldridge, 2009, p. 103).

4.8 LIMITATIONS

For a critical overall assessment of the performed empirical study, it is necessary to discuss its limitations. The limitations consist of five aspects. First of all, the data frames G2 and G2NEW did not contain the variable NSFR since the observation number of the NSFR was 15 (because the fulfillment of the ratio is obligatory since July 2021 (BaFin, 2020, no page). Therefore, the full influence of the regulatory requirements cannot be assessed. Several liquidity variables were used (CTTA, TDTTA, TDETTA, and LCR) to consider this restriction. In particular, the LCR is a new liquidity ratio and has to be fulfilled so that the study considered the liquidity requirements (although without the NSFR).

Another restriction is the sample size of the final regressions. The regressions in G1NEW have a sample size of 59 observations and G2NEW of 36 observations. The reason for the sample size is the outlier elimination by using the IQR. In the beginning, G1NEW has a sample size of 144 but included relatively many outliers, which biased the regression results. The appendix 11 shows the same regression with a greater sample size to establish and confirm the bias of having outliers in the data set, including outliers. The regression coefficients are statistically insignificant, and the R^2 and adjusted R^2 are not meaningful (R^2 of 0.002 and 0.00002).

Furthermore, in this case, the F-test for the R^2 is not statistically significant. The same framework is given for G2NEW. Moreover, the regression simulation with the biased data frame shows that regression with this data frame cannot model a regression (R^2 of 0.063 in regression 1, 0.056 in regression 2, 0.017 in regression 3, and 0.068 in regression 4).

The next limitation is the different types of variables, which makes the regression comparison difficult. This limitation resulted from the necessary variable transformation for having a normal distribution form for the used parametric test methods. Nevertheless, the regression models' evaluation includes statements on the influence's general direction (if positive or negative).

The other limitation of this study is the different number of variables in the final regressions, making the comparison difficult. Regression 3 and 4 contain 9 explanatory variables, while regression 5 and 6 contain six explanatory variables. However, this restriction should be put into context, that although the models have a different number of variables, the R^2 and the adjusted R^2 are largely similar. The adjusted R^2 in regression 3 is 0.398, in regression 4 0.33, in regression 5 0.287 and in regression 6 0.292. All regression models have good explanatory power. The reasons for changes in the capital, risk, and earning development are based on the regulatory package and several empirical statements that the interest rate statistically significant impacts capitalization (cp. previous chapters).

The last limitation is that the data set consists of publicly listed European banks. For example, the shadow banking system or newly developed finance sources as crowdfunding cannot be affected by the regulatory requirements (Admati et al., 2013, p. 4). In summary, the restrictions are given, but the given data set has to be adjusted, which creates the restrictions. On the other hand, if there were no restrictions, this would result from a weak and not meaningful study with no statistically significant results. The assessment of the restrictions is necessary, but also to place them in the above context.

5 SUMMARY AND CONCLUSION

5.1 TARGET ACHIEVEMENT

This dissertation had multiple objectives. The first step was to identify the research gap based on broad literature review, and the impact of the financial crisis in 2007 and 2008 on the European banking sector was highlighted. Furthermore, the reasons for the introduction and implementation of the CRR and CRD IV were described. These objectives were achieved in Chapter 2. The next objective was to describe the European banking branch's regulatory requirements focusing on the introduced financial ratios (higher TCR, TIER1, NSFR, LCR, and LR). Chapter 2 achieved these objectives through a detailed explanation of the regulatory requirements within the banking sector. Another objective was to understand the various approaches of the dividend policy to compare and evaluating them, as a central component of this dissertation.

Therefore, Chapter 3 includes the irrelevance theorem of Modigliani & Miller and discusses several theories of information asymmetry (agency theory, signaling theory, pecking-order theory). Additionally, trade-off theory and approaches from the behavioral finance concluded chapter 3 and thus, this sub-objective was achieved too. The next core objective was an empirical investigation to empirically operationalize the theoretical foundations developed. For a structured procedure, the research hypotheses were operationalized into testable variables. A broad sample was considered to achieve the objective, and several databases were required (Bloomberg, Thomson Reuter, ECB SDW, EBA risk analysis, and data). The use of data from the 2005–2019 period ensured that the data frame contained a time before and after the implementation of the new regulatory requirements. Therefore, the data set were divided into two subgroups (before and after 2013). After the data collection, the data were structured for the empirical investigation (excluding missing values). After the descriptive statistic, an outlier analysis was performed. The identified outliers were deleted.

Furthermore, all variables were tested on a normal distribution. The descriptive statistics were obtained and presented both numerically and visually (attached in the appendix 9, 10, 15, and 16) and the explorative statistics was performed thereafter. Based on correlation analysis, regression models were defined and executed. As mentioned above and described in chapter 2, the regulatory requirements statistically significant impact the dividend policy (operationalized by the DPR). Additionally, other explanatory variables were detected and even deleted owing to the model diagnostic. The regression models' model diagnostic and adjustments with a final comparison of the regression models concluded the empirical section. This dissertation shows that the CRR and CRD IV influence the dividend policy of European banks. The following table summarizes the dissertation objectives and achievements.

Table 64: Comparison of study objectives and achievements

Objective	Achievement
Identify the research gap	Achieved
Identify the reason for implementation of CRR and CRD IV	Achieved
Present the regulatory frameworks of Basel I to IV	Achieved
Present dividend policy approaches	Achieved
Empirical investigation	Achieved

Source: Own table

The findings of this dissertation contribute to the research as follows. The results are relevant for investors in the European banking sector. The empirical investigation shows that after implementing the new regulatory requirements, the capital ratio positively influences the DPR, while before 2013, the capital ratios negatively influence the DPR. Therefore, investors with a focus on sustainable dividend payments should take the capital ratio into account. Strong capital ratios do not have to contradict dividend payments. Banks' financial management can consider this dissertation's findings to manage their business in a sustainable and financially healthy way to be attractive to investors.

5.2 OUTLOOK

Considering the empirical findings of this dissertation, the banks' fulfillment of the regulatory requirements should be considered by investors and banks' management. Since the regulatory requirements are still being introduced, the long-term effects cannot be assessed fully at this point. Therefore, an area for further research could be the long-term impact of the regulatory requirements. Moreover, significant events and developments (for example, climate change or the COVID-19-pandemic) have a sustainable and long-term impact on business models. These impacts directly influence the business activities and ultimately on key financial ratios, which affects the dividend policy. For example, the increased leverage of corporates lead to a phenomenon of zombie corporates: corporates, which are normally not able to service their debt, caused on a low profitability, and are only able to service their debt with cheap money (Banerjee and Hofmann, 2018, p. 67; von Buttlar, 2020, no page; Siedenbiedel, 2020, no page; Röhl, 2020, p. 2; Banerjee and Hofmann, 2020, p. 2). To illustrate the extent of this phenomenon, the amount of leverage of these unproductive zombie corporates should be taken into account: 1.36 trillion USD is the leverage amount at the end of 2020, compared to 500 billion USD at the peak of the 2007/2008 financial crisis (von Buttlar, 2020, no page). The reason for the lending of the banks is the evergreening: a continuing lending to corporates in order to avoid a depreciation of the previous loans (Siedenbiedel, 2020, no page). It can be assumed that the sleeping credit defaults will affect the banks (Schivardi, Sette and Tabellini, 2017, p. 2), if these corporates are bankruptcy regardless of the cheap money. Furthermore, the lending to zombie corporates leads to a lending misallocation since the lending to well rated borrowers is restrained (Schivardi, Sette and Tabellini, 2017, p. 2). That the phenomenon of zombie corporates and in consequence a zombie economy is not only an academic issue is shown by the controversy of the European Central Bank or the Bank for International Settlements (BIS) in the midst of the Covid-19 pandemic: On the one side, the ECB stated out that the lending requirements has not been changed (assessment of customers creditworthiness and their ability of payback their loans and the continuously risk assessment) and that the government intervention in form of the guarantees do not changed the lending requirements (ECB, 2020, no page). On the other side, the several measures (for example the using of the built capital buffers (reduction of the countercyclical buffer from 0.25 % to 0 %, cp. BMF, 2020, p. 19), cp. countercyclical buffer, as in chapter 2.4.1.1 explained) against the Covid-19 impacts made it more difficult to run the customer and risk assessment due to the break of loan repayment and therefore banks have to increase their loan loss provision (as in chapter 2.1 explained) (ECB, 2020, no page). Remarkable is that the ECB pointed out that there is nevertheless a risk of zombie corporates (and as a consequence a higher NPL risk and loan default risk), which have to keep in mind (ECB, 2020, no page). The analysis of the BIS showed that the number of zombie corporates is not only a Covid-19 phenomenon, but it was also already identified in the 1980s with 4 % of all listed corporates (Banerjee and Hofmann, 2020, p. 22). By considering the not listed corporates (SMEs), a zombie corporate ratio of 30 % to 40 % is assumed (Banerjee and Hofmann, 2020, p. 23). Large bank institutions increased their loan loss provision im some cases by 200 % to 400 % (Die Bank, 2020, no page) and in a scenario analysis the ECB calculated that the NPL could increase by an amount of 1.4 trillion €. These relationships could be further objects for scientific investigations. Another necessary research arises as a result of the ongoing development of the regulatory requirements (CRR II and CRD V, cp. Bundesbank, 2019, p. 31-50) and its impact on the dividend policy. Overall, the dividend policy's determination can be specified for banks, including the impacts of the regulatory requirements because banks have a system relevant role in the entire economy. Since this dissertation examines the influence of the CRR and CRD IV on European banks' dividend policy, further research could investigate the relationship between regulatory requirements (after transmission) and other business areas and countries.

APPENDIX

Appendix 1

Figure 34: Wiley editing certificate

Wiley Editing Services

ENGLISH EDITING CERTIFICATE

This document certifies that the manuscript listed below was edited for proper English language, grammar, punctuation, spelling, and overall style by one or more of the highly qualified native English speaking editors at Wiley Editing Services

Manuscript title

An empirical analysis of the impact of the regulatory requirements on the dividend policy and payout of European banks

Authors

Serkan Akbay

Order No

SEAKB_1

Date Issued

January 04, 2021

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WILEY

Source: Wiley Editing Service, 2020, no page

Appendix 2

Table 65: Risk weights categories

0 %	"Cash Claims on central governments and central banks denominated in national currency and funded in that currency Other claims on OECD central governments and central banks Claims collateralised by cash of OECD central-government securities or guaranteed by OECD central governments
0, 10, 20 or 50 % (national discretion)	Claims on domestic public-sector entities, excluding central government, and loans guaranteed4 by such entities
20 %	Claims on multilateral development banks and claims guaranteed by, or collateralised by securities issued by such banks Claims on banks incorporated in the OECD and loans guaranteed by OECD incorporated banks Claims on banks incorporated in countries outside the OECD with a residual maturity of up to one year and loans with a residual maturity of up to one year guaranteed by banks incorporated in countries outside the OECD Claims on non-domestic OECD public-sector entities, excluding central government, and loans guaranteed by such entities Cash items in process of collection
50 %	Loans fully secured by mortgage on residential property that is or will be occupied by the borrower or that is rented
100 %	Claims on the private sector Claims on banks incorporated outside the OECD with a residual maturity of over one year Claims on central governments outside the OECD (unless denominated in national currency - and funded in that currency -see above) Claims on commercial companies owned by the public sector Premises, plant and equipment and other fixed assets Real estate and other investments (including non-consolidated investment participations in other companies) Capital instruments issued by other banks (unless deducted from capital) All other assets"

Source: BCBS, 1988, p. 21-22

Appendix 3

Table 66: Five categories of off-balance-sheet activities

Category	**Description**	**Credit risk conversion factor**
A	Substitute for loans (General guarantees of indebtedness, bank acceptance guarantees and standby letters of credit serving as financial guarantees for loans and securities)	100 %
B	Certain transaction-related contingencies (Performance bonds, bid bonds, warranties and standby letters of credit)	50 %
C	Short-term, self-liquidating trade-related contingent liabilities (Documentary credits)	20 %
D	Commitments with an original maturity exceeding one year	50 %
E	Interest and exchange rate related items (Swaps, options, future)	Two alternative methods for calculating

Source: BCBS, 1988, p. 13

Appendix 4

Table 67: Rating definition

Category	Definition
AAA	"An obligation rated 'AAA' has the highest rating assigned by S&P Global Ratings. The obligor's capacity to meet its financial commitments on the obligation is extremely strong.
AA	An obligation rated 'AA' differs from the highest-rated obligations only to a small degree. The obligor's capacity to meet its financial commitments on the obligation is very strong.
A	An obligation rated 'A' is somewhat more susceptible to the adverse effects of changes in circumstances and economic conditions than obligations in higher-rated categories. However, the obligor's capacity to meet its financial commitments on the obligation is still strong.
BBB	An obligation rated 'BBB' exhibits adequate protection parameters. However, adverse economic conditions or changing circumstances are more likely to weaken the obligor's capacity to meet its financial commitments on the obligation.
BB, B, CCC, CC, and C	Obligations rated 'BB', 'B', 'CCC', 'CC', and 'C' are regarded as having significant speculative characteristics. 'BB' indicates the least degree of speculation and 'C' the highest. While such obligations will likely have some quality and protective characteristics, these may be outweighed by large uncertainties or major exposure to adverse conditions.
BB	An obligation rated 'BB' is less vulnerable to nonpayment than other speculative issues. However, it faces major ongoing uncertainties or exposure to adverse business, financial, or economic conditions that could lead to the obligor's inadequate capacity to meet its financial commitments on the obligation.
B	An obligation rated 'B' is more vulnerable to nonpayment than obligations rated 'BB', but the obligor currently has the capacity to meet its financial commitments on the obligation. Adverse business, financial, or economic conditions will likely impair the obligor's capacity or willingness to meet its financial commitments on the obligation.
CCC	An obligation rated 'CCC' is currently vulnerable to nonpayment and is dependent upon favorable business, financial, and economic conditions for the obligor to meet its financial commitments on the obligation. In the event of adverse business, financial, or economic conditions, the obligor is not likely to have the capacity to meet its financial commitments on the obligation.
CC	An obligation rated 'CC' is currently highly vulnerable to nonpayment. The 'CC' rating is used when a default has not yet occurred, but S&P Global Ratings expects default to be a virtual certainty, regardless of the anticipated time to default.
C	An obligation rated 'C' is currently highly vulnerable to nonpayment, and the obligation is expected to have lower relative seniority or lower ultimate recovery compared with obligations that are rated higher.

D	An obligation rated 'D' is in default or in breach of an imputed promise. For non-hybrid capital instruments, the 'D' rating category is used when payments on an obligation are not made on the date due, unless S&P Global Ratings believes that such payments will be made within five business days in the absence of a stated grace period or within the earlier of the stated grace period or 30 calendar days. The 'D' rating also will be used upon the filing of a bankruptcy petition or the taking of similar action and where default on an obligation is a virtual certainty, for example due to automatic stay provisions. An obligation's rating is lowered to 'D' if it is subject to a distressed exchange offer." (S & P, 2018, no page)

Source: S&P, 2018, no page number

Appendix 5

Table 68: Additional information for the data adjustments

Number of banks total	**45**
-Banks that joined to the index since 2005	-17
= Number of banks adjusted	**28**
Gross observations (15 years for each bank)	**420***
-Missing values for CASH	15
-Missing values for NETLOANS	2
-Missing values for NPL	79
-Missing values for RWA	6
-Missing values for TCR	3
-Missing values for DIVPAID	23
Sum of missing values	128
= Number of used observations	**292****

Source: Own table

*Include 14 values for the variable RWA from Bloomberg

*Include 2 values for the variable TCR from Bloomberg

*Include 1 value for the variable NSFR from Bloomberg

*Include 6 values for the variable LCR from Bloomberg

*Include 48 values for the variable DIVPAID from Refinitiv

**Include 2 values for the variable RWA from Bloomberg

** Include 1 values for the variable NSFR from Bloomberg

** Include 4 values for the variable LCR from Bloomberg (thereof 1 common observation with NSFR)

** Include 22 values for the variable DIVPAID from Refinitiv

Additional information for the DIVPAID:

The source Thomson Reuter/Datastream defined the Cash Dividends Paid as cash dividends to shareholders of common and preferred stocks. Refinitiv defined the dividends as the dividends to the shareholders of common stocks.

Appendix 6

Table 69: Definition of the used variables

Cash & due from banks	"Cash on hand + due from banks (receivable from, or short-term to, other banks and/or financial institutions, which usually bear minor interest earnings)
Net loans	Loans to bank + demand loans (to banks) + consumer loans such as auto loans, credit card loans, loans for education, real estate loans, and mortgage loans (first mortgage or secondary mortgage loans) + advances (to customers) + loans for investments, or securities trading + loans to government or other local authorities + consumer or commercial loans + claims from the public + loans to customers + loans in process or foreclosed loans + secured or unsecured loans
NPL	Non-accrual loans + reduced rate loans + renegotiated/restricted loans (accruing and non-accruing) + loans past due 90 days or more (accruing and non-accruing) + loans past due below 90 days, if so defined by the lender (accruing and non-accruing)
Total assets	Cash & due from banks + other earning assets, total + net Loans + property/plant/equipment, total - net + goodwill - net + intangibles, net + long-term investments + other long-term assets, total + other Assets, total
Total deposits	Non-interest bearing deposits + interest bearing deposits + other deposits"

Source: Based on Thomson Reuter definition, 2020, no page

Appendix 7: Correspondence C. Röhl and author

Von: “Christian W. Röhl” <cwroehl@gmail.com>

Datum: Donnerstag, 27. Februar 2020 um 22:28

An: Serkan Akbay <serkan-akbay@gmx.de>

Betreff: Re: Frage zu Dividendenabfrage

Hallo Herr Akbay,

das ist kein Datenfehler, was Sie da beschreiben. Vielmehr haben Unternehmen in unterschiedlichen Ländern abweichende „Dividend Frequency“ (die Sie übrigens auch über ein Bloomberg Mnemonic auslesen können). In Deutschland und der Schweiz wird jährlich gezahlt, in den USA und Kanada quartalsweise und in Frankreich, Spanien und Großbritannien sehen wir sowohl jährliche als auch unterjährige Ausschüttungen – bisweilen sogar eine „Final Dividend“ und zwei Interimsdividenden. Hinzu kommt, dass manche Firmen den Ausschüttungsrhythmus immer mal wieder ändern.

Sie müssen also Jahreswerte bilden, wenn Sie Vergleichbarkeit schaffen wollen. Also für jedes Unternehmen mit DVD HIST die Dividendendaten ziehen, den jeweiligen Zeilen das Jahr des Ex-Tages zuweisen – und dann können Sie das mit einer Pivot Table schön aggregieren und auswerten. Auch Sonderdividenden lassen sich so abgrenzen, denn DVD HIST weist ja den „Dividend Type“ aus.

Beste Grüße, auch an Clemens

Christian W. Röhl

Sent from iPhone

Am 27.02.2020 um 21:09 schrieb Serkan Akbay <serkan-akbay@gmx.de>:

Sehr geehrter Herr Röhl,

gerne melde ich mich mit wärmsten Empfehlungen von Herrn Prof. Dr. Dr. habil. Clemens Jäger bei Ihnen.

Da Sie diverse Dividendenstudien durchgeführt und umfangreiche Expertise haben, können Sie mir (hoffentlich) weiterhelfen.

Ich schreibe aktuell meine Doktorarbeit (Schwerpunkt: bankenbezogene Dividendenpolitik) und benötige hierfür vierteljährliche Dividendendaten von 28 kap.marktorientierten Banken (insbesondere ‚Dividend paid' und ‚Dividend payout ratio'). Ich habe einen Datenexport über Bloomberg und Thomson Reuter durchgeführt. Leider liegen die Daten nur zum Teil vor (mal jährlich, mal halbjährlich und mal für einzelne Quartale).

Haben Sie weitere Ideen, wie ich zuverlässig an weitestgehend vollständige Quartalsdaten zur der Dividendenpolitik komme?

Alternativ habe ich überlegt, die Jahreswerte zu linearisieren (mit den damit verbundenen Limitationen in der Auswertung).

Können Sie mir diesbezüglich bitte weiterhelfen?

Selbstverständlich können wir auch gerne telefonieren.

Daher freue ich mich auf Ihre Rückmeldung.

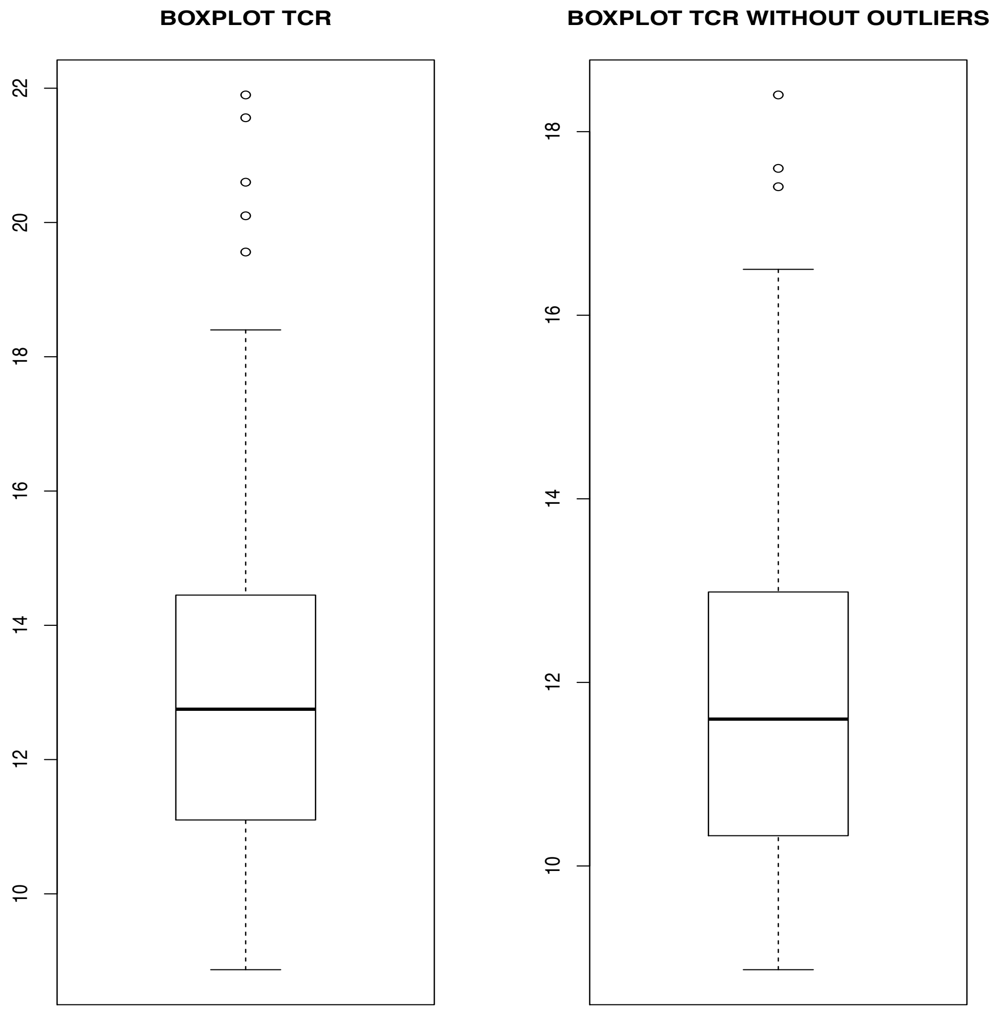
Vielen Dank vorab!

Viele Grüße

Serkan Akbay

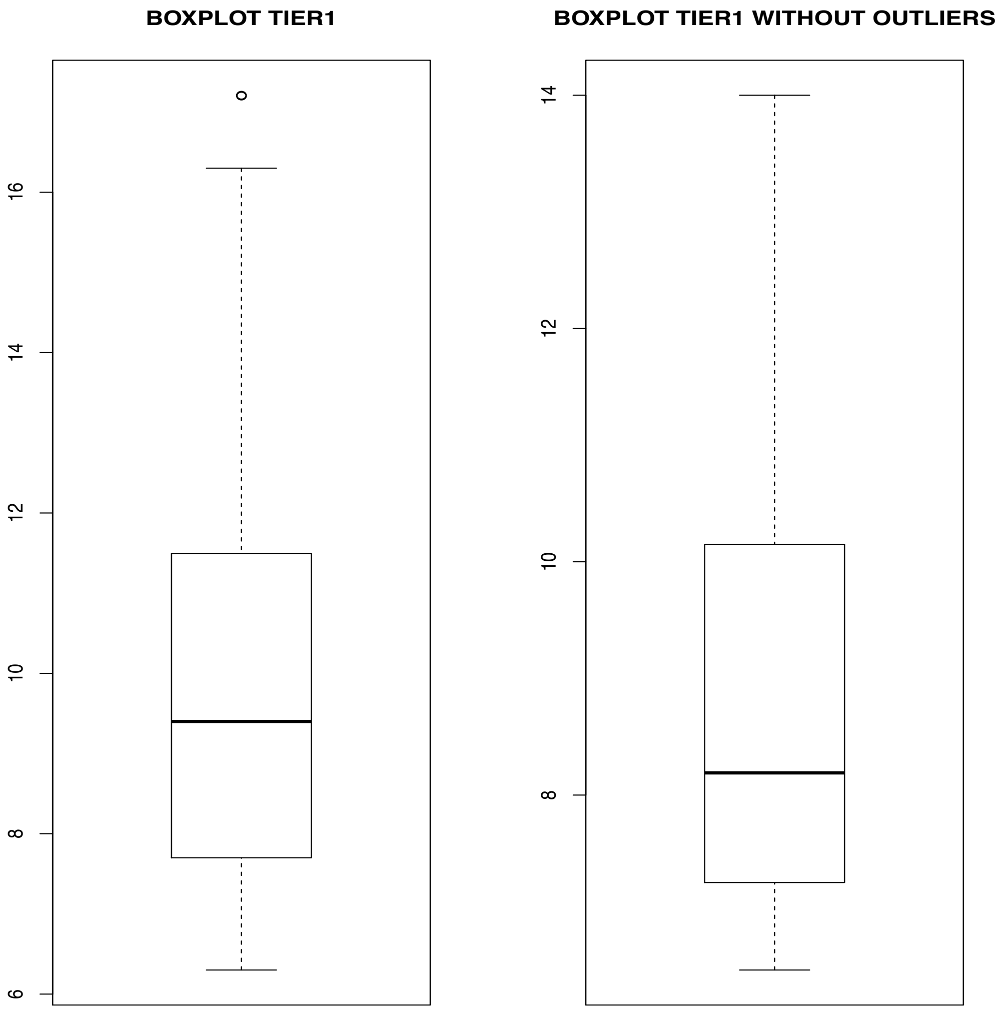
Appendix 8: Boxplot comparison for data frame G1 with G1NEW

Figure 35: TCR boxplot comparison



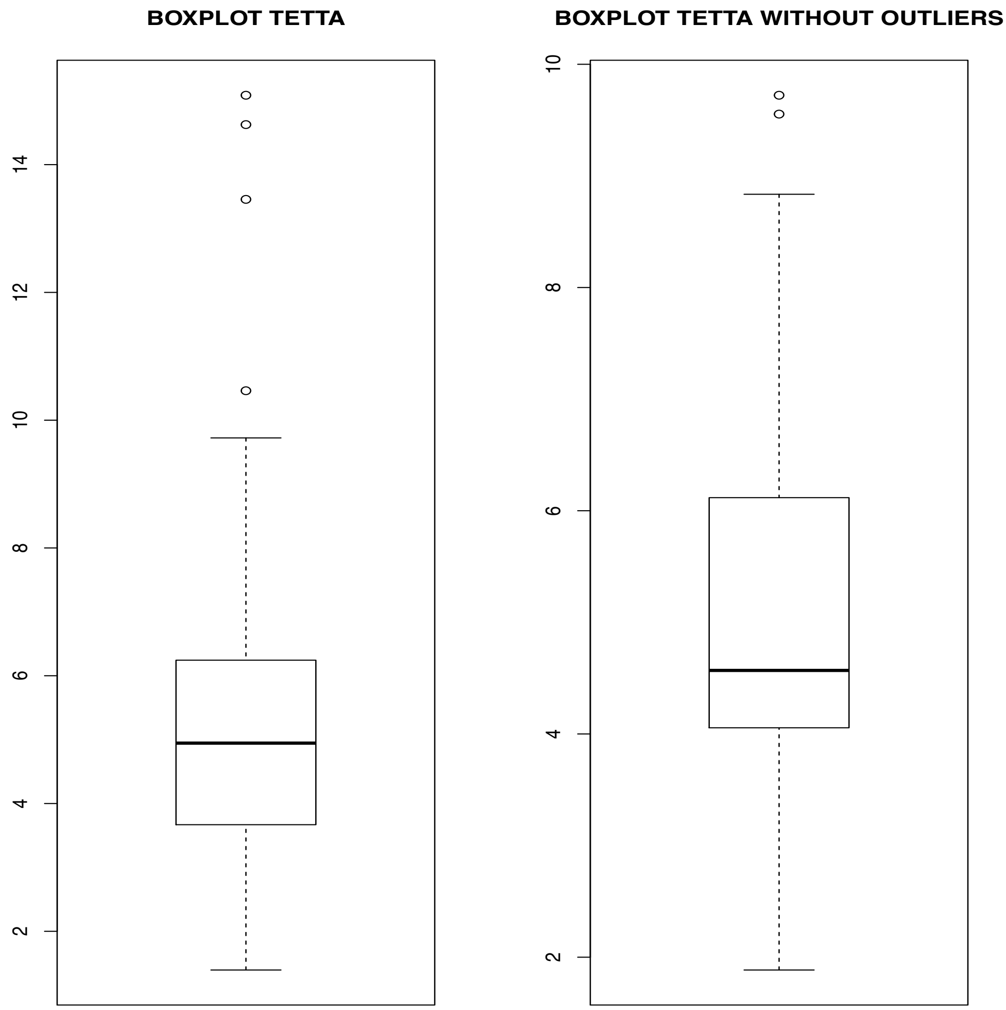
Source: Own figure

Figure 36: TIER1 boxplot comparison



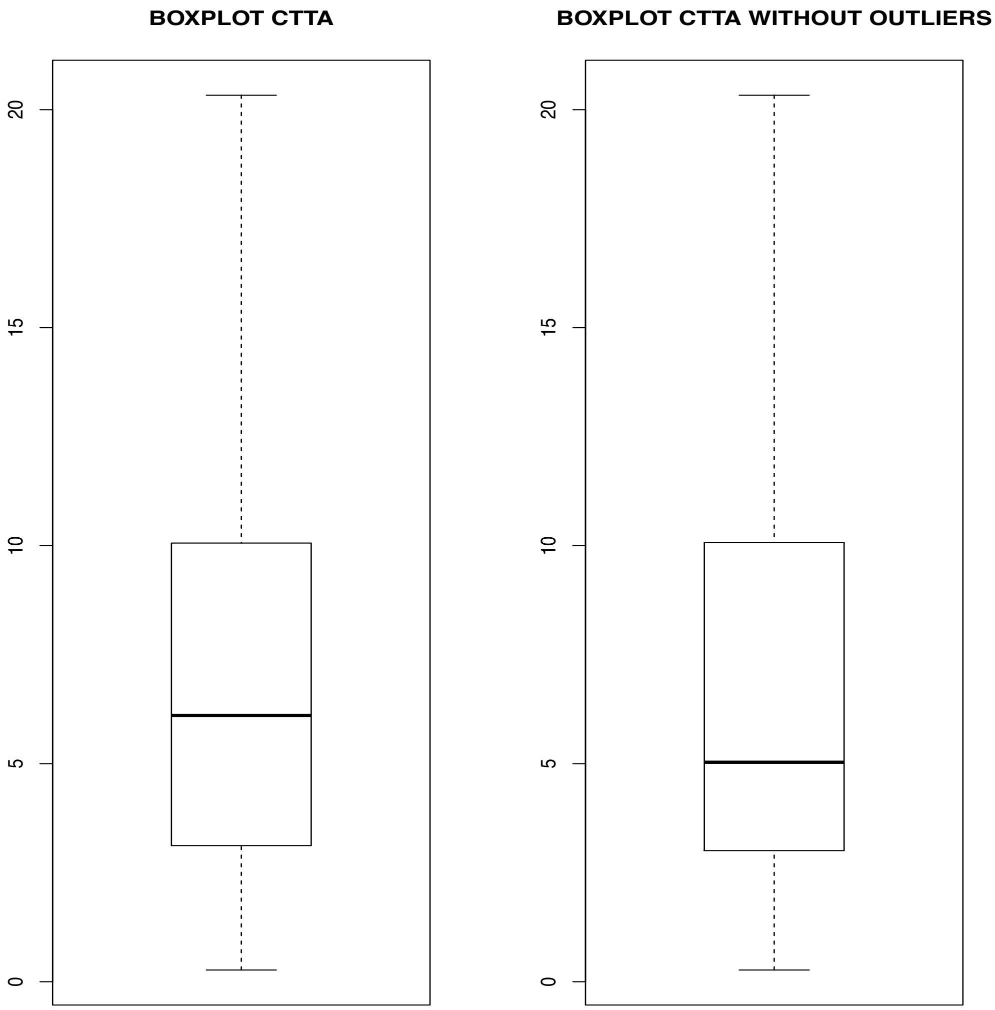
Source: Own figure

Figure 37: TETTA boxplot comparison



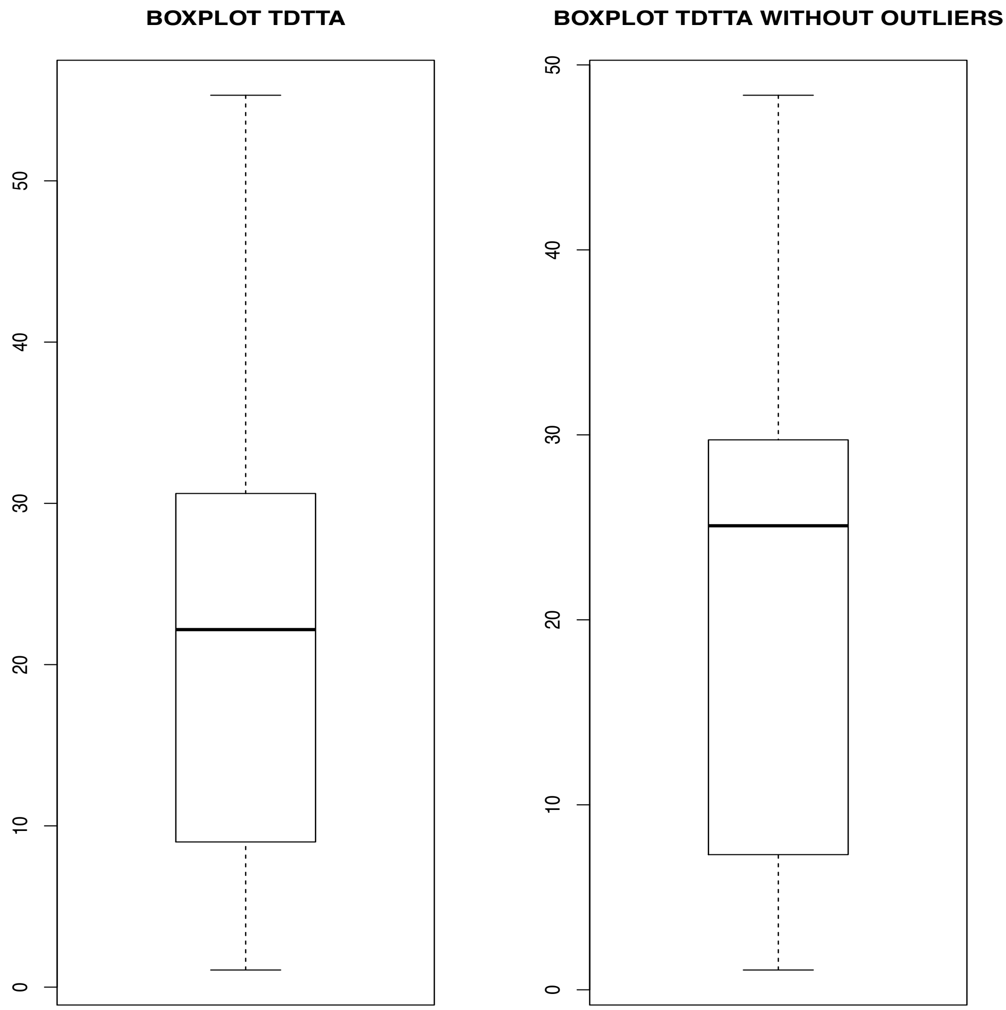
Source: Own figure

Figure 38: CTTA boxplot comparison



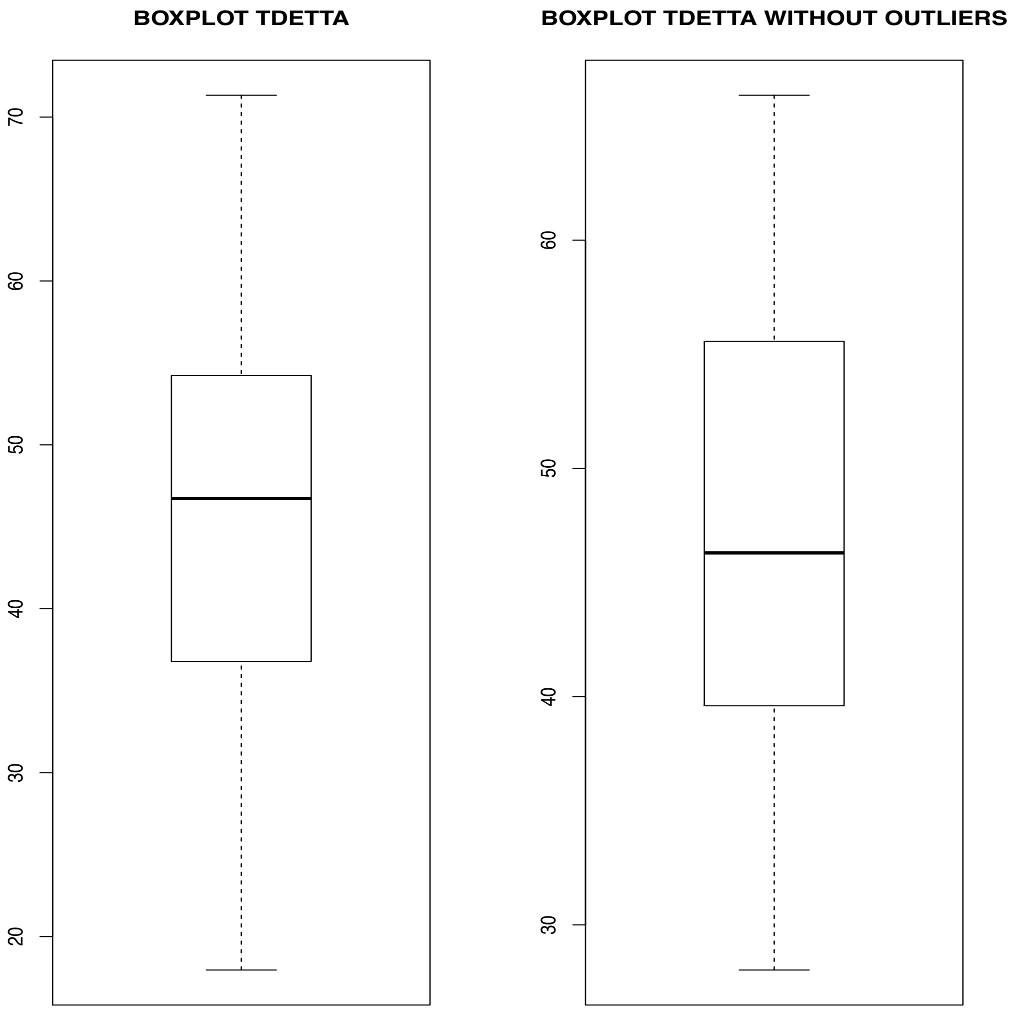
Source: Own figure

Figure 39: TDTTA boxplot comparison



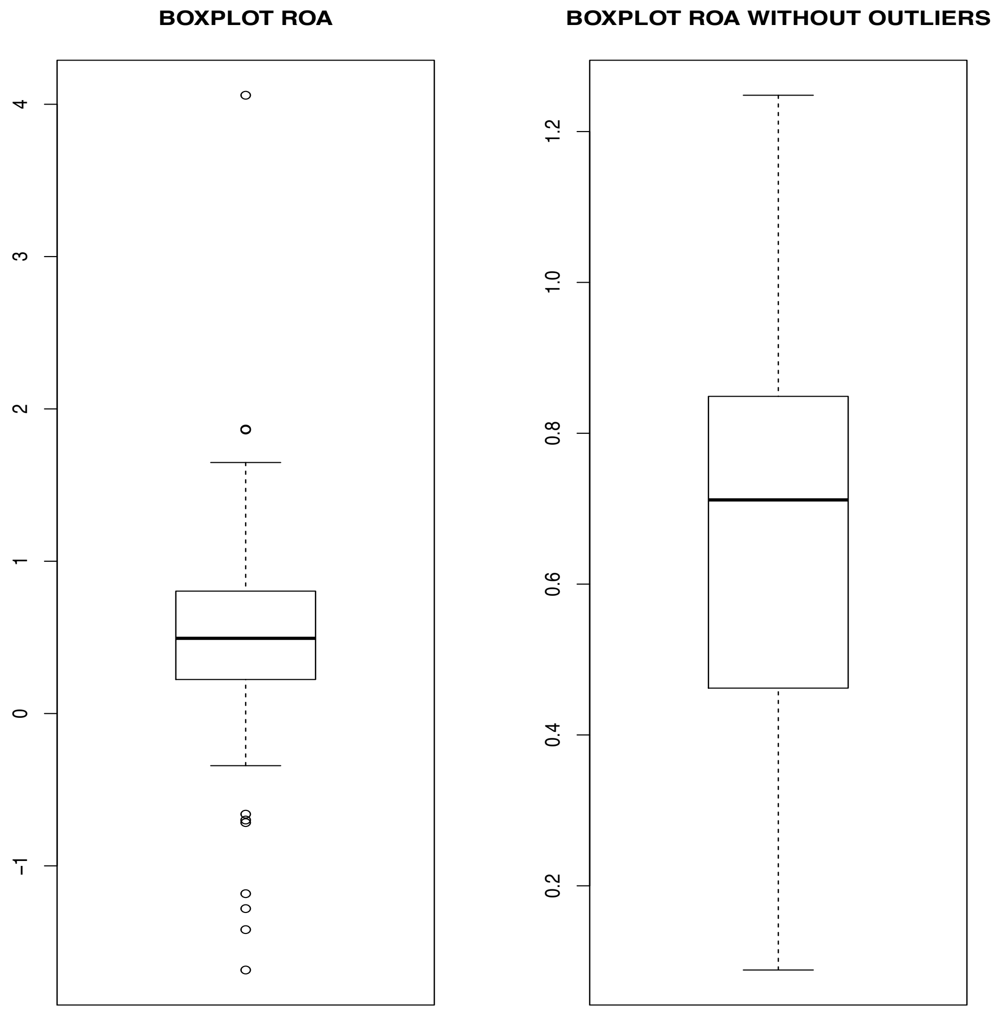
Source: Own figure

Figure 40: TDETTA boxplot comparison



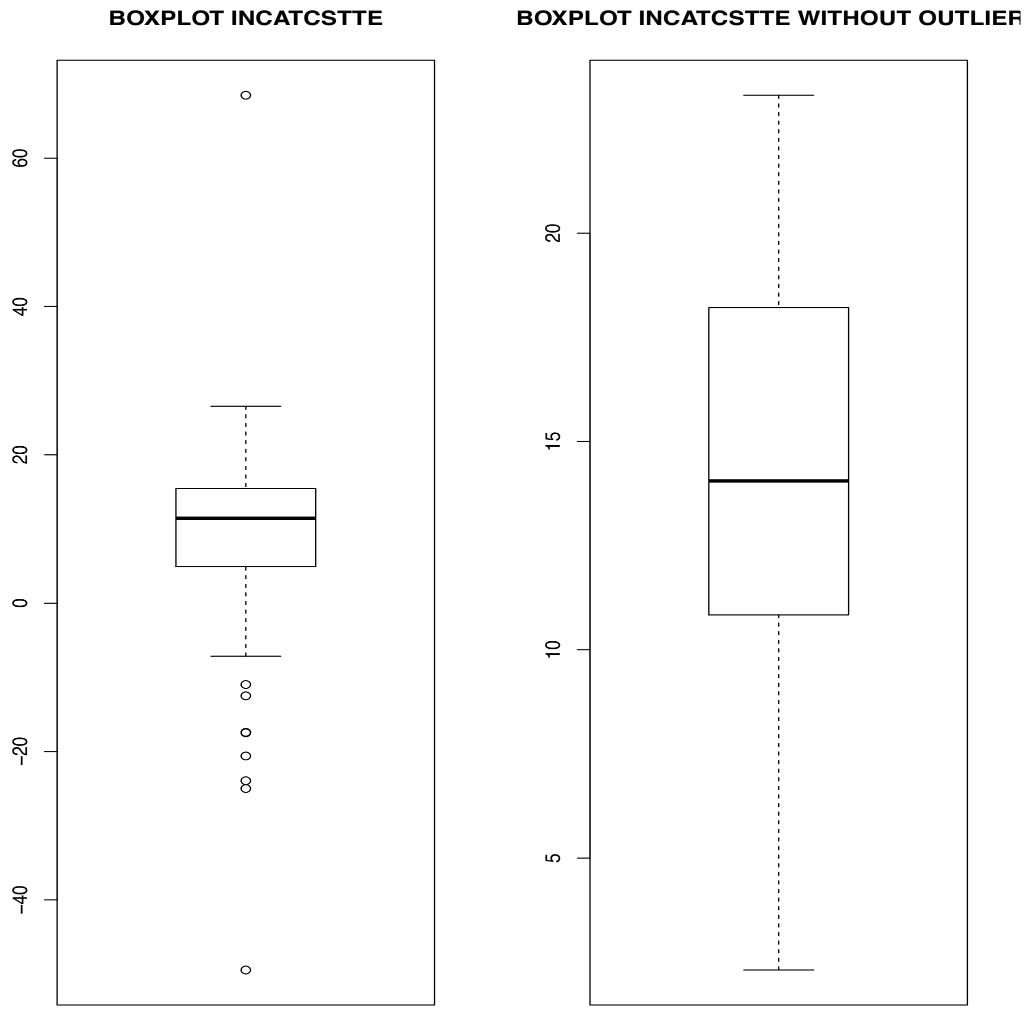
Source: Own figure

Figure 41: ROA boxplot comparison



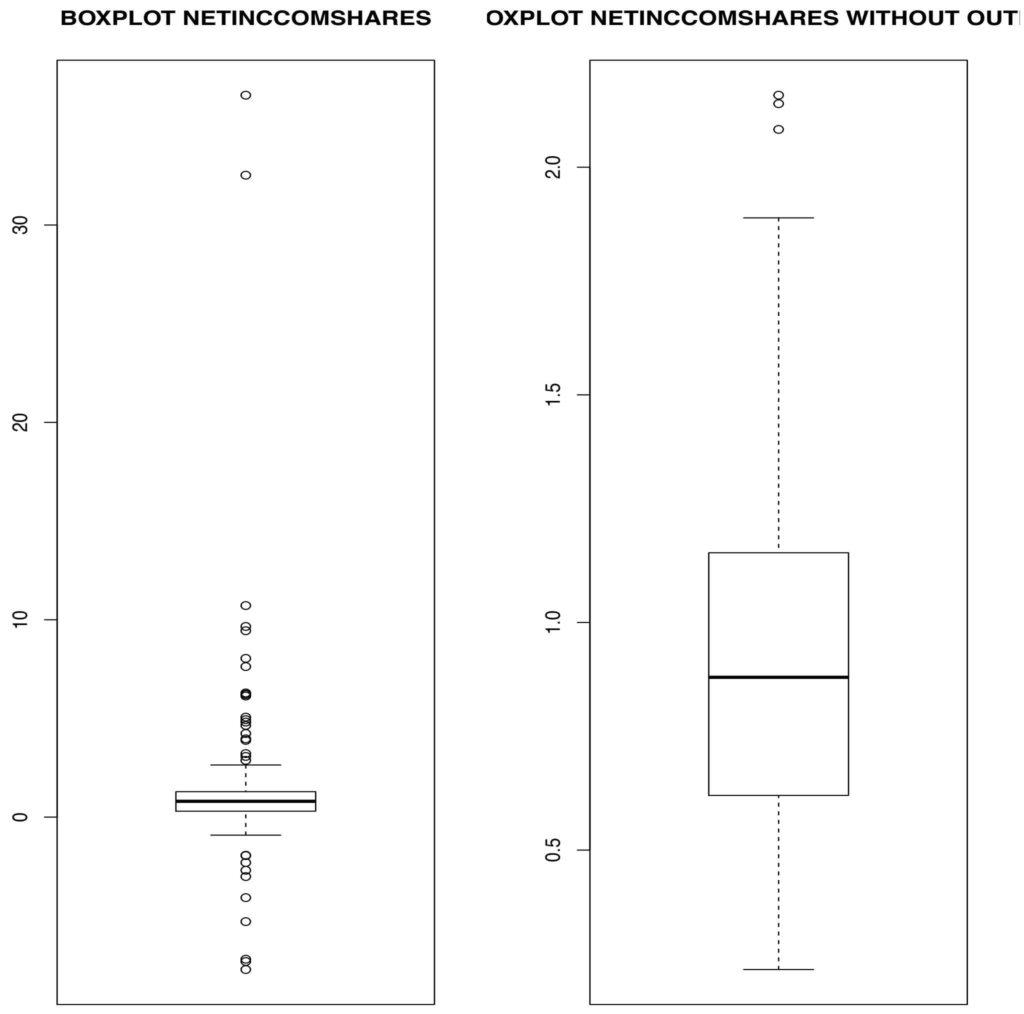
Source: Own figure

Figure 42: INCATCSTTE boxplot comparison



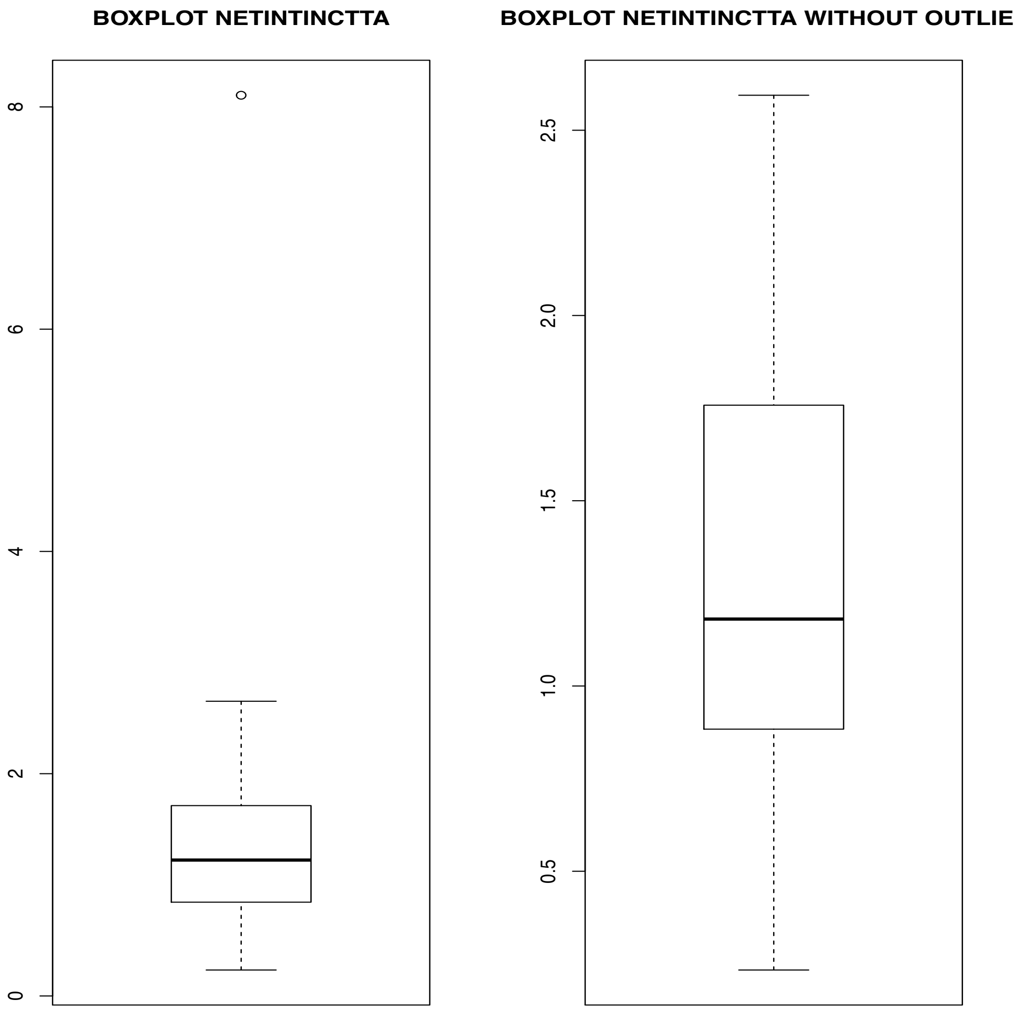
Source: Own figure

Figure 43: NETINCCOMSHARES boxplot comparison



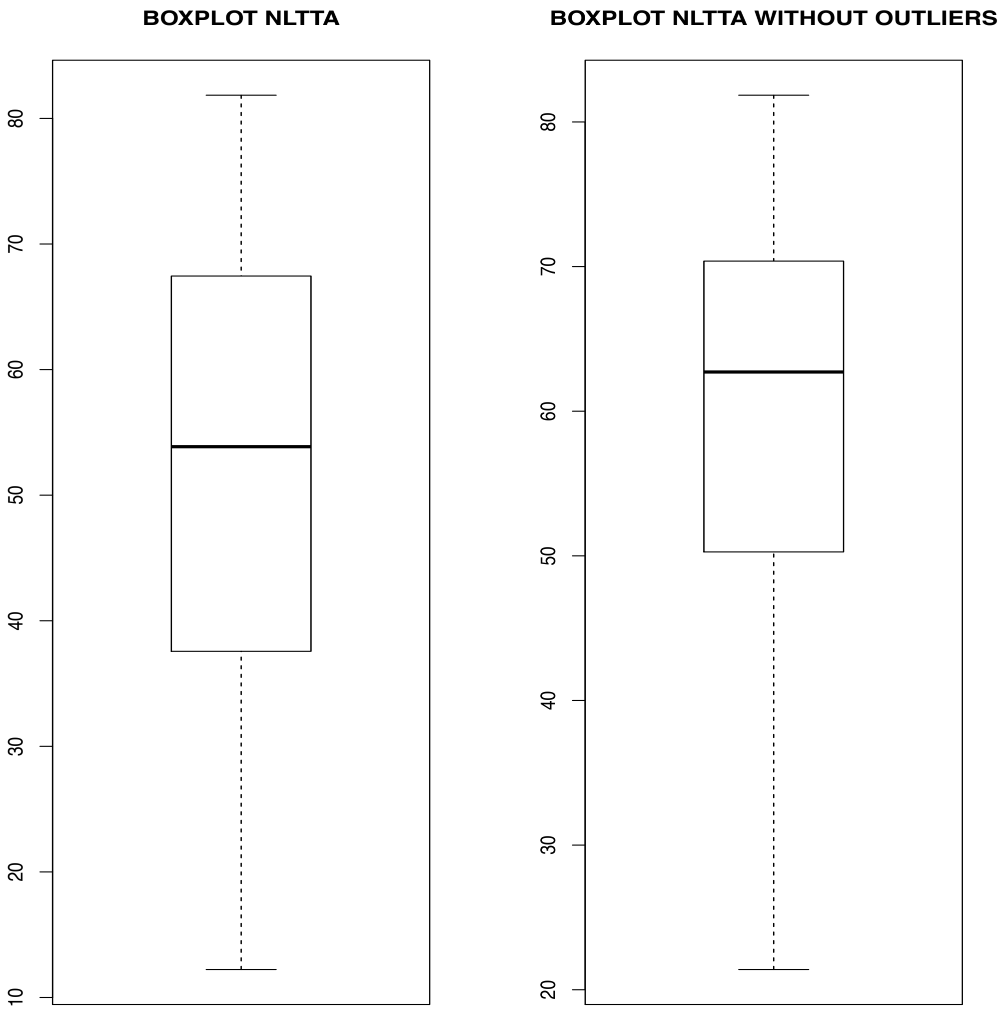
Source: Own figure

Figure 44: NETINTINCTTA boxplot comparison



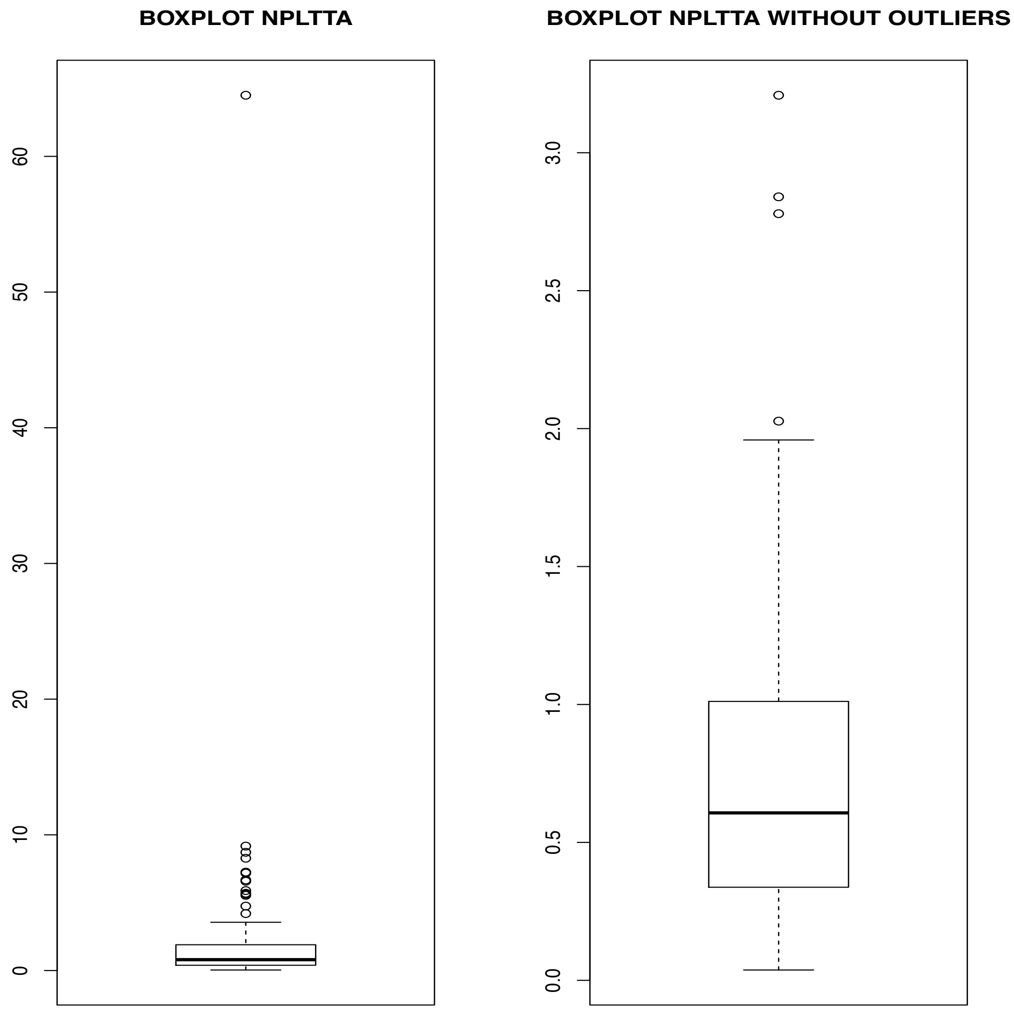
Source: Own figure

Figure 45: NLTTA boxplot comparison



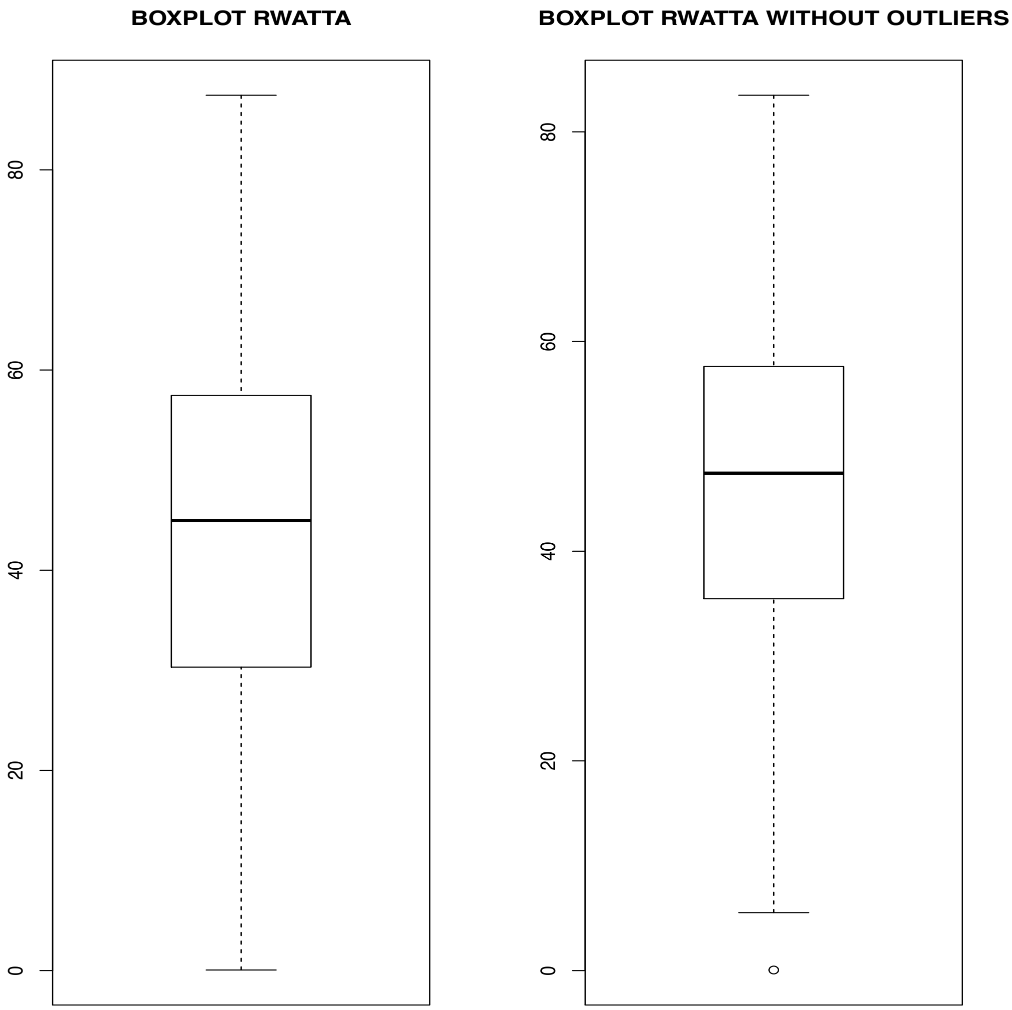
Source: Own figure

Figure 46: NPLTTA boxplot comparison



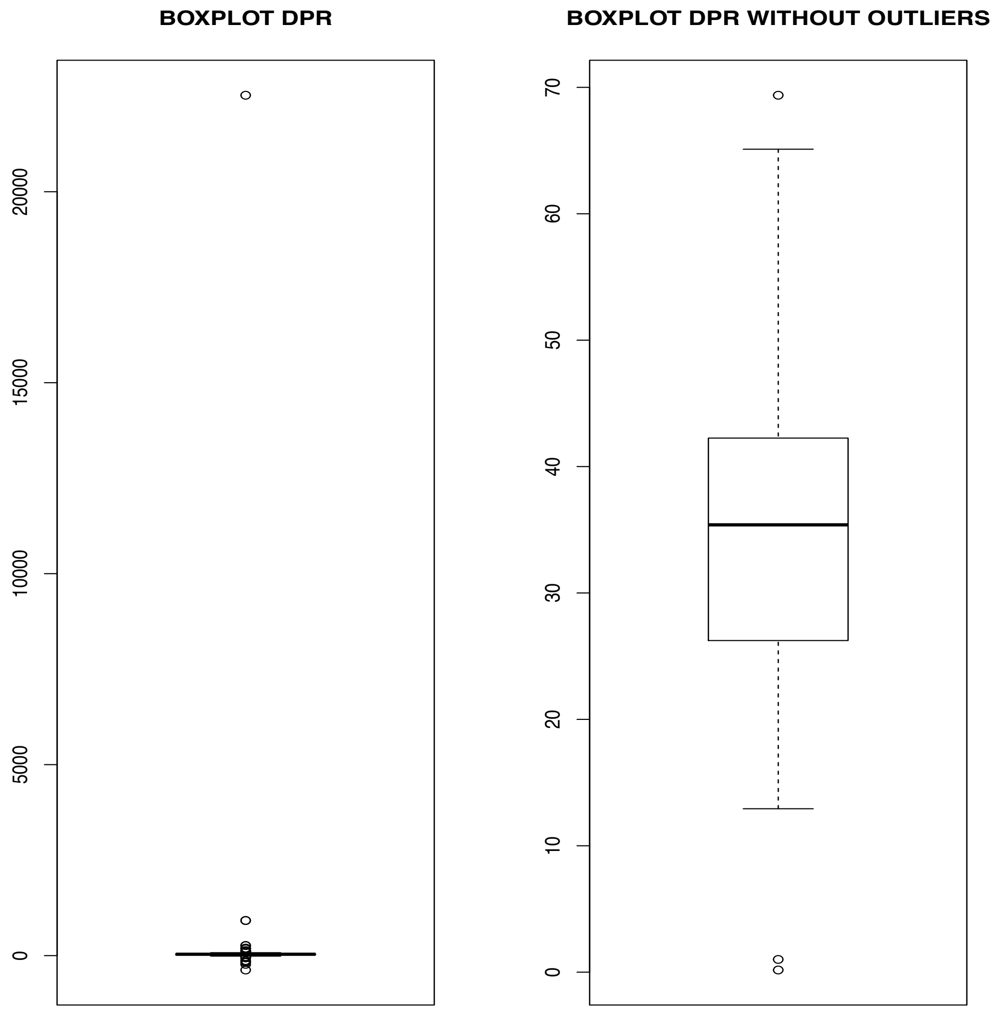
Source: Own figure

Figure 47: RWATTA boxplot comparison



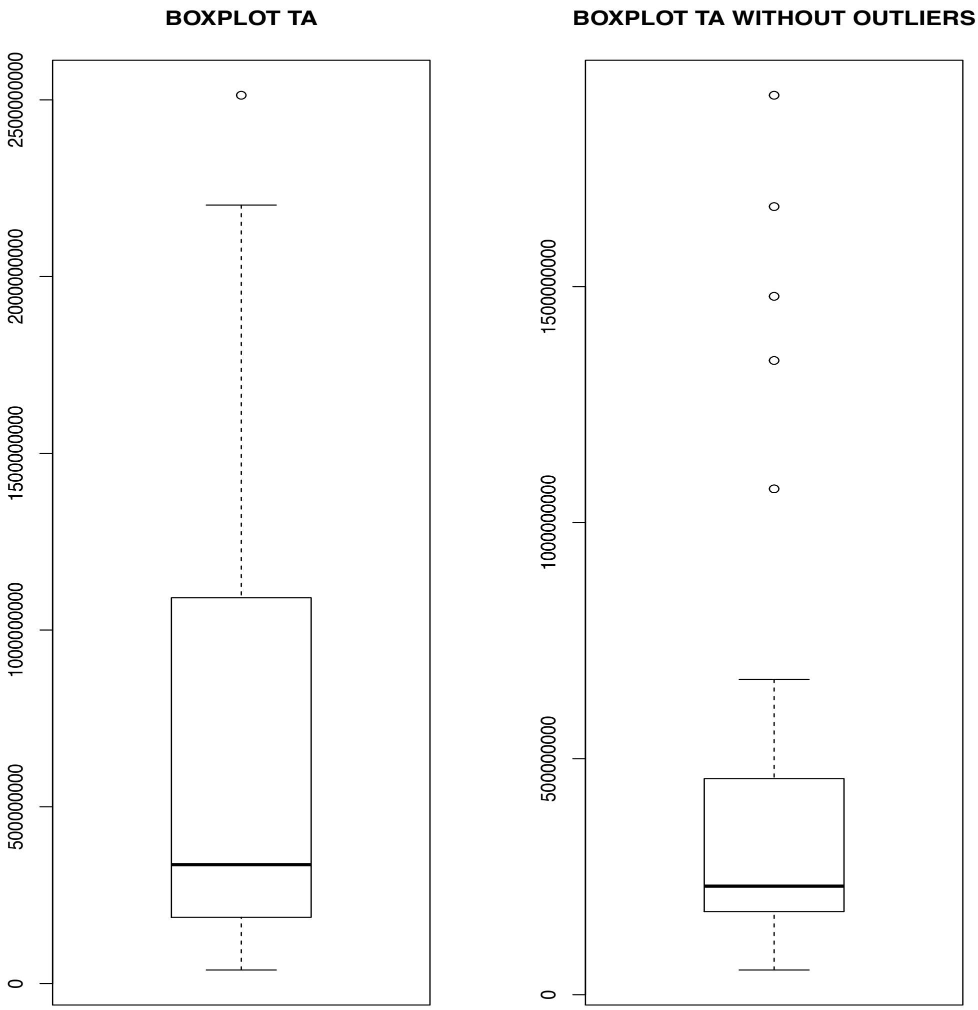
Source: Own figure

Figure 48: DPR boxplot comparison



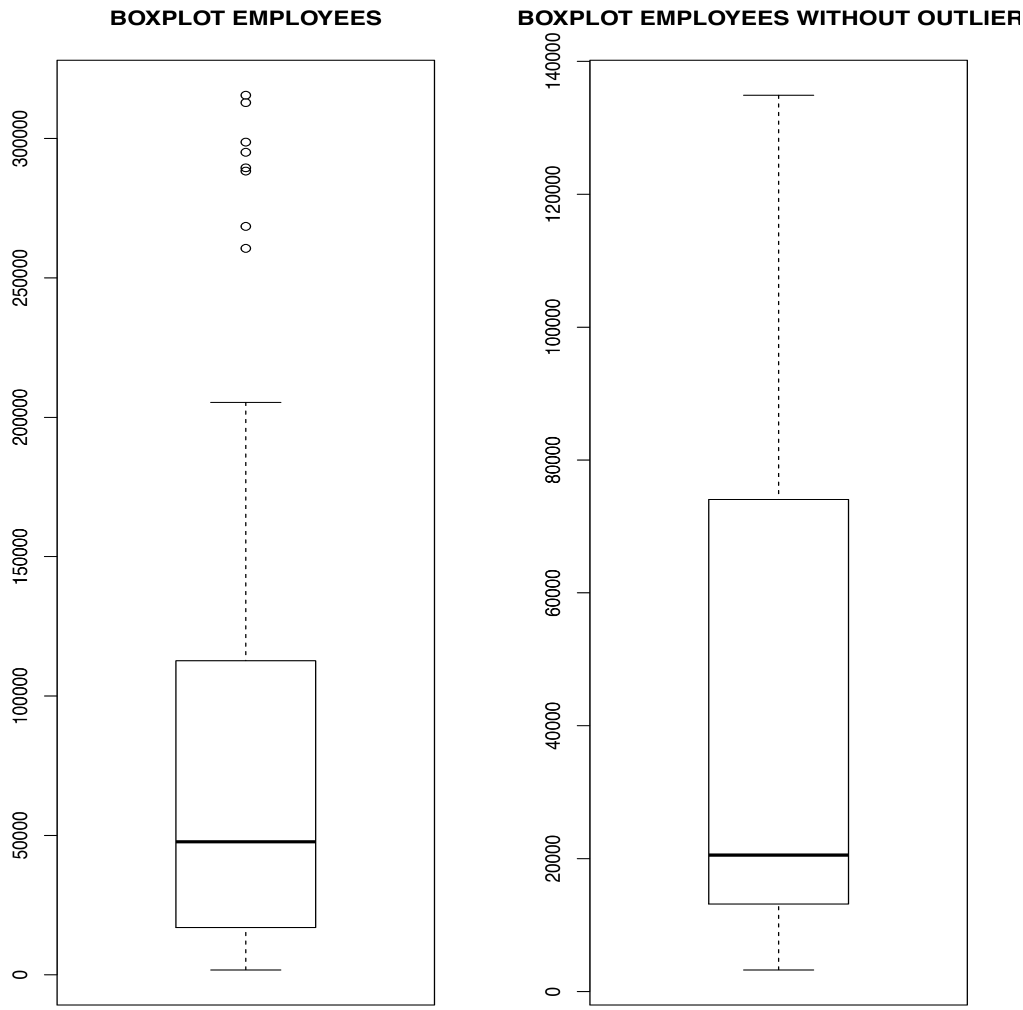
Source: Own figure

Figure 49: TA boxplot comparison



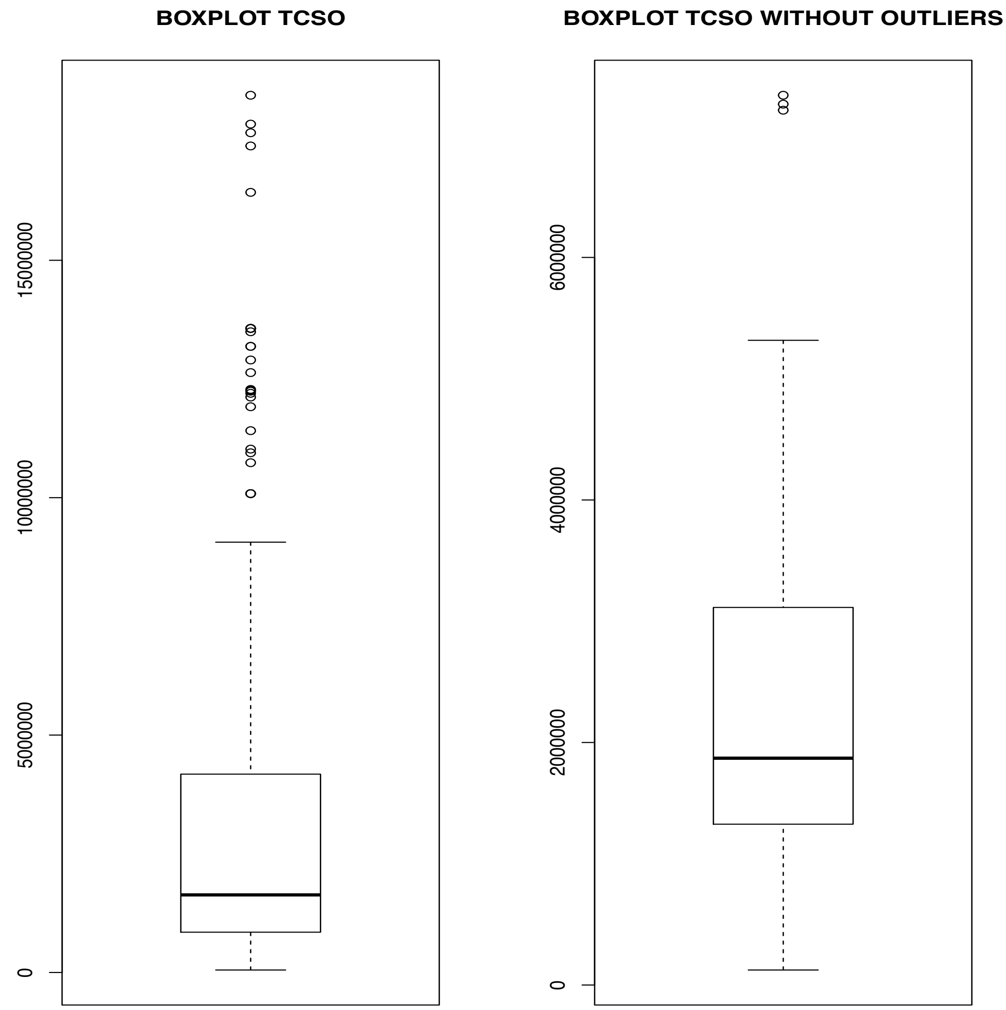
Source: Own figure

Figure 50: EMPLOYEES boxplot comparison



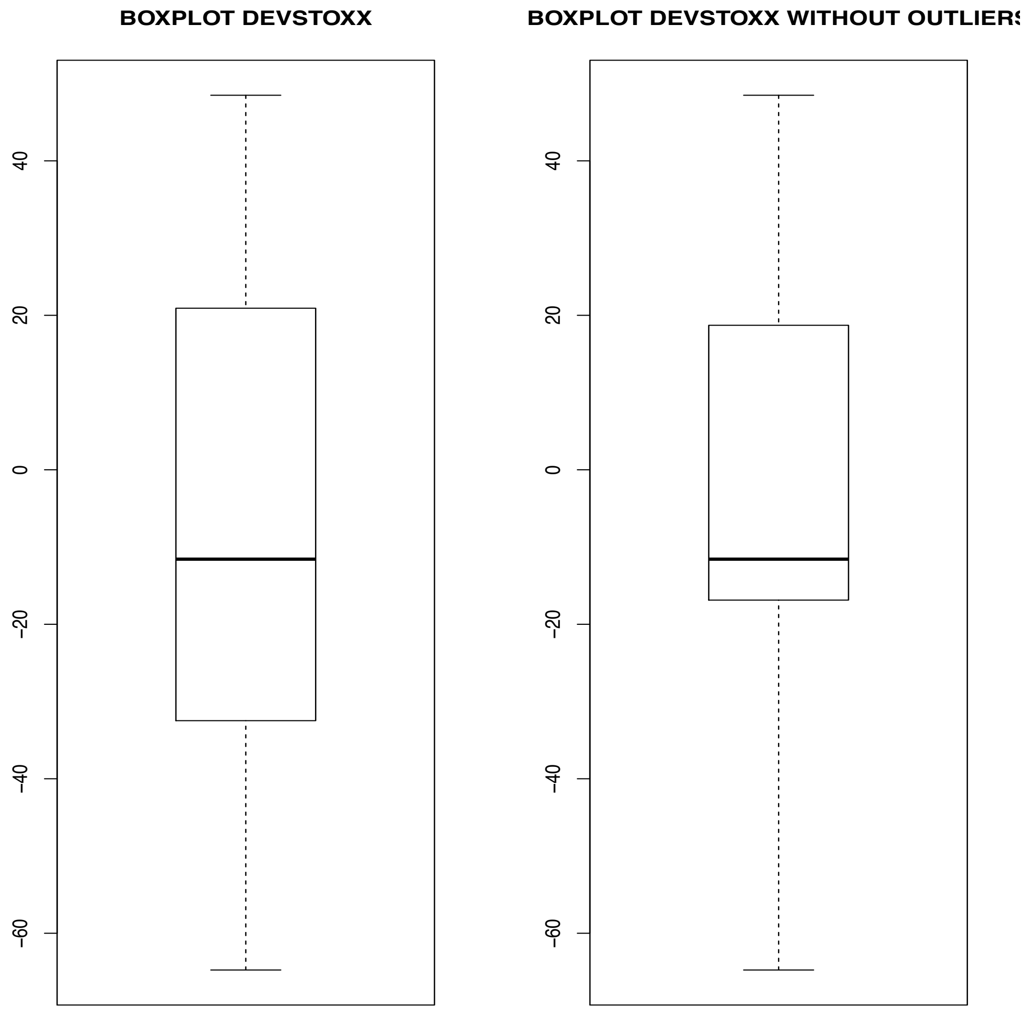
Source: Own figure

Figure 51: TCSO boxplot comparison



Source: Own figure

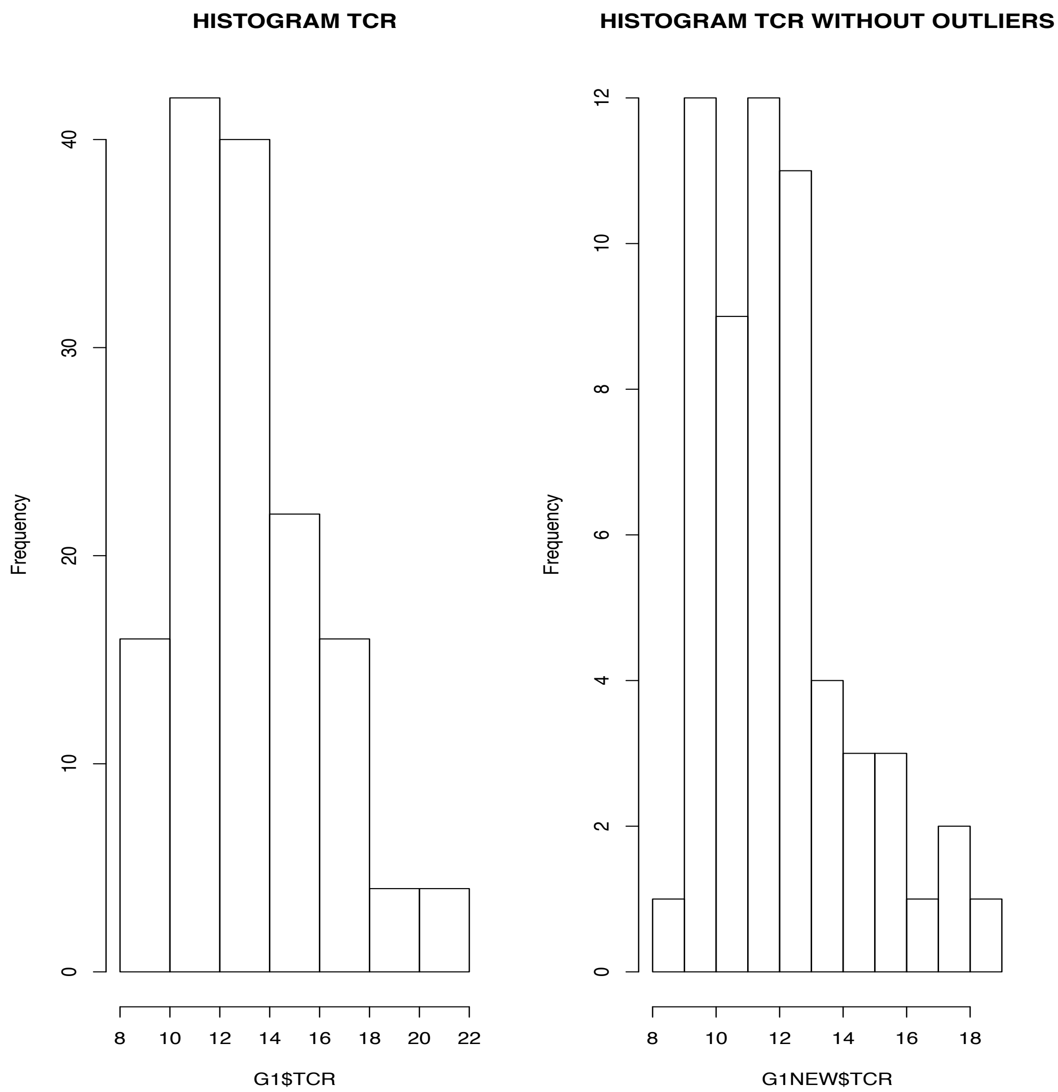
Figure 52: DEVSTOXX boxplot comparison



Source: Own figure

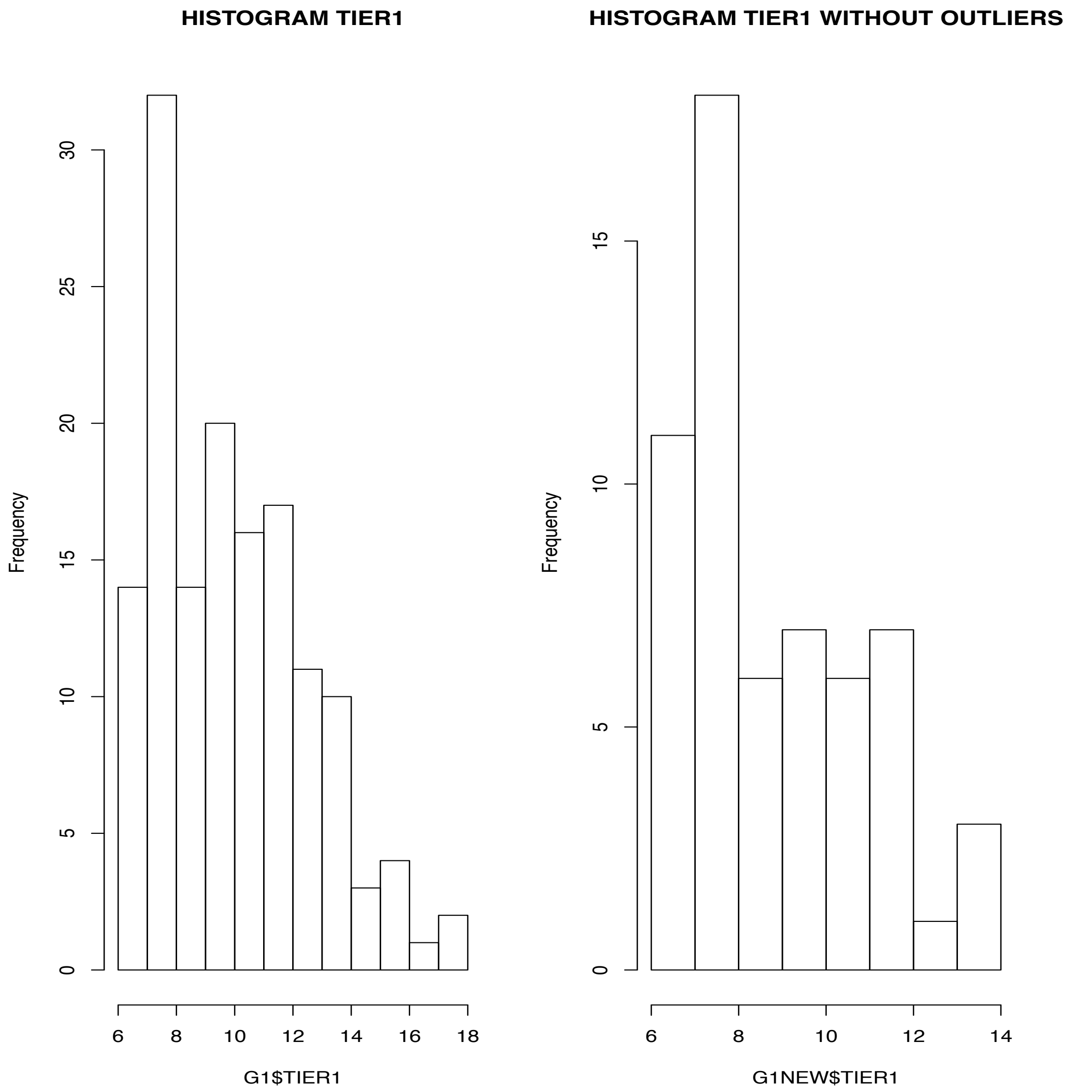
Appendix 9: Histogram comparison for G1 with G1NEW

Figure 53: TCR histogram comparison



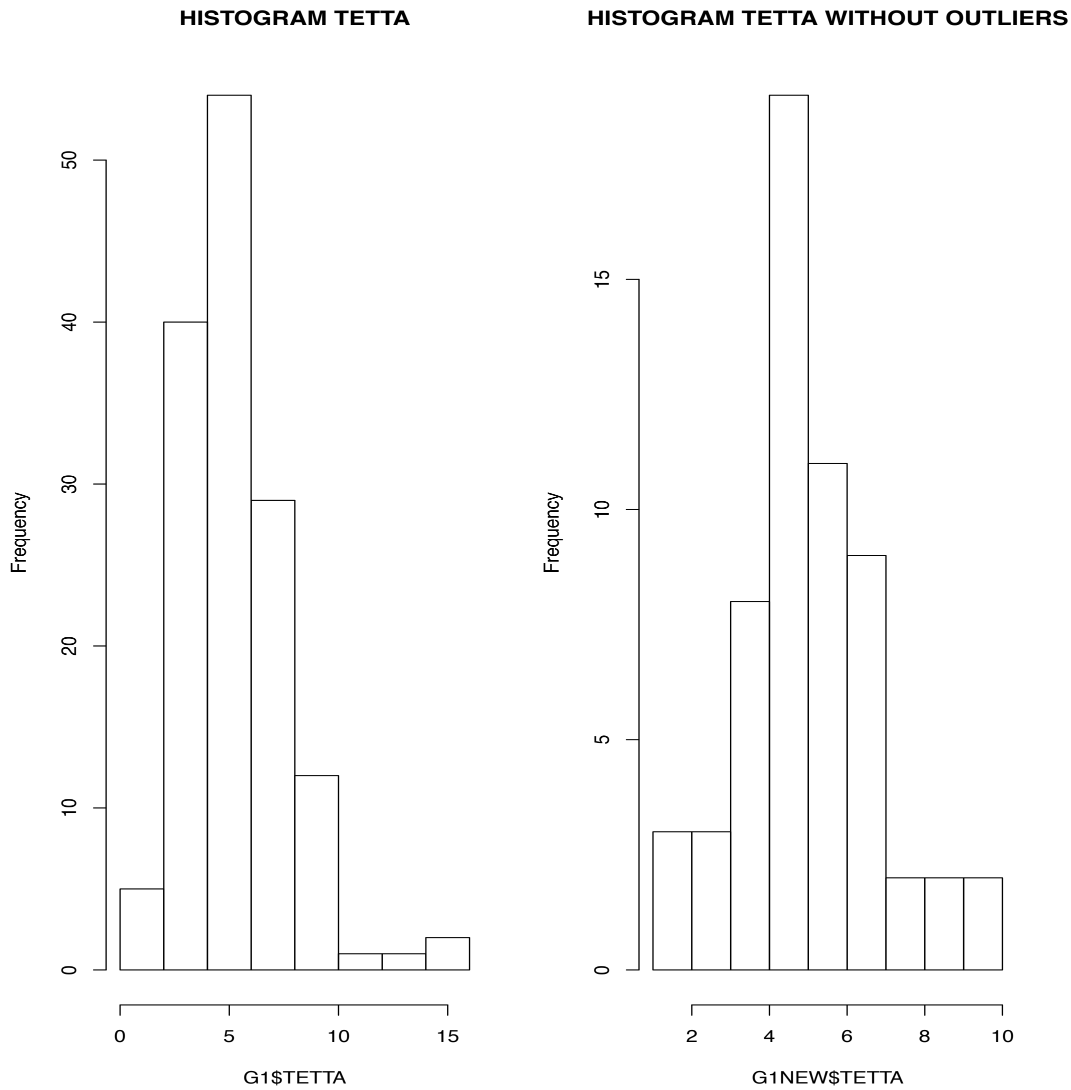
Source: Own figure

Figure 54: TIER1 histogram comparison



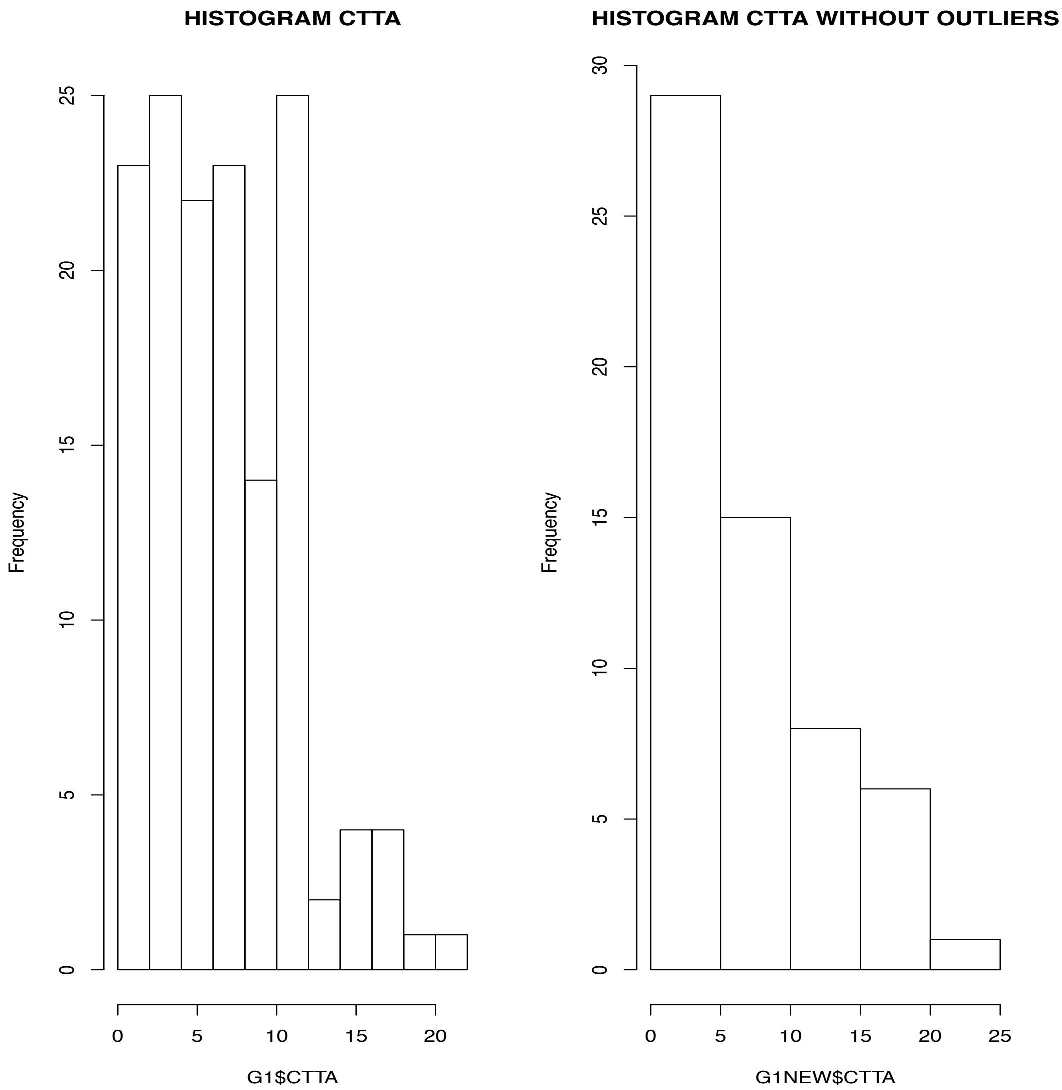
Source: Own figure

Figure 55: TETTA histogram comparison



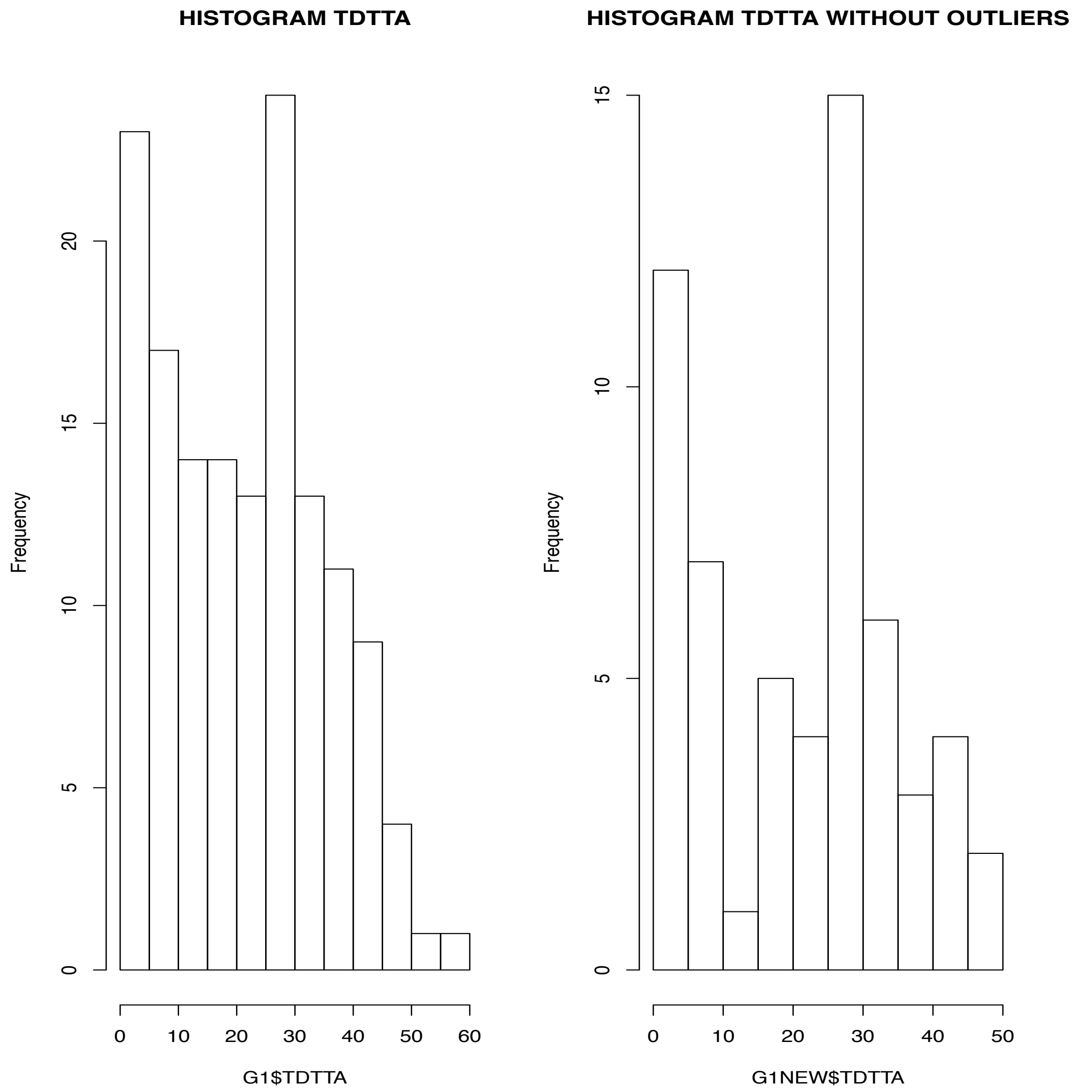
Source: Own figure

Figure 56: CTTA histogram comparison



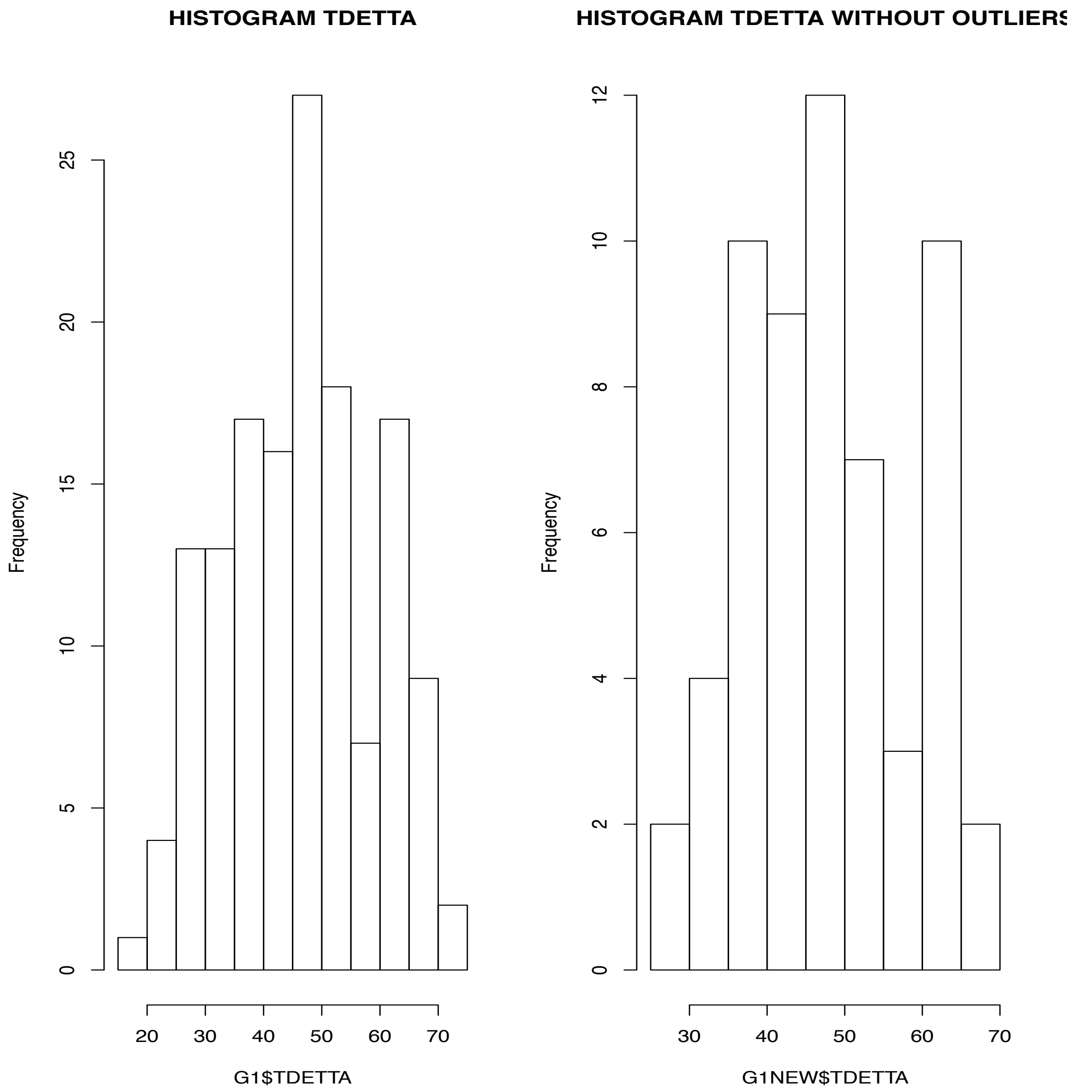
Source: Own figure

Figure 57: TDTTA histogram comparison



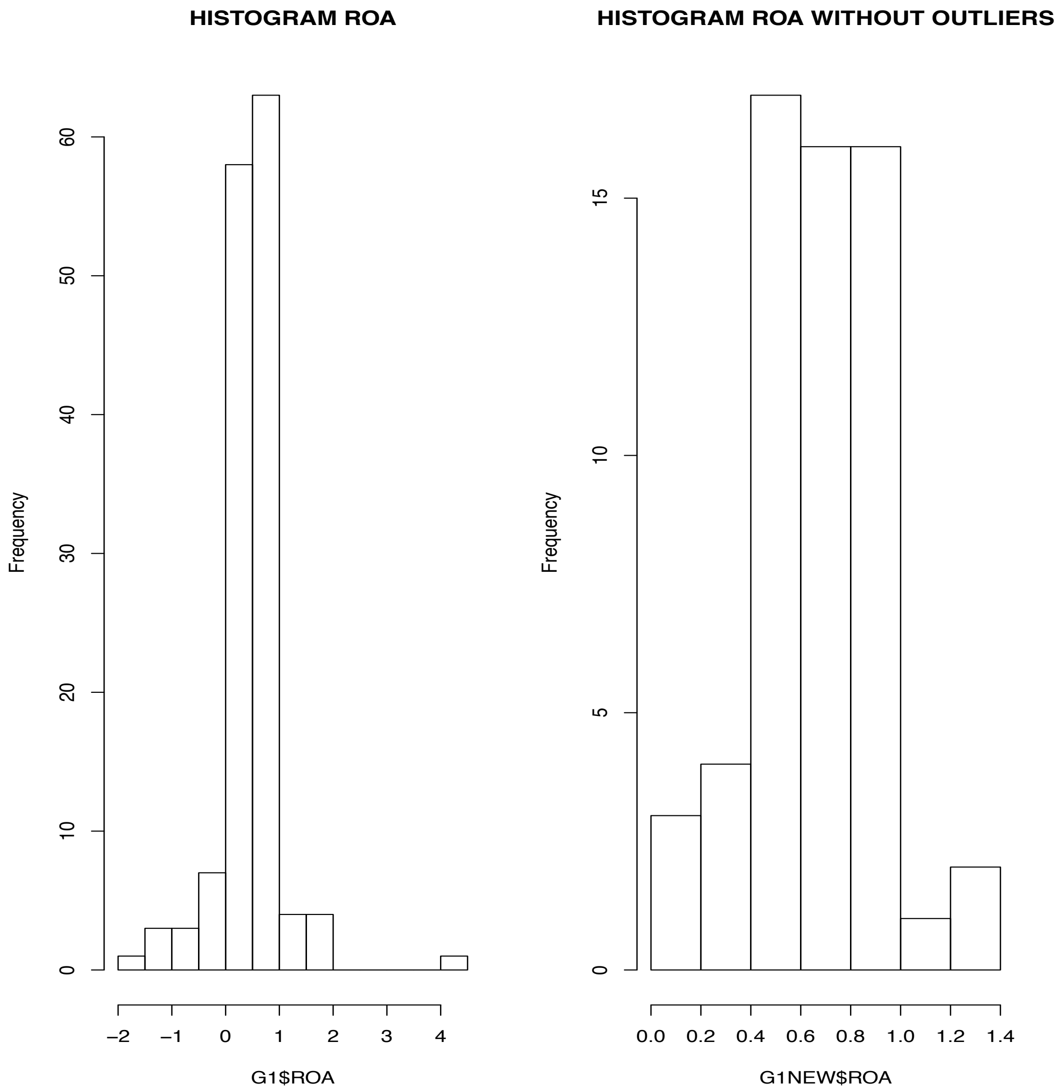
Source: Own figure

Figure 58: TDETTA histogram comparison



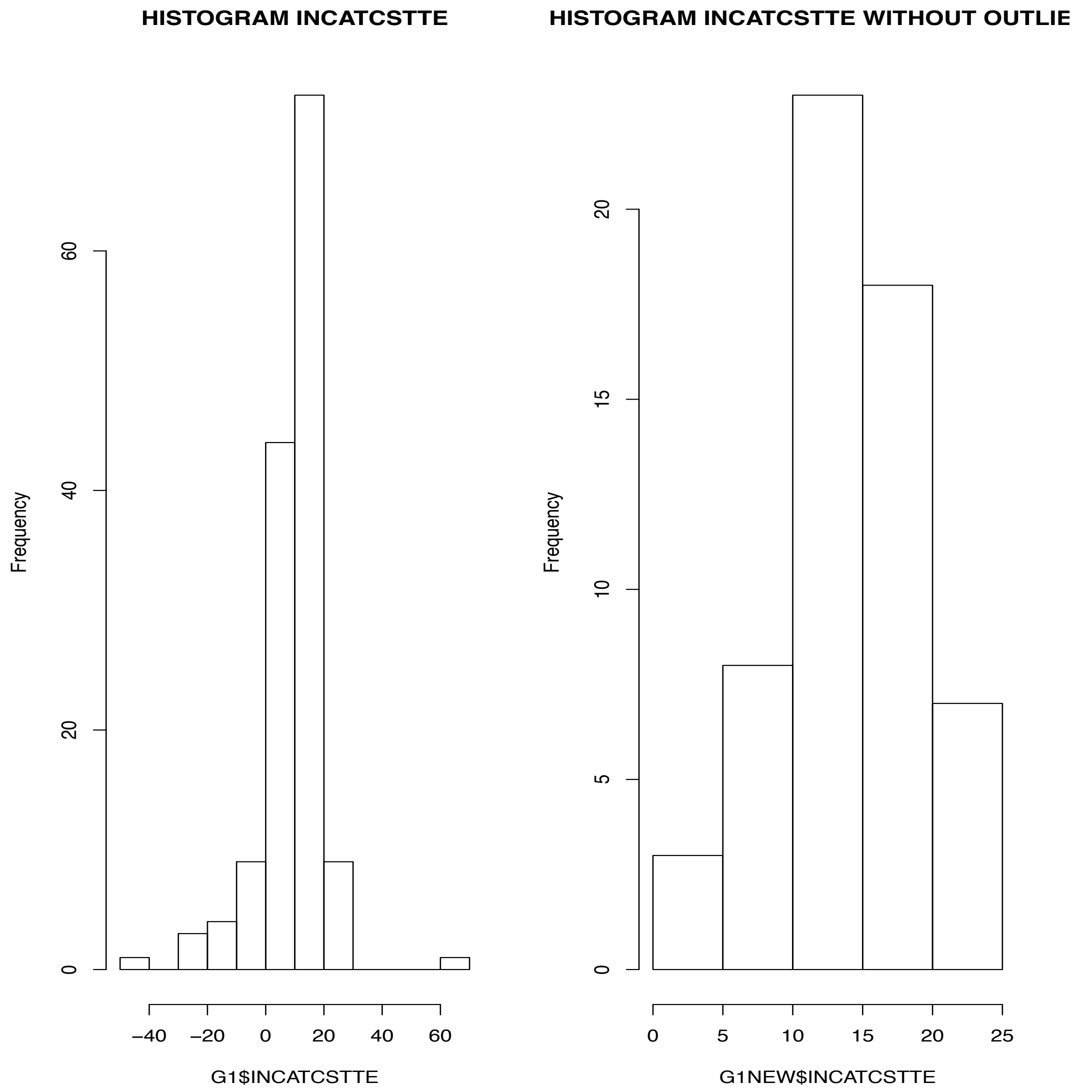
Source: Own figure

Figure 59: ROA histogram comparison



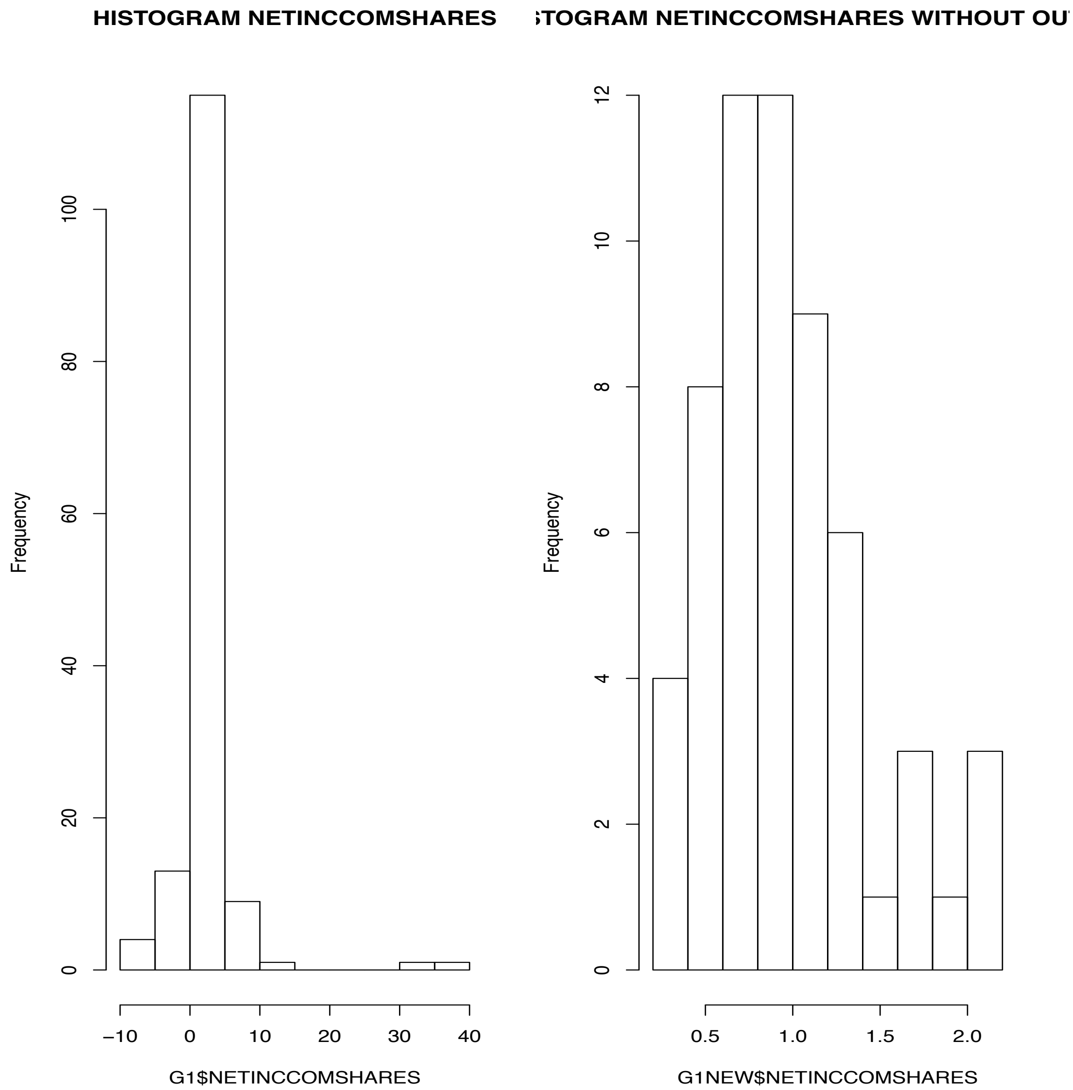
Source: Own figure

Figure 60: INCATCSTTE histogram comparison



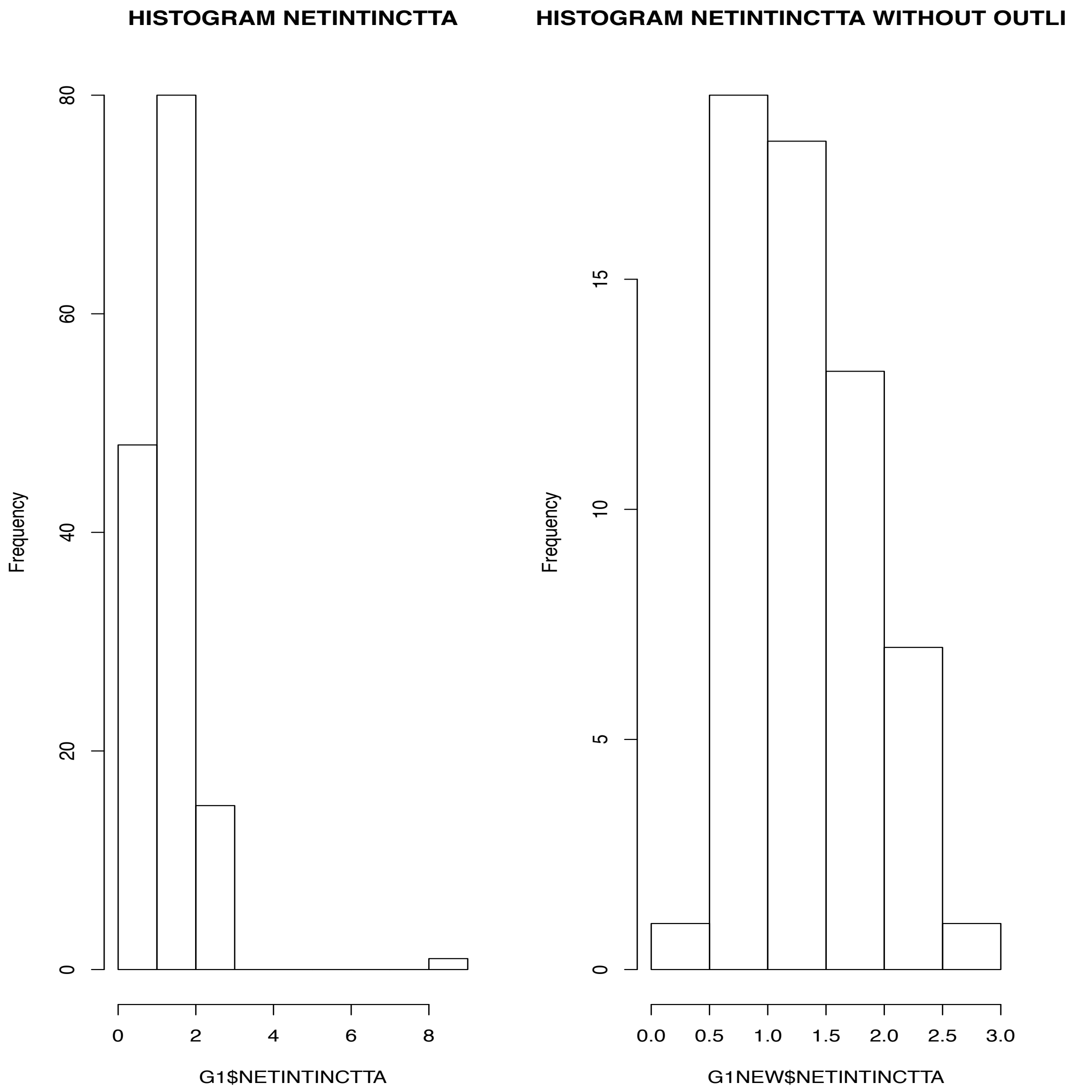
Source: Own figure

Figure 61: NETINCCOMSHARES histogram comparison



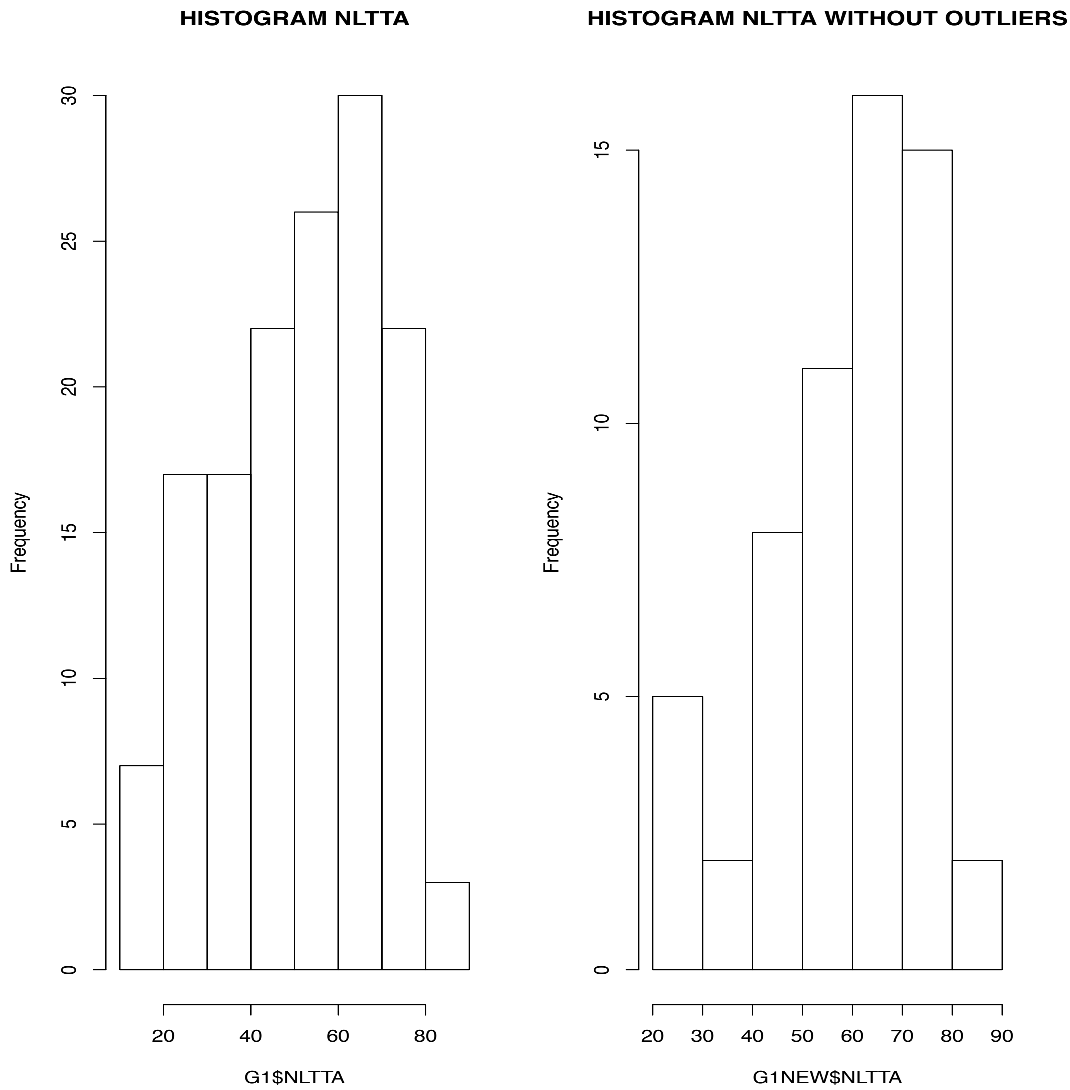
Source: Own figure

Figure 62: NETINTINCTTA histogram comparison



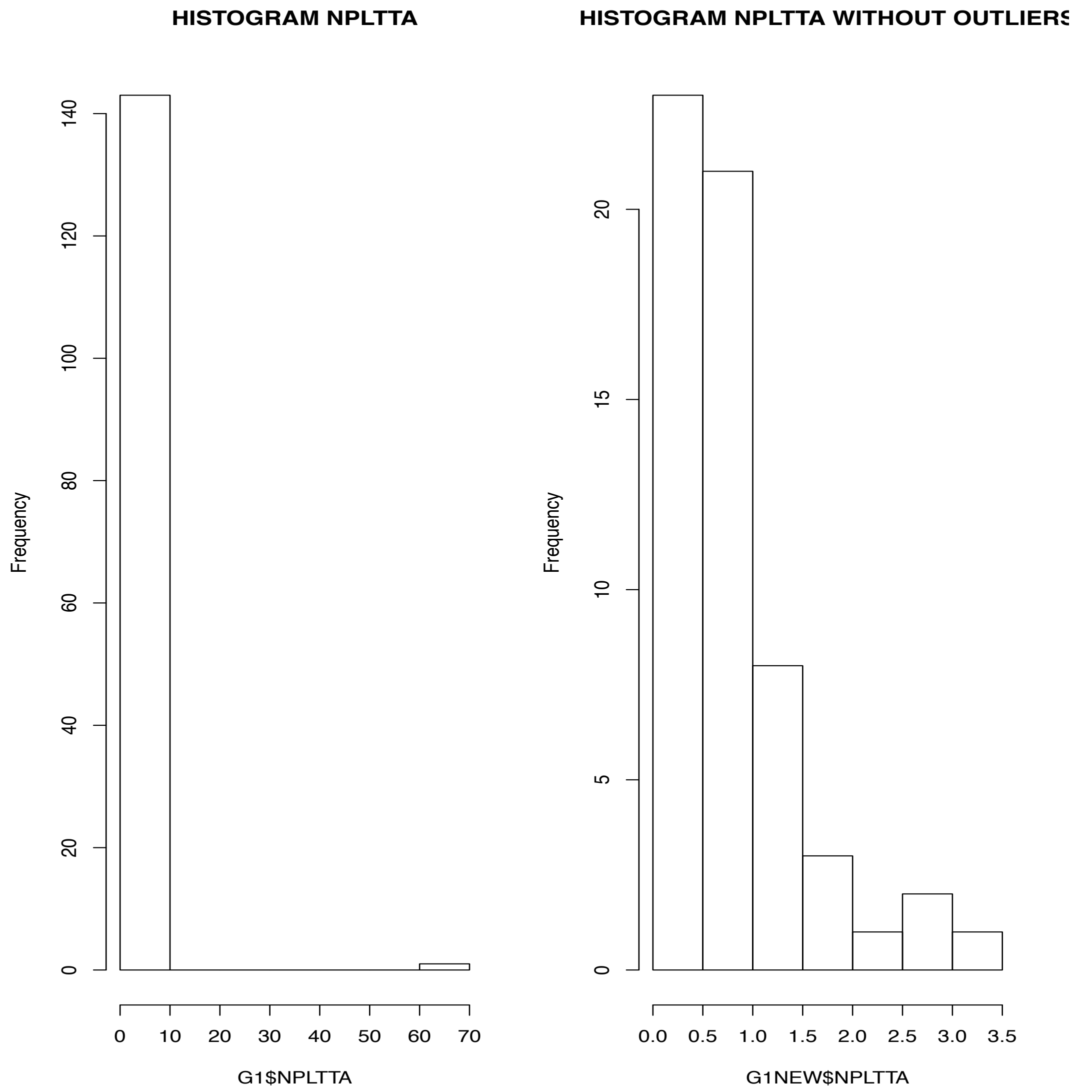
Source: Own figure

Figure 63: NLTTA histogram comparison



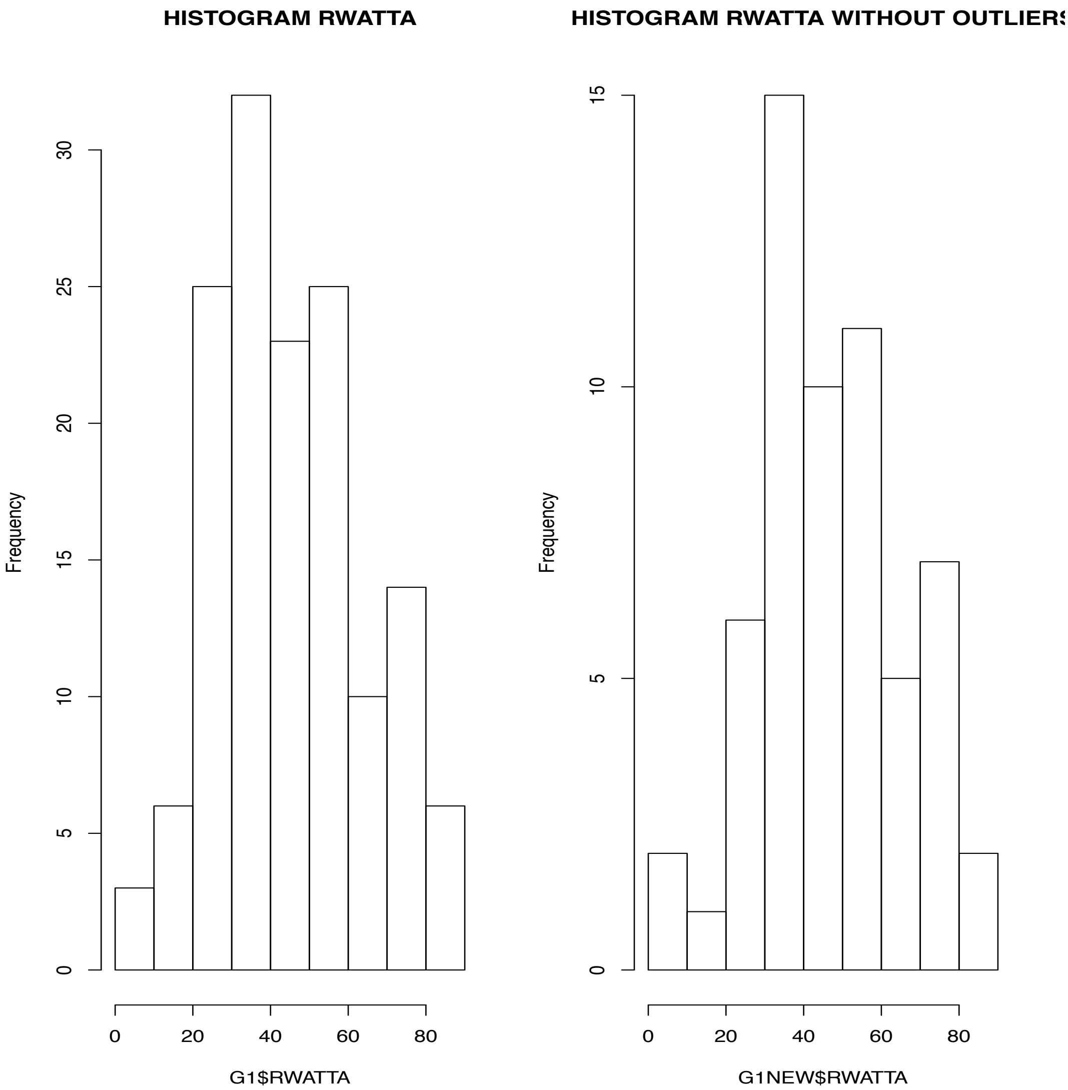
Source: Own figure

Figure 64: NPLTTA histogram comparison



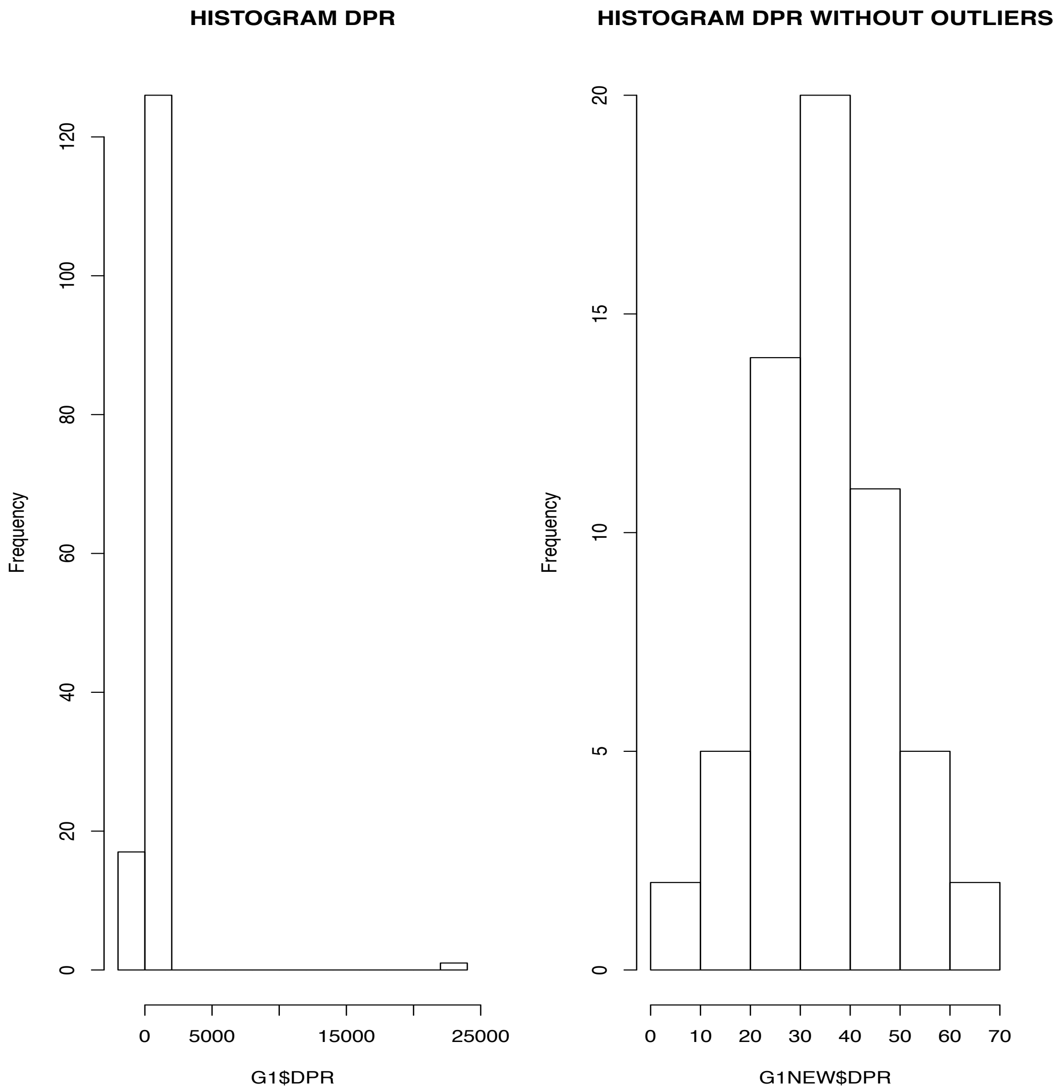
Source: Own figure

Figure 65: RWATTA histogram comparison



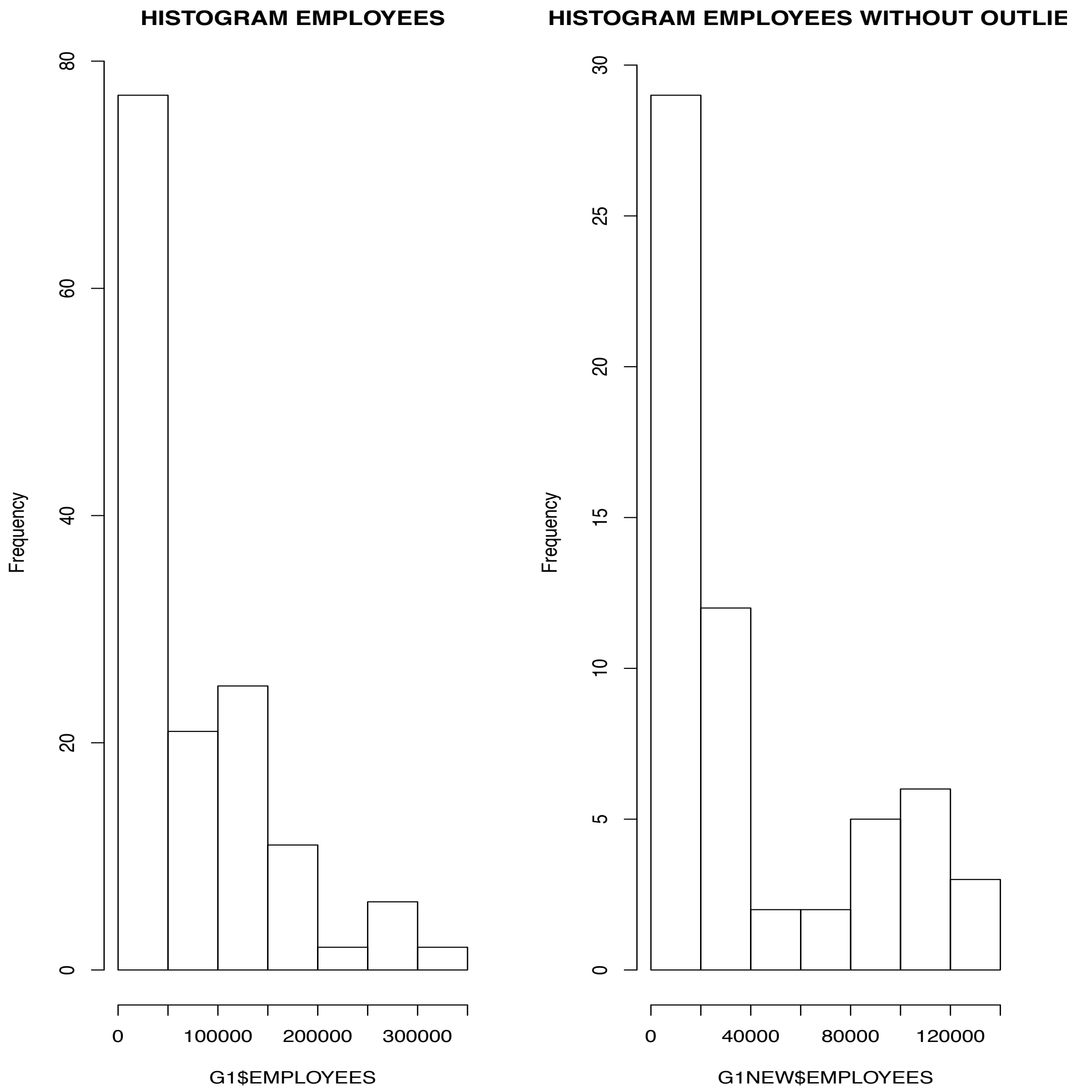
Source: Own figure

Figure 66: DPR histogram comparison



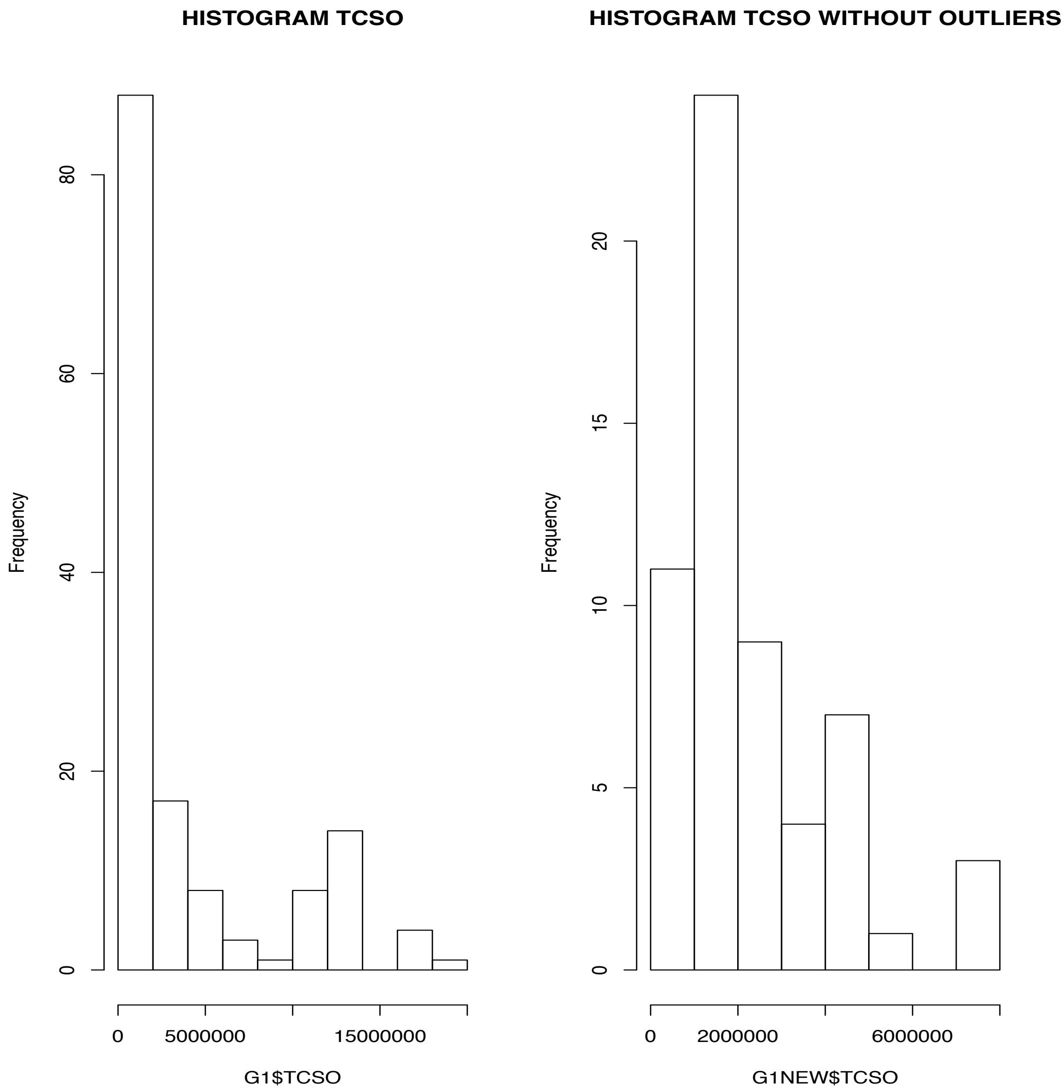
Source: Own figure

Figure 67: EMPLOYEES histogram comparison



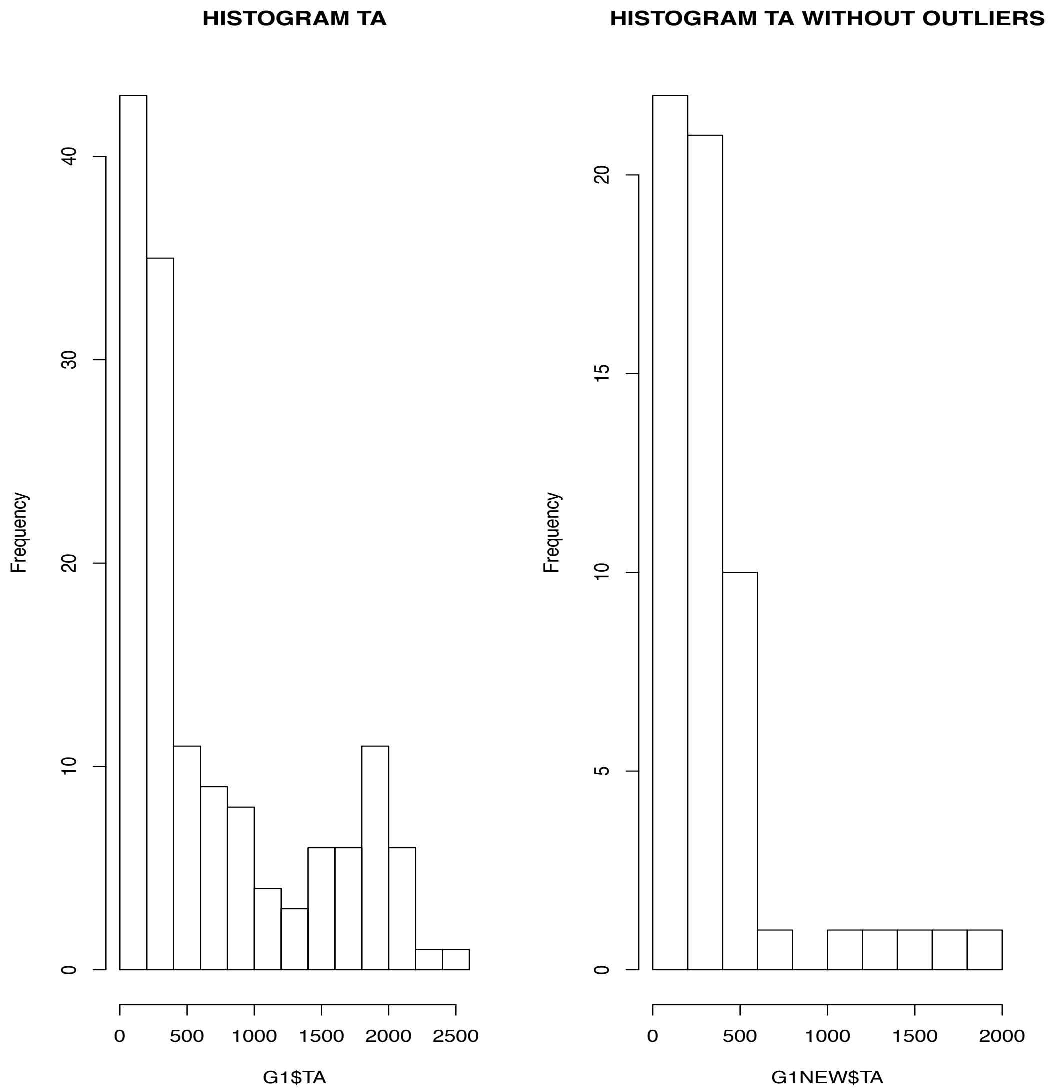
Source: Own figure

Figure 68: TCSO histogram comparison



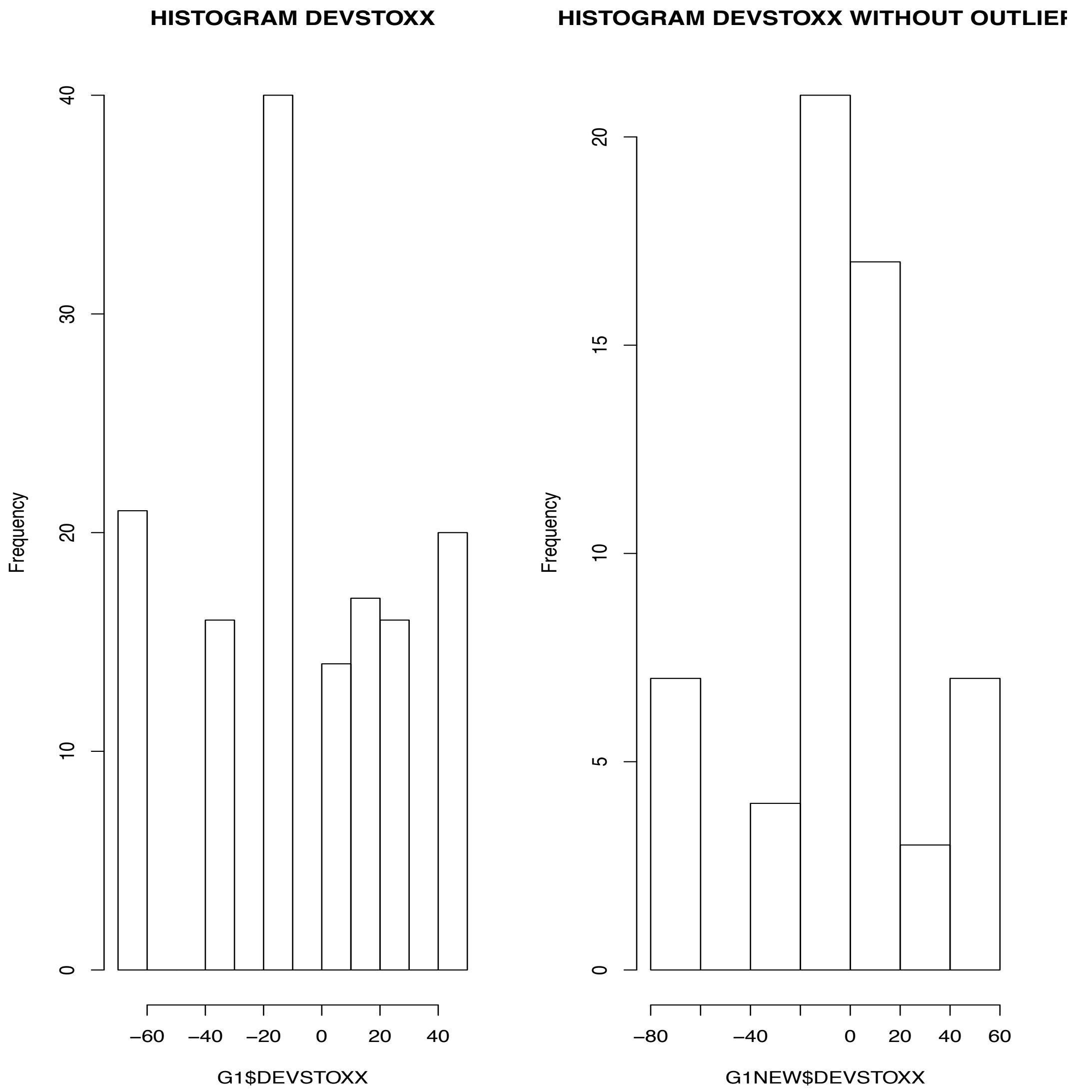
Source: Own figure

Figure 69: TA histogram comparison



Source: Own figure

Figure 70: DEVSTOXX histogram comparison



Source: Own figure

Appendix 10: Further explanations for the variable transformations

In principle, it is not necessary for the regression analysis to transform all included variables into a normal distribution (STATISTIK-PETER, 2020, no page). The application of the appropriate procedure depends particularly on the distribution form of the dependent variable (STATISTIK-PETER, 2020, no page; INWT Statistic, 2020, no page). Most of the literature focus mainly on the assumption of a normal distribution of the interfering term (Hackl, 2005, p. 66; Fahrmeir, Kneib and Lang, 2009, p. 107; Ohr, 2010, p. 648).

Appendix 11

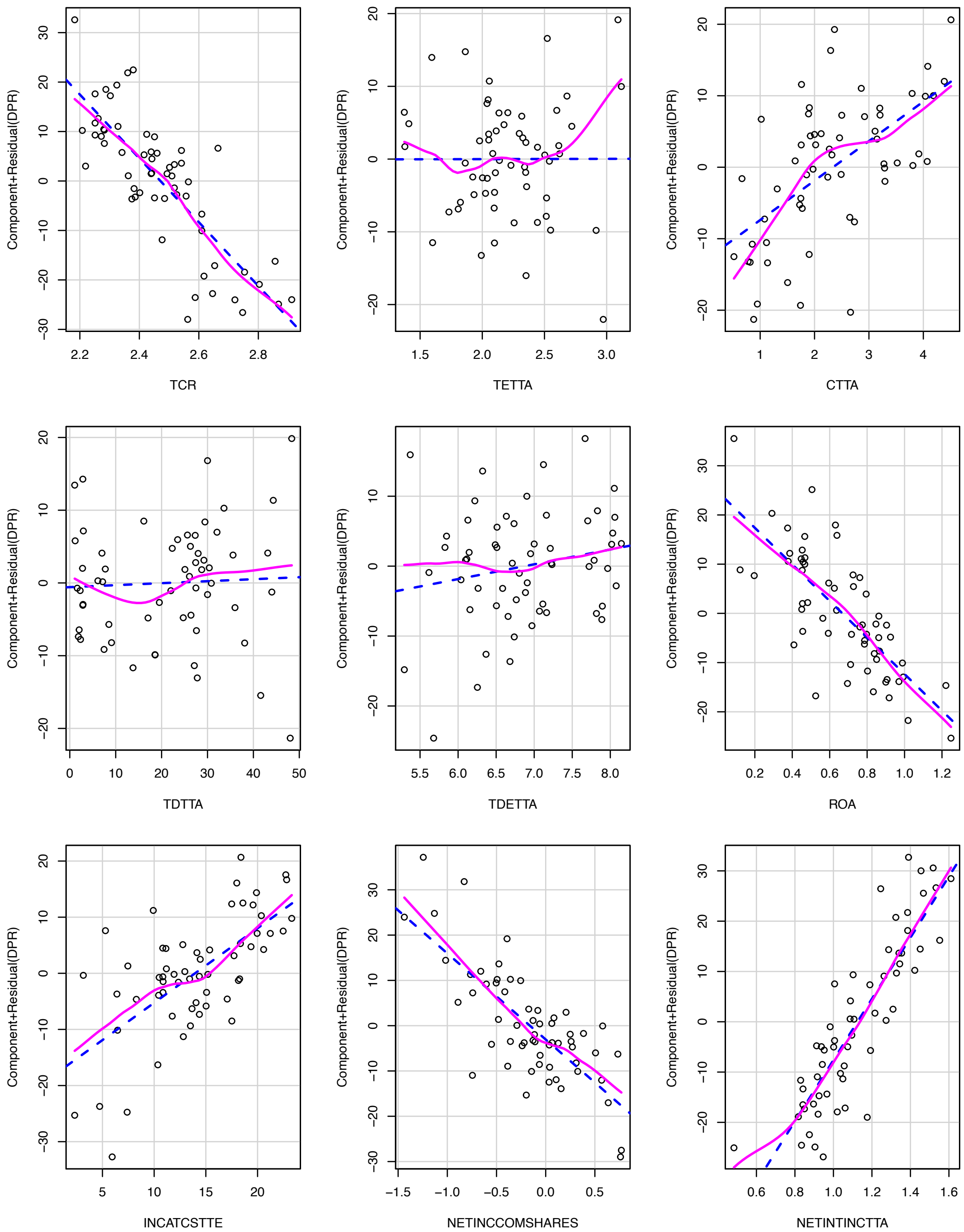
Table 70: Results for single regressions with the data frame G1

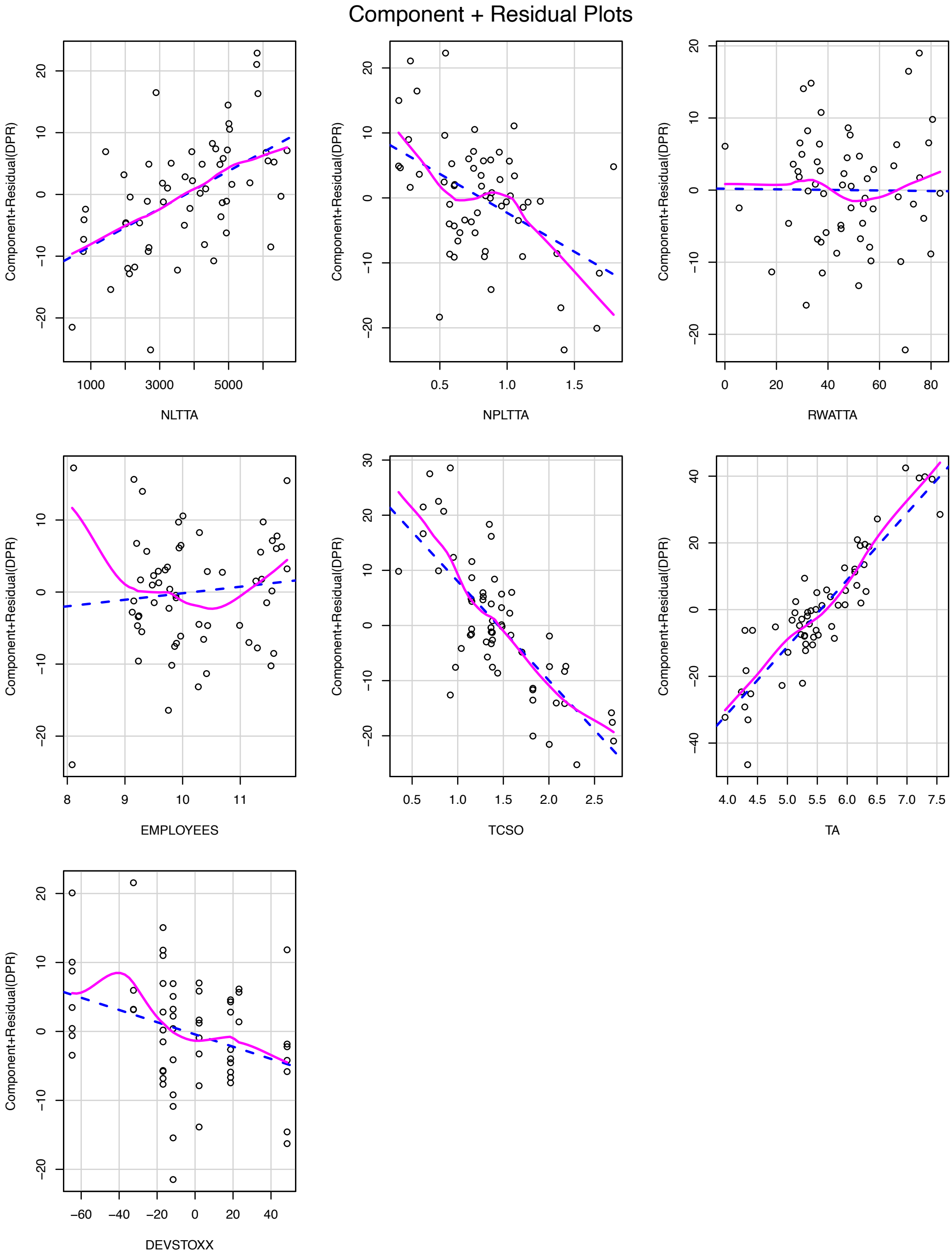
	Dependent variable:	
	DPR	
	(1)	(2)
TCR	-32.542	
	(57.643)	
TIER1		3.593
		(61.344)
Constant	629.392	164.776
	(775.712)	(630.010)
Observations	144	144
R^2	0.002	0.00002
Adjusted R^2	-0.005	-0.007
Residual Std. Error (df = 142)	1,882.065	1,884.153
F Statistic (df = 1; 142)	0.319	0.003
.p < 0.1; *p <0.05; **p <0.01; ***p < 0.001		

Source: Own table

Appendix 12: Cr plot for G1NEW

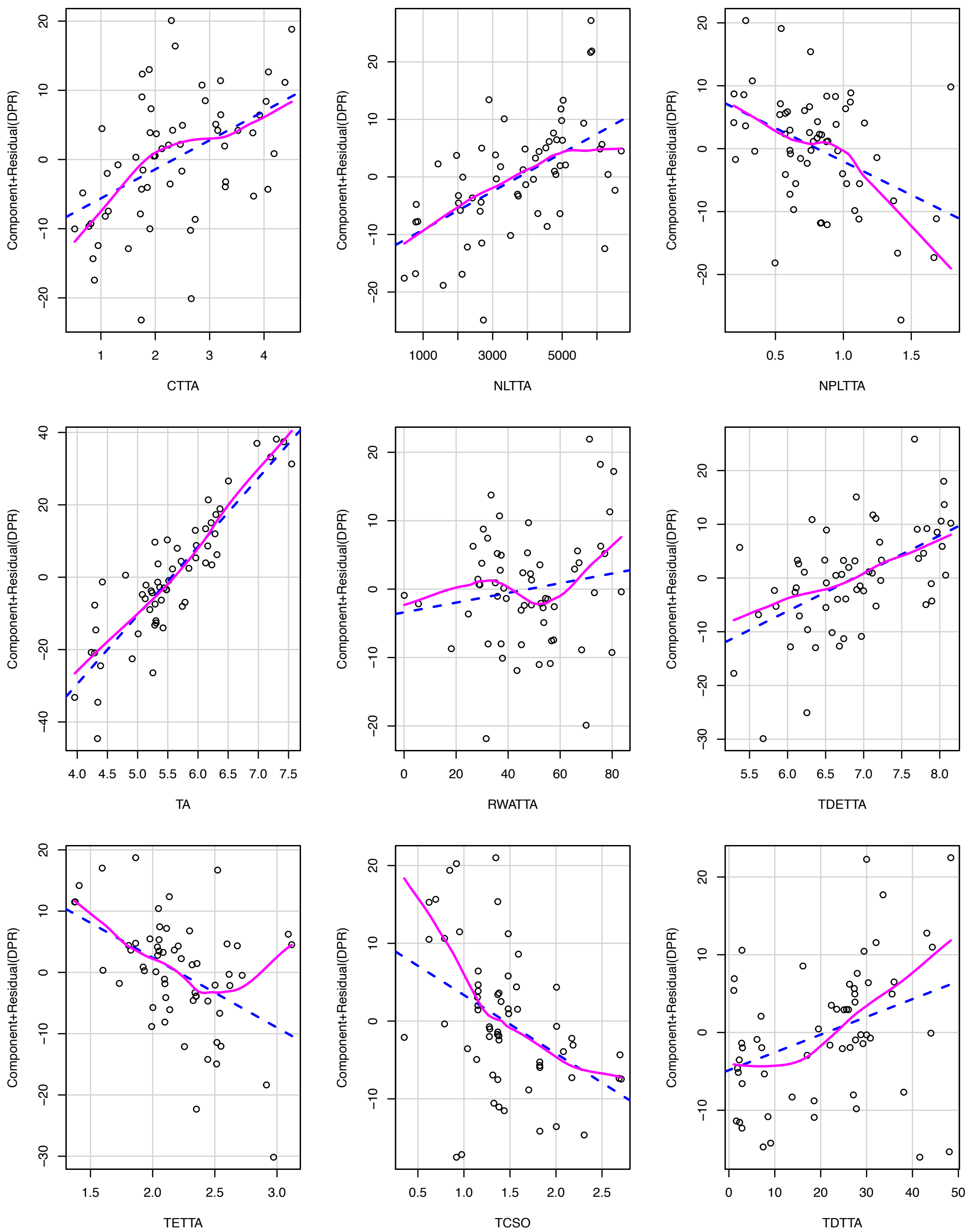
Figure 71: Cr plot for regression 3 of G1NEW

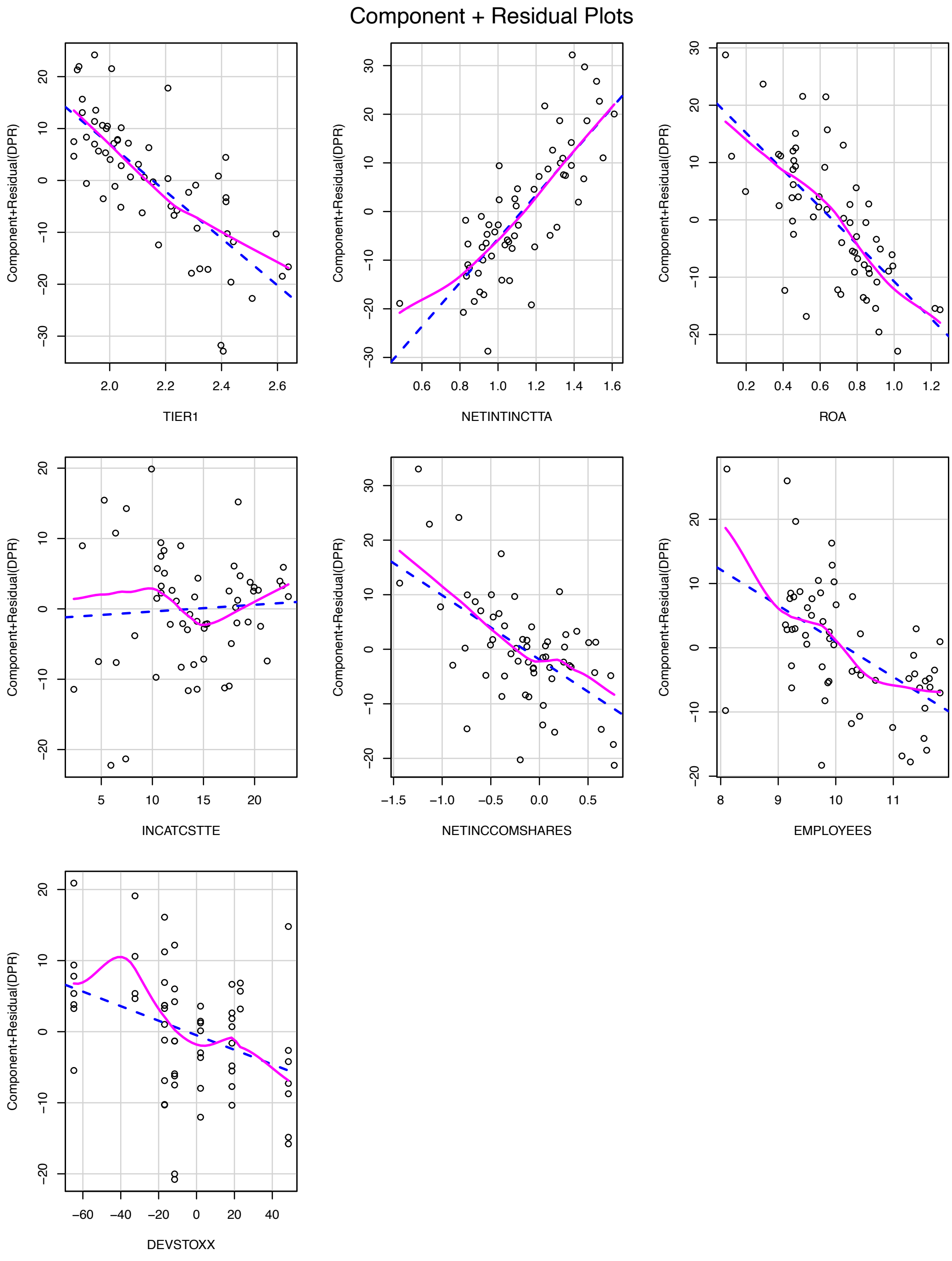




Source: Own figure

Figure 72: Cr plot for regression 4 of G1NEW

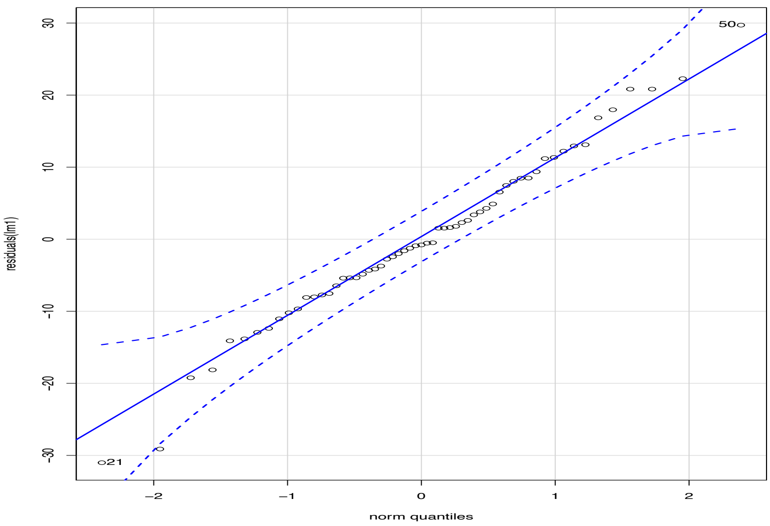




Source: Own figure

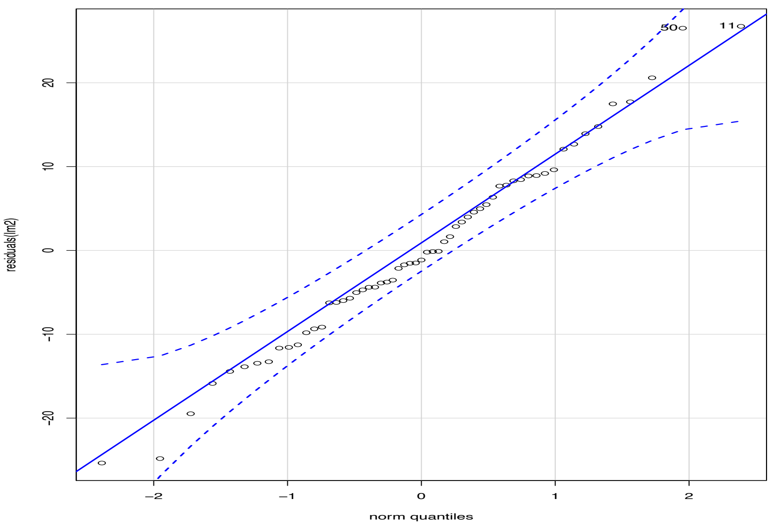
Appendix 13: Residuals q-q-plot for G1NEW regressions

Figure 73: Residuals q-q-plot for regression 1



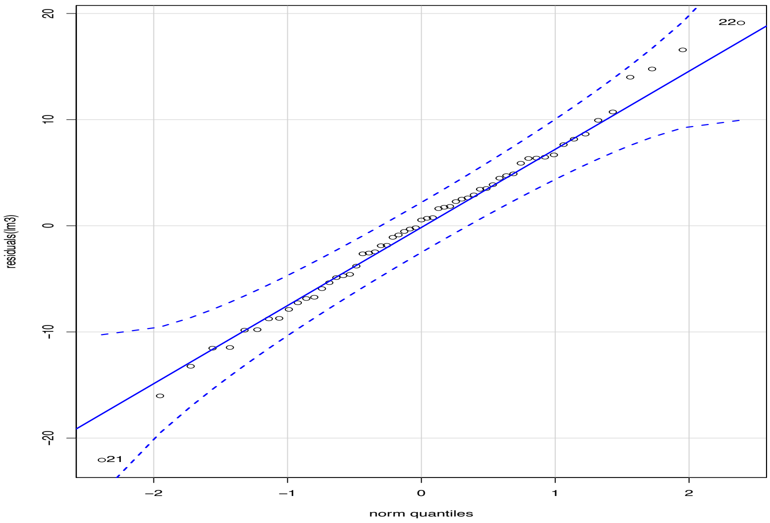
Source: Own figure

Figure 74: Residuals q-q-plot for regression 2



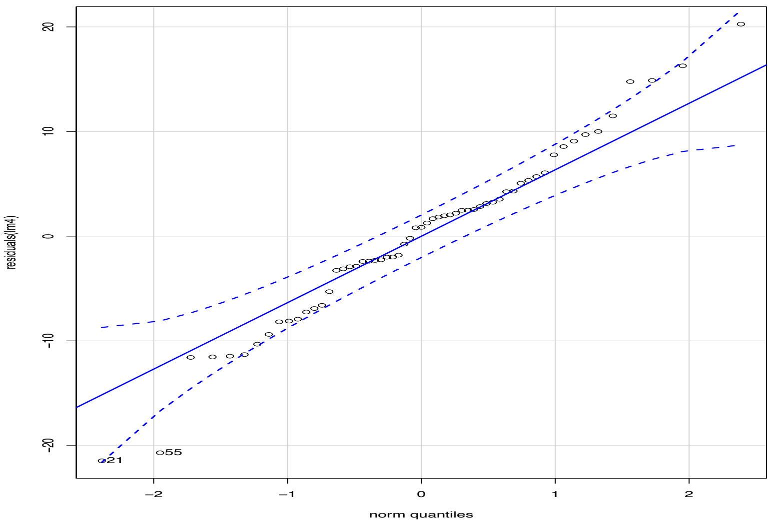
Source: Own figure

Figure 75: Residuals q-q-plot for regression 3



Source: Own figure

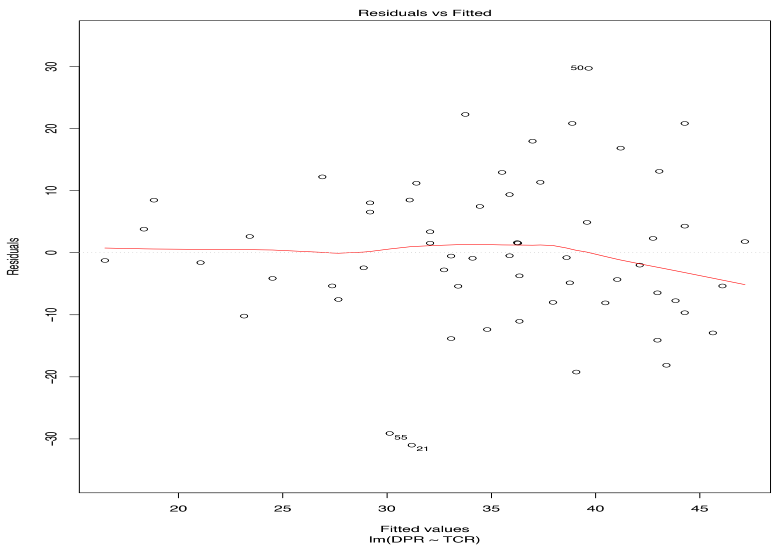
Figure 76: Residuals q-q-plot for regression 4



Source: Own figure

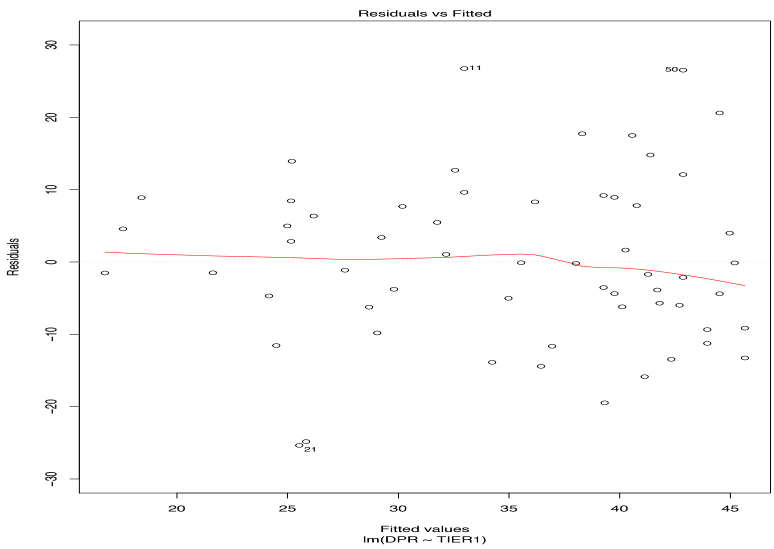
Appendix 14: Tukey-Anscome-plot for G1NEW regression

Figure 77: Tukey-Anscome-plot for regression 1



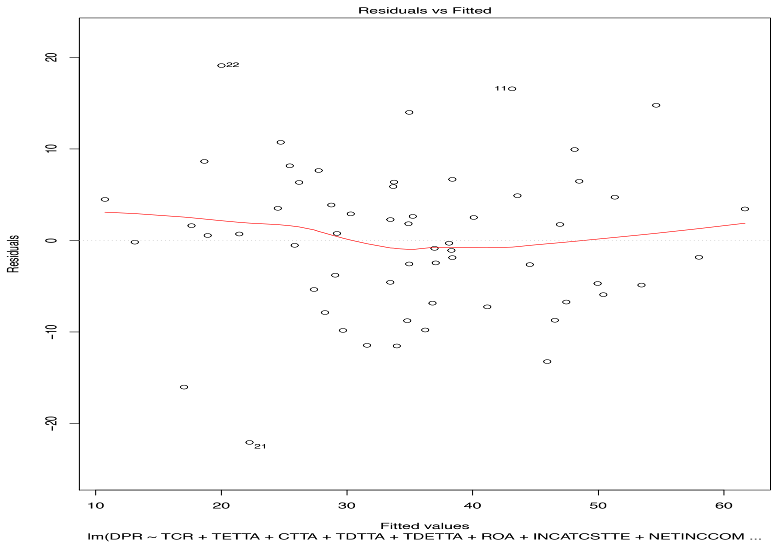
Source: Own figure

Figure 78: Tukey-Anscome-plot for regression 2



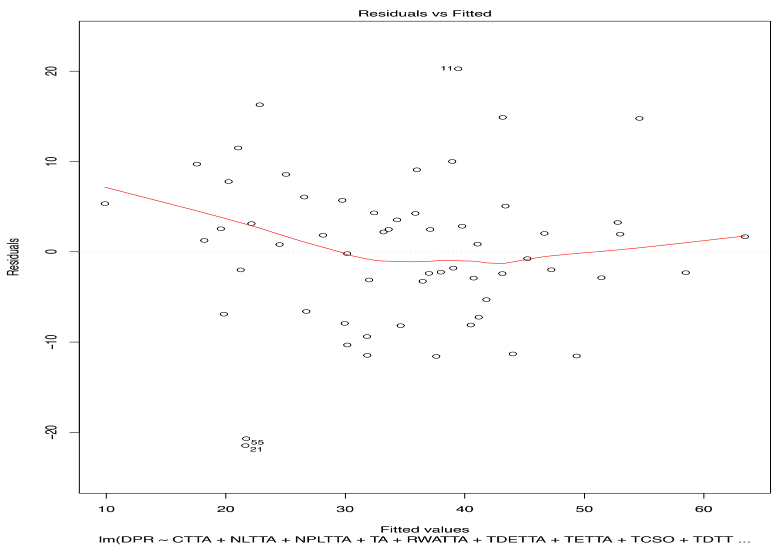
Source: Own figure

Figure 79: Tukey-Anscome-plot for regression 3



Source: Own figure

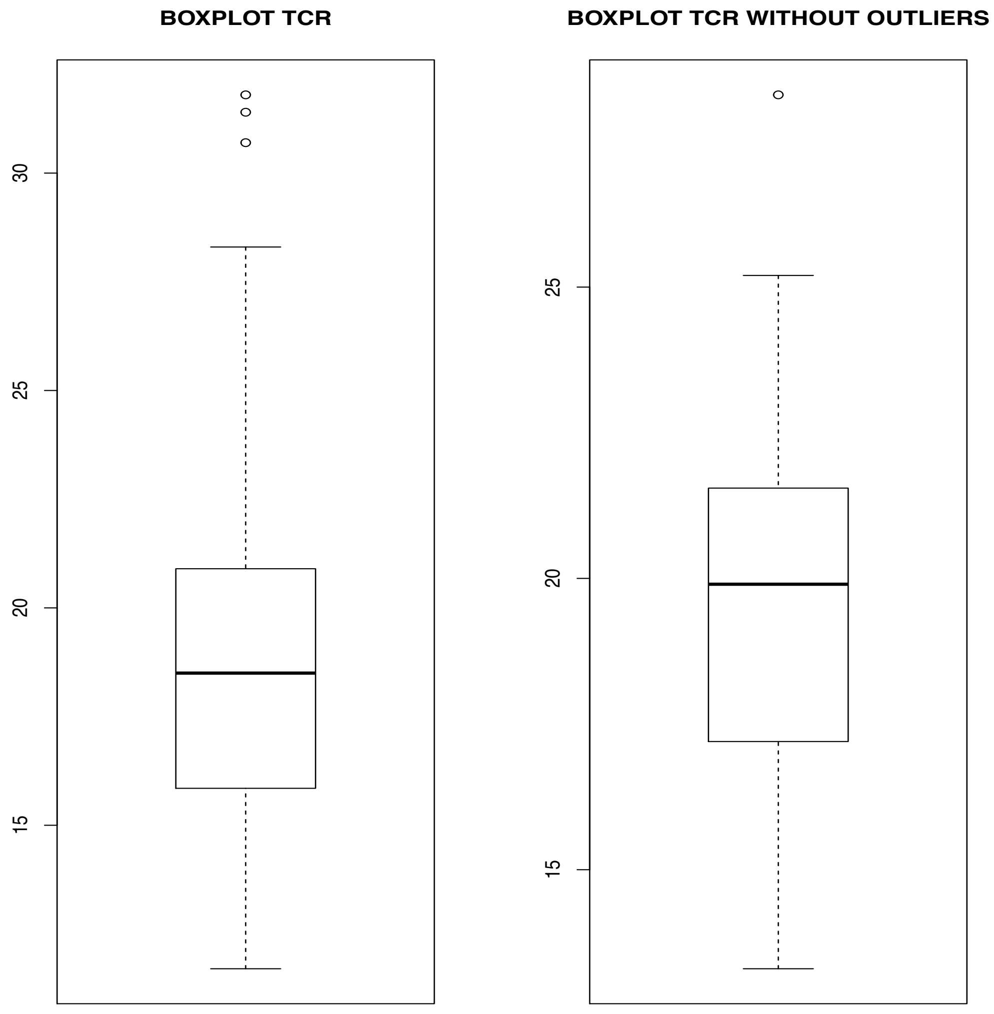
Figure 80: Tukey-Anscome-plot for regression 4



Source: Own figure

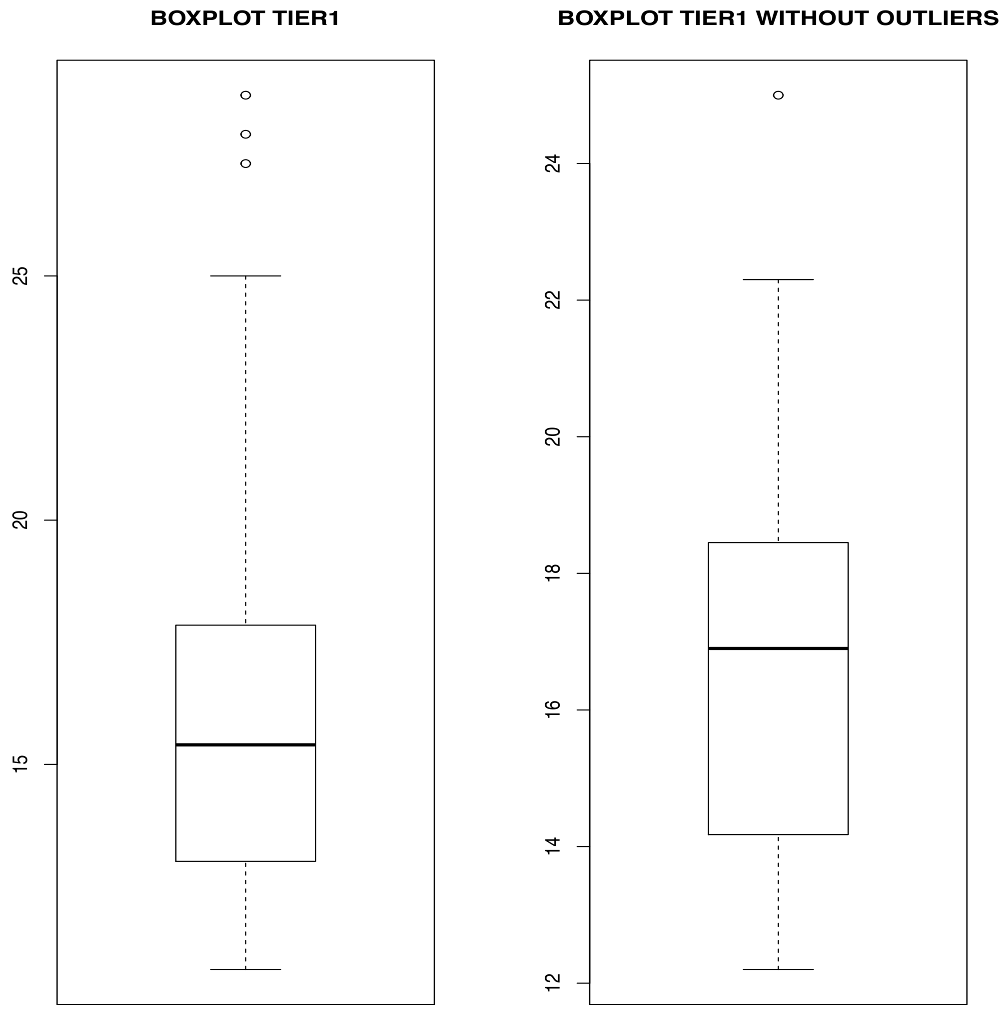
Appendix 15: Boxplot comparison for data frame G2 with G2NEW

Figure 81: TCR boxplot comparison



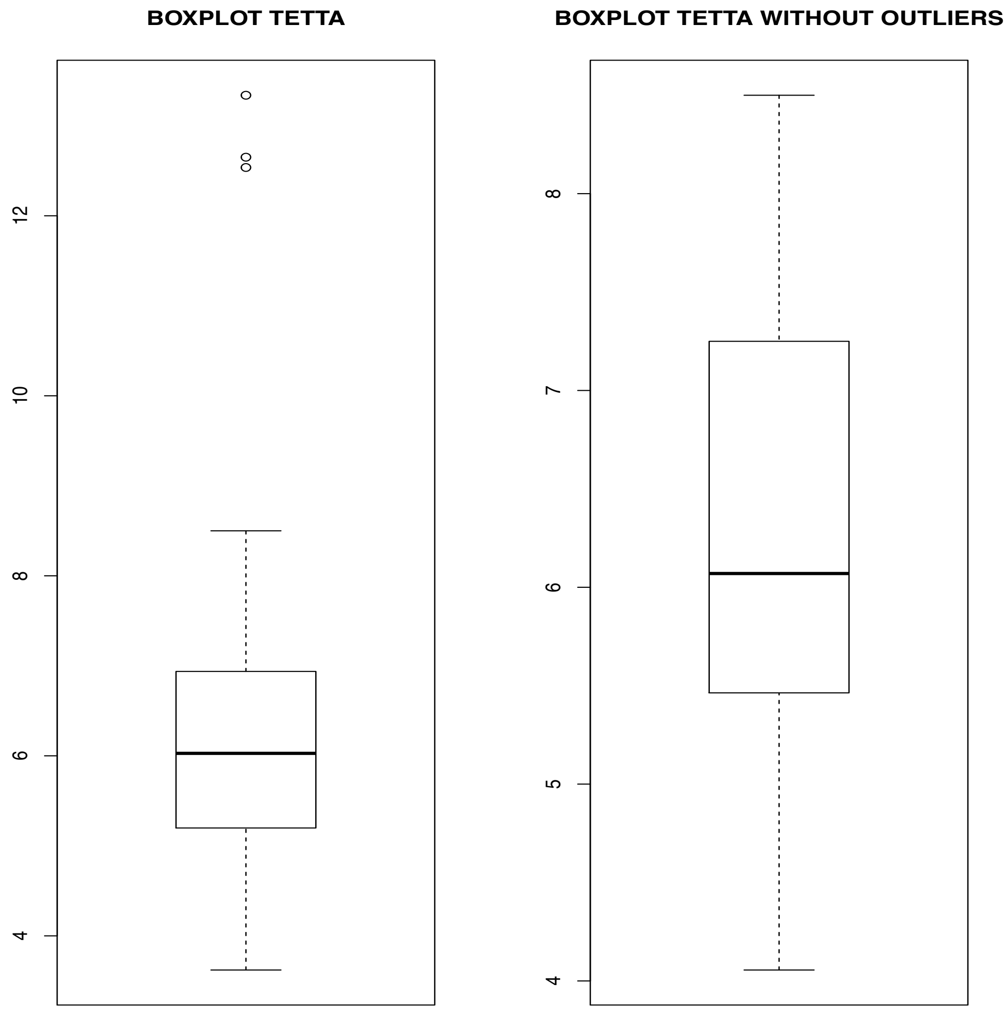
Source: Own figure

Figure 82: TIER1 boxplot comparison



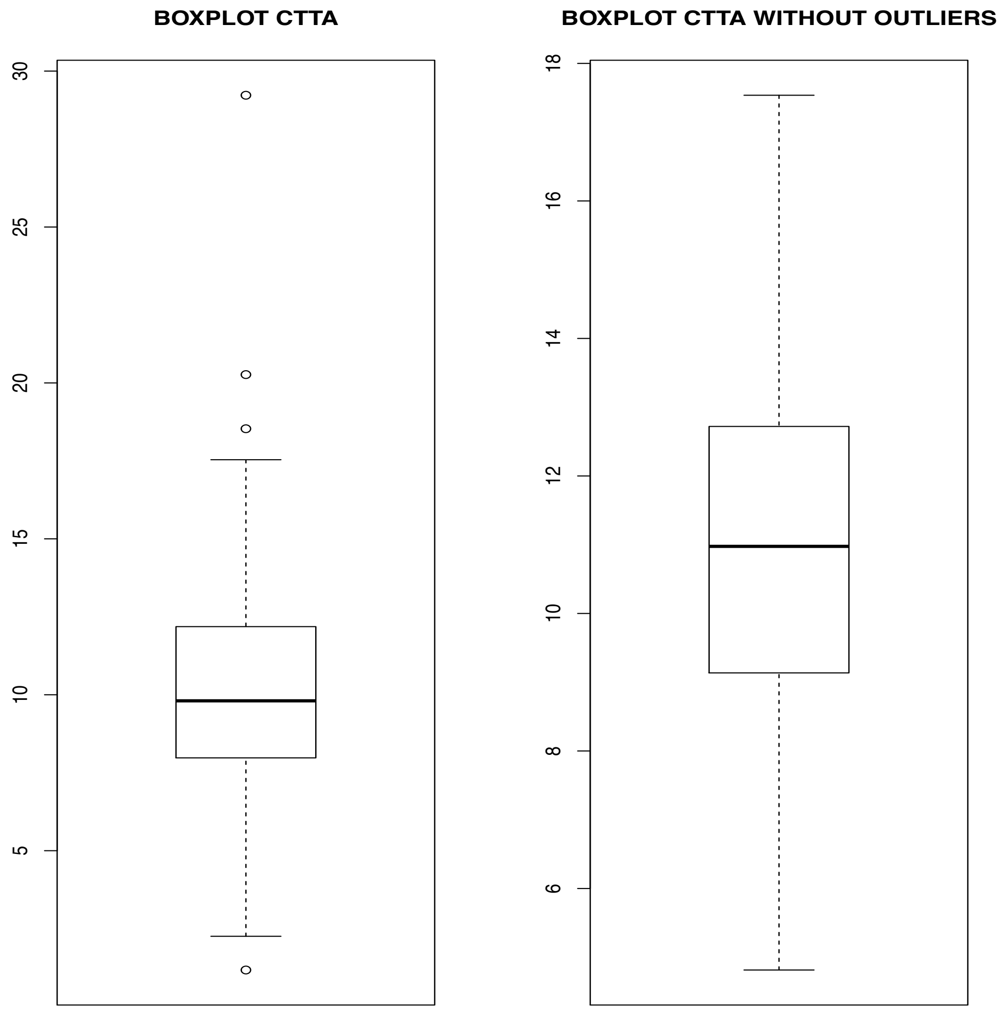
Source: Own figure

Figure 83: TETTA boxplot comparison



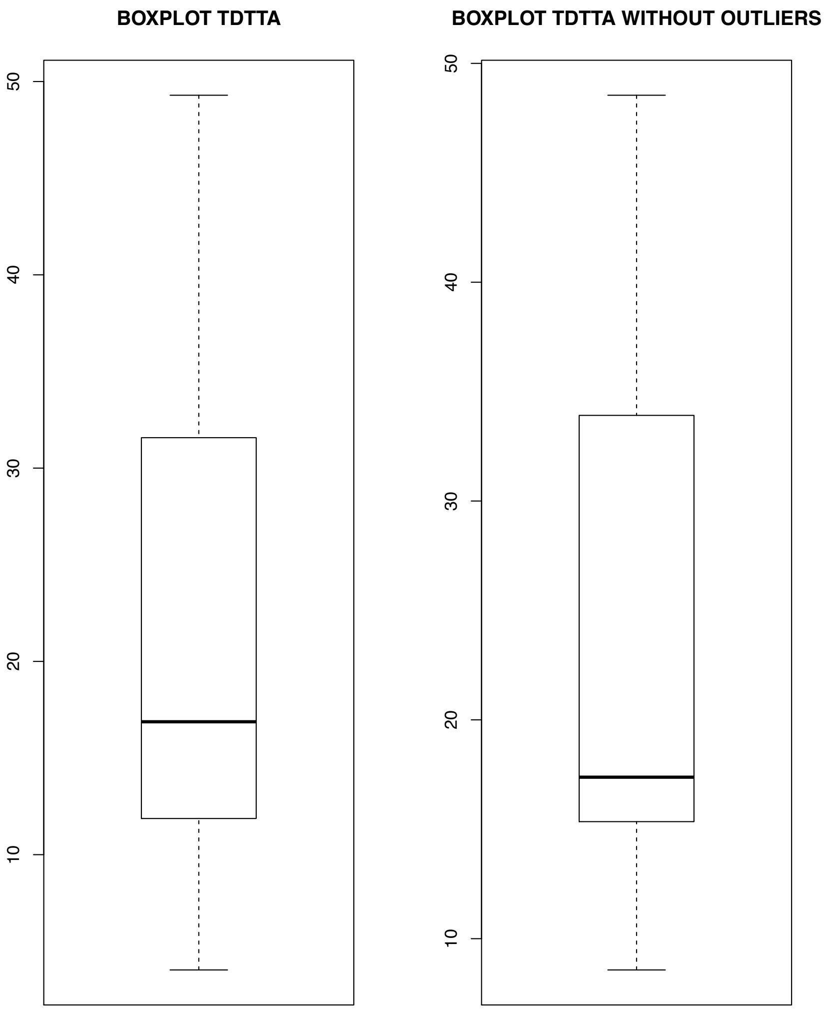
Source: Own figure

Figure 84: CTTA boxplot comparison



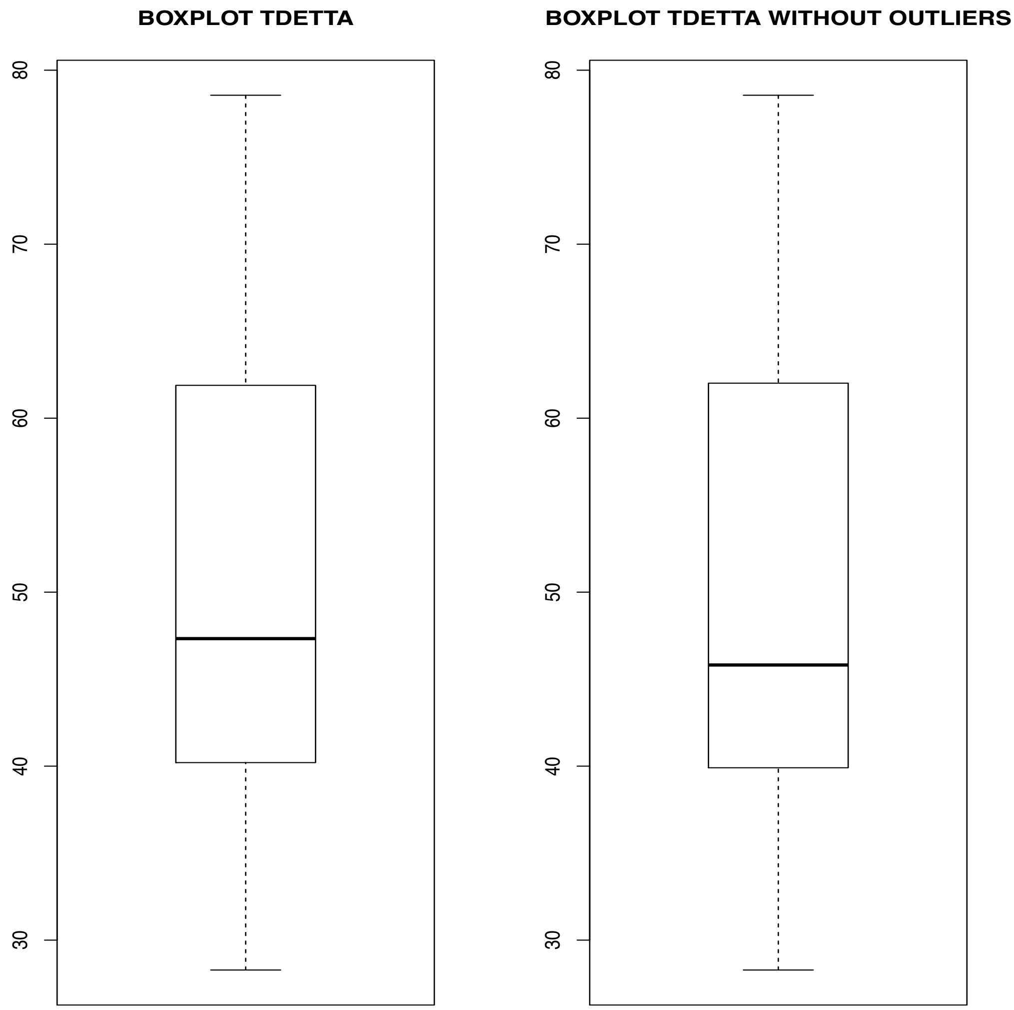
Source: Own figure

Figure 85: TDTTA boxplot comparison



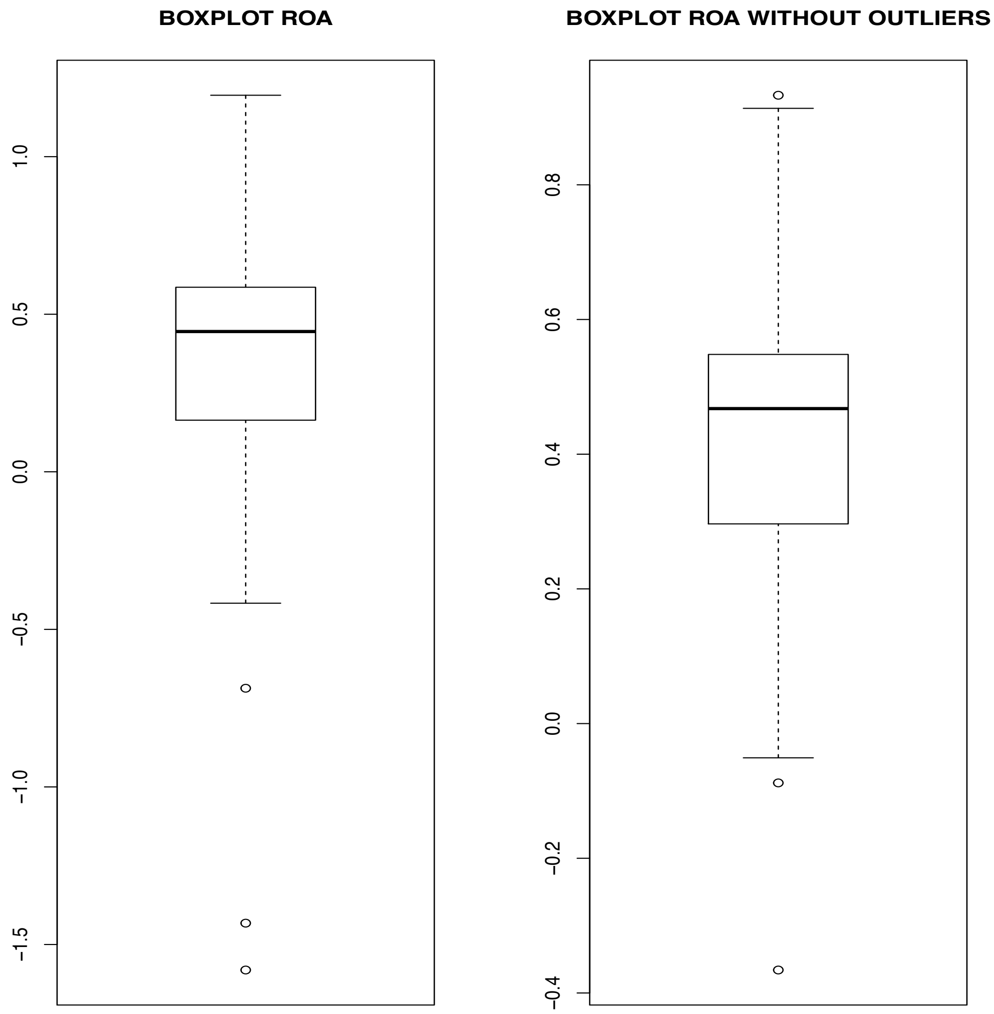
Source: Own figure

Figure 86: TDETTA boxplot comparison



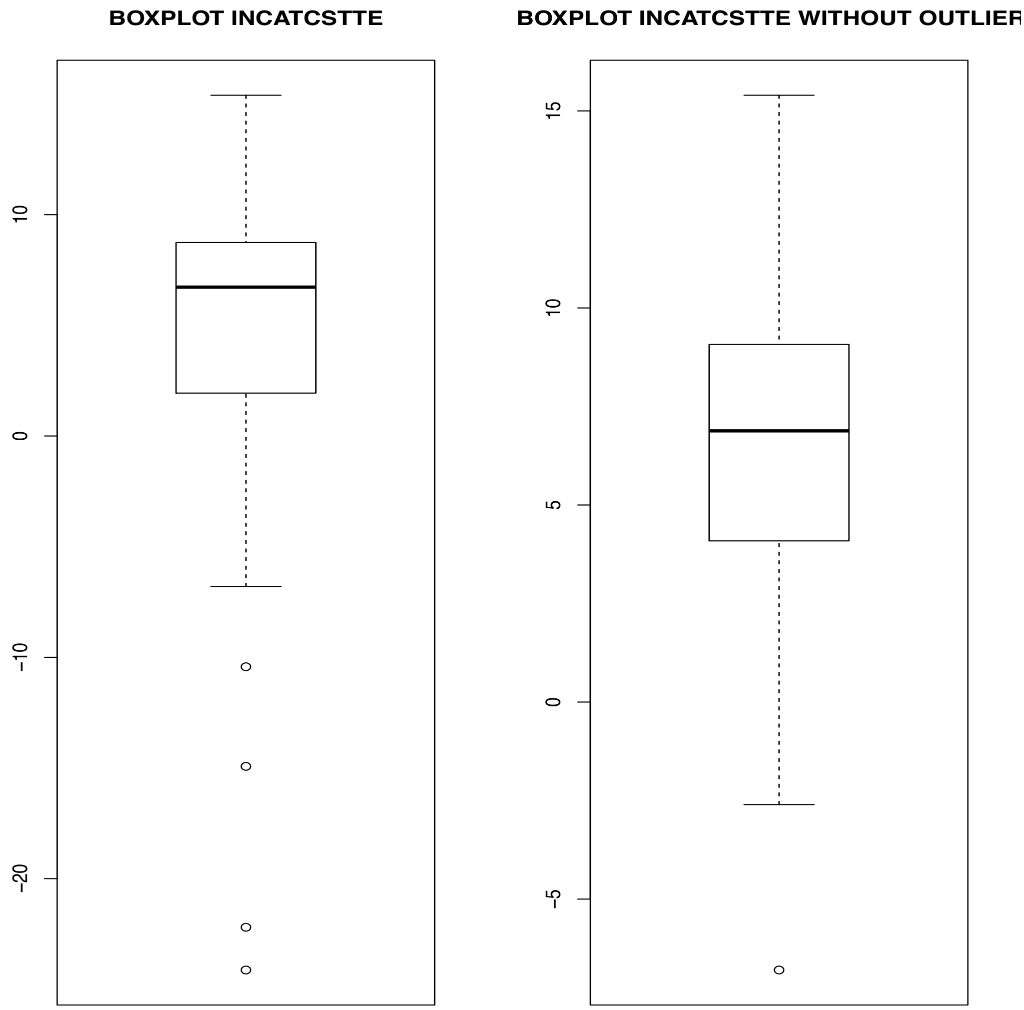
Source: Own figure

Figure 87: ROA boxplot comparison



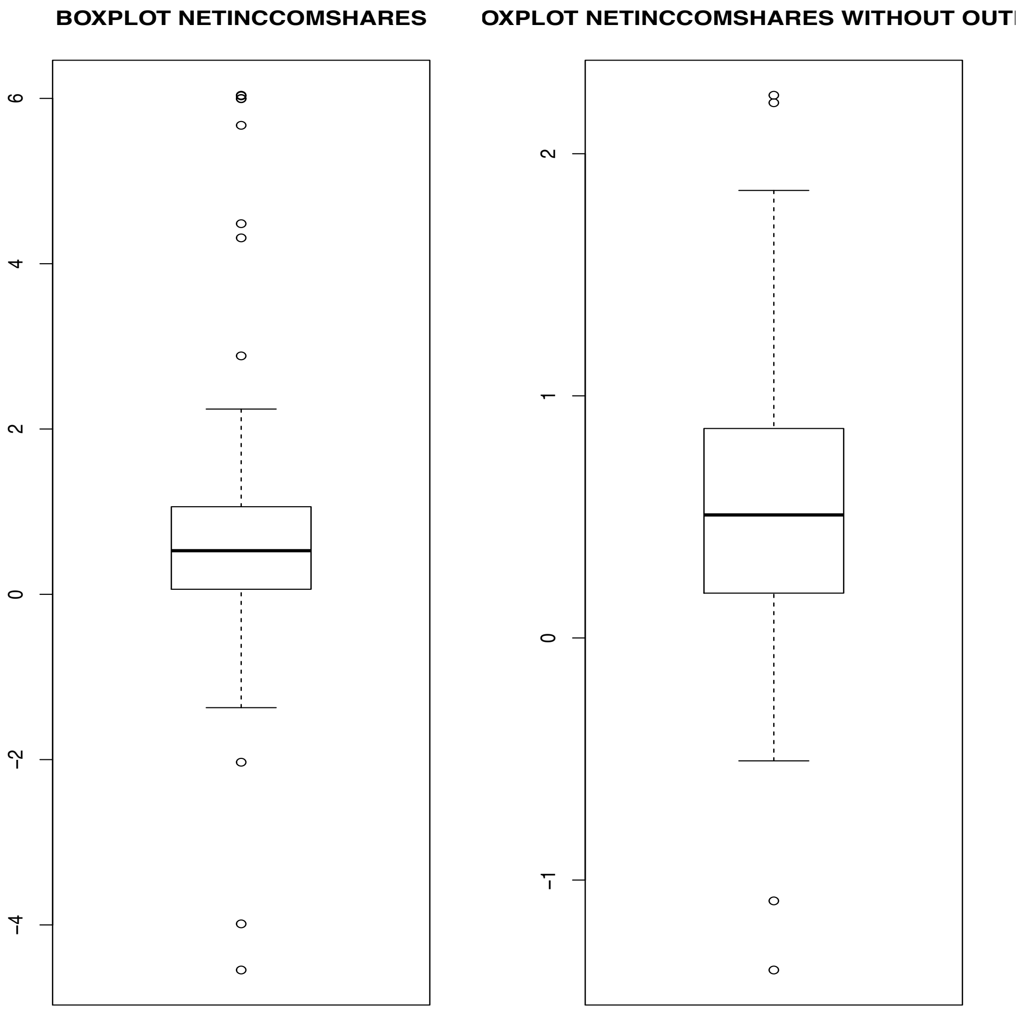
Source: Own figure

Figure 88: INCATCSTTE boxplot comparison



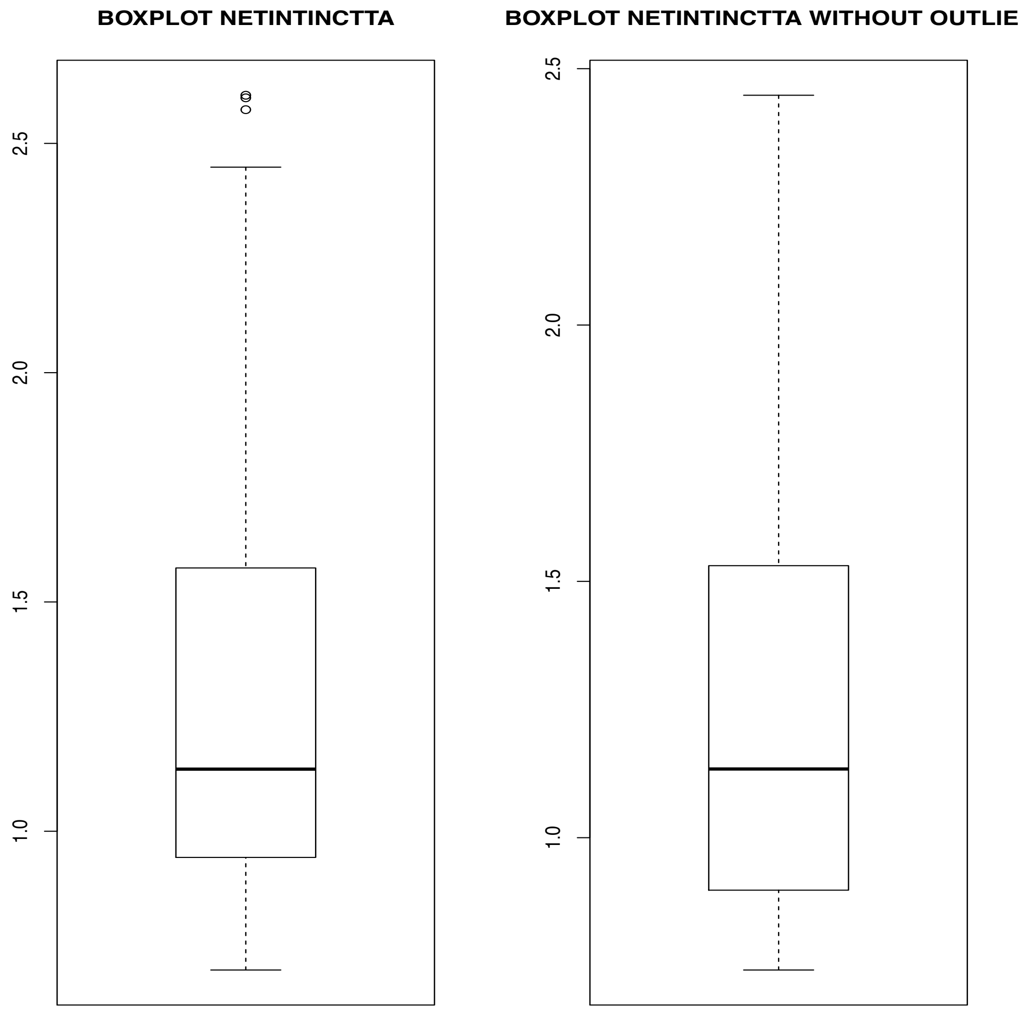
Source: Own figure

Figure 89: NETINCCOMSHARES boxplot comparison



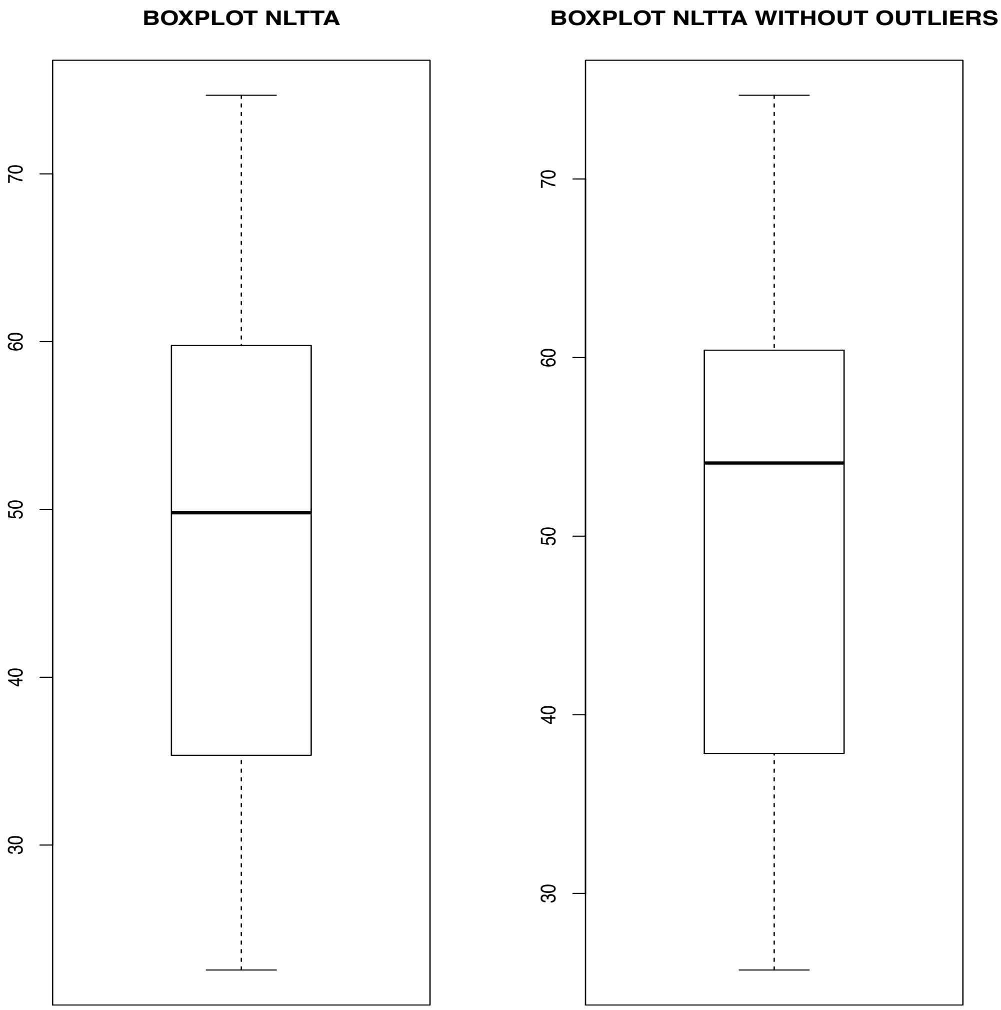
Source: Own figure

Figure 90: NETINTINCTTA boxplot comparison



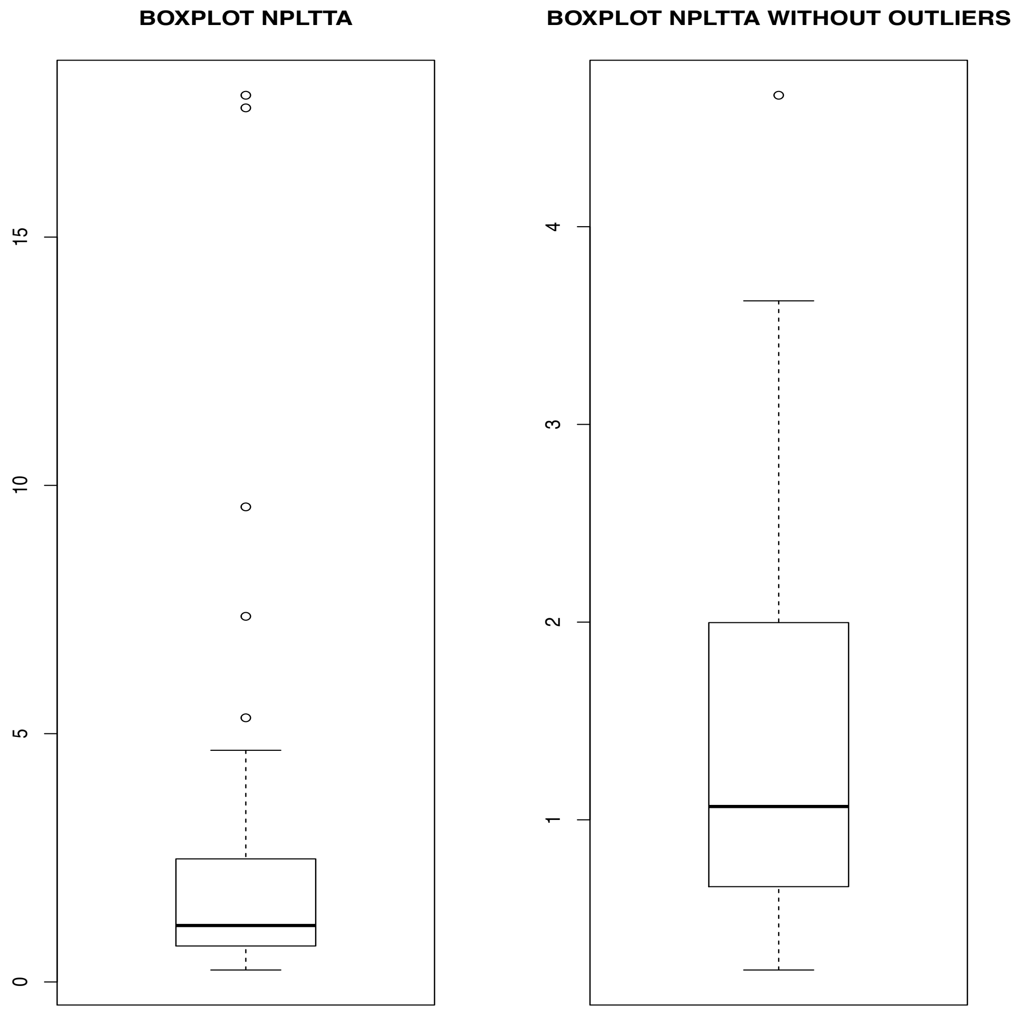
Source: Own figure

Figure 91: NLTTA boxplot comparison



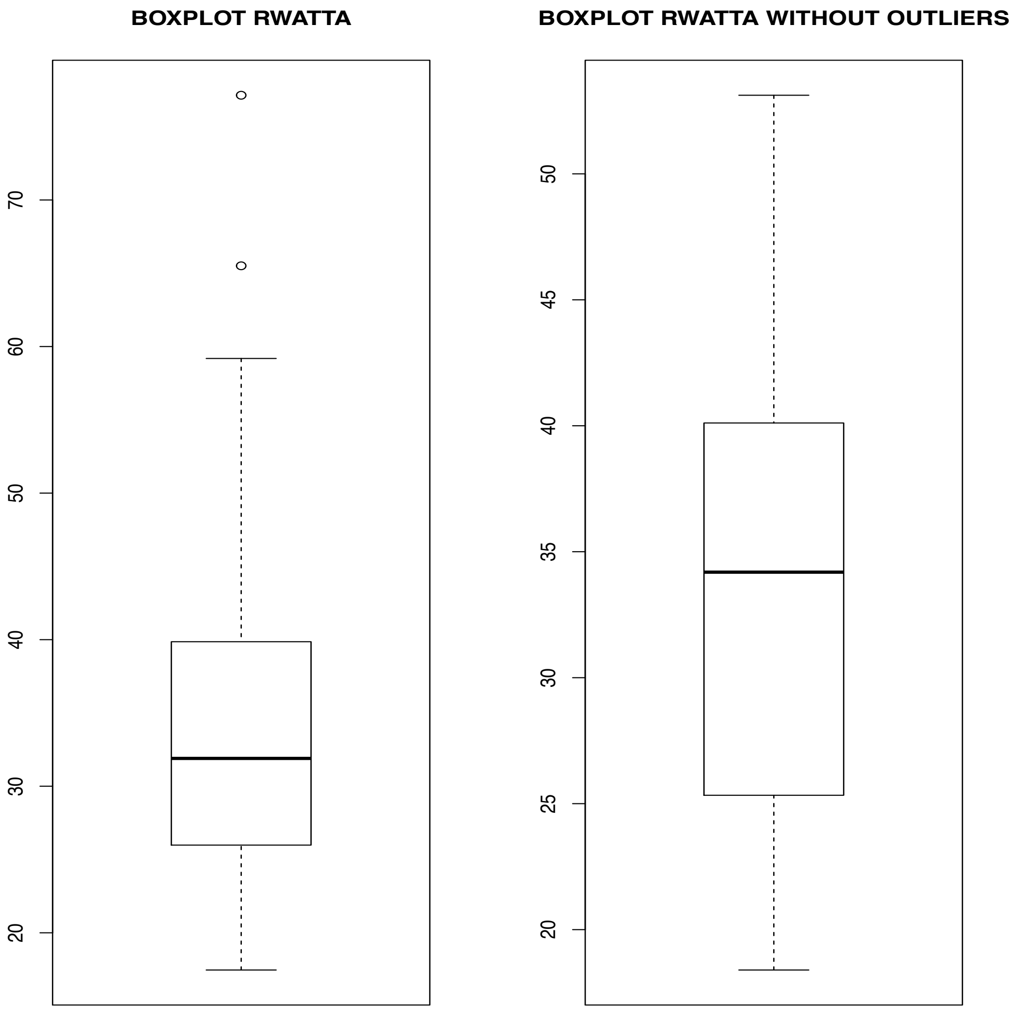
Source: Own figure

Figure 92: NPLTTA boxplot comparison



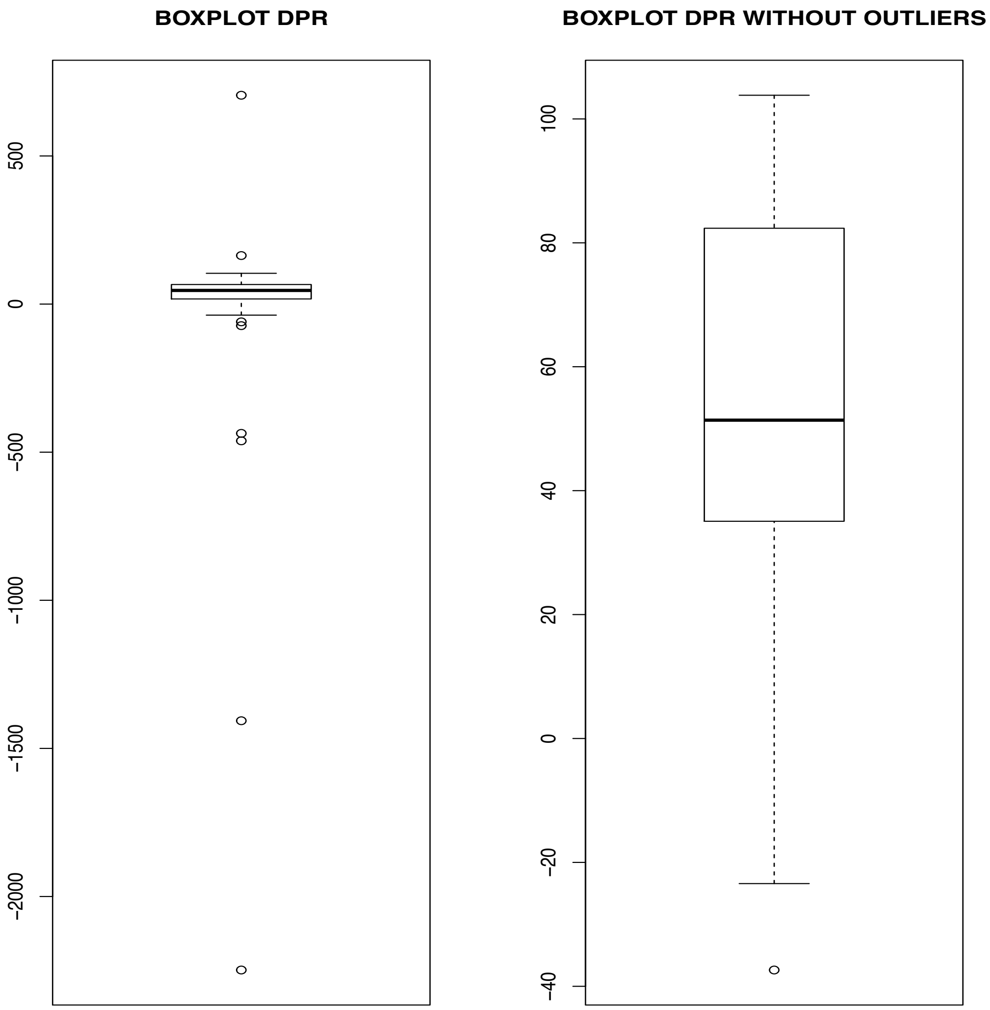
Source: Own figure

Figure 93: RWATTA boxplot comparison



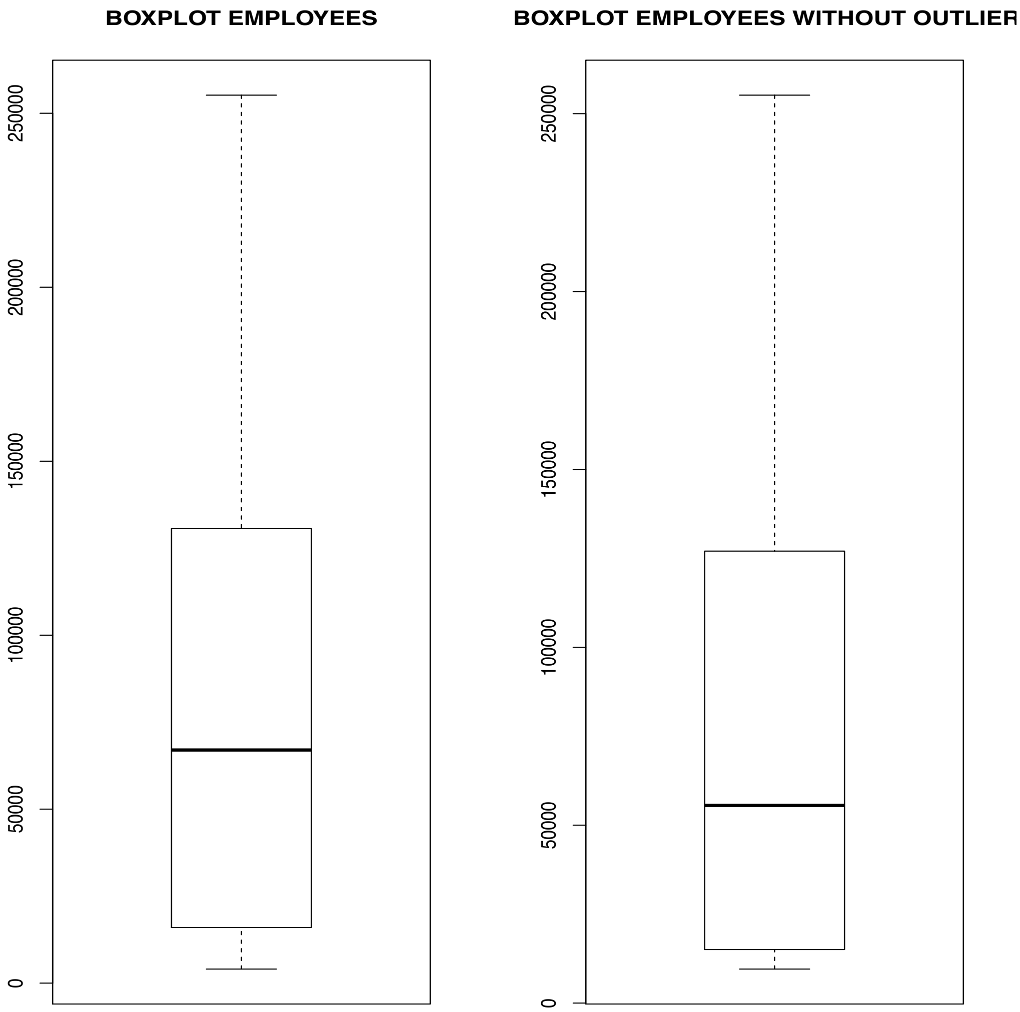
Source: Own figure

Figure 94: DPR boxplot comparison



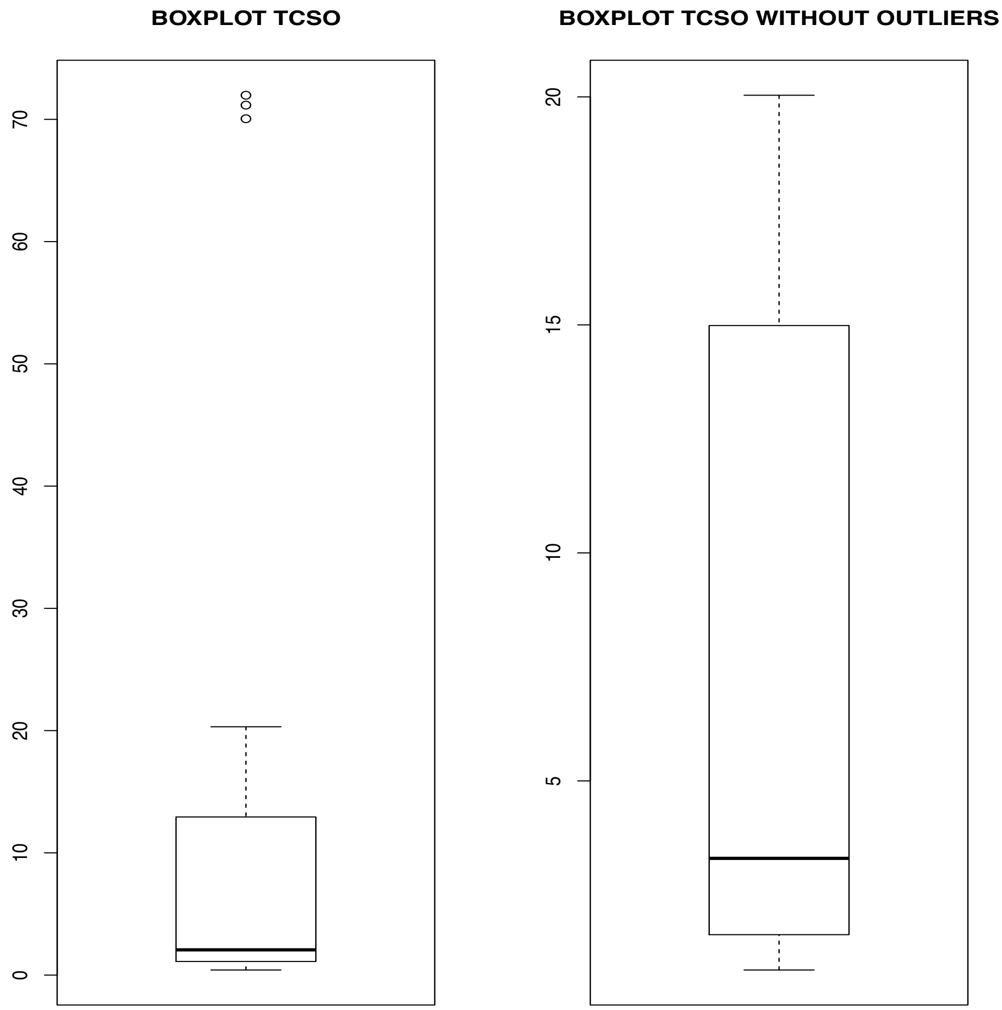
Source: Own figure

Figure 95: EMPLOYEES boxplot comparison



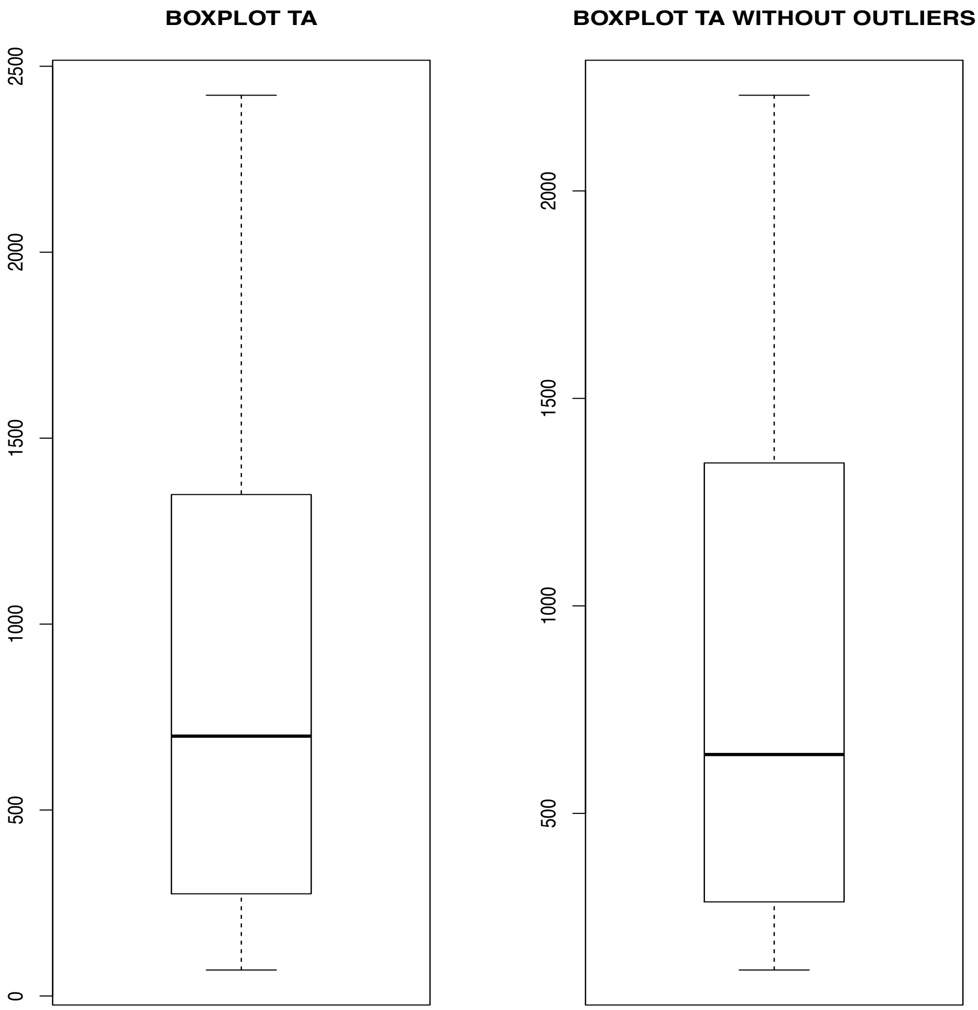
Source: Own figure

Figure 96: TCSO boxplot comparison



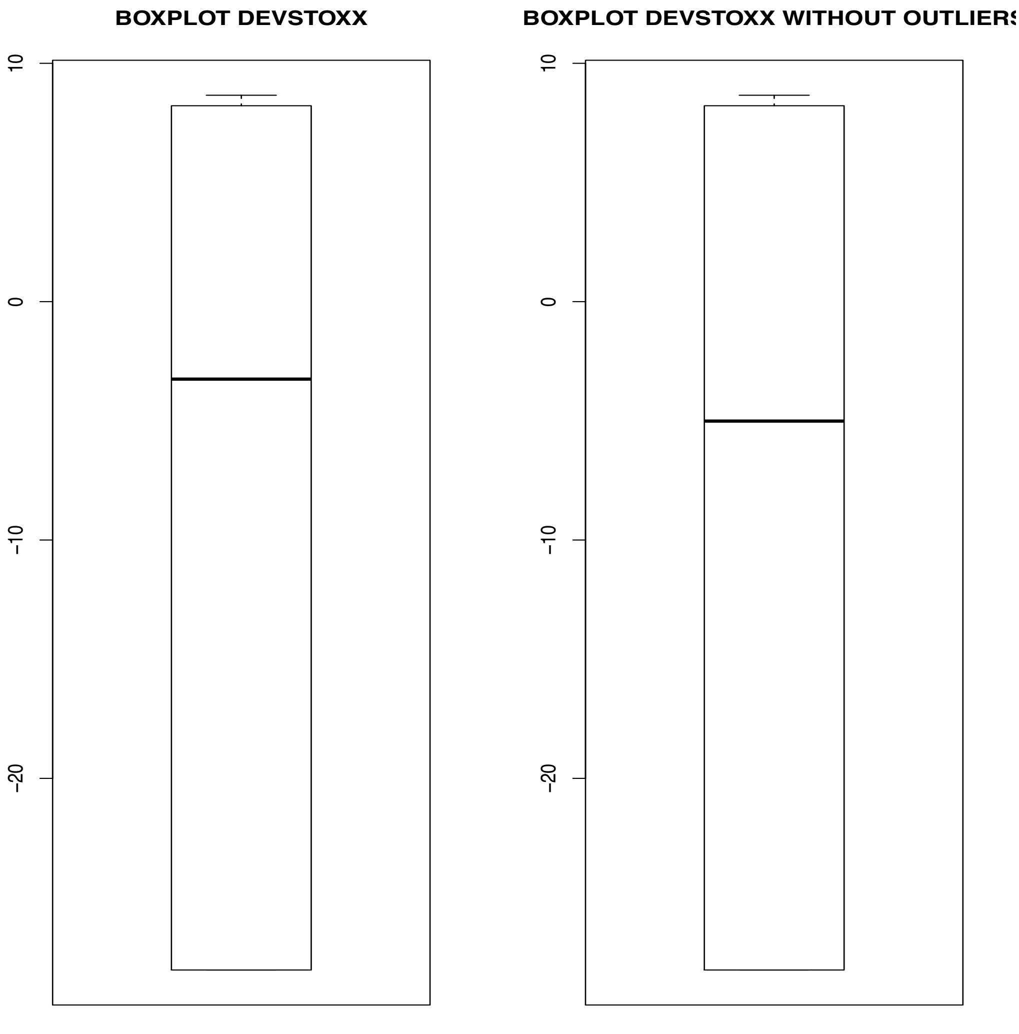
Source: Own figure

Figure 97: TA boxplot comparison



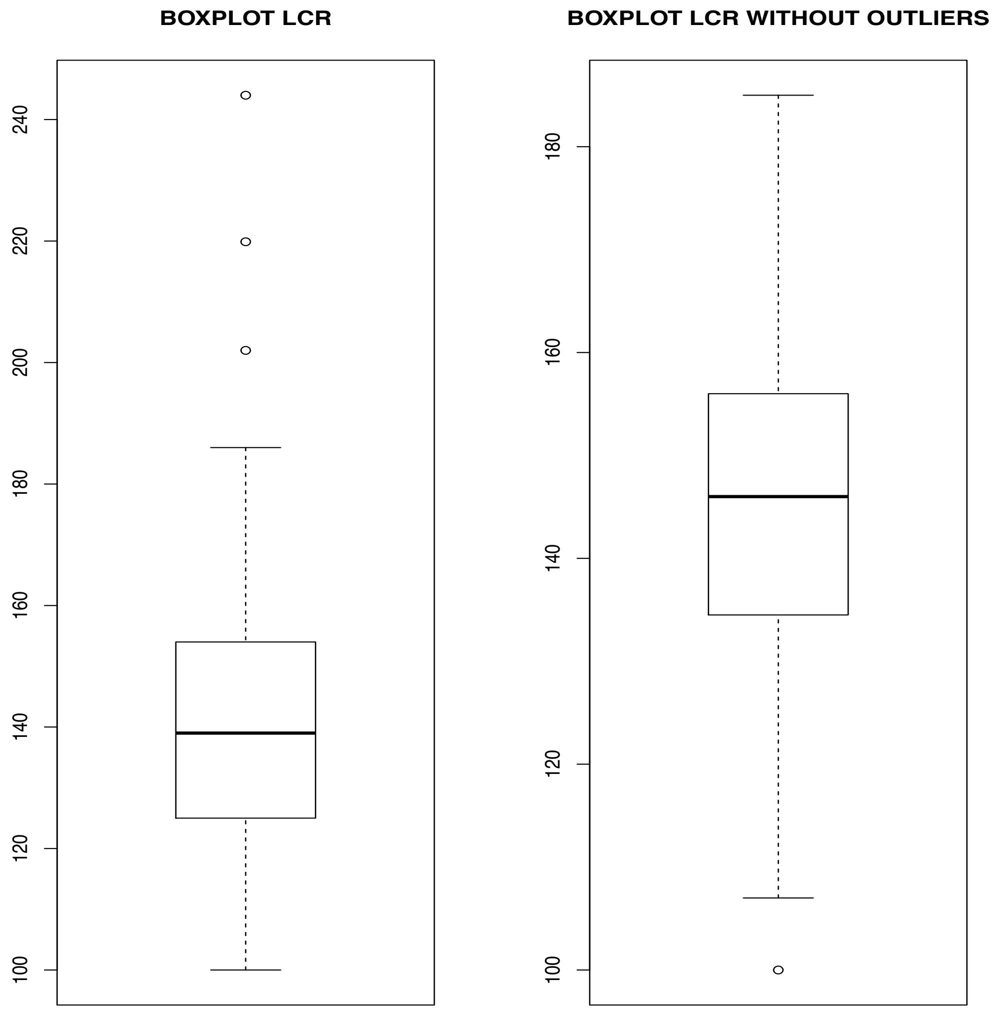
Source: Own figure

Figure 98: DEVSTOXX boxplot comparison



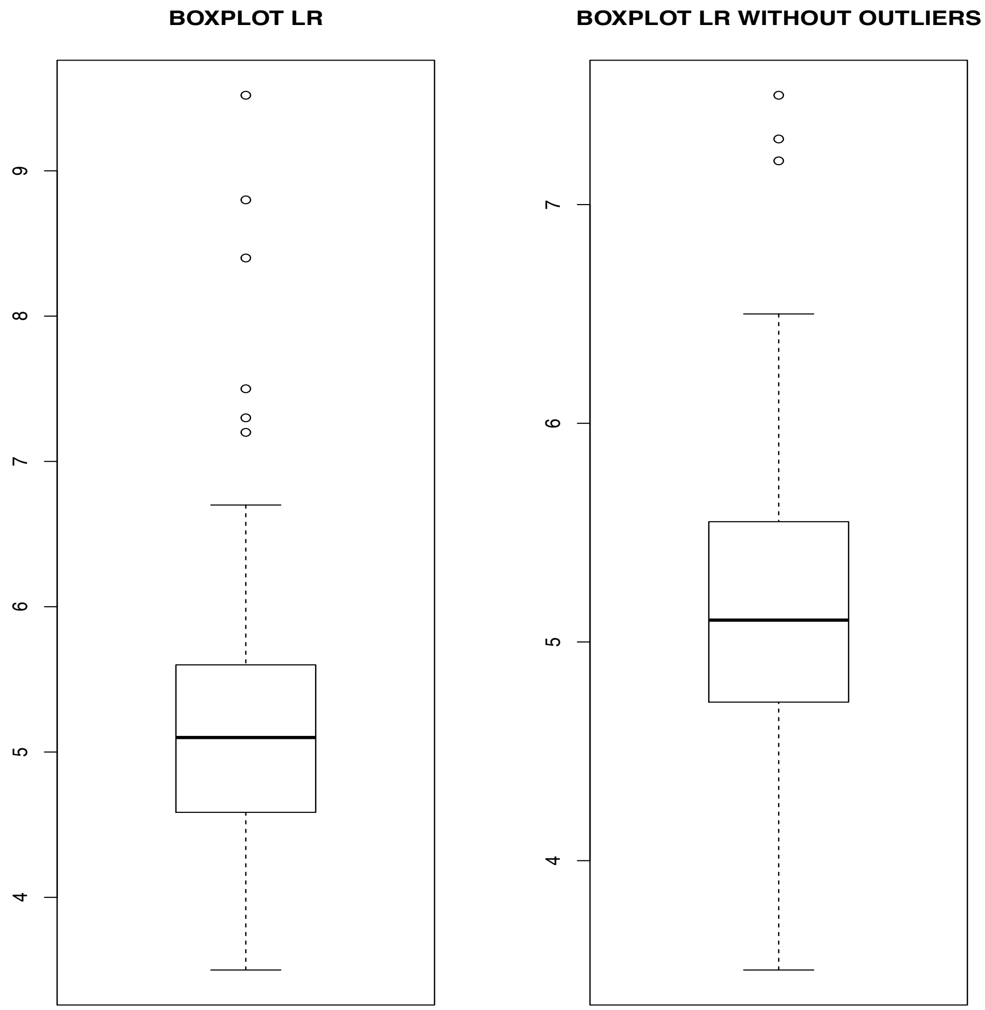
Source: Own figure

Figure 99: LCR boxplot comparison



Source: Own figure

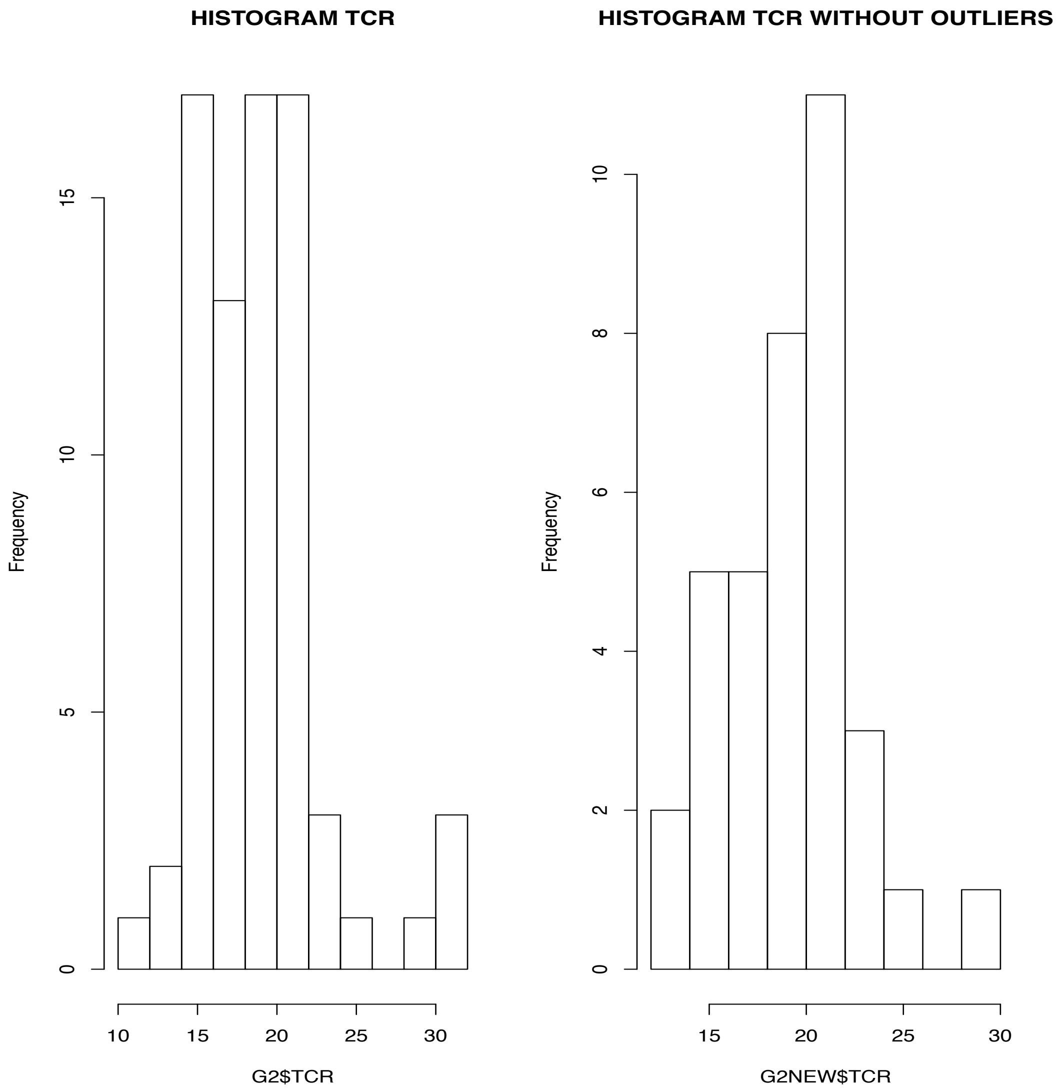
Figure 100: LR boxplot comparison



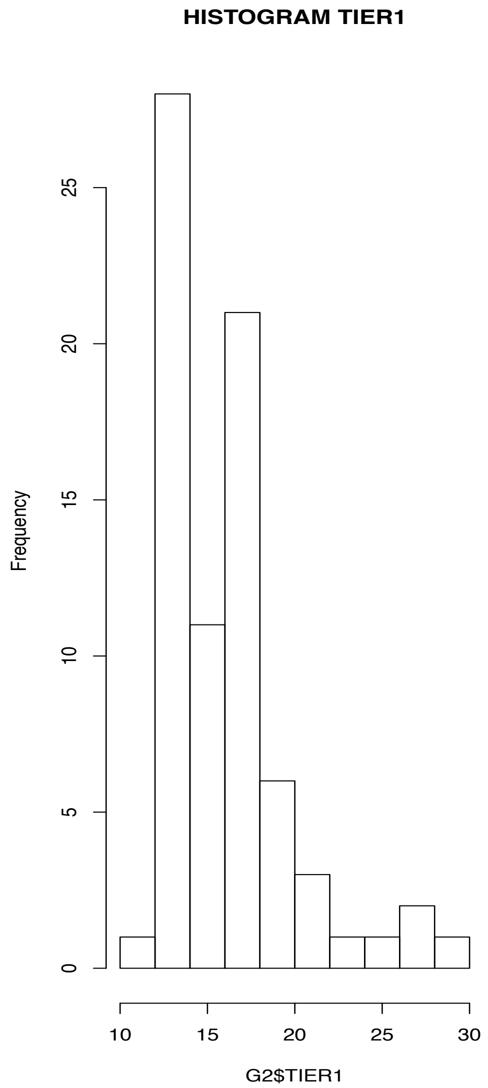
Source: Own figure

Appendix 16: Histogram comparison G2 and G2NEW

Figure 101: TCR histogram comparison



Source: Own figure


HISTOGRAM TIER1
Frequency
0
5
10
15
20
25
10
15
20
25
30
G2$TIER1

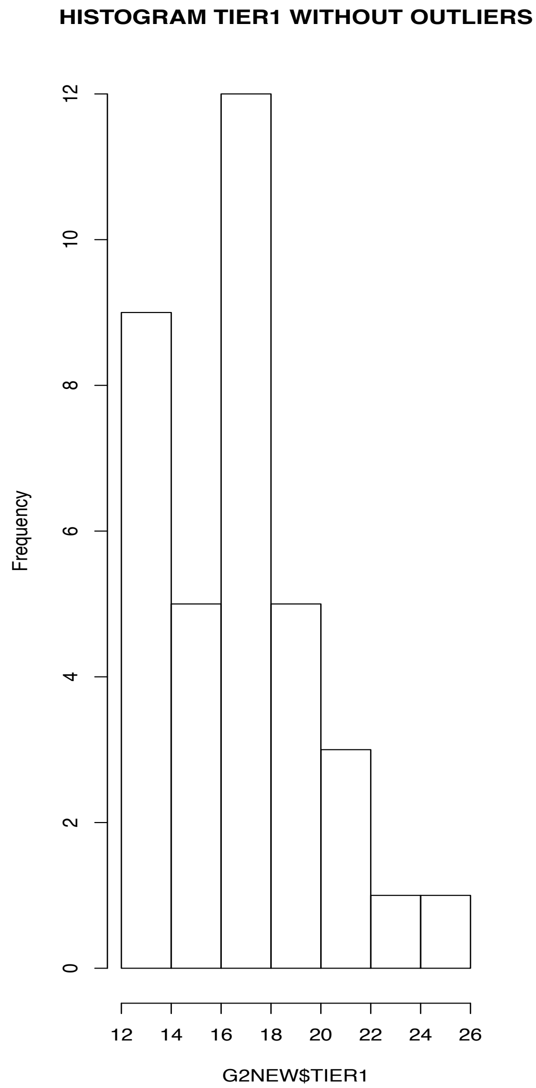
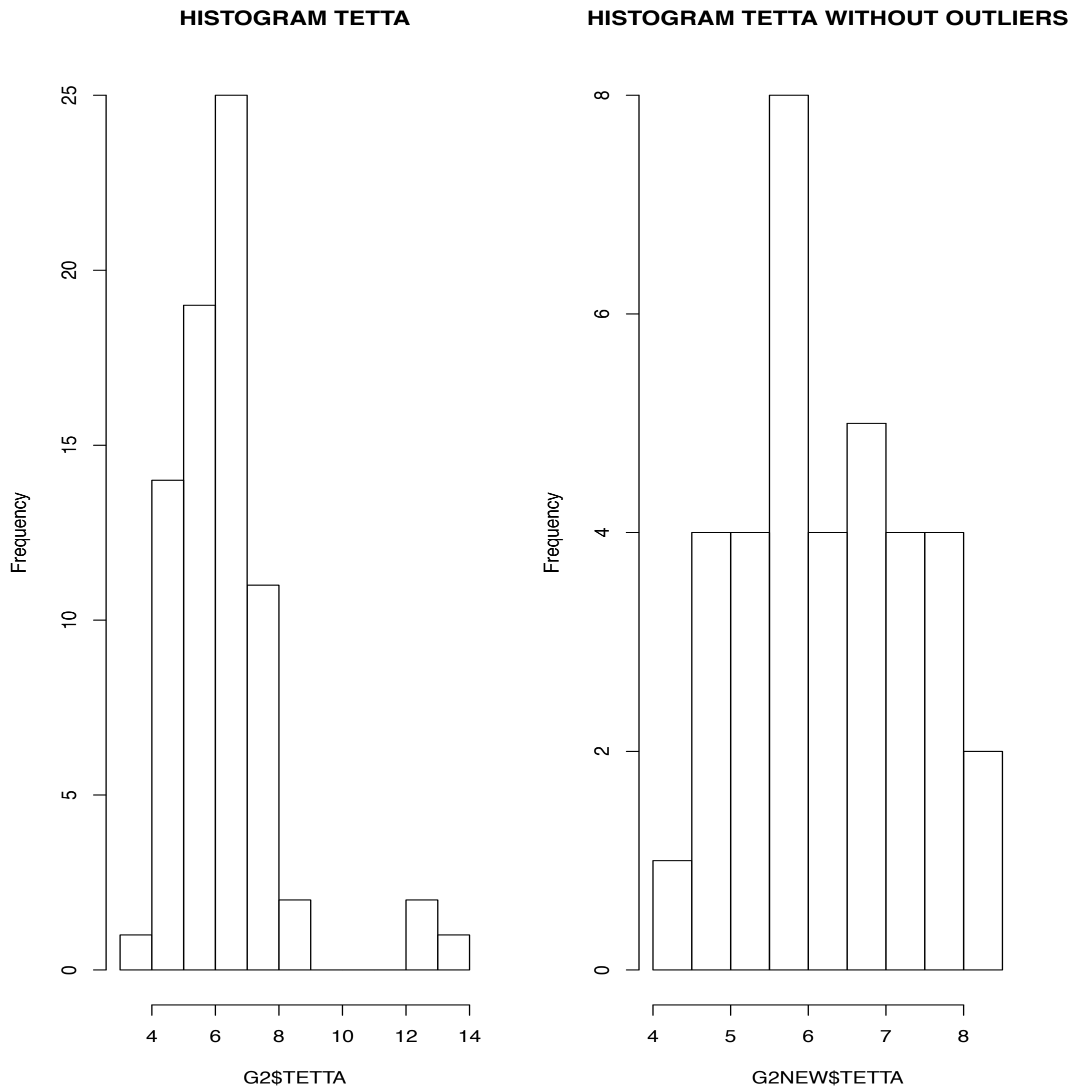
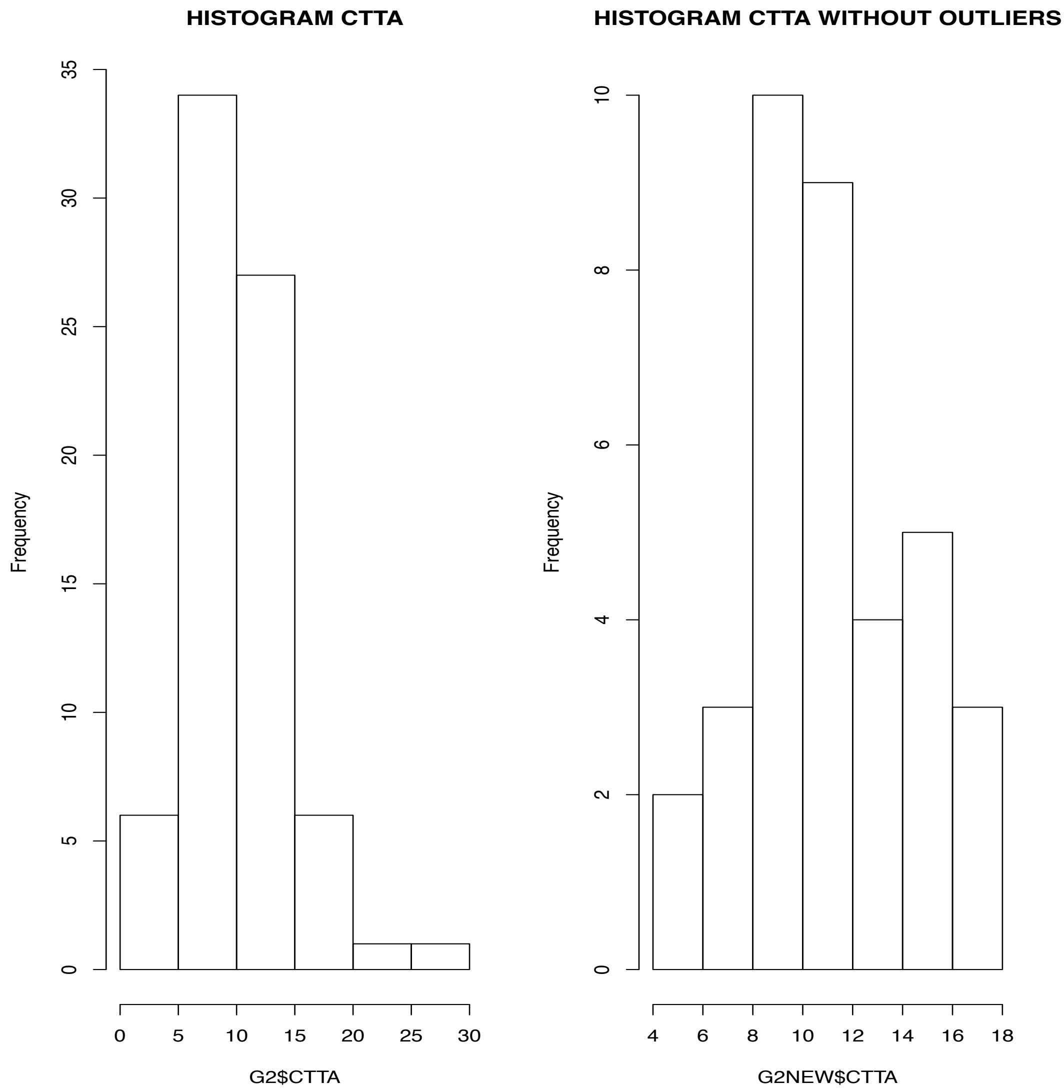

HISTOGRAM TIER1 WITHOUT OUTLIERS
Frequency
0
2
4
6
8
10
12
12
14
16
18
20
22
24
26
G2NEW$TIER1

Figure 102: TETTA histogram comparison



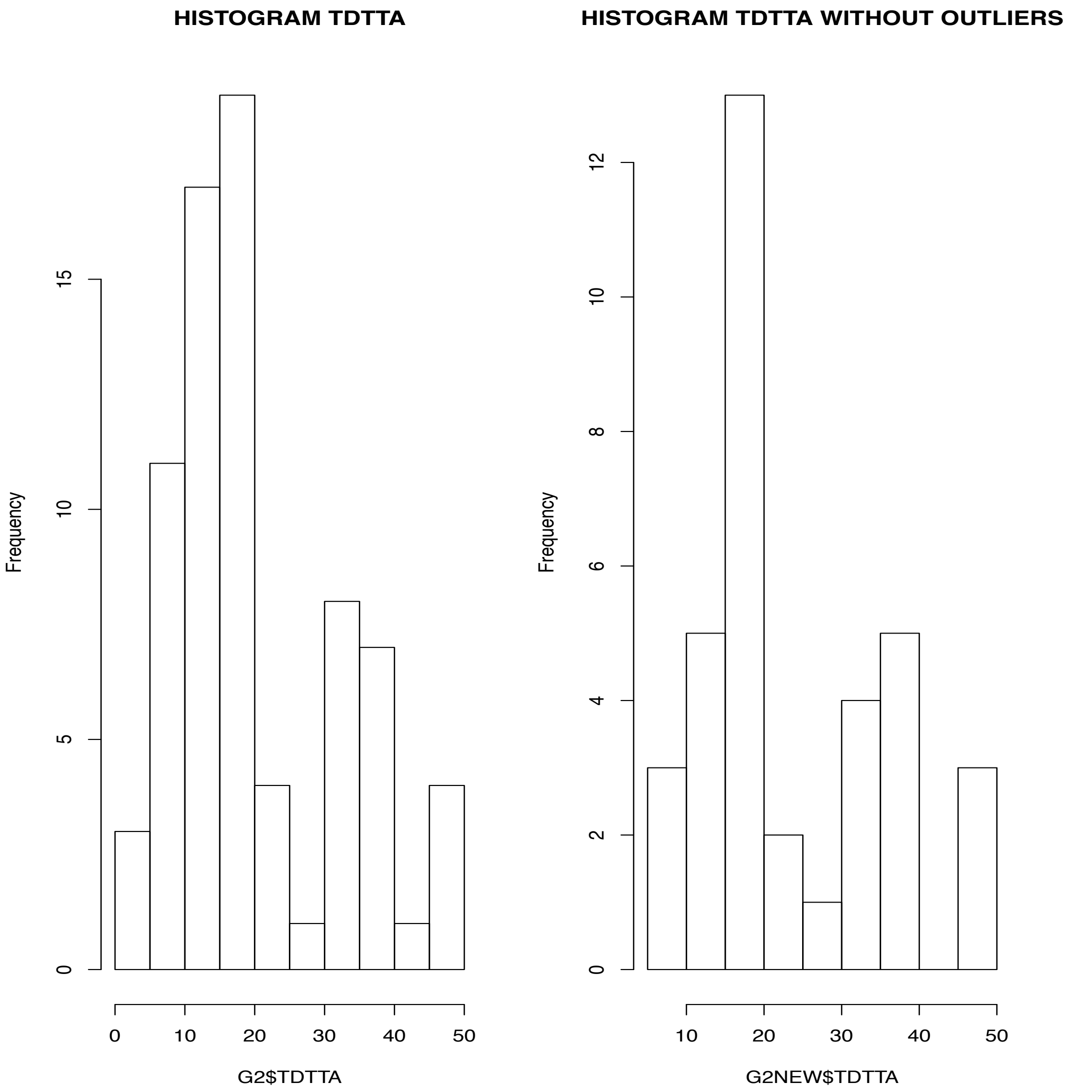
Source: Own figure

Figure 103: CTTA histogram comparison



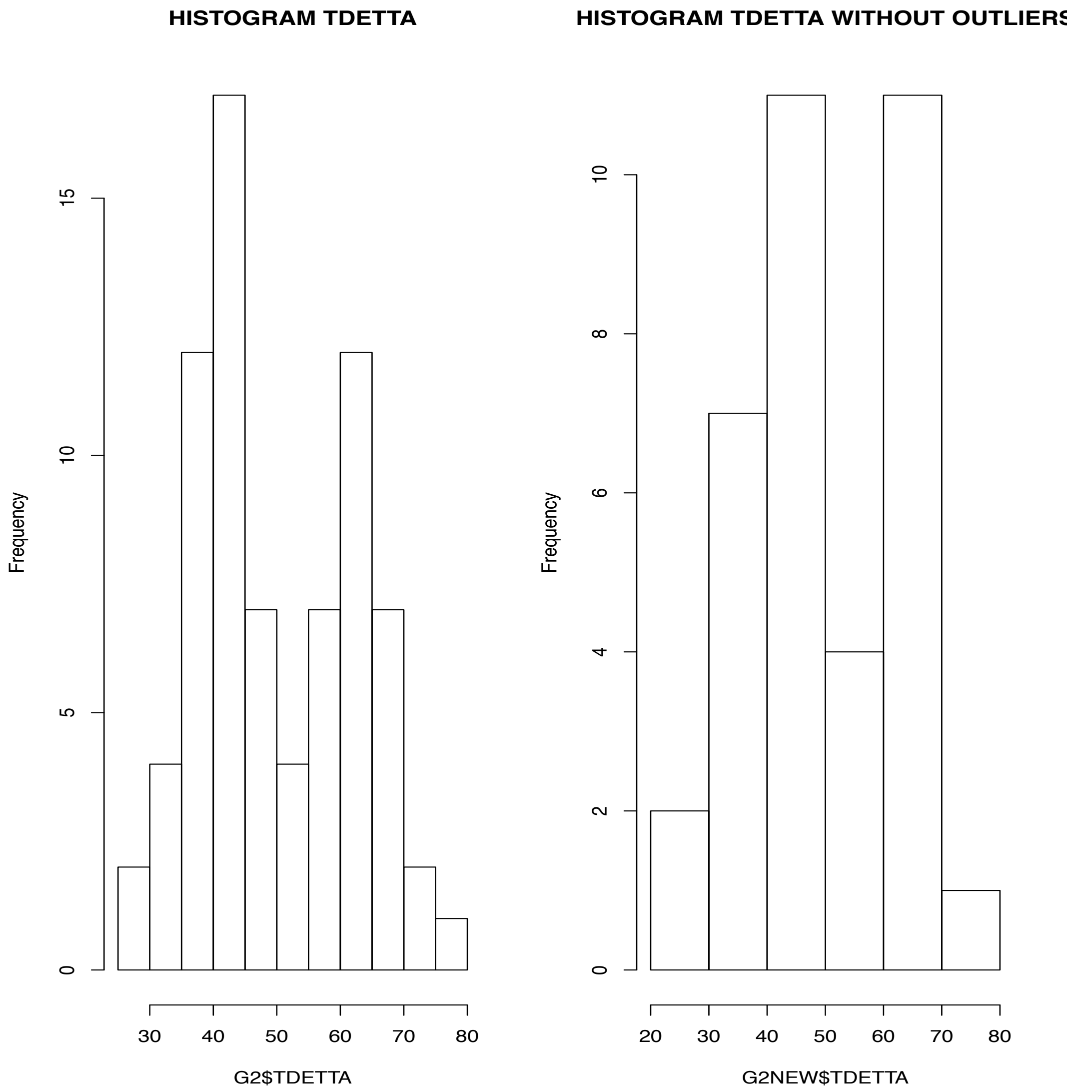
Source: Own figure

Figure 104: TDTTA histogram comparison



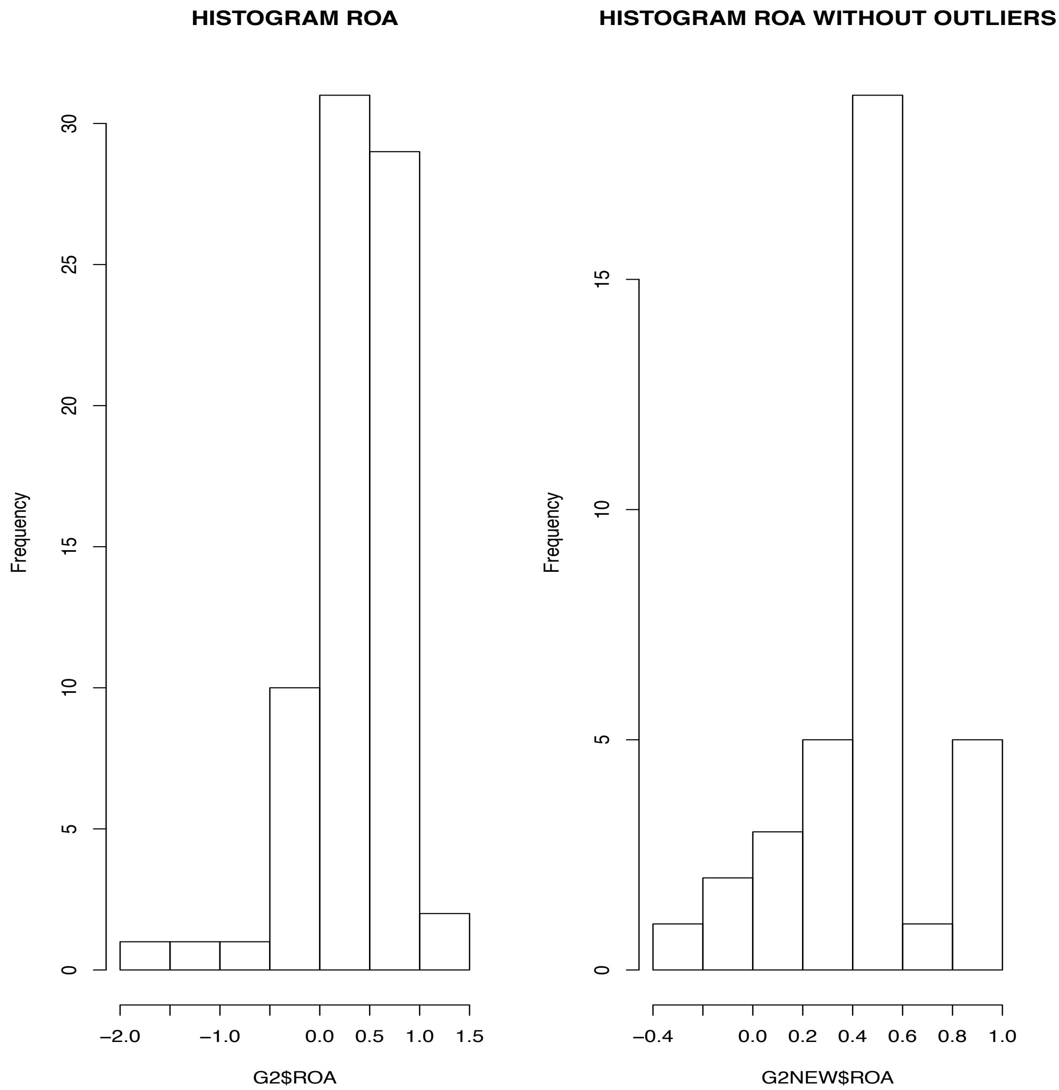
Source: Own figure

Figure 105: TDETTA histogram comparison



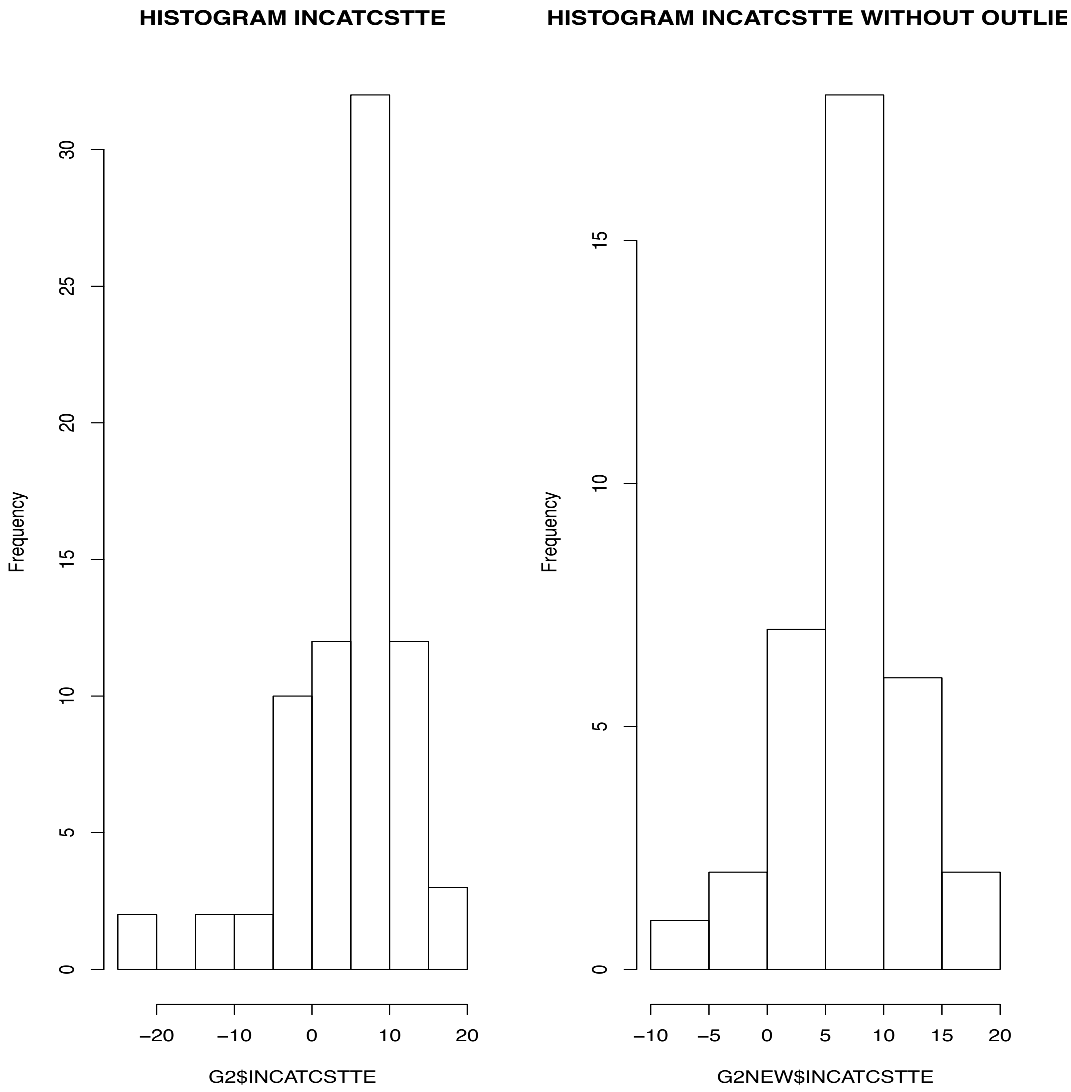
Source: Own figure

Figure 106: ROA histogram comparison



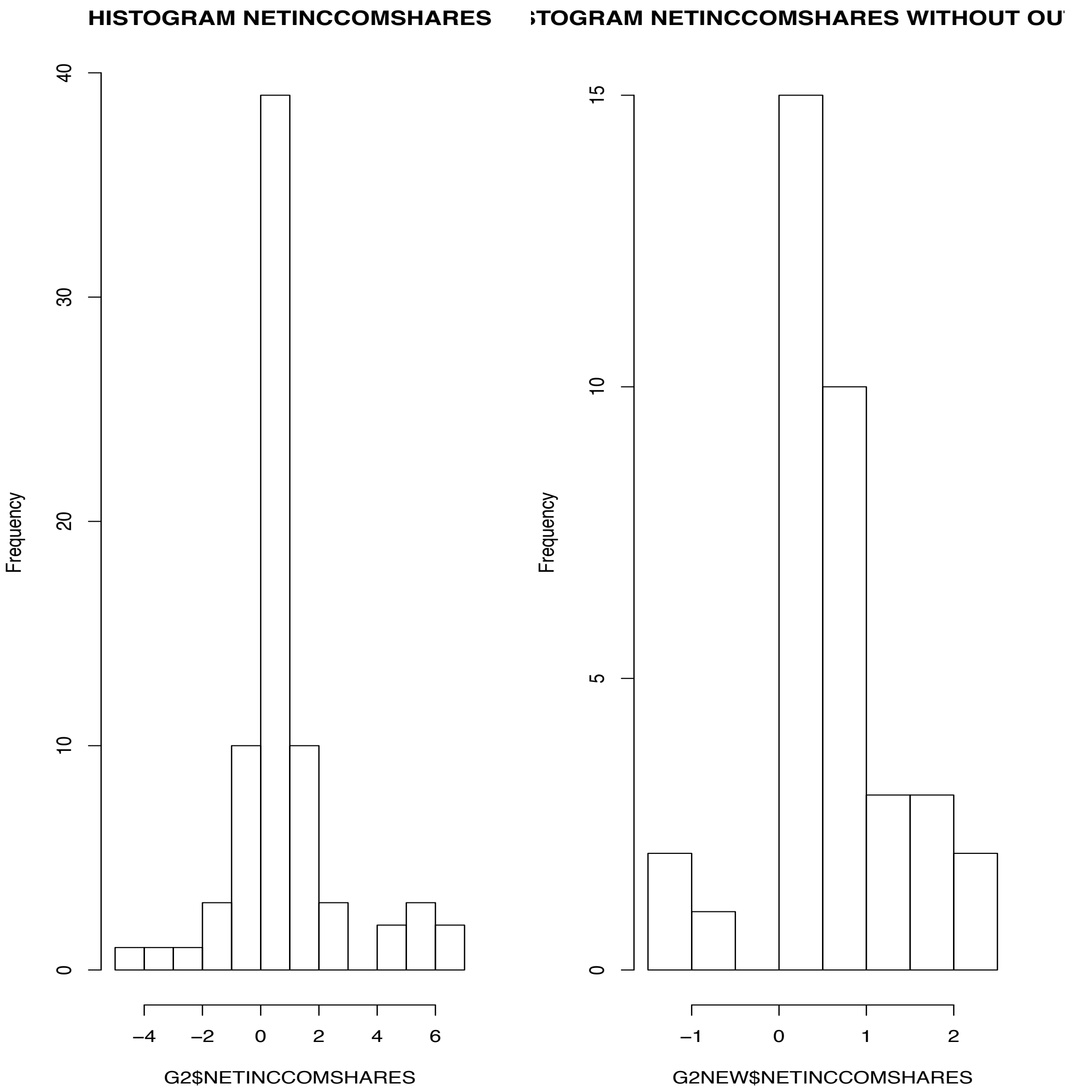
Source: Own figure

Figure 107: INCATCSTTE histogram comparison



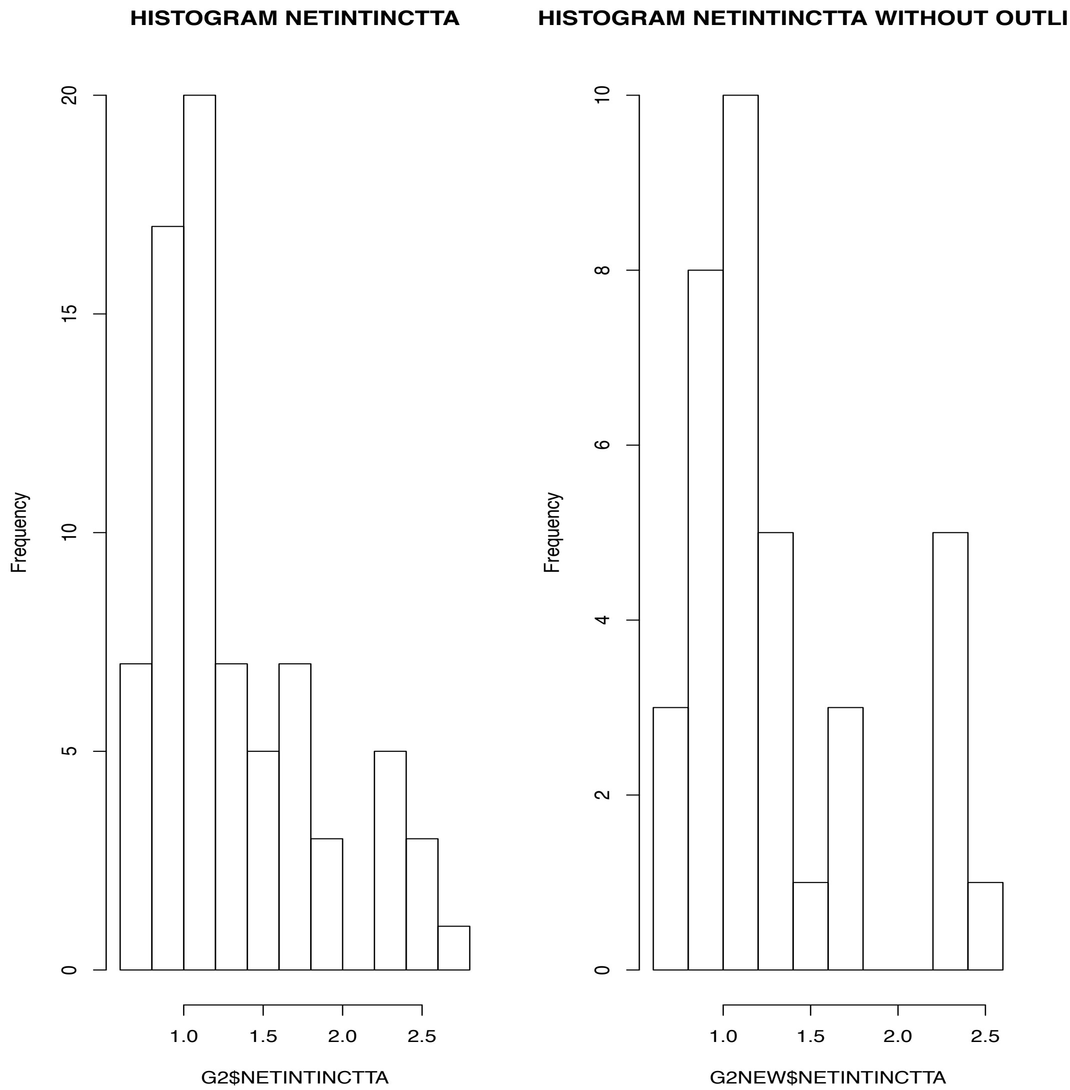
Source: Own figure

Figure 108: NETINCCOMSHARES histogram comparison



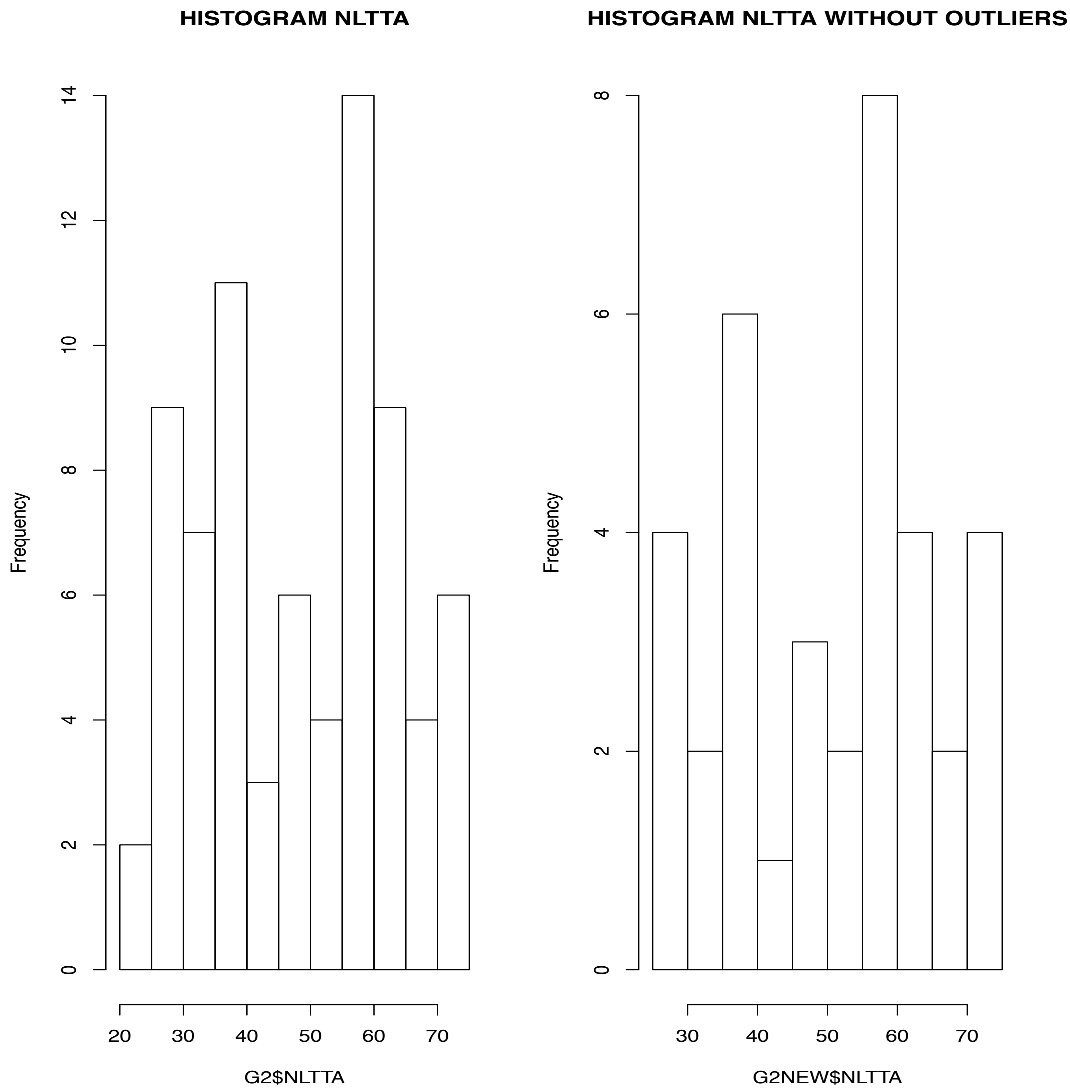
Source: Own figure

Figure 109: NETINTINCTTA histogram comparison



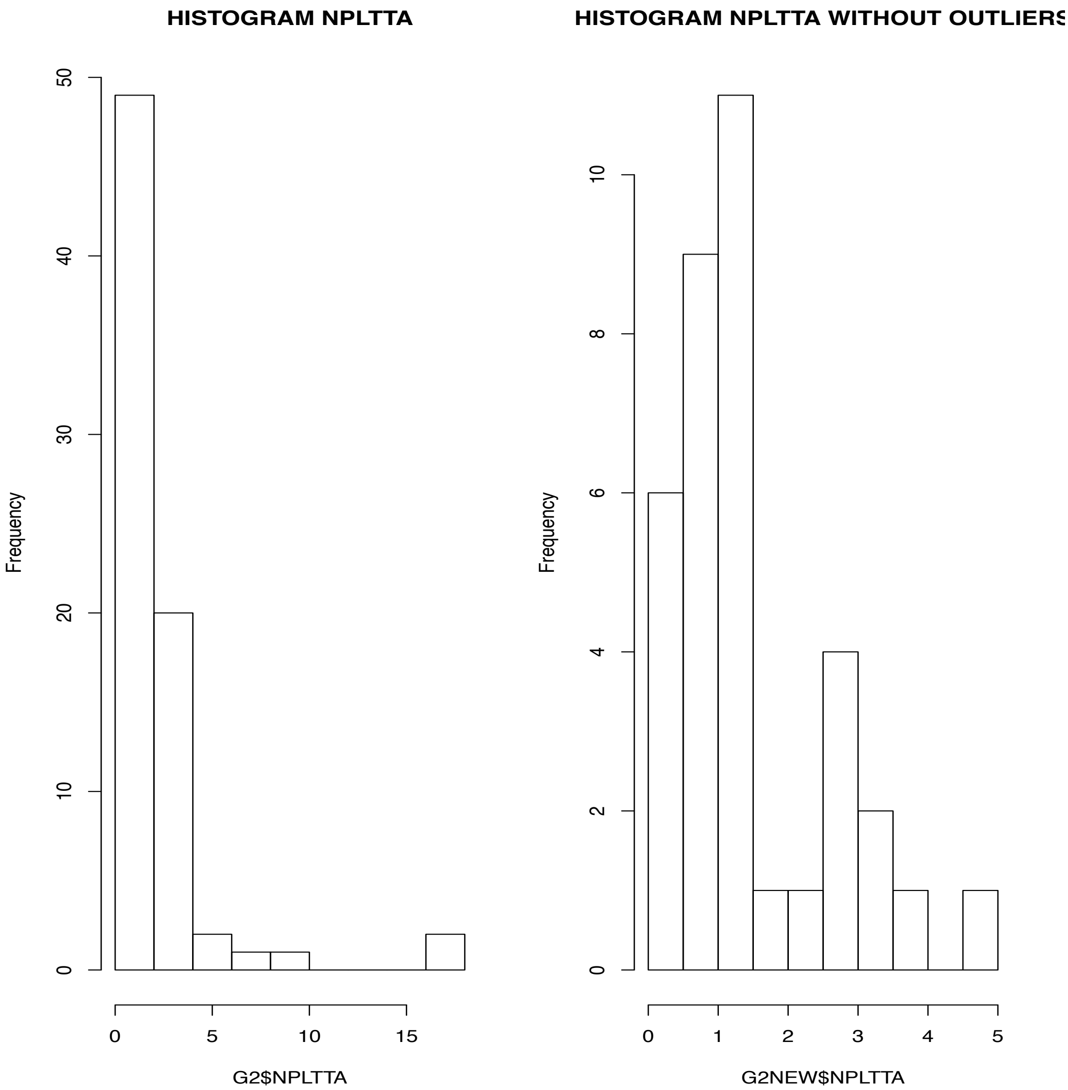
Source: Own figure

Figure 110: NLTTA histogram comparison



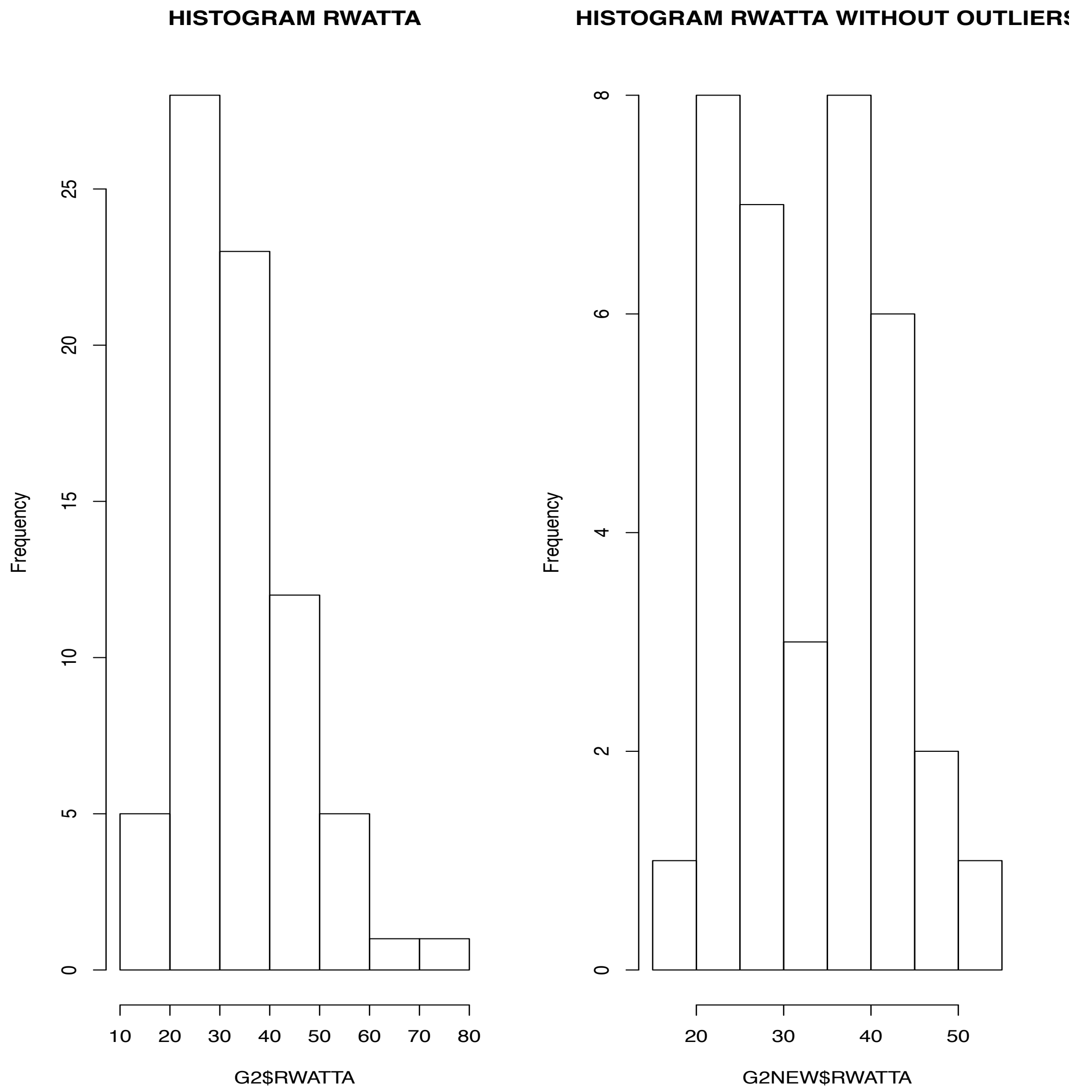
Source: Own figure

Figure 111: NPLTTA histogram comparison



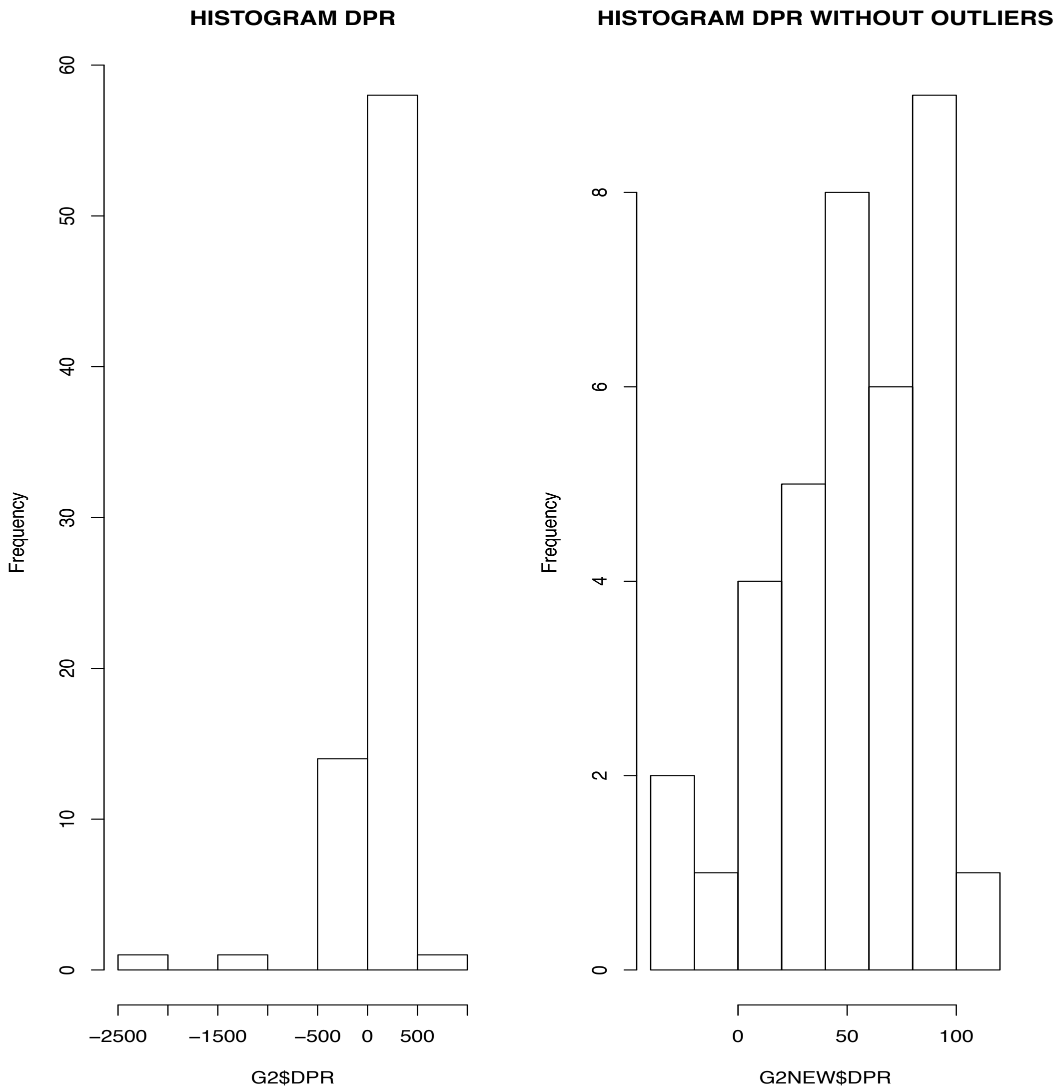
Source: Own figure

Figure 112: RWATTA histogram comparison



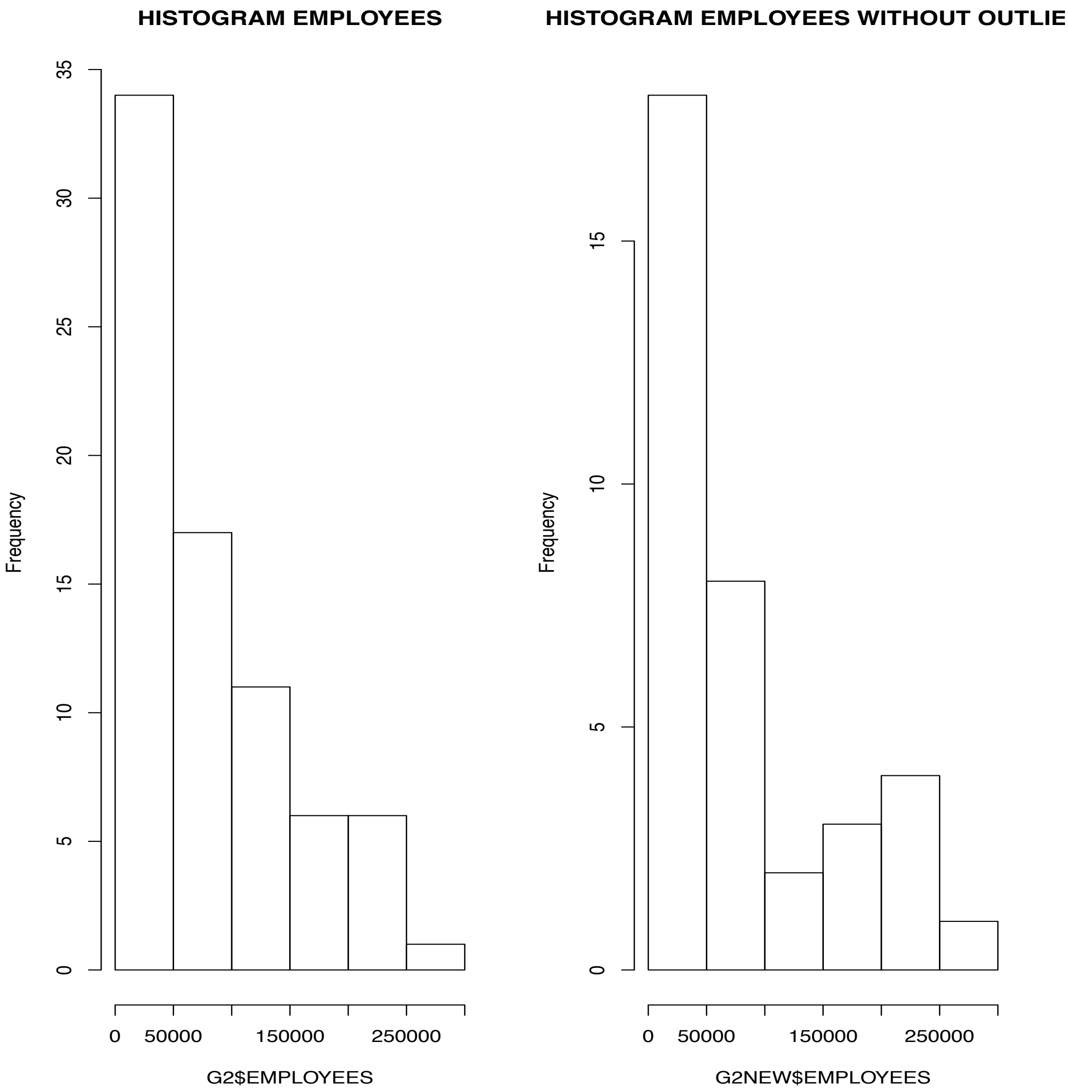
Source: Own figure

Figure 113: DPR histogram comparison



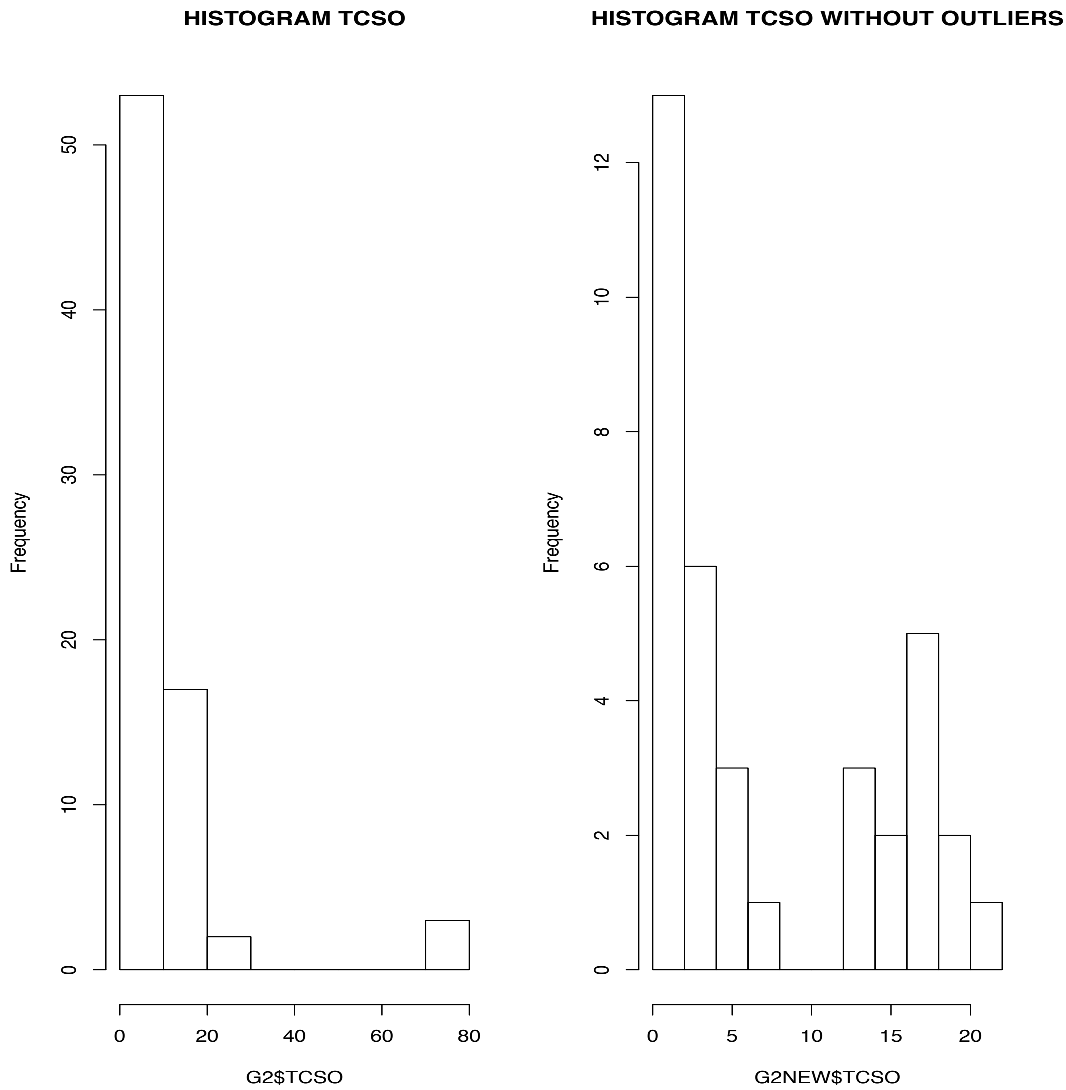
Source: Own figure

Figure 114: EMPLOYEES histogram comparison



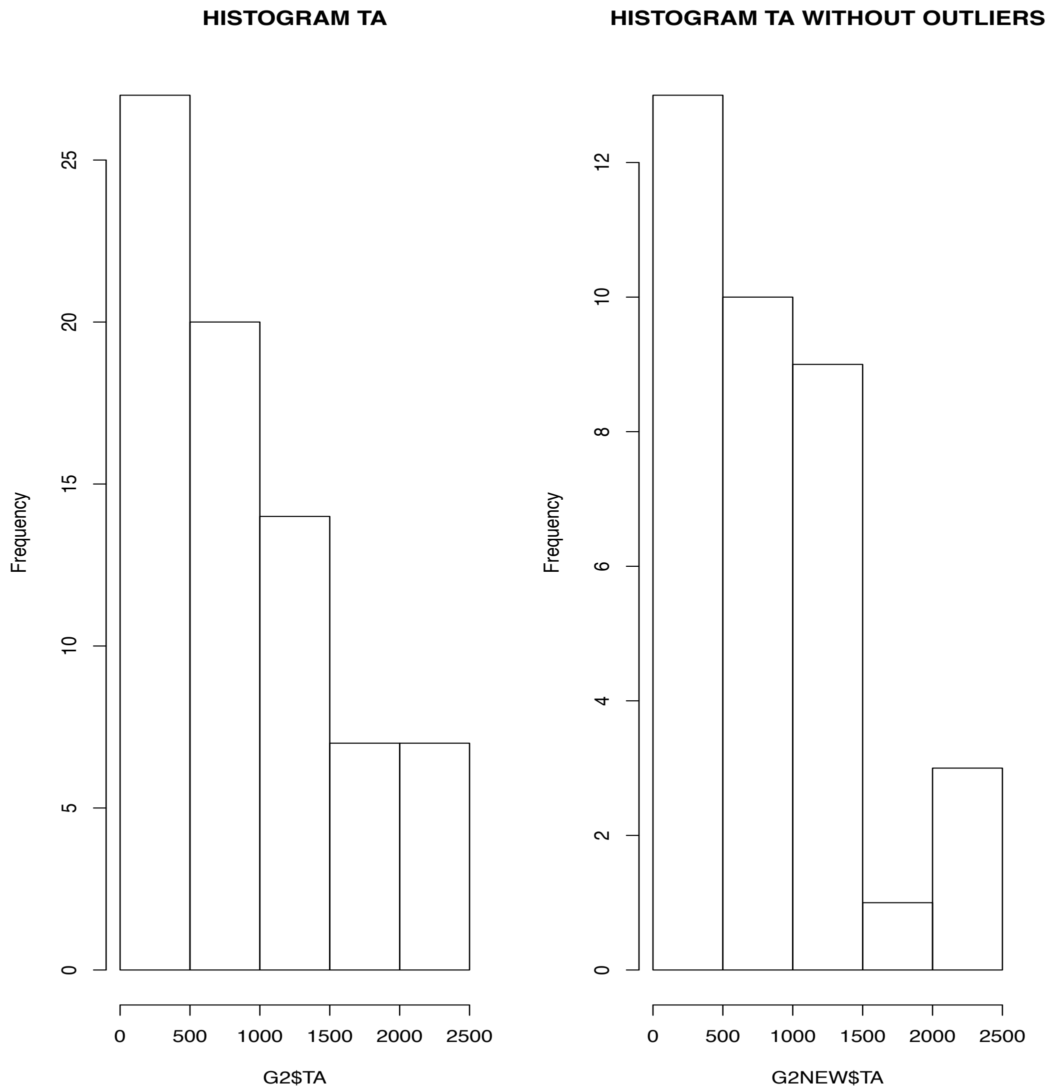
Source: Own figure

Figure 115: TCSO histogram comparison



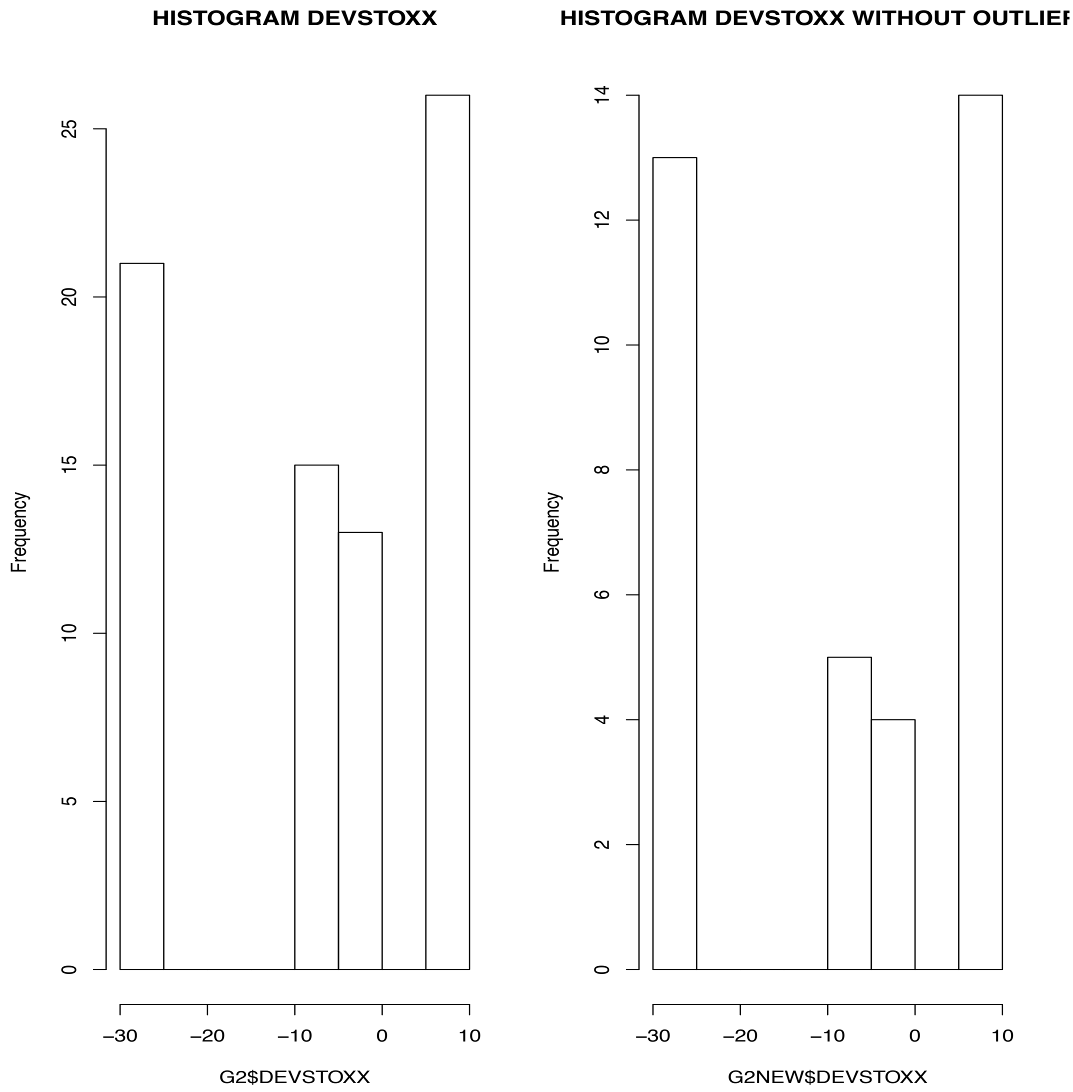
Source: Own figure

Figure 116: TA histogram comparison



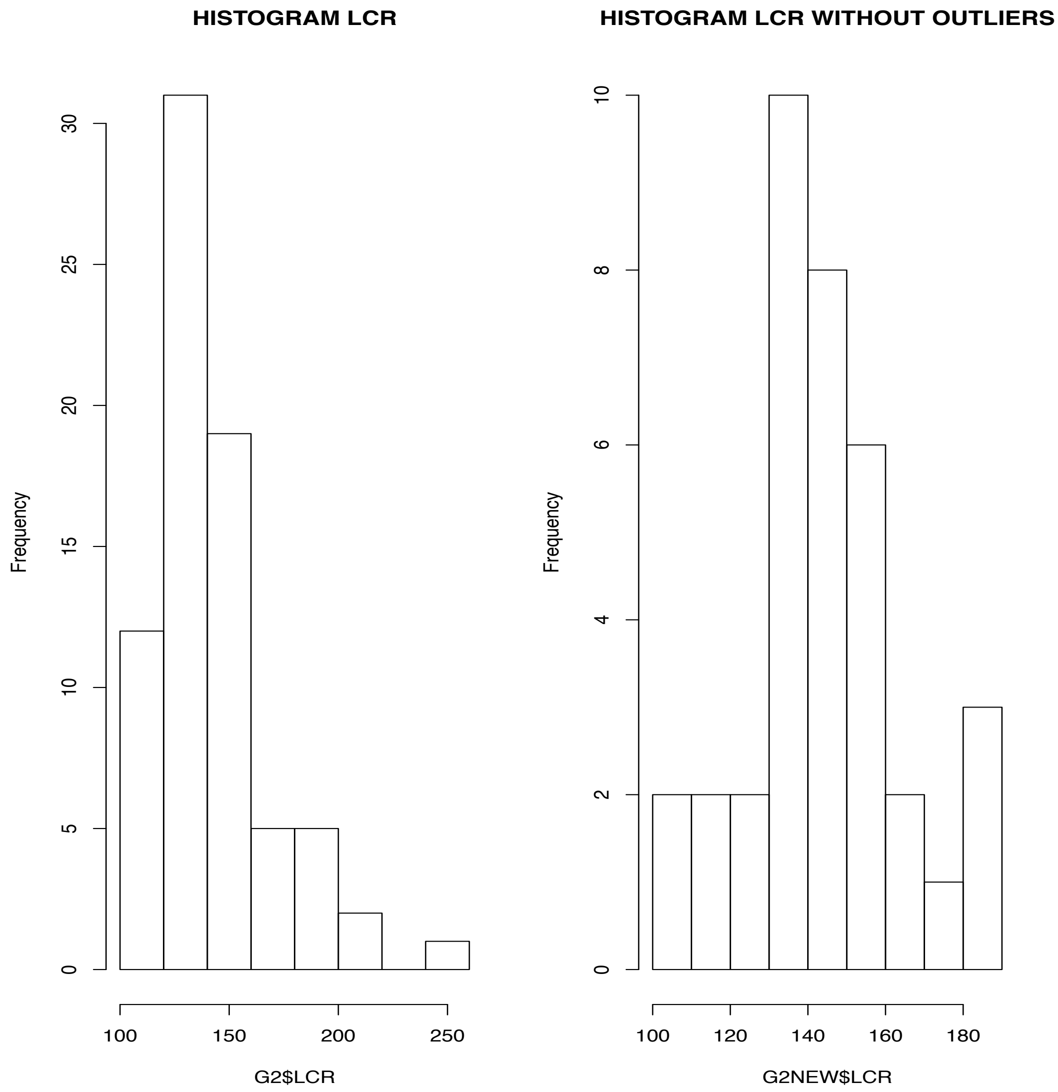
Source: Own figure

Figure 117: DEVSTOXX histogram comparison



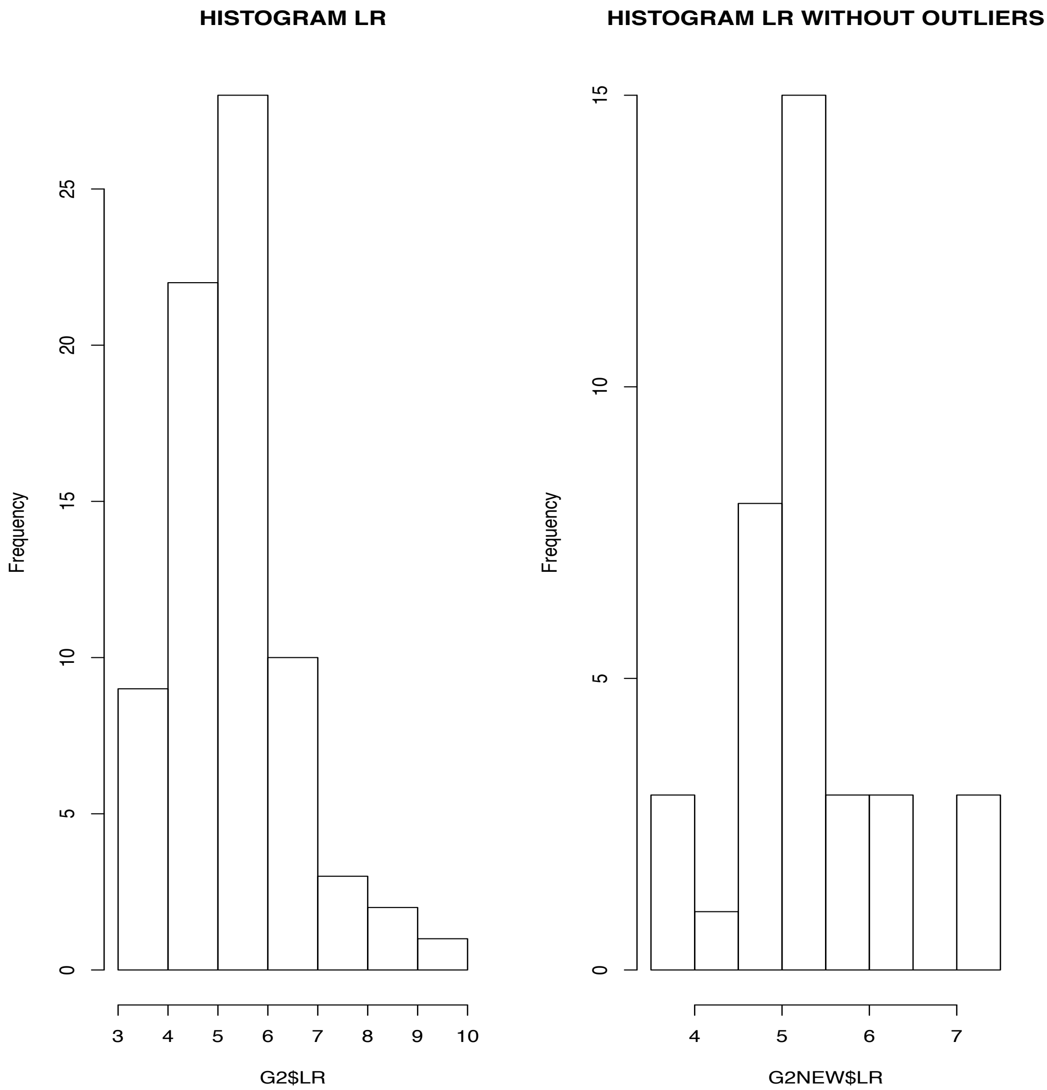
Source: Own figure

Figure 118: LCR histogram comparison



Source: Own figure

Figure 119: LR histogram comparison



Source: Own figure

Appendix 17

Table 71: Results for single regressions with the data frame G2

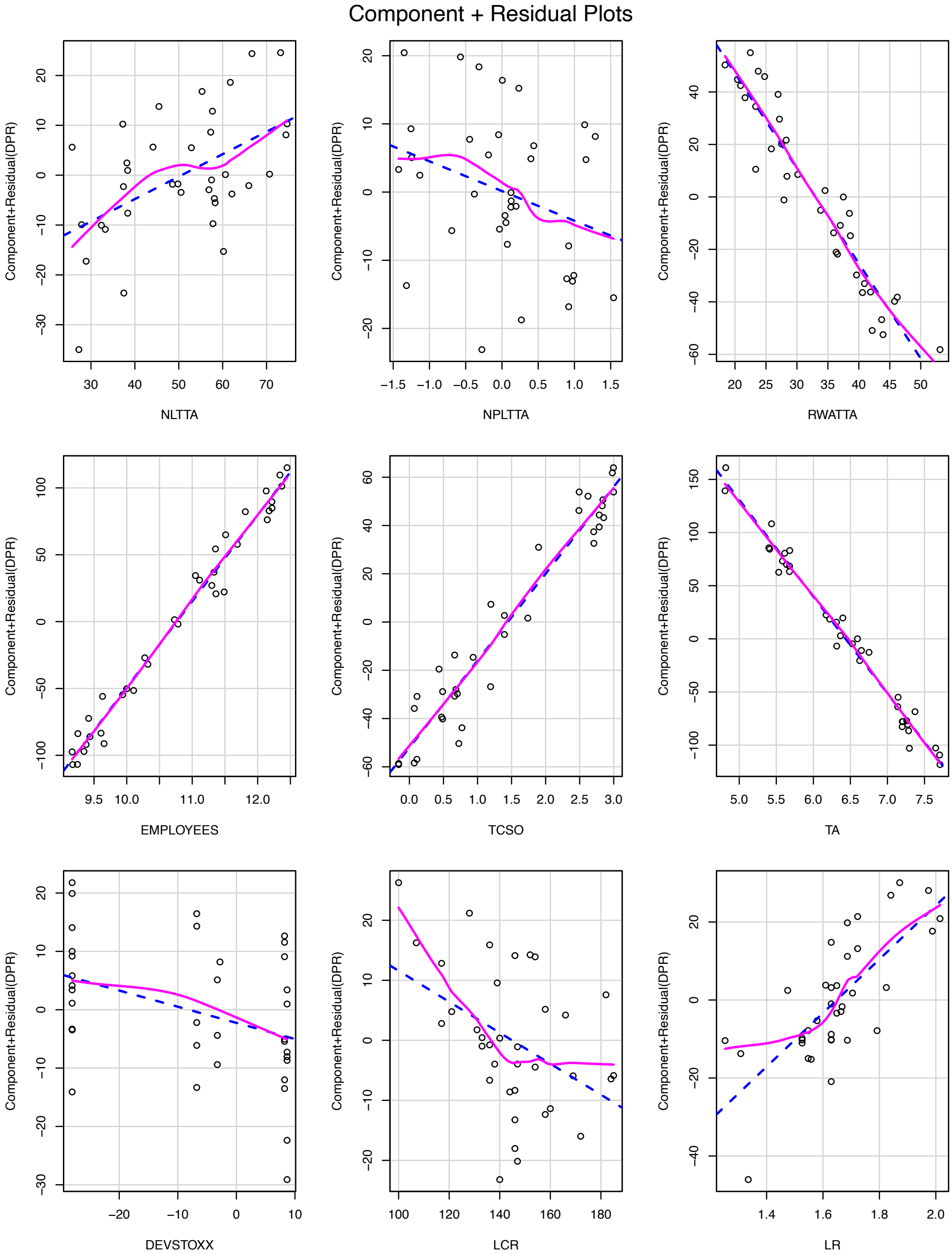
	Dependent variable:			
	DPR			
	(1)	(2)	(3)	(4)
TCR	21.187** (9.530)			
TIER1		21.057** (10.149)		
LCR			1.660 (1.467)	
LR				73.734** (32.068)
Constant	-411.226**	-349.576**	-249.017	-400.268**
	(183.447)	(166.999)	(213.026)	(172.959)
Observations	75	75	75	75
R^2	0.063	0.056	0.017	0.068
Adjusted R^2	0.051	0.043	0.004	0.055
Residual Std. Error (df = 73)	323.614	324.946	331.497	322.902
F Statistic (df = 1; 73)	4.943**	4.305**	1.280	5.287**

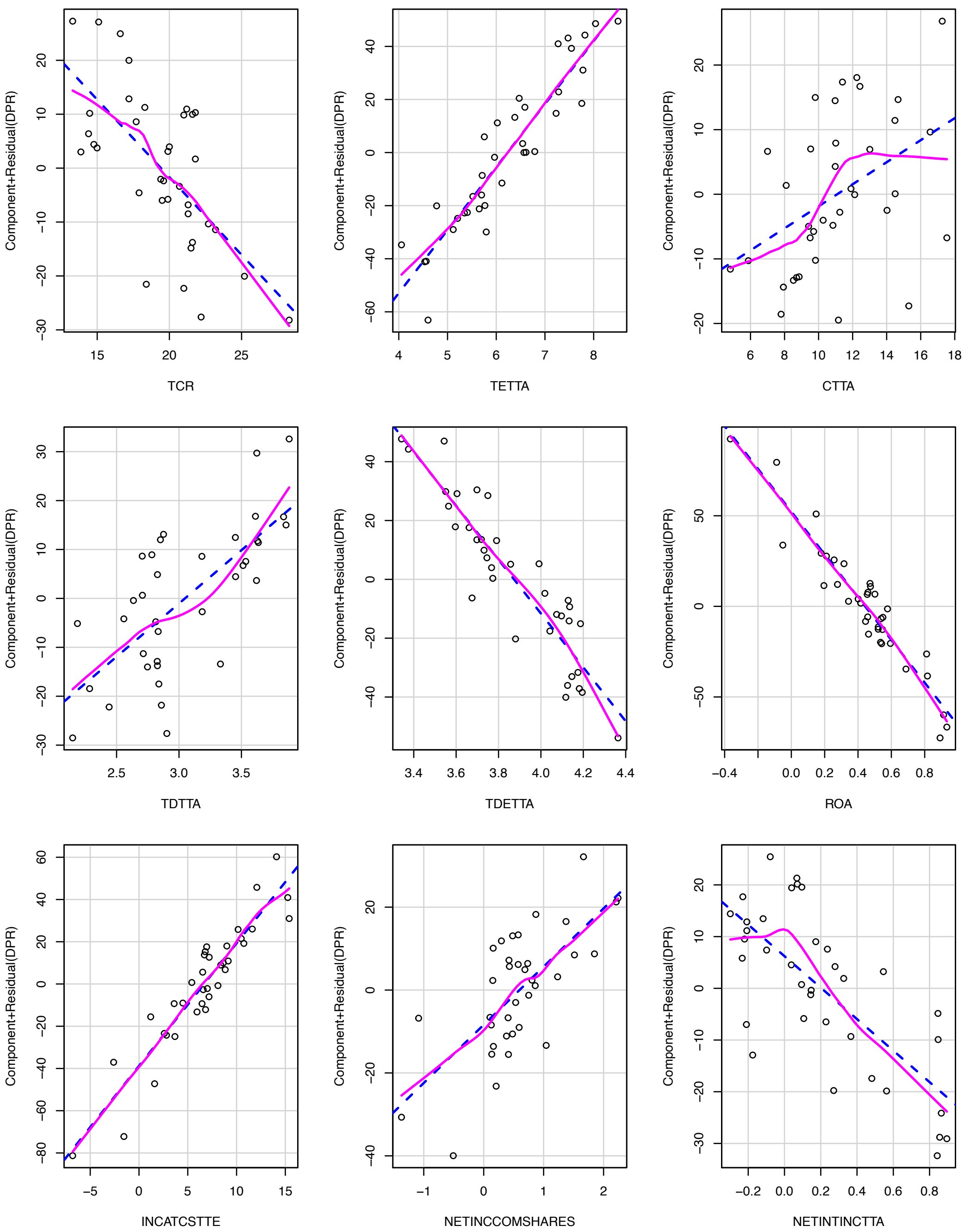
*p**p***p<0.01

Source: Own table

Appendix 18: Cr plots for regressions of G2NEW

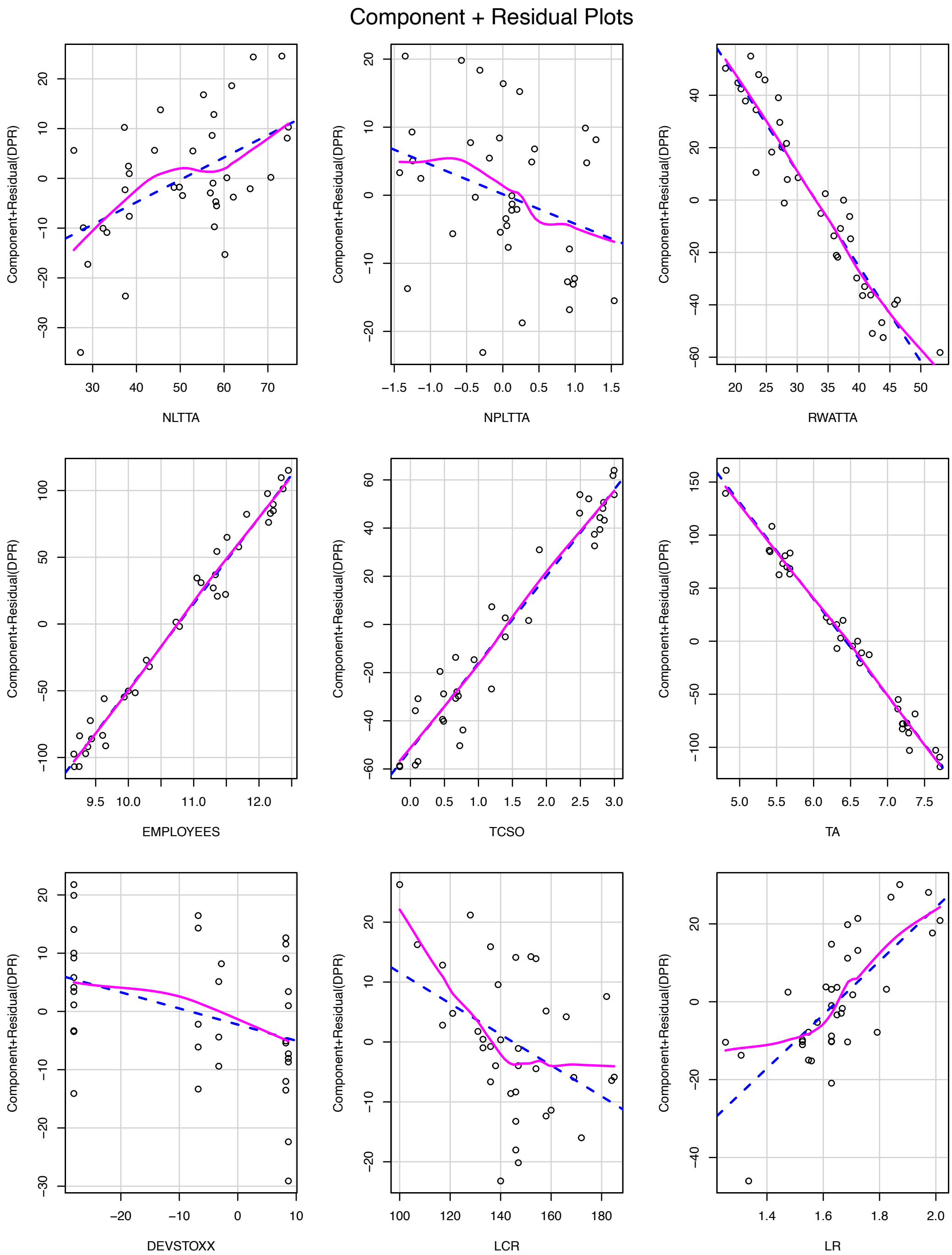
Figure 120: Cr plot for regression 5

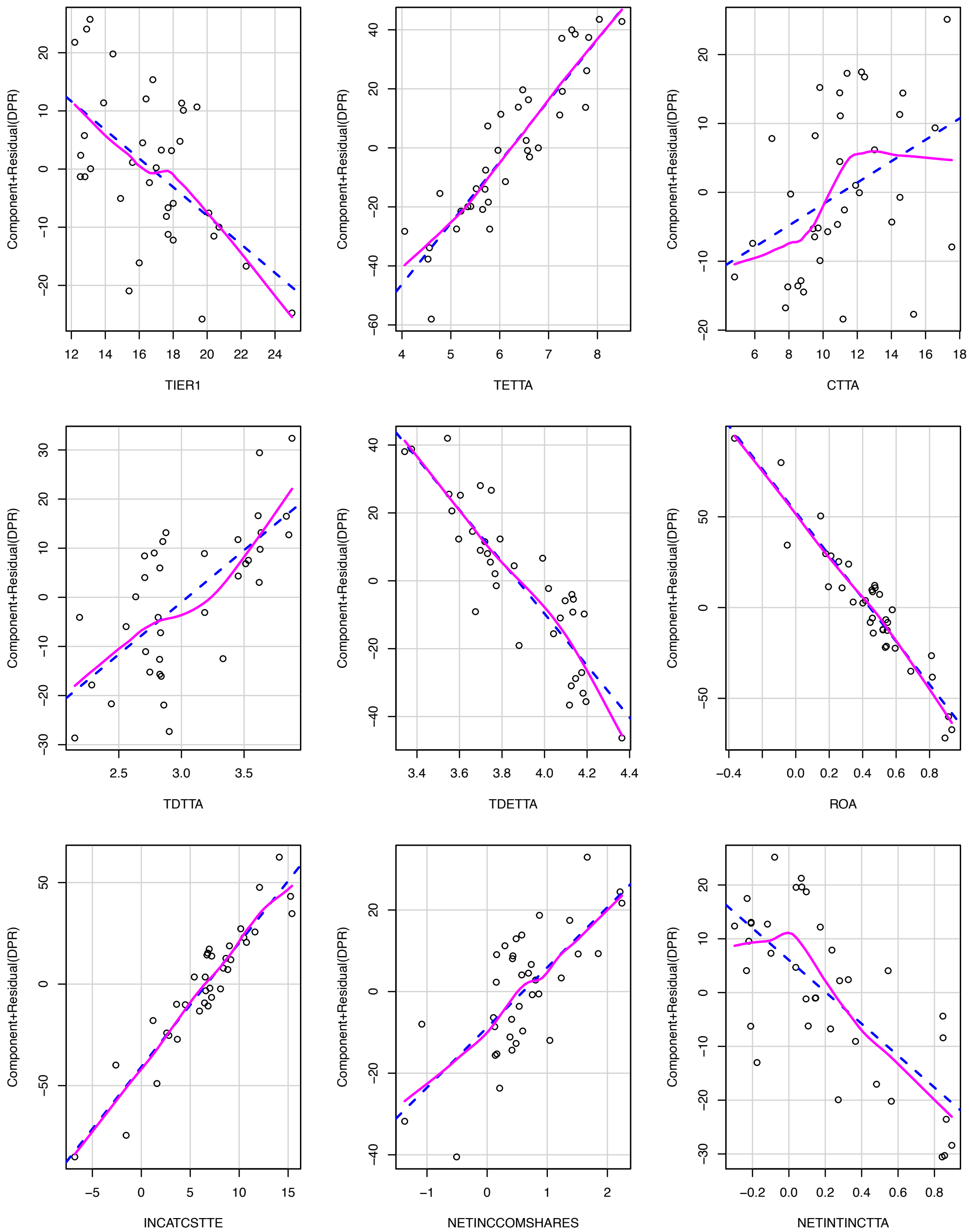




Source: Own figure

Figure 121: Cr plot for regression 6

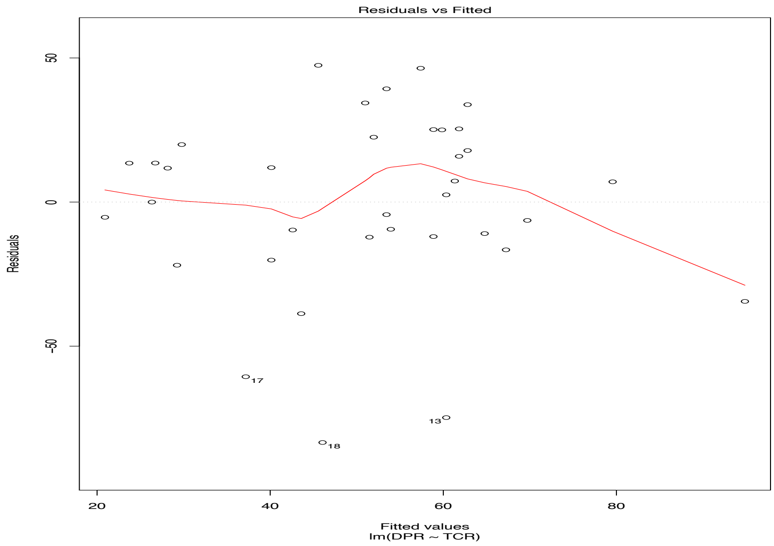




Source: Own figure

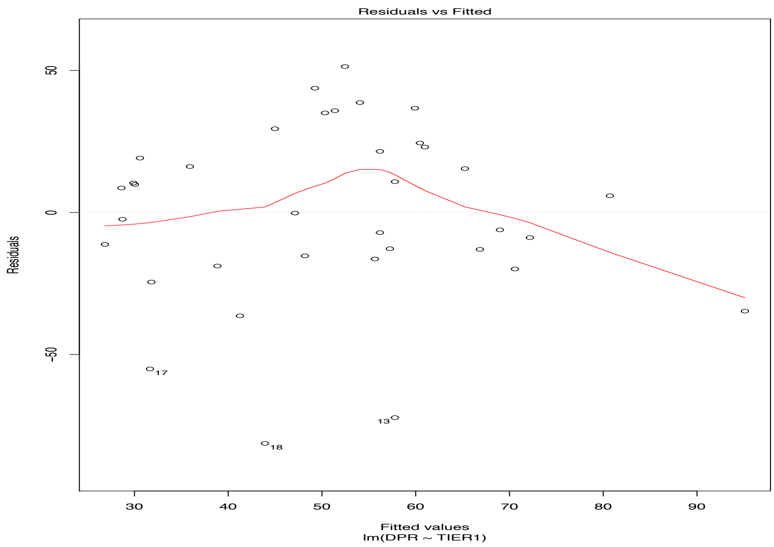
Appendix 19: Tukey-Anscombe-plot for G2NEW

Figure 122: Tukey-Anscombe-plot for regression 1



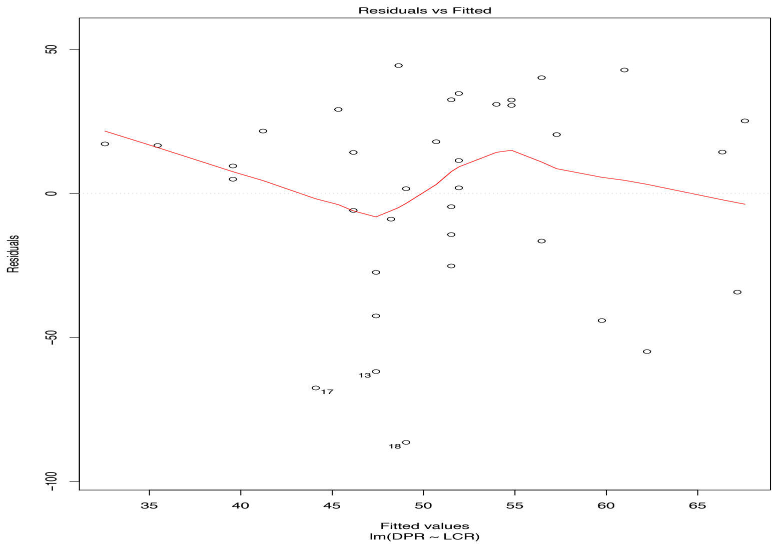
Source: Own figure

Figure 123: Tukey-Anscombe-plot for regression 2



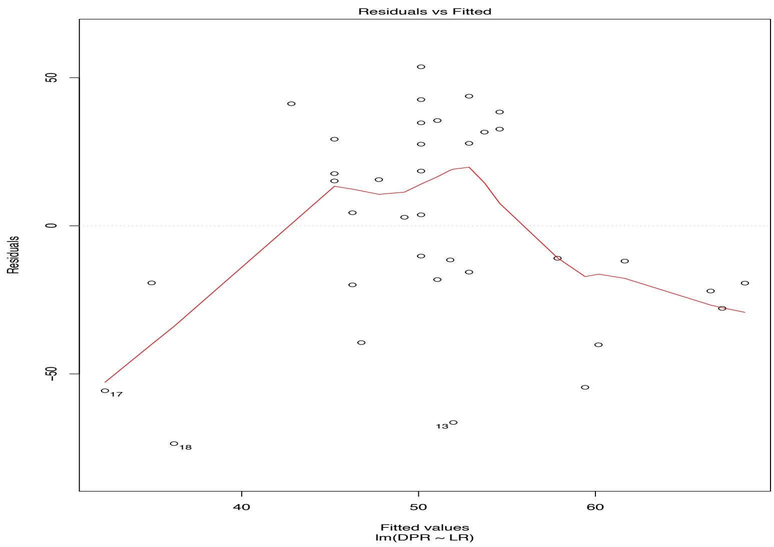
Source: Own figure

Figure 124: Tukey-Anscombe-plot for regression 3



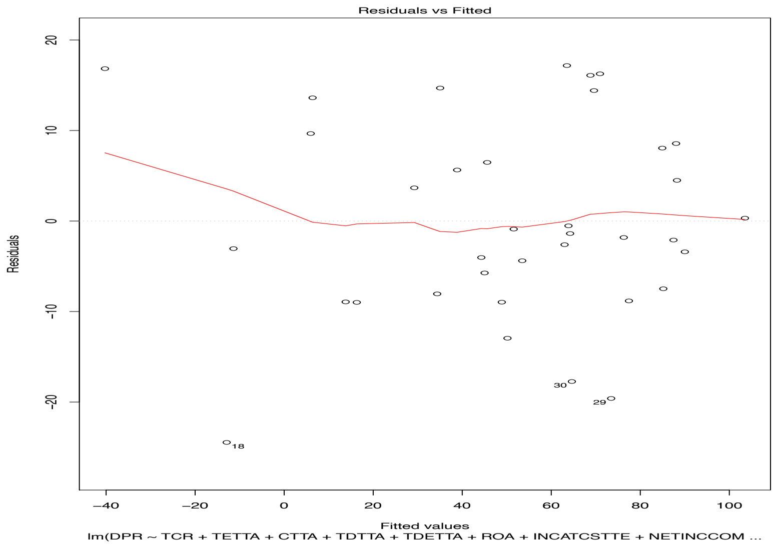
Source: Own figure

Figure 125: Tukey-Anscombe-plot for regression 4



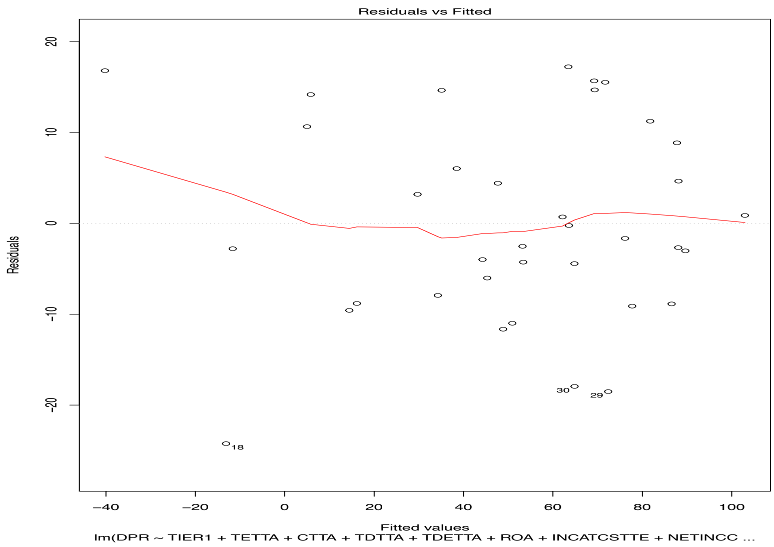
Source: Own figure

Figure 126: Tukey-Anscombe-plot for regression 5



Source: Own figure

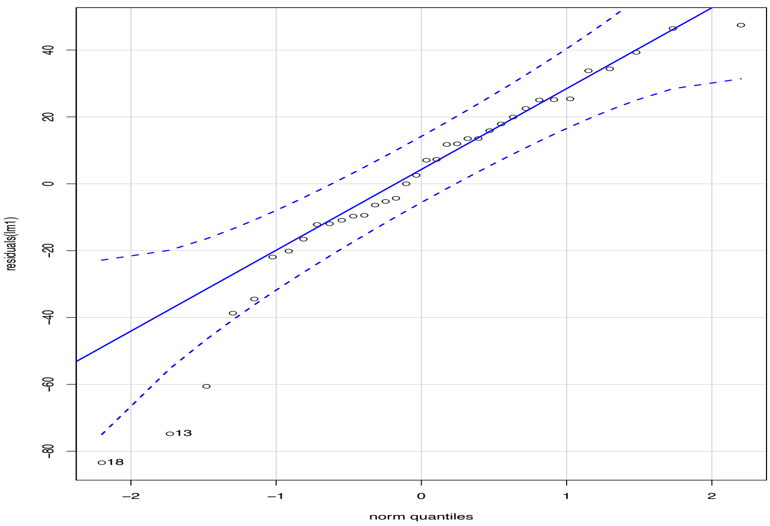
Figure 127: Tukey-Anscombe-plot for regression 6



Source: Own figure

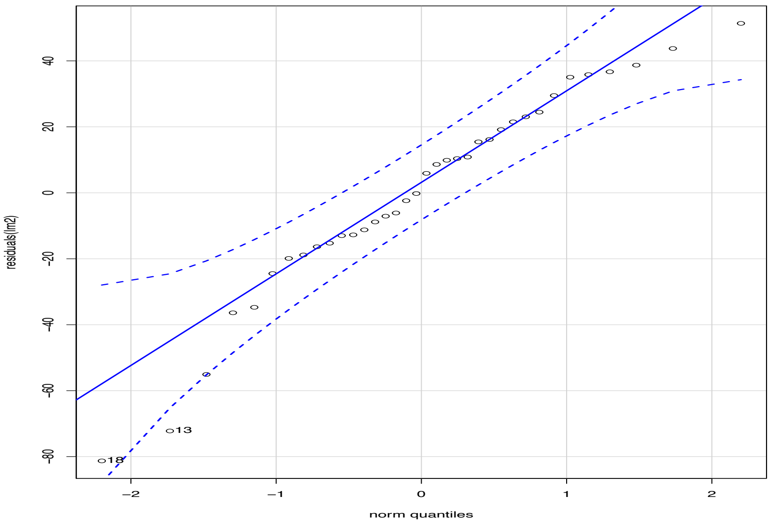
Appendix 20: Residual q-q-plots for the regression 1 to 6 of G2NEW

Figure 128: Residual q-q-plot of regression 1



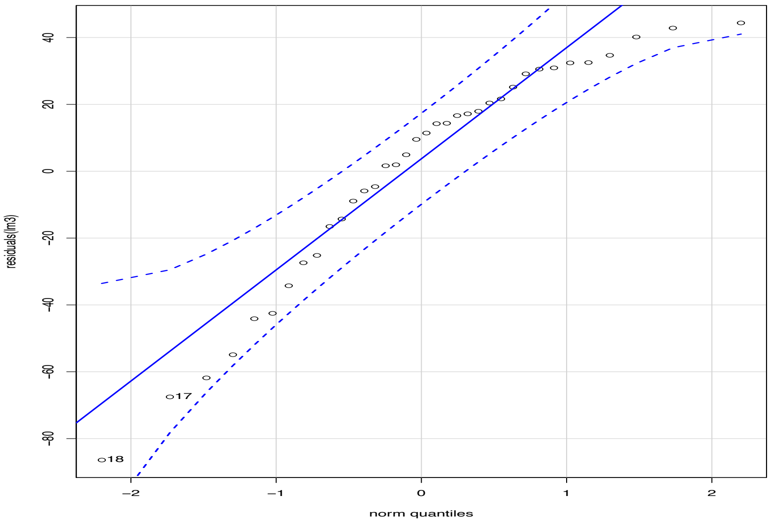
Source: Own figure

Figure 129: Residual q-q-plot of regression 2



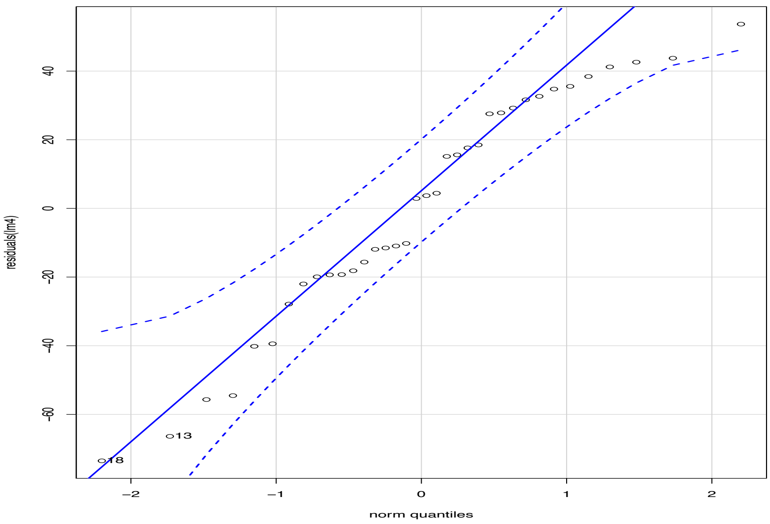
Source: Own figure

Figure 130: Residual q-q-plot of regression 3



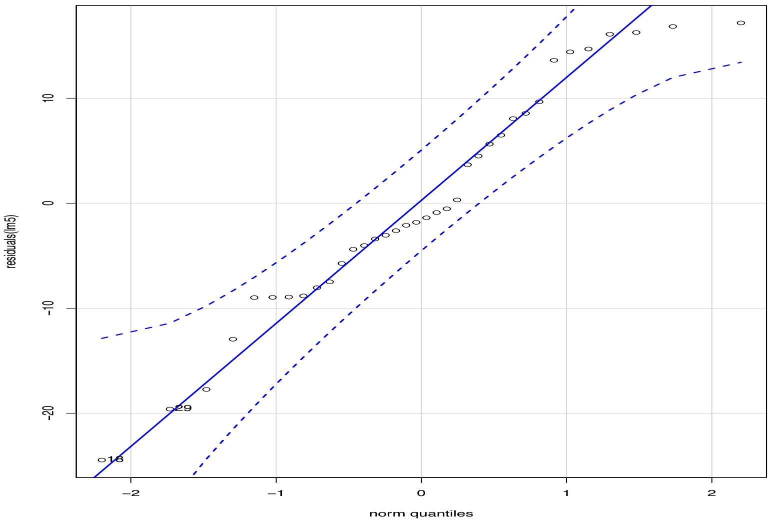
Source: Own figure

Figure 131: Residual q-q-plot of regression 4



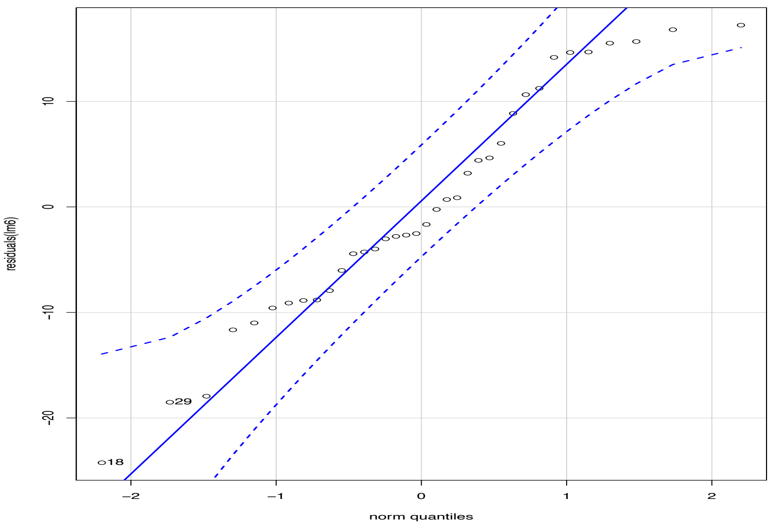
Source: Own figure

Figure 132: Residual q-q-plot of regression 5



Source: Own figure

Figure 133: Residual q-q-plot of regression 6



Source: Own figure

Appendix 21

Equation 10: Calculation of the RWA

$$\text{Correlation (R)} = \frac{0.12\times\left(1-EXP(-50\times PD)\right)}{(1-EXP(-50)+0.24\left[1-\frac{\left(1-EXP(-50\times PD)\right)}{\left(1-EXP(-50)\right)}\right]} \quad (1)$$

$$\text{Maturity adjustment (b)} = (0.11852 - 0.05478 \times \ln(\text{PD}))^2 \quad (2)$$

$$\text{Capital requirement (K)} = \left[\text{LGD} \times \text{N}\left[(1-\text{R})^{-0.5} \times \text{G(PD)} + \left(\frac{\text{R}}{(1-\text{R})^{0.5}}\right) \times \text{G}(0.999)\right] - \text{PD} \times \text{LGD}\right] \times (1-1.5\times \text{b})^{-1} \times (1+(\text{M}-2.5)\times \text{b}) \quad (3)$$

$$\text{Risk} - \text{weighted assets (RWA)} = K \times 12.5 \times EAD \quad (4)$$

Source: BCBS, 2004, p. 60

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