Behavioral Finance Views on Bank Regulation to Strengthen Bank Stability

Dissertation

zur Erlangung des Grades eines Doktors

rer. pol.

der Fakultät III – Wirtschaftswissenschaften, Wirtschaftsinformatik

und Wirtschaftsrecht der Universität Siegen

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Datum der Disputation: 24.05.2023

Dekan der Fakultät III:

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Acknowledgments

In the context of my dissertation, I would like to express my gratitude to a few special people.

First and foremost, I would like to thank my PhD supervisor, Prof. Dr. Wiedemann, who has always supported, encouraged, and counseled me during my time at the Chair of Banking and Finance. Besides enabling me to develop professionally as well as personally as a lecturer, he gave me the opportunity to follow my own research interests. Because of him, I can look back on a unique and instructive chapter in my life ending with this dissertation. In addition, I would like to show my appreciation for Prof. Dr. Hiebl and Prof. Dr. Stein for their support and guidance in my research projects. In particular, Prof. Dr. Hiebl's fruitful discussions and his scientific expertise helped my methodological development enriching my publications. Furthermore, I would like to thank Prof. Dr. Eigler for chairing the dissertation committee.

I am grateful to my co-authors Christiane Bouten, Arndt-Gerrit Kund, Nicolas Mues and Florian Neitzert for the excellent and exciting collaboration within our research projects. I am equally obliged to my colleagues Michelle Graversen, Jan-Philipp Dielmann and Yanik Bröhl. You have shown me that working together can form fantastic friendships. Moreover, I would like to acknowledge Maria Otten, who is always there for me and my colleagues, especially in times of need. In short, you all make it incredibly hard for me to say goodbye.

Further, I am beyond grateful for my mother, who has always believed in me and motivated me over the years. Finally, let me express my perhaps deepest thanks to my wife, Kerstin for not only supporting me privately but also academically by always having my back.

Sometimes it is difficult to put thoughts into words. Therefore, consider this as a sincere gratitude and appreciation for all you have done and accomplished for me.

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List of Abbreviations

ABS	Association of Business Schools
AT1	Additional Tier 1
BCBS	Basel Committee on Banking Supervision
CEO	Chief Executive Officer
CET1	Common Equity Tier 1
CoCo bonds	Contingent Convertible Bonds
Cons	Constant
CPI	Consumer Price Index
C2GDP	Credit to GDP Gap
e.g.	Exempli Gratia
FSB	Financial Stability Boards
GDP^{growth}	Annual Change in GDP
i.e.	Id Est
ln(GDP)	Logarithm of GDP in USD
LR	Leverage Ratio
MREL	Minimum Requirement for Own Funds and Eligible Liabilities
NII	Net Interest Income
NNII	Net Non-Interest Income
NOPI	Total Net Operation Income
NPL	Ratio of Non-Performing to Total Loans
PANAS	Positive and Negative Affect Schedule
QCA	Qualitative Content Analysis
ROA	Return on Assets
ROE	Return on Equity
ROID	Income Diversification
Size	Logarithm of Total Assets
TLAC	Total Loss Absorbing Capacity
T1	Tier 1
T2	Tier 2
VHB	German Academic Association of Business Research

A. Introduction

A.1. Motivation of the Research Topic

The financial crisis of 2007 and 2008 put global bank regulation and supervision to the test (Anginer et al. 2021). Excessive risk-taking by bankers and investors and the resulting opaque securitization, weak risk management, and lack of transparency in financial decisions acted as fire accelerants of systemic risk in the banking landscape (Bermpei et al. 2018). As a result, regulatory frameworks and regulations have been fundamentally overhauled. However, despite longstanding efforts, banks and regulation are still in a discovery phase (Cihak et al. 2013; Anginer et al. 2021), and scandals continue to overshadow the banking landscape, such as the Libor scandal of 2011 and the Cum-Ex transactions of banks in Germany, to name a few.

Research, regulation, and practice continue to search for solutions. Given the ongoing problems, it could be assumed that the revisions and innovations in banking regulation to date have failed to achieve their goal. While the bank capital adequacy regulation is well advanced, overregulation may generate undesirable effects and inhibit bank productivity and efficiency (Barth et al. 2013). Therefore, instead of fundamental criticism, it seems reasonable to look for new steering impulses within bank regulation.

This dissertation is intended as a starting point in this regard. The origins of the crisis and resulting regulatory priorities are first presented in detail. The aim of this dissertation is to sharpen the regulatory focus by presenting three papers and formulate steering impulses for regulation. To better identify the commonalities between the three papers presented in this dissertation, the course of the financial crisis in 2007 and 2008 and countermeasures developed as the core of current regulatory efforts receive close scrutiny.

The financial crisis of 2007 and 2008 resulted from an excess of systemic risks. Systemic risks are partial or complete disruptions of the financial system that can lead to serious consequences for the real economy (FSB 2009). The rise of these risks was already apparent after the dotcom

bubble in 2000. The high liquidity in the U.S. market fostered by the Federal Reserve ensured a consistently low U.S. federal prime rate (Acharya and Naqvi 2012). As a result, credit became more attractive to customers of all creditworthiness classes, motivating bankers to extend more and more mortgage loans to customers with low credit ratings. By 2006, the share of subprime mortgage loans had risen to 13%. They alone accounted for 20% of all new residential mortgages (Crouhy et al. 2008). As a result of high demand, house prices rose. Cheap loans and rising prices seemed like a high-return, low-risk bet for bankers and customers. Customers wanted to take advantage of the upward trend in the housing market. Bankers, in turn, profited from the commissions on their new business. To ease the burden on their own bank balance sheets, the subprime mortgage loans at risk of default were securitized with loan receivables from customers with medium and good credit ratings into mortgage-backed securities and passed onto third parties (Duca et al. 2010). The resulting diversification effect within the newly created security was intended to limit default risk and absorb the potential defaults of subprime mortgage loans.

The focus on profits led to an underestimation of the systemic risk growing in the background. Banks worldwide believed in mortgage-backed securities as interesting investment opportunities with an attractive risk/return profile (McLemore et al. 2022). The consequences of this became apparent after the key U.S. prime rate rose again. House prices fell, loans became more expensive, and customers of all creditworthiness classes were increasingly unable to meet their liabilities (Kouretas 2009). The consequences of the crisis shook financial and banking stability at an unprecedented scale. The high write-downs created a banking crisis, which often ended in bail-outs, with banks having to be financially supported by government intervention (Leanza et al. 2021). The financial crisis increasingly turned into a sovereign debt crisis.

Numerous actions were taken to manage the systemic risks that had arisen. In addition to quick rescue packages in the form of monetary and fiscal policy support, G20 countries called for the

long-term stabilization of the financial system, which was addressed by revising the Basel Framework (BIS 2010a). Other actions included expanded bond purchases between 2010 and 2014 to stimulate the real economy, which was unable to withstand the pull of the recession. Then, at the end of 2015, the prime rate in Europe, which had been falling steadily toward the zero bound since 2008, gradually rose again (Cukierman 2019).

This course of the financial crisis revealed the extent to which excessive risk-taking combined with the insufficient loss-absorbing capacity of banks can damage economies (Demirguc-Kunt et al. 2013). Counteractive measures such as monetary and fiscal policy tools, bond purchases, and prime rate changes were some of the direct policy actions taken to mitigate the acute consequences of the crisis. Their core purpose was macroprudential control at the time of the crisis to lead to and generate economic equilibrium (Angeloni et al. 2015). The actions were initiated by states or central banks on the basis of economic policy considerations. Since this dissertation intends to generate new impetus for the regulatory requirements, macroprudential control and actions are not the subject of further investigation.

Regulatory efforts included the revision of the Basel Framework by the Basel Committee on Banking Supervision (BCBS). The aim of this initiative was to increase resilience to future crises in microprudential terms (i.e., at the bank level). Global uniform standards were intended to counter systemic risks and support the procyclical behavior of banks before and during crises (Ly and Shimizu 2021). The overarching aim was to combat banking crises proactively rather than symptomatically. The BCBS was supported in this by supervisory bodies such as the Financial Stability Board (FSB) and European Banking Authority, which also monitor the global financial system as recommendation-issuing bodies. The revision of the Basel Framework manifested in the new Basel III regulations (BIS 2010b).

The first publications of the Basel Accord after the financial crisis focused on improvements in the quantity and quality of a bank's regulatory capital. For example, the BCBS published

proposals to improve global capital regulation and capital conservation, the ratios for liquidity management, the leverage ratio as a corrective measure for risk-based capital, and the calculation bases for determining risk-weighted assets (BIS 2010a).

At this point, a second focus area began to emerge, which was to become increasingly important in subsequent years. To ensure that all the regulatory requirements were met, the BCBS and FSB shifted the focus to responsible corporate governance (BIS 2010b, p. 335) and a solid risk culture within banks (BIS 2010b, p. 536). In doing so, they signaled that communication and employee behavior are as important as the mathematical models used to determine regulatory capital.

Based on the preliminary conceptual considerations so far, the initial question for this dissertation can be described as follows: What insights can be derived from the financial crisis (as a representative event of other crises and scandals) that have not yet been intensively investigated in regulation and what implications can arise from these insights for the two regulatory focal points (quantitative mathematical approaches and communication and behavioral approaches). The aim is to analyze the extent to which the topics are interrelated, and emerging interdependencies can generate new steering impulses for regulatory initiatives. The greatest commonality of the topics discussed is that all past undesirable developments resulted from the individual decisions of decision makers. This opens up a new perspective for banks and regulation. In addition to the common arguments that a too low loss absorption capacity of banks or the too strong performance orientation in bankers' compensation structures led to the crisis (Fabrizi 2018), the gaze should be directed toward the individual decisions of decision makers. This could lead to the insight that the focus should be shifted from trying to improve the existing regulatory requirements for banks to the question of whether management properly implements the regulatory requirements or for what reasons they do not.

Hence, the individuality of people has to be analyzed. The heterogeneity of banks' decision makers also leads to different situation assessments (Buelow and Cayton 2020). Groundbreaking in this context are the findings of Hambrick and Mason (1984) and Bertrand and Schoar (2003). Hambrick and Mason (1984) showed early on that upper echelon characteristics influence the outcome of an organization. Bertrand and Schoar (2003) also found an influence of decision makers on organizational performance based on their individual managerial style. These research papers underlined that the different behaviors of decision makers and their individual situation assessments are important factors influencing the strategy of banks as well as their risk-taking. This aspect is particularly interesting in relation to banking crises. If the influence of the individual characteristics of decision makers on banks' risk-taking can be systematically derived and recorded in an overarching framework, this could be a strong argument that decision makers' regulation decisions deserve attention as opposed to the regulatory requirements themselves needing to be tightened.

The research area must be separated from the questions discussed in corporate governance. While corporate governance formulates requirements for decision makers (John et al. 2016), our approach serves to examine decision making and decision-making quality in greater detail. Unlike corporate governance, it does not formulate a target state, but examines the actual state of behavior. The financial crisis of 2007 and 2008 serves as an instructive starting point, as research interest in managerial behavior has increased significantly since then. However, the factors to which the heterogeneity of decision makers can be attributed remain to be investigated.

Furthermore, it needs to be investigated whether, despite the existing heterogeneity, all decisions are of consistently high quality, a decisive point with respect to the systemic risk of the banking system. If decision quality as a whole is variable, this would explain why systemic risks reached irrational levels in the years before the financial crisis. Accordingly, it is necessary

to examine whether decision makers' behavior varies depending on their individual characteristics but overall make adequate decisions on the implementation of the regulatory requirements.

To analyze decision makers' behavior collectively, it seems useful to check to what extent they can also implement the mathematical focus of regulation within banks. Thus, whether and how decision makers actively manage regulatory capital with appropriate financial instruments could be examined. More specifically, whether decision makers use the most qualitatively appropriate financial instruments to manage their bank's going-concern capital (capital that should ensure the continuation or orderly resolution of banks) could be analyzed. To analyze this effect, whether suitable financial instruments are issued when the headroom between the required regulatory capital ratios and bank's actual capital ratios is low could be examined. If decision makers make adequate decisions on their regulatory capital management, the issuance of financial instruments should increase when such headroom is low. If this is not the case, decision makers may seem unable to make the right decisions for their banks on an ongoing basis due to their individual characteristics. To better understand the importance of active capital management in the context of this dissertation, it is first necessary to briefly describe the structure of regulatory capital.

Regulatory capital ratios are defined as follows: Tier 1 (T1) capital consists of Common Equity Tier 1 (CET1) at 4.5% and Additional Tier 1 (AT1) at 1.5%. In addition, there is further capital in the form of Tier 2 (T2) capital as supplementary capital at 2%. The required percentages can be achieved with various financial instruments. CET1 includes a combination of shares and retained earnings. AT1 and T2 consist of subordinated financial instruments (BIS 2010a). In addition to these capital components, regulatory capital consists of additional capital buffers such as the capital conservation buffer, countercyclical capital buffer, and systemic risk buffer, which are not discussed in more detail because they are not significant for the focus of this

dissertation. In addition to these capital ratios, there are bank-specific adjustments. For example, global systemically important banks (G-SIBs) must hold more loss-absorbing capital, which is defined by total loss-absorbing capacity (TLAC). Accordingly, G-SIBs must now hold an additional 18% of their risk-weighted assets as well as 6.75% of the denominator of the liquidity ratio. The liquidity ratio itself must be at least 3% and may also be subject to bank-specific adjustments (Deutsche Bundesbank 2016).

The extent to which banks exceed the required minimum ratios depends on their individual risk-taking or definition of sufficient loss-absorbing capacity. If, for example, decision makers use financial instruments of inferior quality to manage their going-concern capital, this would demonstrate that the regulatory requirements are sometimes deficiently implemented and would further signal a change of direction for the regulatory requirements. Steering impulses are needed to improve decision making, as decision makers influence the risk-taking of the bank through their individual behavior and, sometimes, inadequate decisions, which partly leads to crises.

Following this line of argumentation, a steering impulse could come from an expansion of the BCBS's communication and behavioral approaches. Existing approaches focus directly on employees and influence decision making. To sensitize employees and decision makers to risk issues such as the active management of regulatory capital, a risk-related tone from the top in line with the risk culture of the respective banks could help. Although the idea of an adequate risk culture is not new in regulation, suitable implementation ideas are lacking in practice. In line with the focus of this dissertation, a well-implemented risk-related tone from the top could help employees and decision makers to make better decisions that correspond with banks' risk-taking.

The dissertation is structured in three stages. First, we examine whether the individual characteristics of decision makers influence the risk-taking of banks, thereby leading different

decisions to arise. Based on this, we use the example of mathematical models related to regulatory focus to examine the extent to which the regulatory requirements are adequately implemented by decision makers overall. Using the example of communication and behavioral approaches to regulation, we then show how a steering impulse in the form of a risk-related tone from the top can help improve the implementation of the regulatory requirements. The risk-related tone from the top should ensure that decision makers act in the spirit of the bank's risk-taking and consider risk in all decisions.

Based on the conceptual understanding developed so far, this dissertation addresses the following research questions:

Research question 1: What is the influence of the individual characteristics of decision makers on a bank's risk-taking?

Research question 2: Are the decision making and decision-making quality of decision makers consistent with the desired implementation of the regulatory requirements?

Research question 3: How can decision makers communicate risk-related issues so that they are adequately implemented in the bank?

In line with these research questions, this dissertation is organized into three papers (see Table A1 for a summary of the titles, authors, methods, papers, and history of submissions and presentations of the papers). Taken as a whole, these papers aim to provide a steering impulse for regulation to improve the implementation of the regulatory requirements.

Title	Authors	Methodology and sample	Contribution	Presentations and submissions
The Relationship Between CEO Characteristics and Banks' Risk-Taking: Review and Research Directions	Patrick Hertrampf Martin R. W. Hiebl Arnd Wiedemann	Systematic Literature Review: Sample of 58 empirical articles on CEO characteristics and banks' risk-taking.	(a) Providing the first systematic literature review on CEO characteristics and banks' risk-taking. (b) Developing of an overarching framework in relation to the topic addressed. (c) Critical analysis of the methods and variables used to measure banks' CEO characteristics and risk-taking and identifying future research avenues based on the findings.	Presented at the HVB PhD Research Seminar 2020 at the University of Düsseldorf, the Risk Governance Conference 2020 at the University of Siegen, and the British Accounting and Finance Association (BAFA) 2022 at the University of Nottingham. Submitted and accepted for presentation at the European Academy of Management (EURAM) 2022 at the School of Management and Law in Zürich and the Annual Conference for Management Accounting (ACMAR) 2022 at the WHU – Otto Beisheim School of Management in Vallendar. Submitted to *European Financial Management* (VHB-Jourqual3: B).
Bail-in Requirements and CoCo Bond Issuance	Arndt-Gerrit Kund Patrick Hertrampf Florian Neitzert	Quantitative: Data cover 49 publicly listed significant institutions from 22 countries over 2012 to 2018 with 389 issued CoCo bonds during this time.	(a) AT1-eligible CoCo bonds are issued more when the bank's leverage ratio headroom is closer to the minimum regulatory requirements. (b) There is no correlation between T2 CoCo bond capital issuance and TLAC headroom.	Submitted to *Finance Research Letters* (VHB-Jourqual3: B): Accepted.

Title	Authors	Methodology and sample	Contribution	Presentations and submissions
The Risk-Related Tone from the Top: Evidence from German Regional Banks	Arnd Wiedemann Volker Stein Christiane Bouten Patrick Hertrampf Nicolas Mues	Sequential Mixed Methods Design: Surveying 197 board members in 2019 and conducting eight interviews with CEOs of German regional banks. Combining the results with the current state of the research and the 2014 FSB Guidelines.	(a) Measuring the self-perception of the risk-related communication behavior of board members. (b) Developing requirements and practical guidance on how the tone from the top can implement a risk-related common set of values in the bank.	Presented at the Risk Governance Conference 2021 at the University of Siegen. Submitted to the *Journal of Risk Research*: Accepted.

Table A1: Detailed overview of the three research papers included in this dissertation

A.2. Associated Research Papers and Methodological Approach

A.2.1. Influence of behavioral factors of decision makers on the risk-taking of banks

In the media, the causal chain of the financial crisis of 2007 and 2008 can be deduced primarily from bankers' greed for profit that ultimately drives banks' risk-taking (Srivastav and Hagendorff 2016). With respect to the general influence of risk-taking, research has found more nuanced results, although research gaps still exist, which are expected to be filled by this dissertation. In particular, the variations in risk-taking can be traced to several factors. The common origin, however, are still the decisions of decision makers that subsequently result in risks such as insufficient capital adequacy and using the wrong financial instruments (Tversky and Kahnemann 1981).

This leads to the question of whether the decisions made are homogeneous and of consistently high quality. Heterogeneous decisions based on individual decision makers' characteristics might distort banks' risk-bearing capacity. Research typically shows that the individual characteristics of decision makers trigger risk-taking by banks and lead to heterogeneous decisions (Delgado-García et al. 2010); however, the results are mixed and fragmented and fail to provide an overarching picture. To understand the influence as a whole, a framework is thus needed that shows the interdependencies between decision makers' different characteristics and banks' risk-taking.

Therefore, in the first paper of this dissertation (The Relationship Between CEO Characteristics and Banks' Risk-Taking: Review and Research Directions, Section B), a critical systematic literature review is conducted. By collating the empirical findings, literature reviews can make an overall statement about a research focus. Critical analyses are especially important when research is disparate and interdisciplinary, as they can identify research gaps and suggest new methods (Snyder 2019).

The literature search is conducted following the three-phase model suggested by Tranfield et al. (2003). The first phase should aim to provide information about the motivation and necessity of the research topic under investigation. For this purpose, preparatory measures are taken, such as sketching an overview of the content, to start the subsequent research in a targeted manner.

For the second phase (quality check of the papers) and third phase (evaluation of the results), several research methods are combined to ensure that the quality of the sample reaches the highest possible scientific level. To ensure the highest quality standards, only those papers listed in the Association of Business Schools (ABS) Guide 2018 are included in the literature review. In addition, they are selected according to the A/B/C logic of Pittaway et al. (2004). The bibliographies of the identified papers are searched to find further potential papers, following Webster and Watson's (2002) procedure. Only those papers that clearly fit the research topic according to the defined fixed restrictive scheme are included in the sample. The final sample has 58 papers.

After the selection of qualified contributions, the evaluation takes place in the third step. Instead of a pure reproduction of the contents, a more demanding integrative approach is chosen for this literature review. The focus is on a critical reflection of the results and generation of new knowledge (Torraco 2005). The analysis follows Alvesson and Sandberg (2014, 2020). Our critical systematic literature review aims to describe the current state of the literature, identify problematic or limiting views, and find new ideas from the various streams of interdisciplinary research. To break up traditional scientific views and pursue new ways for research, regulation, and practice, novel ideas, theories, and models should be proposed instead of using tried-and-tested scientific approaches (Alvesson and Sandberg 2014).

The framework should then be developed using the upper echelons theory. The research results should provide crucial information on how the decisions of CEOs (defined in this paper as decision makers) affect the risk-taking of banks. Based on the analysis, demographic, socio-

psychological, psychological, and biological characteristics that affect a CEO's decision making and thus a bank's risk-taking can be identified. In this context, antecedents can amplify the influences. Depending on the variables considered, increasing, decreasing, and varying effects on risk-taking can be identified. The analysis of these effects shows no reason to assume that continuously occurring irrational behavior can be attributed to CEOs. Only heterogeneity can be confirmed that influences risk-taking. The question remains of whether adequate decisions are made for the sake of a bank despite the heterogeneity present in the collective.

A.2.2. Regulatory capital management driven by decision makers

To answer the second research question, we examine whether the quality of the decisions of decision makers is consistent with an efficient fulfilment of the regulatory requirements. If the decisions are of consistently high quality (i.e., all banks in the sample fulfil the regulatory requirements with the least effort for them), this would indicate that the decision-making process is without meaning for the regulatory authorities. In other words, focus should remain on quantitative models to limit risk-taking. Thus, communication and behavioral approaches would have no or only a negligible impact on banks' risk-taking. Conversely, if the heterogeneous decisions and hence risk-taking of banks can be observed, decision behavior at the individual level as well as that of all decision makers seem to be an essential new aspect for regulatory efforts.

Therefore, the second paper of this dissertation (Bail-in Requirements and CoCo Bond Issuance, Section C) examines 49 listed banks from 25 countries from 2012 to 2018. We analyze 214 AT1 and 175 T2 contingent convertible bonds (CoCo bonds), which were designed to improve the qualitative and quantitative capital adequacy of banks after the financial crisis. CoCo bonds are hybrid subordinated financial instruments that can be counted in AT1 as well as in T2. In balance sheet terms, banks have the option of recognizing them as either equity or debt. They can be converted into CET1 or extraordinary profits by means of a contractually

defined trigger. Therefore, CoCo bonds are beneficial for banks. The fixed trigger event strengthens a bank's loss absorption capacity as well as absorbs the potential deficits in bail-in capital. Since the financial crisis, banks have been obliged to follow the bail-in principle; that is, they must increase their TLAC to reduce the probability that they would resort to the bailout fund in the event of a resolution.

Due to the design characteristics of CoCo bonds (i.e., they are preferred over de jure instruments) and characteristics of AT1 and T2 capital, it can be assumed that the respective recognition is an active management decision. The alternative would be to raise further equity; however, this often turns out to be costly. The variability of CoCo bonds in their balance sheet allocation is a further advantage. While AT1 capital is subject to the going-concern approach and influences TLAC and the liquidity ratio, T2 capital is subject to the gone-concern approach and influences only TLAC. Measured against the headroom of the liquidity ratio and TLAC compared with the regulatory minimum capital ratios, whether the decision makers of banks use the design features of CoCo bonds to manage their going- or gone-concern capital ratios specifically is examined.

For the analysis, a panel dataset is used in which the CoCo bond issues are assigned to the respective bank. This results in a dataset with 343 bank-year observations. As panel data analyses interrogate and measure changes in units at constant intervals, they capture the dynamics of change within the dataset (Hsiao 2022). Thus, in this paper, CoCo bond emissions at the bank level are examined over several years. A regression model with bank and time fixed effects is used for the evaluation. Stepwise, the model is extended to control for bank- and macro-specific variables.

The results are expected to shed light on whether banks with a low liquidity ratio headroom issue AT1-eligible CoCo bonds more frequently. At the same time, we examine whether banks with a low TLAC headroom issue more T2-eligible CoCo bonds. The results provide significant

implications for regulation. If the hypothesis can be rejected, the results would suggest that banks use other de jure debt instruments in AT1 and T2 that do not have the resilience of hybrid capital. This would confirm that while decision makers comply with the regulatory requirements, they – consciously or unconsciously – do not make the best decisions in terms of their bank's loss absorbency.

A.2.3. Improved risk awareness through a risk-related tone from the top

The previous papers serve to uncover that the individual characteristics of decision makers influence their decisions and thus a bank's risk-taking. The third paper (The Risk-Related Tone from the Top: Evidence from German Regional Banks, Section D) provides a steering impulse aimed at regulation. Furthermore, this paper intends to offer practical implications by presenting an implementation schedule for banks. In doing so, the results of the paper reveal the importance of elaborating on and expanding communication and behavioral approaches for regulation. In terms of content, the aim is to improve both the risk-related decision making of decision makers and the quality of their subsequent decision making.

In 2014, the FSB published its "Guidance on Supervisory Interaction with Financial Institutions on Risk Culture", an initial guide to implementing a risk culture. Risk culture, as defined by the FSB, consists of four elements: tone from the top, accountability, effective communication, and challenge and incentives. The third paper addresses a risk-related tone from the top as part of the risk culture. The aim is to create a self-reinforcing process that sensitizes employees in general but decision makers in particular, as they initiate the risk-related tone from the top to make decisions in line with the risk-bearing capacity of their bank. Self-reinforcing in this context means that the process is intended to create a feedback effect. It starts with decision makers as initiators of the risk-related tone from the top and their role model function and is intended to influence employees' risk-taking on behalf of the bank. At the same time, the

behavior of employees and results of their actions are reflected back to them and might lead them to change their decision making.

A sequential mixed methods design is chosen for the study. In the first step, the opinion of a population is assessed using a quantitative analysis. In the second step, the results are complemented and analyzed in more detail by a qualitative analysis of expert opinions derived from interviews to reveal the otherwise unobserved heterogeneity in the responses within the quantitative analysis (Ivankova et al. 2006).

In the third paper, the quantitative analysis is conducted using a questionnaire on risk-related communication by board members. The questionnaire was sent in letter form to 379 board members of German regional banks between August and December 2019. The response rate after the first mailing was 42% (158 responses) of usable questionnaires. Two follow-up mailings increased this to 52% (197 responses) of usable questionnaires for the analysis. Usable questionnaires include those with only a few missing responses. The usual tolerance level for missing responses is an error rate of about 5% (Tabachnick and Fidell 2013). For the present study, missing values are imputed using linear interpolation. This is characterized by a linear fit, consistent with the neighboring points within the population. Compared with other methods, the advantage is that the knowledge generated from the study can be used to estimate the single value (Nielsen 2019).

The questionnaire is analyzed descriptively. Three elements are examined. The first element includes contextual variables such as personal characteristics (e.g., age of the respondent) and bank information (e.g., number of employees, total capital ratio). The second element relates to questions on management style and communication behavior. For this, the board members are asked about semantic differentials (i.e., bipolar pairs of adjectives), following the example of Osgood and Tannenbaum (1955). The weighting toward a particular adjective can be expressed using a Likert scale. The third item is designed to reveal the extent to which board members

personally perceived that a risk culture has already been implemented in their bank. As before, respondents express their agreement with certain statements on risk culture using a Likert scale (see Appendix Table A3).

The qualitative analysis is conducted with the help of a literature review and eight semi-structured expert interviews with the CEOs of German regional banks. In addition to quantitative analysis, expert interviews allow researchers to better capture external circumstances and emotions to discover new knowledge and interdisciplinary approaches (Antwi and Hamza 2017). Due to the semi-structured nature of the interviews, although key questions are formulated in advance, interviewees are free to respond. Semi-structured interviews also allow researchers to capture the dynamics of the interview, as they can spontaneously respond to contextually arising topics and formulate further questions (see Appendix Table A2).

The analysis is carried out using a qualitative content analysis, which includes or confirms the results from the semantic differentials. The methodological procedure is based on Thomas (2006). After transcribing the interviews, patterns on the communication behavior of board members are inductively filtered, from which a system of categories is derived using the MaxQDA software. The evaluation of the quantitative and qualitative analysis is subsequently consolidated in a table using the 2014 FSB Guidelines. The results improve our understanding of the regulatory requirements and provide implications for practice, ensuring that the requirements can be better implemented in daily life.

The remainder of the dissertation is organized as follows. Following this introduction in Section A, Papers 1–3 are presented in Sections B, C, and D, respectively. Section E discusses and concludes the results.

B. The Relationship Between CEO Characteristics and Banks' Risk-Taking: Review and Research Directions

Authors: Patrick Hertrampf, Martin R. W. Hiebl, Arnd Wiedemann

Paper´s status: This paper has been presented at the HVB PhD Research Seminar 2020 at the University of Düsseldorf, the Risk Governance Conference 2021 at the University of Siegen and the British Accounting and Finance Association (BAFA) Conference 2022 at the University of Nottingham. The paper has been accepted for presentation at the European Academy of Management (EURAM) 2022 at the School of Management and Law in Zürich as well as accepted for presentation at the Annual Conference for Management Accounting (ACMAR) 2022 at the WHU – Otto Beisheim School of Management in Vallendar. The paper has been submitted to the *European Financial Management*.

We, the authors of the paper, hereby declare that this paper's first author, Patrick Hertrampf, was responsible for collecting and analyzing most of the data and writing most of the paper.

Patrick Hertrampf

Martin R. W. Hiebl

Arnd Wiedemann

B.1. Introduction

A variety of factors influence the risk-taking of banks. Well-known examples of external macro-factors are the monetary policy of central banks, banking supervision and the general economy (Angeloni et al., 2015; Maddaloni and Peydró, 2011; Delis and Kouretas, 2011). However, especially in times of crisis, another factor stands out: the human factor (Power, 2009). In particular, the global financial crisis of 2007 and 2008 marked the peak of an era of excessive risk-taking by banks (Delis and Kouretas, 2011). The crisis proved that managers' individual behavior, especially the behavior of CEOs, has a significant impact on the risk-taking of their banks (Ganon et al., 2017). Against this backdrop, in this paper, we examine how CEOs affect banks' risk-taking. Due to their leadership responsibility and competency in strategic decision-making, they are the key representatives of human factors in relation to a bank's risk-taking (Andreou et al., 2016; Medcraft, 2016).

In the finance literature, the influence of the individual characteristics of CEOs and their sometimes irrational behavior on a bank's risk-taking has long been underrepresented (Bertrand and Schoar, 2003). This research area has only received increased scholarly attention in recent years. However, the findings in this literature appear fragmented and inconclusive and consensus on the influences, interdependencies and interrelationships is lacking. In the present paper, we provide a critical evidence-based survey of existing research on CEO characteristics and banks' risk-taking to suggest improvements and new ideas for research, regulation and practice (Leuz, 2018). Evidence-based management serves as a means to base decisions by regulators and practitioners related to the influence of CEOs on the risk-taking of banks on scientific and empirical evidence (Rousseau et al., 2008).

Methodologically, we provide a systematic literature review (Simsek et al., 2021; Tranfield et al., 2003) of research that has empirically examined the relationship between CEO characteristics and banks' risk-taking. Such systematic review methods have traditionally

received little attention in the finance literature. However, they have recently become increasingly popular (e.g., Klarin, 2020; Babar and Habib, 2021; Pitthan and Witte, 2021). Our review is guided by the ideas of Alvesson and Sandberg (2013). We thus aim to critically reflect and – where necessary – reimagine the existing literature in a way that new light is shed on existing phenomena to generate new insights and open the view for other ways of thinking about them (Patriotta, 2020).

We use Hambrick and Mason's (1984) upper echelons theory to illustrate the relationships between CEO characteristics and the risk-taking of banks to bridge existing research gaps. Upper echelons theory has already received vast attention in the management literature (e.g., Abatecola and Cristofaro, 2020; Neely et al., 2020) compared with in the finance literature. Using this theory, we aim to explain how CEO characteristics influence banks' risk-taking and suggest a theory-driven agenda for future research. Among other findings, we show that current risk-taking variables exhibit too much heterogeneity and that a reclassification of those variables could provide better information about banks' risk-taking. We also present extensions of upper echelons theory that have not yet been explored in the finance literature.

The remainder of our paper is organized as follows. In Section 2, we provide the theoretical and empirical basis and introduce upper echelons theory. In Section 3, we detail our review methods and sample construction. In Section 4, we present the content analysis and identify problems, for which we propose solutions in Section 5. The paper ends with a conclusion.

B.2. Theoretical and Empirical Background

B.2.1. Behavioral finance and banks' risk-taking

The finance literature has predominantly been guided by rational choice theory, which views individuals and thus CEOs as a collective and assumes that they act rationally in principle as well as in uncertain situations (Bachelier, 1900; Mandelbrot, 1963). Neoclassical economics theories such as the efficient market hypothesis are based on this idea (Fama et al., 1969).

Accordingly, CEOs are assumed to have homogeneous expectations of the probability of economic market situations occurring (Sharpe, 1964; Lintner, 1965). Although they may vary in their risk-taking, their market assessments are identical and decisions rational under uncertainty (Fama, 1970).

In the economics and finance literature, the guiding principle of the rational choice theory has received increasing criticism. According to Shiller et al. (1984), uncertain situations alter individuals' risk-taking and induce behavioral anomalies. By examining investor behavior, they provide empirical evidence that irrational asset price movements in capital markets can arise from social dynamics. However, rationally acting individuals would not participate in this under the framework of rational choice theory (Shiller, 2003).

Important implications from these advancements for our paper include that social dynamics suggest herd behavior. Accordingly, the decisions of individuals are not always rational; they may also be subject to behavioral anomalies (Shiller, 2016). In addition to differentiating between rational and irrational decision bases, research finds evidence that certain behavioral characteristics apply only to certain groups of individuals within a collective (MacCrimmon and Wehrung, 1990).

Mano (1994) states that collectivistic behavioral anomalies can be reduced or enhanced by manipulating the mood of the individual. This adds an individual-related component to general behavioral anomalies. The influence on the mood state can vary depending on the character of the individual. This opens a new level of behavioral finance. It distinguishes individuals from each other and examines their individual influence on, for example, the outcome of an organization. Both rational and irrational decision-making bases can then be identified. The individual characteristics of a person provide information about their decision-making behavior. This can have both a positive and a negative impact on the organization. The global financial crisis showed that CEOs have a significant impact on financial stability through their

behavior, particularly in too-big-to-fail banks (Zardkoohi et al., 2018). We can thus broadly infer that CEOs and their characteristics may be idiosyncratic and influence their organizations' choices, including banks' risk-taking. However, to date, the finance literature lacks an overarching framework that systematically maps the influence of CEO characteristics on the risk-taking of their banks.

Potential explanatory models are scarce. Bertrand and Schoar (2003) show that managerial fixed effects matter for a wide range of corporate decisions. However, they focus on the general influence of management or managerial style on the economic outcomes of an organization. Kaplan et al. (2012) find a positive relationship between CEOs' general abilities/execution skills and company performance. Abernethy and Wallis (2019) build on the research of Bertrand and Schoar (2003) by distinguishing managerial fixed effects within the managerial effects framework and extending the theory to include demographic, psychological, social-psychological and biological variables. These personal characteristics of top managers align well with Hambrick and Mason's (1984) upper echelons theory that focuses on the characteristics of top managers and elaborates on their influence on an organization's choices and outcomes. Since we want to represent the influences of an individual, we adapt the idea and focus on how CEO characteristics affect a specific organizational outcome: banks' risk-taking.

B.2.2. Upper echelons theory

Previous studies have shown that management decisions are subject to emotional and cognitive influencing factors called behavioral anomalies (Tversky and Kahnemann, 1981; Mano, 1994). Hambrick and Mason (1984) see the organization as a reflection of its CEO. Hence, upper echelons theory explores strategic choices under bounded rationality and states that organizational outcomes can be predicted from CEO characteristics and idiosyncrasies (Plöckinger et al., 2016). For this reason, we adopt upper echelons theory and focus our analysis on CEO characteristics (Hambrick and Mason, 1984).

As CEOs cannot absorb and process all the information in complex decision situations, they fall back on their values and norms to reduce such complexity. Hence, corporate decisions are influenced by the characteristics of their CEO (Hambrick, 2007), including demographic variables such as age, education level and experience (Hiebl, 2014). Subsequently, the relationship between CEO characteristics and strategic choices as well as the outcomes of an organization can be examined (Zona et al., 2013).

Both CEO characteristics and the organization's outcomes can additionally be influenced by its environment and company dynamics such as changes in board structure (Hambrick and Mason, 1984). As indicated above, monetary policy, banking supervision and the general economy can affect banks' risk-taking as well. However, we refrain from examining such antecedents when no direct link can be established to CEO characteristics in the research papers or a subsequent link to banks' risk-taking.

Besides the influence of such external factors, Wowak and Hambrick (2010) extend upper echelons theory to include the idea that CEO characteristics interact with pay arrangements as moderating effects. Hence, they distinguish between sorting and incentive effects. The sorting effect shows that CEOs prefer certain types of pay packages. The incentive effect shows that certain types of pay arrangements influence CEOs' behavior. Wowak and Hambrick (2010) see a connection to the risk-taking of CEOs, as incentive payments may be a primary reason for banks' excessive risk-taking. We thus consider pay arrangements in our analysis if the authors of the reviewed studies examined such effects in combination with CEO characteristics. In contrast to Hambrick and Mason (1984), who classify the financial position as part of CEO characteristics, Wowak and Hambrick (2010) view incentive payments as interacting with other CEO characteristics. Given the paramount relevance of incentive payments in major banks and notion that they can be regarded as an organizational choice rather than a CEO characteristic, we follow the latter view. In summary, upper echelons theory suggests that individual

characteristics, the environment and incentives affect CEOs' decisions, decision quality and risk-taking (Brennan and Conroy, 2013; van Scotter and Roglio, 2020; Wang and Chen, 2020).

In our survey of existing empirical research, we not only focus on the risk-increasing effects of CEO characteristics, but also examine how CEO characteristics can change banks' risk-taking (i.e., we identify the increasing, decreasing and varying effects). To reflect the current state of research, we start with a systematic literature review to generate an overall picture.

B.3. Review Methods

B.3.1. Identification of relevant studies

To determine the impact of CEO characteristics on banks' risk-taking, we followed the evidence-based approach of Tranfield et al. (2003) and conducted a systematic literature review. In particular, we started our search for the relevant literature with a comprehensive keyword search in electronic databases (Hiebl, 2021; Simsek et al., 2021). The CEO keywords consisted of "Chief Executive Officer*" and the keyword acronym "CEO*". The set of bank keywords included "bank*", "financial institution" and "financial firm". The risk-taking keywords only consisted of "risk-taking". We grouped the three keyword types and searched for term triplets in the titles, abstracts and keywords of the papers. We used the following electronic databases: EBSCO Business Source Complete, Emerald, Elsevier, JSTOR, Web of Science and Wiley Online Library. Since no literature reviews on the topic exist, we did not narrow the period of consideration. Hence, we identified 1,740 papers. The selection process is shown in Table B1.

Table B1 shows the individual databases that were used to search the literature sources. Also listed is the backward search, which identified a further 20 papers. After removing the duplicates, column three lists the number of papers that meet our quality threshold based on the ABS journal ranking lists for 2018. The fourth column lists papers with classification A or B following the A/B/C logic of Pittaway et al. (2004). The last column describes the total number of papers found suitable.

	Keyword search	Duplicate removal	Association of Business Schools (ABS) Guide	A/B/C	Total hits
Forward search	**1740**	**1281**	**764**	**38**	**38**
EBSCO Business Source Complete	135	89	67	20	
Emerald	856	559	349	0	
Elsevier	19	19	17	13	
JSTOR	420	355	184	1	
Web of Science	64	52	32	2	
Wiley Online Library	246	207	115	2	
Backward search					**20**
Total					**58**

Table B1: Search and selection process and sample construction

Removing duplicates reduced our sample to 1,281 papers. To safeguard a minimum standard of research rigor, we required all papers to be published in journals included in the 2018 ABS Guide. These rankings serve as a quality indicator of papers for researchers and practitioners (Currie and Pandher, 2020) and are often used as a quality indicator in the finance literature and literature reviews (Hiebl, 2021; Xu et al., 2018; Zhao et al., 2021). This focus on ABS-listed journals reduced our sample to 764 papers. To ensure a structured and transparent content analysis, we followed Pittaway et al.'s (2004) suggestion of clustering the sample into particularly relevant papers ("A" papers), potentially relevant papers ("B" papers) and papers with little or no relevance ("C" papers). Thus, only "A" and "B" papers were included in the sample. The A/B/C classification was determined and performed by the first author and cross-checked by the second and third author based on the following criteria:

A. A CEO characteristic is the main topic of the paper and the dependent variable represents banks' risk-taking.

B. The paper examines an antecedent or pay arrangement. CEO characteristics are not the main topic of the paper but are at least included in the results as a control variable (e.g., in the regression analyses). The research paper deals with banks' risk-taking at least partially.

C. Despite appropriate keywords, the paper does not match the core topic of our investigation (i.e., CEO characteristics and banks' risk-taking).

The underlying content analysis examined the extent to which the keywords "financial institutions" and "financial firm" actually referred to banks. If the respective papers did not deal with banks and only focused on other financial institutions such as insurance companies, they were removed. Papers that examined only the overall management level and did not include details on the CEO were also removed.

Our sample was classified into 20 "A" papers, 18 "B" papers and 726 "C" papers. As noted above, "C" papers were eliminated from further analysis. "C" papers also included those that examined CEO incentive pay in relation to banks' risk-taking but ignored any interaction with a CEO characteristic and did not allow researchers to draw conclusions about the relationship between CEO characteristics and banks' risk-taking (e.g., Bhagat and Bolton, 2014; Deng et al., 2019). Similarly, we did not consider managerial fixed effect studies because they do not explicitly examine CEO characteristics.

Following the guidelines suggested by Webster and Watson (2002), we checked the references of all 38 "A" and "B" papers in the sample for further potentially relevant articles (backward search) and included another 20 not covered by the keyword search but which provided content relevant to our review focus. Of these, 10 were classified as "A" papers and 10 as "B" papers. Our final sample was therefore 58 papers. In Section 4, we synthesize the most important findings from these 58 papers and summarize them into 18 key messages.

B.3.2. Sample characteristics

Table B2 presents the bibliographic information of these 58 journal articles. As most (57) were published after the financial crisis of 2007 and 2008, this confirms our assumption that the

financial crisis increased the awareness of considering banks' risk-taking in connection with CEO characteristics.

The sample papers were published between 1995 and 2020. Most (42) were published after 2016, emphasizing that our field of research has recently gained popularity in the scientific community. Further, most papers (39) were published in finance journals compared with five papers in accounting journals and seven each in economics journals and management or socioeconomics journals. In relation to the number of research articles, the number of different journals was high (38). The top four journals in terms of the number of publications were the Journal of Banking and Finance (6), the Journal of Financial Stability (4), the Journal of Corporate Finance (4) and Managerial Finance (3). These four journals all belong to the finance sector. Overall, the topic under investigation is more likely to be found in higher-ranked journals. Of the 27 finance and accounting journals, 21 have a minimum ranking of 3 in the 2018 ABS Guide.

Methodologically, the statistical analyses of the surveyed papers mostly rely on archival data (56 of the 58 papers in the sample). These archival data are mostly freely available via financial statements or obtained from databases such as Compustat, Bankscope, Standard and Poor's and the Center for Research in Security Prices, among others. As mentioned before, the understanding of the term "risk-taking" varies depending on the subject under investigation. The term typically expresses an increase or decrease in bank risk but is specified in detail in the context of the paper in question (Anderson and Fraser, 2000). The selected risk indicators should describe the development of banks' risk-taking over time under the influence of the independent variables. The risk indicators used in the papers are listed in Table B3. Appendix B Table B5 provides a detailed specification of the variables. Most of the papers are longitudinal studies. Only six papers deal with cross-sectional data, partly only as a supplement. These

papers include the two survey studies by Delgado-García et al. (2010) and Bacha and Azouzi (2019).

If we consider 2007–2009 as the main years of the global financial crisis, 47 of the 57 archival papers include these years in their investigations. The sensitivity of the risk indicators in these years can be assumed to be higher and the risk-taking effects better understood. It is also striking that 35 papers (i.e., more than half) deal with U.S. banks, while nine papers are from countries of the European Union and four from Asia. The remaining papers are global studies as well as studies from Australia, the United Kingdom and the Middle East and North Africa (MENA) region. In total, 48 papers examine publicly listed banks, bank holding companies, investment banks, private banks, financial services firms, saving banks or thrifts, cooperative banks and commercial banks; the remainder do not specify the banks under investigation.

The Table B2 reports the journals available in the sample, sorted alphabetically and according to their respective subject areas. The subject areas are divided into Finance, Accounting, Economics and Others. Others includes all journals that could not be assigned to the above-mentioned subject areas. The classification of the ABS Guide 2018 was used as a model for grouping the journals into the respective subject areas. The second column lists the ABS grade of the respective journal. The individual publications within the respective years are listed chronologically below.

Bibliographical information on the reviewed articles	**ABS Grade**	**1995**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**Total**
Finance															**39**
Corporate Governance: An International Review	3											1			1
Finance Research Letters	2												1		1
Financial Markets, Institutions and Instruments	3						1								1
Global Finance Journal	2													1	1
International Journal of Finance and Economics	3										1				1
International Review of Financial Analysis	3										2				2
Journal of Banking and Finance	3		1			1	1			1	1	1			6
Journal of Behavioral and Experimental Finance	1												1		1
Journal of Corporate Finance	4				1			1		2					4
Journal of Financial and Quantitative Analysis	4						1			1					2
Journal of Financial Economics	4*									1					1
Journal of Financial Intermediation	4								1	1					2
Journal of Financial Services Research	3			1											1
Journal of Financial Stability	3									1	1		1	1	4
Journal of International Financial Markets, Institutions and Money	3						1					1			2
Journal of International Money and Finance	3													1	1
Journal of Money, Credit and Banking	4									1					1
Managerial Finance	1											3			3
Pacific-Basin Finance Journal	2												1		1
Research in International Business and Finance	2										1				1
Review of Finance (formerly European Finance Review)	4											1			1
Review of Quantitative Finance and Accounting	3								1						1
Accounting															**5**
Journal of Accounting and Public Policy	3												1		1
Journal of Business Finance and Accounting	3			1											1
British Accounting Review	3												1		1
Contemporary Accounting Research	4												1		1
Journal of Accounting and Economics	4*											1			1
Economics															**7**
Journal of Economics and Business	1				1							1			2
Journal of Monetary Economics	4	1													1
Economic Systems	2											1			1
Quarterly Review of Economics and Finance	2									1	1				2
Journal of Developing Areas	1									1					1
Others															**7**

Bibliographical information on the reviewed articles	ABS Grade	1995	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Personality and Individual Differences	3												1		1
British Journal of Management	4			1									1		2
Journal of Management	4*												1		1
Journal of Management and Governance	1											1			1
Australian Journal of Management	2									1					1
Journal of Governance and Regulation	1								1						1
Total		1	1	3	2	1	4	1	3	11	7	11	10	3	**58**

Table B2: Bibliographical information on the reviewed articles

B.4. Review Results

B.4.1. Risk-taking

In this section, we critically analyze the current state of research and point out potential for improvement. Table B3 shows the analysis of our sample following Hambrick and Mason (1984) and Wowak and Hambrick (2010). It is organized according to the identified antecedents, CEO characteristics and pay arrangements analyzed in the surveyed papers. Further, it provides information on the impact of the variables on banks' risk-taking.

Three types of impact on a bank's risk-taking are listed: increasing, reducing and varying effects. In the case of varying effects, antecedents and CEO characteristics can have different effects on a bank's risk-taking depending on the situation. Increasing and reducing effects, on the other hand, usually occur in combination with psychological, social-psychological and biological variables. Less frequently, they are studied in combination with demographic variables. Before we examine the individual effects in combination with antecedents and CEO characteristics in our analysis, we first investigate the characteristics of risk-taking.

The term risk-taking is understood as a generic term in the papers examined. It subsumes three variants for measuring banking risks. Variant (i) defines risk-taking solely in terms of the change in risk within a risk type. Table B3 shows which risk types are examined in the papers: credit risk, equity risk, insolvency risk, liquidity risk, market risk and operational risk. Variants (ii) and (iii) define risk-taking as total bank risk. They therefore map the bank's entire risk situation. Variant (iii) uses one overarching measure, while variant (ii) attempts to map total bank risk using combinations of risk types. Thus, variant (iii) tries to measure total bank risk directly using specific indicators, some of which are based on regulatory requirements. However, the use of different variants gives rise to some issues (see Appendix Table B5 for a detailed description of the variables).

Table B3 shows the analysis of the sample. The authors and the individual variables (antecedents, pay arrangements, CEO characteristic(s) and kind of CEO variable) identified in connection with the upper echelons theory can be seen. In the "Kind of CEO variable" column, M.V., in the case of multiple variables examined, marks the main variable within the papers. It may be that a paper uses multiple CEO characteristics, but the focus in the paper was on a single characteristic. In the "Types of risk-taking" column, (i), (ii), and (iii) symbolize the ways in which risk-taking is measured. The column "Effect on risk-taking" shows a total of three possible manifestations of changes in risk-taking by the combined upper echelon variables: increasing, decreasing or varying. In addition to the countries and the period examined, the sample size is also indicated. The sample size refers to banks. A few papers do not list banks but, for example, CEOs in the sample size. Such deviations are marked in the column.

Author(s) (year of publication)	Antecedents	Pay arrangements	CEO characteristic(s)	Kind of CEO variable	Types of risk-taking	Effect on risk-taking	Country	Sample size	Period
Dbouk et al. (2020)		✓	Social connections	Demographic, social-psychological	(i) Insolvency	Increasing	United States	481	2000–2012
Chen and Ebrahim (2018)		✓	Social connections	Demographic, social-psychological	(ii) Insolvency, credit	Increasing	United States	172 bank CEO turnovers	1995–2010
Aljughaiman and Salama (2019)	Risk Governance		Power	Social-psychological	(ii) Market, credit, operational, insolvency, liquidity	Varying	MENA region	65	2005–2015
Ooi et al. (2020)			Religiosity	Demographic	(ii) Credit, insolvency, total bank	Varying	Indonesia	39	2010–2017
Adhikari and Agrawal (2016)			Religiosity	Demographic	(ii) Market, insolvency	Reducing	United States	1459	1994–2010
Byrd et al. (2012)			Power, Ownership	Social-psychological	(i) Insolvency	Reducing	United States	130	1987–1992
Berger et al. (2014)			Power, gender, education, age	M.V. Demographic, social-psychological	(ii) Credit, total bank	Varying	Germany	826	1994–2010
Akbar et al. (2017)			Power	Social-psychological	(ii) Market, equity, insolvency	Reducing	United Kingdom	276	2003–2012
Chen and Lin (2016)			Power	Social-psychological	(i) Credit, liquidity, market	Varying	Worldwide	1604	2002–2010
Luu (2015)			Power	Social-psychological	(iii) Total bank	Reducing	Asia	100	2009–2012
Anginer et al. (2016)		✓	Power	Social-psychological	(i) Equity	Reducing	International	N/A	2003–2011
Pathan (2009)			Power	Social-psychological	(ii) Insolvency, market, total bank	Varying	United States	212	1997–2004
Zeineb and Mensi (2018)			Power	Social-psychological	(i) Insolvency	Increasing	Gulf Cooperation Council	56	2004–2013
Mollah and Liljeblom (2016)			Power	Demographic, M.V. social-psychological	(i) Credit, insolvency	Varying	Worldwide	378	2007–2011
Altunbaş et al. (2019)			Power	Demographic, M.V. social-psychological	(ii) Insolvency, market	Increasing	United States	960	1998–2015
Hung et al. (2017)			Political connection	Demographic, M.V. social-psychological	(i) Credit, insolvency	Reducing	China	70	2007–2014

Author(s) (year of publication)	Antecedents	Pay arrangements	CEO characteristic(s)	Kind of CEO variable	Types of risk-taking	Effect on risk-taking	Country	Sample size	Period
Berger et al. (2016)			Ownership	Social-psychological	(i) Insolvency	No influence on excessive risk-taking	United States	341	2007–2010
Pathan et al. (2016)			Ownership	Social-psychological	(ii) Credit, insolvency, market	Varying	United States	212	1997–2004
Bacha and Azouzi (2019)			Overconfidence, optimism, loss aversion	Demographic, M.V. psychological	(i) Credit	Varying	Tunisia	11 banks involving 106 bankers	N/A
Ho et al. (2016)			Overconfidence	Demographic, M.V. psychological	(i) Credit, insolvency, operational	Increasing	United States	1,643 bank-year observations	1994–2009
Mahdi and Abbes (2018)			Overconfidence	Psychological	(i) Credit	Increasing	MENA region	133	2005–2016
Mourouzidou-Damtsa et al. (2019)	National Culture		National culture	Demographic	(ii) Credit, insolvency, market risk	Varying	Europe	99	1995–2014
Buyl et al. (2019)	Corporate Governance		Narcissism	M.V. Psychological, social-psychological	(i) Credit	Increasing	United States	92 CEOs banks	2006–2014
Bushman et al. (2018)		✓	Materialistic	Psychological	(i) Market	Increasing	United States	284 banks involving 445 CEOs	1992–2013
Ahmed et al. (2019) (b)			Masculinity	Biological	(ii) Market, insolvency	Increasing	United States	104	2006–2014
Skala and Weill (2018)			Gender	Demographic	(ii) Total bank, credit, insolvency	Reducing	Poland	365	2008–2012
Sghaier and Hamza (2018)			Gender	M.V. Demographic, social-psychological	(ii) Market, insolvency	Reducing	Europe	112	2000–2015
Ahmed et al. (2019) (a)		✓	Experience	Demographic	(ii) Total bank, credit	Varying	United States	104 banks involving 134 CEOs	2006–2014
King et al. (2016)		✓	Education	M.V. Demographic, social-psychological	(ii) Credit, operational	Varying	United States	149	1992–2011
Farag and Mallin (2017)	Corporate Governance		Power	Social-psychological variable	(iii) Total bank	Reducing	Europe	99	2004–2012
Liu et al. (2017)		✓	Age, experience	Demographic	(i) Market	Increasing	United States	214	1995–2012
Nguyen et al. (2019)	Corporate Governance	✓	Age, experience, social connection	Demographic	Credit, equity, market	Increasing	United States	78	1993–2007
Faleye and Krishnan (2017)	Corporate Governance		Ownership, power	Social-psychological	(i) Credit	Reducing	United States		1994–2008
Ahmed and Ndayisaba (2016)	Corporate Governance	✓	Power	Social-psychological	(i) Insolvency	Varying	Australia	45	2004–2015

Author(s) (year of publication)	Antecedents	Pay arrangements	CEO characteristic(s)	Kind of CEO variable	Types of risk-taking	Effect on risk-taking	Country	Sample size	Period
Jiang et al. (2019)	Regulation (POST-Regulation)	✓	Age, experience	Demographic	(i) Insolvency	Reducing	China	14 banks involving 156 CEOs	2006–2013
Niu (2010)		✓	Overconfidence	Demographic, M.V. psychological	(i) Equity	Increasing	United States	98 banks involving 131 CEOs	1993–2002
Sun (2018)		✓	Experience	Demographic	(i) Credit, operational	Varying	United States	655	1999–2005
Cerasi et al. (2020)		✓	Age, gender	Demographic	(ii) Credit, market	Reducing	Worldwide	1197	2006–2014
Fabrizi (2018)		✓	Experience	Demographic	(i) Credit	Increasing	United States	81	2003–2009
van Bekkum (2016)		✓	Age	Demographic	(i) Market	Reducing	United States	429	2007–2009
Belkhir and Chazi (2010)		✓	Experience	Demographic	(i) Market	Increasing	United States	700	1993–2006
Bharati and Jia (2018)		✓	Age, experience	Demographic	(i) Market	Varying	United States	217	1993–2009
DeYoung et al. (2013)		✓	Experience	Demographic	(ii) Market, credit, operational	Varying	United States	114 banks involving 145 CEOs	1995–2006
Yang (2017)		✓	Experience	Demographic	(ii) Market risk, credit, operational	Varying	United States	82	1992–2010
Shah et al. (2017)		✓	Experience, ownership	Demographic, social-psychological	(i) Market	Varying	United States	81	2002–2013
Guo et al. (2015)		✓	Age, experience	Demographic	(ii) Credit, equity, insolvency, market	Increasing	United States	134	1992–2008
Houston and James (1995)		✓	Age, experience	Demographic	(i) Market	No influence on excessive risk-taking	United States	134	1980–1990
Al-Own et al. (2018)		✓	Age, experience, ownership	Demographic, social-psychological	(i) Insolvency	Increasing	Europe	60	2006–2011
Hagendorff and Vallascas (2011)		✓	Age, experience, power	Demographic, social-psychological	(i) Insolvency	Increasing	United States	172	1993–2007
Bai and Elyasiani (2013)		✓	Experience, power	Demographic, social-psychological	(i) Insolvency	Increasing	United States	132	1992–2008
Uhde (2016)		✓	Age, education, experience, gender	Demographic	(i) Insolvency	Increasing	Europe	63	2000–2010
Zhou et al. (2019)			Age, experience	Demographic	(ii) Credit, insolvency, market	Reducing	Europe	100	2005–2014
Switzer and Wang (2013)			Age, experience	M.V. Demographic, social-psychological	(i) Credit	Increasing	United States	228	2001–2010
Delgado-Garcia et al. (2010)		✓	Affective traits	Demographic, M.V. psychological	(ii) Market, Credit	Varying	Spain	51	2004

Author(s) (year of publication)	Antecedents	Pay arrangements	CEO characteristic(s)	Kind of CEO variable	Types of risk-taking	Effect on risk-taking	Country	Sample size	Period
Acrey et al. (2011)		✓	Age, experience	Demographic	(i) Credit, equity, insolvency, operational	Reducing	United States	84	2004–2008
Boyallian and Ruiz-Verdu (2018)		✓	Age, experience, power	Demographic, social-psychological	(i) Insolvency	Varying	United States	129	2007–2010
Belkhir and Boubaker (2013)		✓	Age, experience	Demographic	(i) Market	Reducing	United States	150	2006–2010
Bennett et al. (2015)		✓	Experience	Demographic	(i) Insolvency	Reducing	United States	371	2006–2008
Total (58)									

Table B3: Descriptions used in this sample

1. The ratios of variant (iii) for the direct measurement of total bank risk are subject to ambiguous interpretations and used inconsistently.

A common variant for measuring total bank risk is the ratio of risk-weighted assets to total assets. This criterion is not only gaining popularity in research, but also being used by regulators (Berger et al., 2014; Ahmed et al., 2019a; Luu, 2015). To complement this approach, the capital adequacy ratio is often considered (Skała and Weill, 2018; Berger et al., 2014; Ooi et al., 2019). In addition to the bank's risk position, the available funds to cover risk are included in the risk assessment. However, not all papers use ratios to calculate total bank risk. The capital adequacy ratio is often omitted. Use and non-consideration seem arbitrary. Neither a uniform nor a dominant approach can be identified in the surveyed papers.

Some papers choose different ratios to calculate total bank risk. Farag and Mallin (2017) use the ratio of impaired loans to total loans to show the financial fragility of a bank, which is related to total bank risk. However, inconsistencies arise here as well. Other papers interpret the ratio exclusively as credit risk and not as a bank's general vulnerability to crises (Aljughaiman and Salama, 2019; Pathan et al., 2016; Zhou et al., 2019). This interpretation is more intuitive, as financial fragility also depends on a bank's capital structure. Therefore, bank capitalization is also decisive but not considered by all authors (Anginer et al., 2016). Delgado-García et al. (2010), Yang (2017) and Mourouzidou-Damtsa et al. (2019) interpret the variance and volatility of return assets as total bank risk in contrast to papers that use the ratio to calculate market risk. According to them, the ratio only measures the total risk of investments, in line with current academic opinion (Belkhir and Chazi, 2010; Bharati and Jia, 2018; Cerasi et al., 2020).

2. The use of combinations of risk types to represent total bank risk as in variant (ii) does not correspond to any continuously applied logic.

In addition to measuring overall total bank risk, other papers attempt to depict the entire risk situation of a bank using a combination of risk types (variant (ii)) (Guo et al., 2015; Acrey et al., 2011). However, the chosen combinations also seem arbitrary. Pathan (2009), for example, tries to make a statement using insolvency risk, market risk and the previously defined total bank risk indicators. Other papers only use market risk and insolvency risk variables to depict the total risk situation (Adhikari and Agrawal, 2016; Sghaier and Hamza, 2018). Still others use credit risk, insolvency risk and additional total bank risk variables (Ooi et al., 2019). It becomes clear that combinations of individual risk types cannot claim, due to their inconsistent use, to consistently capture the risk-taking of a bank across the board. The approaches chosen are too different.

3. The key figures of individual risk types of variant (i) show too much heterogeneity.

In addition, there is significant heterogeneity in the measurement variables for all specific risk types. For example, the measurement variables of credit risk alone can be divided into four main categories: credit failure (probability), securitization, risk provisions and credit portfolio structure/performance. In turn, many individual variables can be found for each category. For instance, credit failure (probability) includes ratios combined with impaired loans (Zhou et al., 2019), non-performing loans (Guo et al., 2015), credit losses (Fabrizi, 2018) and loan loss write-offs (Yang, 2017). In this context, impaired loans have also been interpreted as total bank risk (Farag and Mallin, 2017). In addition, Guo et al. (2015) see non-performing loans as representing the general riskiness of bank assets, reconfirming how differently individual ratios are interpreted and defined. No uniform use exists in the literature.

Other risk types show a high degree of heterogeneity as well. Systematic and idiosyncratic risk can both be derived from the capital market model (Sghaier and Hamza, 2018). These are represented by the beta factor and standard deviation of the residuals from this model (Bharati and Jia, 2018; Belkhir and Chazi, 2010). Together with total risk, defined as the standard

deviation of banks' stock returns, they form the main indicators of market risk in research. In addition, downside risks or tail risks are frequently measured to map system-wide crisis situations, such as those carried out by regulatory authorities as part of stress test scenarios (Altunbaş et al., 2019; Bushman et al., 2018; Chen and Lin, 2016; van Bekkum, 2016).

Insolvency risk is calculated using the Z-score in most papers (Bai and Elyasiani, 2013; Jiang et al., 2019; Uhde, 2016; Ben Zeineb and Mensi, 2018). A higher Z-score is equivalent to a lower risk of bank default. Another variant is the distance to default model of Merton (1974). Hagendorff and Vallascas (2011) are the first to use this risk measure in combination with CEO incentives on a bank's risk-taking. One advantage over pure market risk measures is that accounting data are considered in addition to market data. Alternatively, other papers use the expected default frequency (Acrey et al., 2011; Bennett et al., 2015; Boyallian and Ruiz-Verdú, 2018). In a few cases, a binary distinction is made between failing and non-defaulting banks in the sample to compare both sets of characteristics (Berger et al., 2016; Byrd et al., 2012). The mere enumeration of the different variables already illustrates the lack of differentiation. Again, the choice of measurement variables does not seem coordinated.

Operational risk tries to represent the risk of the business model or business policy (King et al., 2016). One of the main measures of this kind of risk is non-interest income (King et al., 2016) or net operating income (Buyl et al., 2019; DeYoung et al., 2013). This is an attempt to use performance measures that are independent of market risk and result from a bank's operations. However, metrics that simultaneously include market risk and credit risk are also used (DeYoung et al., 2013; Yang, 2017).

Liquidity risk is addressed in only two studies. Banks’ cash reserves are examined by Aljughaiman and Salama (2019) and Chen and Lin (2016) in combination with other risk types. Chen and Lin (2016) point out that risk types are intertwined. For example, market risk in the form of interest rate risk results from maturity mismatches in the banking book. These also

affect credit quality. Borrower defaults, in turn, can lead to liquidity risks. It has also been shown that low liquidity risks simultaneously reduce interest rate risk.

Equity risk is examined in detail by Anginer et al. (2016). They differentiate between regulatory and balance sheet equity. Since banks have discretionary power in the valuation of their assets and capital, they calculate the ratio of the market value of the bank's common equity as a proxy for the market value of a bank's total assets. Anginer et al. (2016) do not explicitly refer to the ratios as equity risk but define risk-taking in terms of low capitalization rates. Zhou et al. (2019) also classify total risk as equity risk, defined as the standard deviation of banks' stock returns. However, this position should be viewed critically, as total risk includes the systematic and idiosyncratic risk of stocks and is therefore used in research to measure market risk as well (Aljughaiman and Salama, 2019).

B.4.2. CEO characteristics

Contemporary research goes beyond simply using demographic variables to describe CEO characteristics, as initially proposed by Hambrick and Mason (1984). Demographic variables are often used to examine the functional background of CEOs in combination with strategic decisions. However, as proxies for a CEO's cognitive framework, they are more of a sufficient but not a necessary condition (Hambrick, 2007). Recent research has chosen a variety of new variables. However, these papers so far appear to be isolated works.

To generate the differentiated picture for CEO characteristics, we classify all the variables using the results of Abernethy and Wallis (2019). In addition to demographic variables, they discover papers in the literature focusing on managerial fixed effects, psychological variables, social-psychological variables and biological variables. While we organize our papers according to their proposed clustering, we exclude managerial fixed effect studies because we explicitly focus on specific CEO characteristics. Table B4 shows the resulting clustering of CEO characteristics from our retrieved papers.

Table B4 shows the CEO characteristics clustered by demographic, psychological, social-psychological, and biological variables. The clustering is based on the results of Abernethy and Wallis (2019). The individual variables result from the 58 papers analyzed and occur as both independent variables and control variables.

Demographic variables	Psychological variables	Social-psychological variables	Biological variables
Age	Affective traits	Ownership	Masculinity
Citizenship	Loss aversion	Political connection	
Education	Materialistic	Power	
Experience	Narcissism	Social connection	
Gender	Optimism		
Religiosity	Overconfidence		

Table B4: Clustering of CEO characteristics as represented in the surveyed papers

This expansion makes it possible to assign thematic clusters to the 17 CEO characteristics identified in the surveyed literature. In Figure B1, these characteristics are clustered and condensed with respect to CEO characteristics. Also integrated are the individual effects on banks' risk-taking found in our sample. They influence banks' risk-taking in combination with an antecedent, a pay arrangement or another CEO characteristic. As independent variables, these are regularly found to impact risk-taking directly. We describe in detail the relations we identify and interpret the results in the following sections.

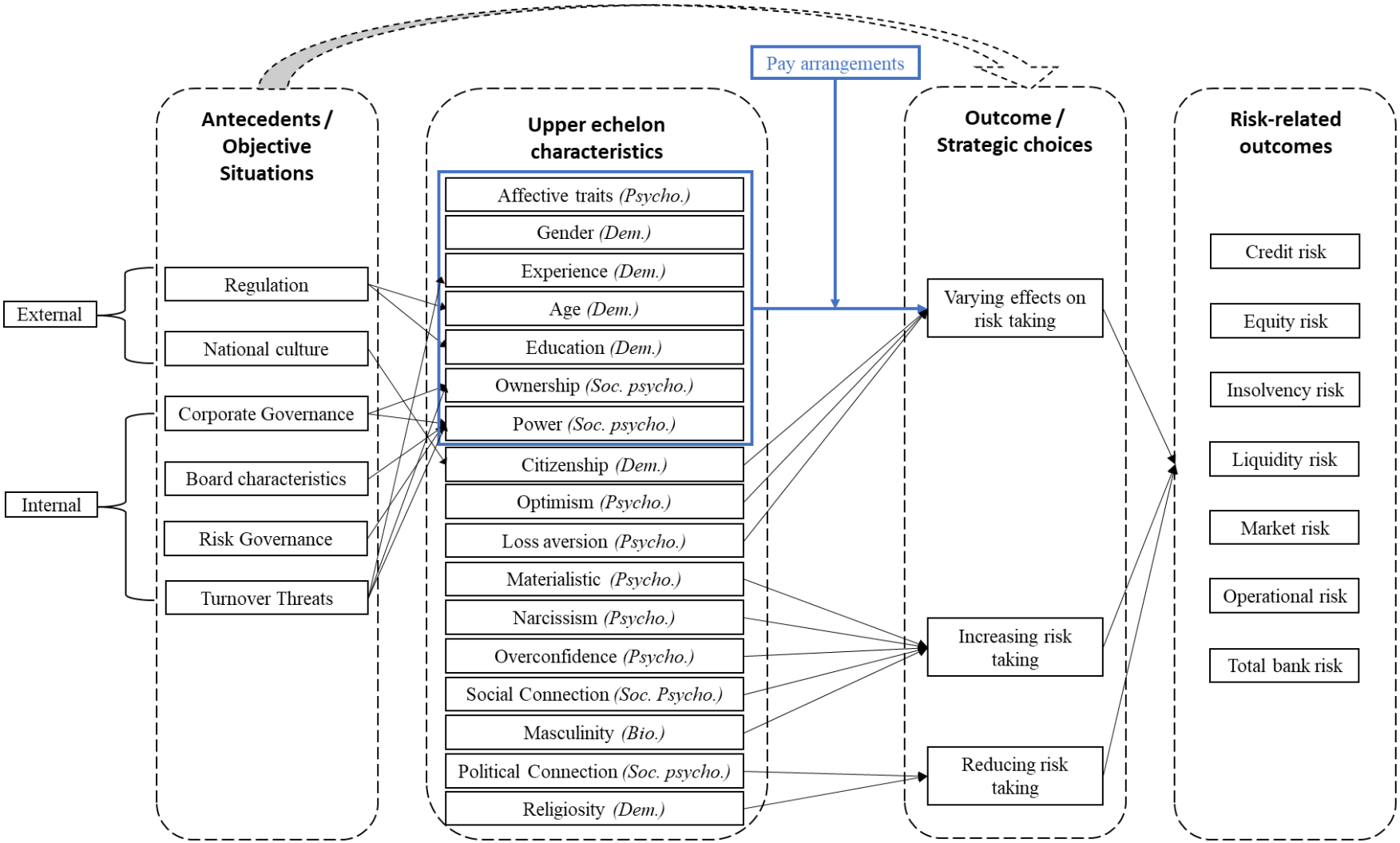

Figure B1: Upper echelons perspective of CEO characteristics and banks' risk-taking (based on Hambrick and Mason, 1984; Wowak and Hambrick, 2010)

B.4.2.1. Effects of demographic variables on risk-taking

Figure B1 shows that the demographic variables are predominantly used in combination with other CEO characteristics and often have varying effects on banks' risk-taking. This aspect is particularly noticeable for CEO age and experience (Acrey et al., 2011; Belkhir and Boubaker, 2013; Nguyen et al., 2019).

1. Statements about the effects of age or experience on a bank's risk-taking vary.

Berger et al. (2014) examine the age, gender and education of CEOs, finding that young CEOs increase overall risk in German private, public and cooperative banks. One reason could be their lack of experience. By contrast, Switzer and Wang (2013) find that a CEO's age does not affect credit risk, at least for U.S. commercial banks and savings banks. Only older CEOs have a reducing effect on risk-taking. Here, the effect is more pronounced for commercial banks than for savings banks. In general, our sample thus suggests that age has a decisive influence on risk-taking (van Bekkum, 2016; Hagendorff and Vallascas, 2011; Bharati and Jia, 2018; Liu et al., 2017).

Zhou et al. (2019) show that due to differences in the experience of CEOs, heterogeneous decision-making positions are created, which lead to cognitive conflicts and thus more defensive decisions about bank risk. In addition, they find that CEOs with crisis experience are better able to manage risks, interpret early warning signals more readily and maintain high accounting quality during a crisis (Ahmed et al., 2019a). These findings suggest that more experienced CEOs actually take more risks, as their knowledge makes them more capable of dealing with risk situations.

However, age and experience vary over time. Hence, as a young CEO gets older and more experienced, their decisions change (Berger et al., 2014). The different results arise from the lack of a uniform classification of young and old CEOs. In addition, banks in different countries

are examined. The extent to which cross-country effects and cultural influences are decisive remains unanswered.

2. Although a CEO's religiosity is a personality trait, the variable is measured using archival data.

According to Adhikari and Agrawal (2016), religious CEOs (i.e., CEOs of banks headquartered in a religious area) are more risk-averse in terms of market risks, especially in times of crisis. Ooi et al. (2019), on the other hand, find varying effects – at least for Indonesian banks. They find that state-owned banks with Muslim and thus religiously influenced CEOs exhibit lower total bank risk. For other banks, however, this effect is not demonstrated. Despite existing results on religiosity, its measurement remains open to criticism. The extent to which the headquarters of a bank allows conclusions to be drawn about the religiosity of a CEO – as assumed by Adhikari and Agrawal (2016) – remains highly doubtful. Religiosity is person-related and can therefore vary – even within highly religious regions. Even a query on the religious affiliation of a CEO would likely be insufficient, as it provides no in-depth information on individual religiosity.

3. The variables gender and education show consistent results.

The surveyed papers mostly agree that the decision quality of CEOs improves as their education level rises. King et al. (2016) show that banks led by CEOs with MBAs generate higher returns, pursue more innovative business models and generate better bank performance outcomes despite higher credit and operational risk. Berger et al. (2014) even find that having a large number of CEOs with doctoral degrees has a risk-mitigating effect on a bank's portfolio risk. Hence, both studies show that education raises decision quality in the assessment of risks.

Another important demographic variable is CEO gender. Skała and Weill (2018) show that female CEOs of Polish cooperative banks take fewer risks. Banks with female CEOs also have

higher capital adequacy ratios while maintaining high credit risk. Hence, they provide greater overall bank stability. One reason for this may be that they are more risk-sensitive and less likely to delegate decisions. Bacha and Azouzi (2019) pick up this aspect using a dataset of Tunisian banks. Their study uses psychological variables to analyze emotional bias in credit decisions. They similarly identify female CEOs as more risk averse. Sghaier and Hamza (2018) further find that female CEOs in bank mergers have a risk-reducing effect for the acquiring bank, as reflected in the bank's market risk. Both studies suggest introducing a gender quota as a measure for regulators to reduce risk-taking.

B.4.2.2. Effects of psychological variables on risk-taking

Psychological variables examine a specific character trait of an individual that can be continuous and fixed over time. Such variables thus reveal the individual emotions and feelings that may influence a CEO's decision-making and risk-taking (Bacha and Azouzi, 2019). One of these emotional biases is overconfidence.

1. Overconfidence and narcissism are measured using archival data, but inconsistently.

Ho et al. (2016) consider CEOs to be overconfident when deferring the exercise of their stock options that were more than 100% in the money at least twice during their tenure. They find that U.S. banks with overconfident CEOs reduce lending standards and increase leverage in pre-crisis years. In this case, CEO overconfidence affects credit risk, insolvency risk and operational risk. Mahdi and Abbes (2018) examine the credit risk of conventional banks from the MENA region. The overconfidence of a CEO is represented by a high loan growth rate, net interest margin, pre-provision income and profit margin. They show that overconfidence leads to excessive risk-taking and hence cost inefficiencies. Bacha and Azouzi (2019) use a questionnaire to ask CEOs of Tunisian commercial banks about their lending decisions. They find that overconfident CEOs tend to emphasize their skills and make credit decisions more intuitively. In addition to overconfidence, they subsume the variables of optimism and loss

aversion under emotional bias. They find that female CEOs have higher loss aversion, tend to prefer the top-down administrative style and delegate tasks less frequently. This result is consistent with the previous findings on female CEOs. Here, lower employee participation is equated with more risk-averse behavior. Optimistic male CEOs, on the other hand, tend to place an exaggerated amount of trust in employees' abilities.

What is striking about the studies is not only the different ways in which overconfidence is measured. It is also evident that secondary data are mostly obtained indirectly. The direct query of the personality traits of a CEO (e.g., via a questionnaire or an interview) is only used by Bacha and Azouzi (2019). The extent to which ratios such as the loan growth rate, net interest margin, pre-provision income and profit margin, as in the paper by Mahdi and Abbes (2018), can approximate overconfidence as CEO characteristic is doubtful.

Closely related to overconfidence is narcissism, another aspect of emotional bias. Buyl et al. (2019) study U.S. commercial banks during the period of the global financial crisis from 2006 to 2014. They find that narcissistic CEOs have higher levels of performance orientation and are more willing to take risks. This behavior leads to increased credit risk-taking. Narcissism is measured by the authors as the prominence of the CEO in the annual report, compensation, relative use of first-person singular pronouns in the letter to the shareholders, number of signatures under the letter to shareholders (reversed) and number of words in the CEO's Marquis Who's Who biography. No psychometric test is used for this variable. Again, the extent to which narcissism can be expressed in this way remains questionable. By increasing credit risk, banks recovered more slowly from the financial crisis. Other reasons could be that these CEOs pursue strategies that strain banks' resources more while making riskier and more expensive investments.

2. Materialism and affective traits are only examined by two studies.

Similar results can be seen for materialistic CEOs. Bushman et al. (2018) examines the purchase of previously classified luxury items such as houses, boats and cars over time. Risk-taking is represented here by market risk. The risk management of materialistic CEOs in U.S. bank holding companies from 1992 to 2013 is found to be insufficiently developed. These CEOs are also found to have fostered a corporate culture that provided more aggressive insider trades around government intervention during the global financial crisis. These practices inevitably increased the downside risk of their banks.

Lastly, Delgado-Garcia and La Fuente-Sabate (2010) show that affective traits impact the total bank risk of Spanish banks and savings banks. To measure the affective traits of CEOs, they use the Positive and Negative Affect Schedule (PANAS) of Watson et al. (1988). The defined risks are intended to represent total bank risk. They find that negative affective traits reduce risk-taking, whereas positive affective traits have no significant influence. By using PANAS, a model from an interdisciplinary research area, they open a different way to measure psychological variables. In other words, they are not bound to archival data and an approximate calculation of psychological variables.

B.4.2.3. Effects of social-psychological and biological variables on risk-taking

Social-psychological variables address the entire social surroundings of CEOs, whereas biological variables show how CEOs' innate characteristics influence their decisions. Social-psychological variables include social connection.

1. The impact of a CEO's social connection is measured only in terms of insolvency risk.

Dbouk et al. (2020) show that social connectedness increases insolvency risk for U.S. publicly listed banks in three ways. They show that CEOs use social networks to obtain information that they subsequently use to make more substantiated decisions. If the impact of the information is

unclear, CEOs rely on the general opinion of the group, but this can lead to unpredictable consequences. This effect is amplified in an uncertain labor market.

Hung et al. (2017) agree that the type of social connectedness matters. They find that Chinese banks with CEOs who have political experience produce higher returns and have significantly lower insolvency risk. The influence of CEOs is particularly high if they have worked in a higher administrative position in the same city. The political connections of CEOs seem to give these banks access to political firms, which tend to be less likely to default. In this context, the power of a CEO within the bank also seems to play an important role.

2. There is no consensus on how CEO power and ownership affect a bank's risk-taking.

Power arises from the design of the CEO's position. The variable is therefore a hybrid of both CEO characteristics and antecedent board structure. In a monistic management system, CEOs may also chair the supervisory board (Chen and Lin, 2016; Luu, 2015; Ben Zeineb and Mensi, 2018). Such CEO duality provides less separation between management and control, which in turn leads to an increased shareholder orientation. Shareholder-oriented banks take on higher liquidity risks to create higher returns for their shareholders. Stakeholder-oriented banks that separate the CEO from the chair of the supervisory board (i.e., those possessing a dualistic management system), on the other hand, have lower credit risk and liquidity risk (Altunbaş et al. 2019).

Mollah and Liljeblom (2016) confirm that CEO power increased the profitability of their banks during the sovereign debt crisis, but also increased their insolvency risk. However, some studies show the contrary perspective. Due to the higher concentration of power and increased responsibility, CEOs act in a more risk-averse manner (Akbar et al., 2017; Byrd et al., 2012; Pathan, 2009). Other studies show that shareholder-oriented banks have higher capitalization rates and lower risk-weighted assets (Anginer et al., 2016; Luu, 2015).

These explanations show that shareholders can have a decisive influence on banks' risk-taking. However, shareholders are not the only external investors. CEOs can also hold shares in their bank, which makes them co-owners (Pathan, 2009; Berger et al., 2016; Akbar et al., 2017). Pathan et al. (2016) describe the relationship between ownership and risk-taking in U.S. bank holding companies as convex. If ownership is considered in combination with the bank's franchise value, an increase leads to higher overall bank risk in the long run. However, Berger et al. (2016) do not confirm these results. They find that during financial crises, CEO stock ownership does not significantly influence why banks fail. Rather, they see an increase in risk due to share ownership by lower levels of management over time.

3. Biological variables have been underrepresented to date.

Lastly, one paper in our sample includes biological variables. Ahmed et al. (2019b) examines the facial features of the male CEOs of publicly listed banks in the United States. They find a positive correlation between the masculinity of facial features and banks' market risk. A high facial width-to-height ratio is associated with high testosterone levels, which serve as an indicator of the risk tolerance, potential aggression and sensation seeking of the CEO.

B.4.3. Effects of pay arrangements on risk-taking

Pay arrangements are the most frequently studied phenomenon in our sample. They occur in combination with seven CEO characteristics. In the reviewed literature, the effects of pay arrangements are interpreted in two ways. First, according to Wowak and Hambrick (2010), pay arrangements are seen as having moderating effects. This is expressed in Figure B1 and corresponds with the upper echelons perspective in management research. In our sample, this view is represented by only two papers. The second view defines pay arrangements as antecedents. In some cases, variables may also directly affect risk-taking without involving the identified CEO characteristics. As defined in our categorization that follows Pittaway et al. (2004), such papers are excluded due to their lack of reference to a CEO characteristic.

Viewing pay arrangements as an antecedent or moderating effect is not only a case distinction, but also represents two perspectives of the phenomenon. According to Wowak and Hambrick (2010), only CEO responses based on their characteristics can be strengthened or weakened by pay arrangements. The fundamental decision is unchanged. Rather, pay arrangements moderate the effect of CEO characteristics on banks' risk-taking. As an antecedent, pay arrangements have a greater influence. They have a direct impact on CEO placement and thus CEO characteristics, which in turn directly influence CEO decisions.

1. Pay arrangements as moderating effects.

King et al. (2016) show that having an education, especially holding an MBA degree, enables CEOs to manage more complex banking firms. At the same time, CEO performance improves when pay arrangements are aligned with a business's risk-taking policies. Anginer et al. (2016) show that banks with the better separation of the CEO and chair roles reduce or even stop distributions to shareholders after a negative income shock. Accordingly, banks with shareholder-friendly governance tend to reduce distributions to shareholders after a bank suffers significant losses.

2. Pay arrangements as antecedents.

2.1 There is no consensus on the effects of incentive compensation on banks' risk-taking.

Houston and James (1995) study bank compensation policies during the deregulation in the 1990s. They show that as tenure increases, equity-based incentives increase CEOs' firm holdings. Hence, their wealth is increasingly linked to firm value. In addition, they find a positive correlation between equity-based incentives and firm value. Thus, they conclude that compensation policies are not associated with excessive risk-taking. Regulatory measures related to CEO compensation would therefore be ineffective and would not reduce risk-taking. Acrey et al. (2011) take the opposite position. According to their results, CEOs focus on short-

term success as their tenure increases because their stock options and stock grants are largely vested. Nevertheless, risk-taking increases only moderately. Non-vested options appear to reduce risk. Shah et al. (2017) even sees no relationship between options, shares and CEO bonuses in relation to banks' risk-taking, either before or after the global financial crisis.

Guo et al. (2015) draw different conclusions. They examine too-big-to-fail banks before and during the financial crisis. They find that performance-based compensation can improve bank performance and even reduce the probability of default despite the presence of higher risk. At the same time, overly variable compensation can lead to excessive risk-taking, which can decrease the bank's performance and increase the probability of default (Cerasi et al., 2020; Uhde, 2016). The effects are influenced by the number of the compensation components, which increases with CEO tenure.

2.2 An increase in compensation vega leads to higher risk-taking.

The compensation of CEOs can also be viewed differently. DeYoung et al. (2013) distinguish two types of incentives in compensation contracts, delta and vega. Delta measures the sensitivity between pay and performance (Boyallian and Ruiz-Verdú, 2018; Fabrizi, 2018), whereas vega measures the sensitivity between pay and risk. Here, CEO wealth changes in relation to stock return volatility (Yang, 2017; Hagendorff and Vallascas, 2011). The two ratios map the relation between a bank's performance and its risk-taking.

According to Bai and Elyasiani (2013), during the deregulation between 1980 and 2000, banks used compensation incentives to exploit their growth potential. They contradict Houston and James (1995) by stating that CEOs with a high vega take more systematic and idiosyncratic risks. Credit risk and operational risk also increase. In addition, they show that senior CEOs and CEOs that also serve as chair of the board of directors earn more than the rest of the top management team. This aspect is consistent with the common wisdom that seniority increases the compensation components of CEOs. Banks thus generate more income from non-interest

activities, issue riskier mortgages and invest more in private mortgage securitizations and less in on-balance sheet business loan portfolios. Bank mergers are also affected. CEOs with a high compensation vega tend to pursue riskier acquisitions (DeYoung et al., 2013; Hagendorff and Vallascas, 2011; Sun, 2018; Yang, 2017).

One option for banking supervisors is to regulate vega. The results show that credit risk, market risk and insolvency risk are affected by remuneration incentives (Al-Own et al., 2018). Niu (2010) also sees the potential of self-regulation. He assumes that the risk-taking effect triggered by vega can vary depending on the CEO. As previously discussed, overconfident CEOs tend to be riskier. However, shareholders can identify such CEOs in advance and adjust the sensitivity of the vega in their compensation contracts.

2.3 The effect of the compensation delta on risk-taking is interpreted in contradictory ways.

The following papers consider the effect of CEO seniority and build on these findings. Fabrizi (2018) examines the effects of compensation delta, finding that CEOs with a high compensation delta executed riskier securitization transactions before and during the global financial crisis. An additional effect emerges: banks with high leverage tend to have a better long-term performance. CEOs with delta compensation and low leverage, in turn, want to compensate for this disadvantage by taking higher risks (Bharati and Jia, 2018).

Boyallian and Ruiz-Verdú (2018), however, show that a CEO with a high delta compensation in a more leveraged bank takes more risks. As the CEO's goal is to increase firm value and subsequently the stock price, they favor shareholders because any increase in firm value above the bank's debt benefits the shareholders of leveraged banks. These findings can also be applied to CEO compensation vega. If a CEO receives stock options, the growing convexity within the stock option value and stock price relation leads to higher risk-taking. Consequently, CEOs align themselves with the interests of shareholders and thus disadvantage debtholders (Belkhir and Chazi, 2010).

3. Inside debt reduces CEO risk-taking.

In addition to the varying effects that increase banks' risk-taking, some risk-reducing effects can be observed. For example, CEOs with inside debt holdings (i.e., pension benefits and deferred compensation) reduce the interest rate risk of their banks. One way of incentivizing a CEO to invest more of their money in their bank in the long term could be tax benefits (a reduced marginal tax rate) linked to deferred compensation (Belkhir and Boubaker, 2013). Banks with CEOs who held a high proportion of inside debt relative to inside equity had lower insolvency risk during the global financial crisis (Bennett et al., 2015; van Bekkum, 2016). Jiang et al. (2019) demonstrate similar effects in Chinese banks.

B.4.4. Effects of antecedents on risk-taking

In our analysis, we also consider the impact of antecedents on banks' risk-taking in conjunction with CEO characteristics. We subdivide these into internal and external effects. National culture and regulation, which are external domains, cannot be influenced directly by the bank or CEO, whereas corporate governance, corporate culture and risk governance are internal effects and thus can be influenced directly.

1. The external effects are represented by only two papers.

Mourouzidou-Damtsa et al. (2019) show that national culture is a key determinant of total bank risk in Europe. Individualism, hierarchy and trust are used as proxies of the cultural values of a society, which affect the decisions of a CEO in a bank. Individualism leads to a focus on corporate profits and individual well-being. Hierarchy puts social power to the foreground. In both cases, banks take more risks. By contrast, trust – as a corporate value – affects the way customers are treated. Banks that aim to generate trust are more risk averse. These results suggest implications for how a CEO compensation structure could be designed according to their cultural imprint.

The second external antecedent is regulation. Jiang et al. (2019) analyze the effects arising from a voluntary and a mandatory introduction of deferred compensation for CEOs in Chinese banks. More risk-averse banks exhibit lower insolvency risk after the introduction. The mandatory introduction of deferred compensation has a more pronounced risk-reducing effect on banks. CEOs are more willing to take risks. Thus, regulation can indeed influence banks' risk-taking by adjusting the incentive compensation paid.

2. No fully comprehensive framework exists on how corporate governance should be structured in a risk-aware bank.

Corporate governance, an internal antecedent, deals with board characteristics and their influence on risk-taking. While corporate governance is directly related to power, power can also be a direct characteristic of a CEO. Corporate governance is often discussed in combination with pay arrangements and ownership (Haan and Vlahu, 2016). The results from the literature provide only hints about which points are crucial for effective corporate governance, but no clear picture about how it should be comprehensively structured.

Liu et al. (2017) study U.S. bank mergers, finding that banks with weak corporate governance engage in mergers that are detrimental to their shareholders when CEOs benefit through manipulated bonus compensation schemes. However, corporate governance that focuses on shareholder value can also lead to problems. In such a setting, Ahmed and Ndayisaba (2016) find that insolvency risk in Australian banks rises. If short-term rewards for management are linked to shareholder value, CEOs tend to invest in riskier financial products, which increases the expected probability of default.

Thus, corporate governance must be balanced. To increase its effectiveness, it is crucial to take a closer look at the board structure. Faleye and Krishnan (2017) find that credit risk in U.S. banks with independent boards, smaller boards and non-classified boards is lower. It is also lower when there is no CEO duality. Farag and Mallin (2017) examine the relationship between

risk-taking and the proportion of female directors in corporate governance. The results confirm those presented earlier in relation to the demographic variables. Corporate governance rules that promote a higher proportion of female directors on the board reduce total bank risk and financial fragility in European banks.

The extension of corporate governance to risk governance also appears to increase effectiveness. Aljughaiman and Salama (2019) study banks from the MENA region. They find higher risk-taking when tasks from a risk governance perspective are included, such as the introduction of a board-level risk committee and appointment of a chief risk officer. Hence, they find a significant reduction in total bank risk. Closely related to corporate governance is corporate culture. Nguyen et al. (2019) examine U.S. publicly listed banks and subdivide them based on distinct cultural foci. They find that banks take more risks when their CEOs are willing to compete aggressively. In turn, banks that focus on control and security take fewer risks.

In terms of job security (or the risk of job losses), Chen and Ebrahim (2018) draw similar conclusions. Using U.S. banks, they find a concave relationship between CEO turnover threats and credit and insolvency risk. At medium to higher turnover threats, CEOs are more risk averse. If the threat is consistently high, risk-taking drops. This seems to have a psychological effect on whether CEOs feel secure and comfortable in their position or fear for their job.

B.5. Future Research Directions

B.5.1. Extensions of upper echelons theory

In Section 4, we identified 18 key messages that provide a basis for critically rethinking the individual variables of CEO characteristics and their relations with banks' risk-taking. In the following, ideas for future research based on these key messages are developed. The results of Hambrick and Finkelstein (1987) and Hambrick et al. (2005) show that the original upper echelons theory can be extended. These extensions, which we excluded from our review

because the papers analyzed did not address them, offer several fruitful directions for future research.

Figure B1 highlights that only the direct influence of CEO characteristics on risk-taking is measured in our analysis. Pay incentives are partially included as moderating effects. However, as Hambrick and Finkelstein (1987) show, other moderating effects could be considered. They recognize that a CEO's freedom and managerial discretion in business decisions contribute to CEO characteristics having an even larger impact on managerial choices and organizational outcomes. A second moderator suggested by Hambrick et al. (2005) are the job requirements. When cognitive load and thus job demands are high, CEOs tend to make quick and emotionally charged decisions (Hambrick et al., 2005). Some CEOs prefer polychronicity in projects and tasks. That is, they like to carry out multiple tasks simultaneously. For other CEOs, this may be a stressor and impair their cognitive ability (Chen, 2020). Like managerial discretion, Hambrick et al. (2005) suggest that if job demands are high, CEO characteristics have an even larger impact on managerial choices, which can be expected to apply to banks' risk-taking as well. However, the roles of both managerial discretion and executive job demands as potential moderators of the relationship between CEO characteristics and banks' risk-taking have not been examined. Such research could yield important information on how the impact of CEO characteristics on risk-taking could be curbed or even extended.

B.5.2. Antecedents and CEO characteristics

Altogether, 15 of our 18 key messages deal with antecedents or CEO characteristics. However, as highlighted above, many of the research findings have considerable limitations, which can be divided into three main criticisms: (i) the use of proxy variables and their inconsistent application, (ii) the resulting contradictory results and (iii) the paucity of existing papers on specific characteristics. In the following, we propose potential solutions to these three criticisms.

While most demographic variables can be collected using archival data, archival research cannot fully grasp CEOs' psychological and biological characteristics (Abernethy and Wallis, 2019; Hanlon et al., 2022). One example is CEOs' individual religiosity. While religious affiliation can be measured using archival data, the degree of individual religiosity cannot. Our key messages showed that CEO religiosity as well as psychological, socio-psychological and biological variables require more sophisticated measurement methods. To examine human behavior, more profound and versatile results can be obtained by using questionnaires or interviews than archival data. Although the creation and analysis of such data mean greater effort than analyzing databases, this approach can yield a more nuanced understanding of the drivers of CEOs influencing banks' risk-taking.

Questionnaire studies are rarely the focus of the finance literature, but this methodology can explain risk behavior in more detail. In this context, Baker and Mukherjee (2007) note that the risk of non-response bias or the problem that the data cannot be generalized can be countered by appropriate sampling and testing. Questionnaire-based survey research can thus enhance the quality and depth of the available data and open up the possibility of achieving different results from those obtained using archival data. Using questionnaires, personal characteristics can be queried directly and do not have to be derived using sometimes crude proxies (e.g., religiosity, as noted above; see also Abernethy and Wallis, 2019). Questionnaire data can also be enriched with in-depth interviews conducted with CEOs (Cronholm and Hjalmarsson, 2011). The starting point for such research designs could therefore be a questionnaire to query the CEO characteristic of interest in a sufficiently large sample. The subsequent interviews could then build on the questionnaire results to elaborate on the previously determined core findings.

Questionnaire-based research on CEO characteristics and banks' risk-taking could also use well-established measurement scales from psychology. Approaches such as the five-factor model of Costa and McCrae (1992) and 10-item personality inventory of Gosling et al. (2003),

a shorter version of the Costa–McCrae model, are widely used in behavioral research. The 10-item personality inventory measures the Big Five personality characteristics (extraversion, agreeableness, conscientiousness, emotional stability and openness), which are well established in psychology research (Costa and McCrae, 1992). In the model, 10 items are requested, each consisting of a pair of words. The participants then use a seven-point Likert scale to decide with which word they identify and to which intensity. Subsequently, the variables can be summarized using a factor analysis. This allows the personality profile of a participant to be condensed into one variable to measure its effect on risk-taking. Likewise, CEO narcissism could be mapped using the subscale from the Narcissistic Personality Inventory-13 proposed by Gentile et al. (2013). Jackson (1984) has published several scales for personal characteristics such as sentience and succorance in his Personality Research Form. For affective traits, the PANAS approach proposed by Watson et al. (1988) has become established. Likewise, Schaefer et al. (2003) study overconfidence in two ways. Finally, questionnaire constructs could be used to better determine the individual religiosity of CEOs. For instance, Huber and Huber (2012) use the Centrality of Religiosity Scale, which measures five dimensions of religiosity. Psychological CEO characteristics could also be examined in conjunction with biological CEO attributes. For example, Canace et al. (2020) identify a positive correlation between CEO salary, CEO competencies and CEO attractiveness. In this case, CEO characteristics are surveyed using a 10-point Likert scale.

To other, psychological, social-psychological and biological measures are already widely used in such research fields like for example accounting (Abernethy and Wallis, 2019; Hanlon et al., 2022; Plöckinger et al., 2016), suggesting they are likely to influence organizational risk-taking. This prior evidence reinforces the notion that these CEO characteristics, which can be collected using questionnaire surveys, are likely to influence banks' risk-taking as well; however, they have thus far remained unexamined in the finance literature.

Beyond questionnaire surveys, qualitative interviews could deepen the results from questionnaires in specific areas. In interviews, answers can be assessed more context-sensitively (Heimann et al., 2020). This is especially important when dealing with dynamic characteristics such as the self-esteem of a CEO. A respondent's answer may vary depending on the situation. This aspect cannot be assessed in a questionnaire, but may be teased out in a personal interview. We therefore expect a sequential mixed-method approach to deliver more nuanced insights into the effect of CEO characteristics on banks' risk-raking.

B.5.3. Risk-taking variables

Three of our key messages refer to banks' risk-taking. We criticize the heterogeneity and lack of a clear interpretation of the variables. To eliminate the arbitrary use of the term "risk-taking", the concept must be redefined. A distinction should be made between the consideration of individual risk types (i) and total bank risk (ii and iii). In the case of individual considerations, more refined analysis is necessary. Starting with credit risk, we propose a more detailed classification of credit risk variables based on the degree and scope of credit failure (probability). The reason for this classification is the arbitrary use of existing variables to explain credit risk. We suggest distinguishing between loans that may be at risk of default and loans that have already been defaulted. This would lead to three groups: impaired loans, non-performing loans and loan write-offs. To select the appropriate variable, it is necessary to define in advance which kind of credit risk should be measured. Such a classification would help avoid unspecific statements about credit risk.

Credit risk variables can also be divided into those used in ex-post and ex-ante analyses. An ex-post view examines loans that have already been defaulted using, for example, non-performing loan ratios (Nguyen et al., 2019; Ooi et al., 2019). According to Chen and Lin (2016), the level of non-performing loans is positively correlated with bank failure. Loan loss provisions can be used to measure the ex-ante view of credit risk. These express the risk coverage for loans that

might default in the future (Skała and Weill, 2018; Mourouzidou-Damtsa et al., 2019; Mahdi and Abbes, 2018).

Insolvency risk also requires more fine-grained consideration. Some studies use the Z-score, while others use the distance to default model without providing a rationale for their choices. Indeed, a clear rule for deciding when a variable should be used is lacking. While the distance to default criterion represents a bank's expected probability of default based on option price theory, the Z-score predicts the potential inability to pay using the standard normal distribution. Further, the Z-score can be defined in different ways, while the key figures used in the literature to define the reference value also differ. They address liquidity, leverage, activity and profitability aspects (Gaba et al. 2019). In the distance to default model, the size of the distance-to-capital ratio depends only on the degree of the capital adequacy threshold and volatility of the bank's assets, while size is also affected by the bank's asset-to-liability ratio in the Z-score method. Chan-Lau and Sy (2007) show that the difference between these two measures is only negligible when the analyzed assets (i.e., share prices of banks) are highly volatile. Gaba et al. (2019) state that the distance to default model makes more accurate predictions when a bank suffers from financial distress.

Operational risks are approximated in the literature using metrics that address a bank as a whole. They are not attributed to a division of a bank or a single capital instrument. Thus, the metrics used in the papers in our sample merely represent the riskiness of the whole business. The consideration of individual types of operational risks, for which measurement is complex, can thus be identified as a research gap. An operational loss can be incurred from errors related to processes, people and systems (Ames et al. 2015). The Bank for International Settlements (2001) clusters operational risk into seven types: internal fraud; external fraud; employment practices and workplace safety; clients, products and business practices; damage to physical assets; business disruption and system failures; and execution, delivery and process

management. Recent studies such as Chernobai et al. (2021) revisit this classification. They find that the risk of operational failures also depends on the complexity of a bank. Their results can be used to identify additional variables for operational risk.

When analyzing market risk, the specification should consider systematic risk. As our results show, systematic and idiosyncratic risk variables are combined in the literature to explain total market risk. In this context, systematic risk should include both potential losses and losses from possible extreme events. Extreme events, measured, for example, by the marginal expected shortfall, are not considered in all the studies, but are the foundation for estimating capital losses, especially in times of crisis (Acharya et al., 2017).

Few studies analyze equity and liquidity risks, as further special risk types, which is a gap for future research. In particular, a detailed analysis of liquidity risk and its impact on a bank's risk-taking might by interesting, as banking authorities have recently aimed to establish and improve measures of liquidity risk (Chen et al., 2021).

By contrast, variables representing total bank risk are often used in the literature. In our sample, total bank risk is measured either by a combination of several risk types (ii) or by regulatory ratios (iii). The use of regulatory ratios might have the advantage of expressing a view of total bank risk that is consistent with supervision. As these ratios must be reported by all banks, they are comparable, allowing general statements about the risk level to be made. The combination of risk types is arbitrarily chosen in several of the analyzed papers and therefore inconsistent. However, the idea of combining risk types could be an interesting approach for future research if the business models of banks can be represented in one metric. Savings and cooperative banks cannot be equated with investment banks due to their different business models and resulting different risk strategies (Bülbül et al., 2019). Consequently, they are exposed to these risk types to varying degrees. We therefore propose defining bank type-specific ratios that cover the typical risks associated with a specific business model. For example, the Basel Committee on

Banking Supervision identifies credit risk, liquidity risk, operational risk and insolvency risk as the most significant risk exposure categories for commercial banks (Abid et al., 2021). For investment banks, focusing on the combination of credit risk and market risk might be more conceivable in this context. The idea is to weight risk types in a way that makes banks with the same business model or in the banking sector comparable. Thus, an increase in such total bank risk ratios could be an early warning signal of financial distress for banks adopting a specific business model or operating in specific banking sectors. Further research should aim to identify the most relevant risks for each type of bank and design a suitable way to aggregate them into a total bank risk ratio.

B.5.4. Interaction profiles

One further challenge for the future could be to create CEO profiles for individual risk-taking types. Only a few conclusions can be drawn from our sample. Many variables are subject to total bank risk or several types of risk-taking at the same time. Nevertheless, peculiarities become apparent. First, only the influence of CEO characteristics on a bank's risk-taking has been investigated. It has been shown, for example, that materialistic and masculine CEOs are likely to promote market risk (Ahmed et al., 2019b; Bushman et al., 2018). In particular, social connections are cited in relation to insolvency risk (Dbouk et al., 2020; Chen and Ebrahim, 2018) and credit risk is found to increase under narcissistic CEOs (Buyl et al., 2019). However, CEOs do not usually possess only one of the mentioned characteristics. Thus, the extent to which a materialistic and narcissistic CEO influences a bank’s risk-taking could be investigated in the future as well as which characteristics influence each other. Such joint consideration could lead to neutralizing or reinforcing effects. Consequently, individual CEO profiles could be created and their influence on a bank’s risk-taking examined. This aspect could be particularly interesting in combination with extensions to upper echelons theory. For example,

it is unclear if the moderating effects of job demands and managerial discretion strengthen or weaken the relationship between CEO characteristics and banks' risk-taking.

B.6. Conclusion

The global financial crisis of 2007 and 2008 brought CEOs and their individual characteristics into the focus of research, regulation and practice. It became increasingly clear that the risk-taking of banks is also a reflection of the personal characteristics of their CEOs. However, even if the starting point of much work was the financial crisis and excessive risk-taking by banks, CEO characteristics and their impact on a bank's risk-taking did not and do not have only negative connotations. Therefore, one aim of this paper was to summarize, group and sort the research results thus far presented in the literature. While we identified several ways in which CEOs influence the risk-taking of their banks, the research findings on this topic are fragmented and no comprehensive picture exists.

Thus, the second aim of our paper was to provide an overarching framework for the topic. To derive a comprehensive picture, we used upper echelons theory to examine in depth the influence of CEOs on banks' risk-taking. We found that demographic, psychological, social-psychological and biological characteristics all influence a bank's risk-taking. The effects are reinforced by antecedents and pay arrangements and lead to increasing, reducing and varying effects on risk-taking. We also showed that the influence of incentive structures should be measured not only as an antecedent but also as a moderating effect. Risk-taking by banks is not calculated in a uniform way. It is measured as the change in risk within one risk type, as an aggregation of several risk types to represent total bank risk or using regulatory ratios. We deciphered the sometimes arbitrary use of variables to measure risk-taking and offered solutions for dealing with them in a uniform and comparable way. We also provided suggestions on how to measure CEO characteristics more validly.

Finally, the last aim of our paper was to provide suggestions and proposals for future research. In addition to discussing improved approaches to measuring CEO characteristics and risk-taking variables, we highlighted that a combination of CEO characteristics would lead to better predictions.

Lastly, practitioners (i.e., the decision-makers responsible for hiring CEOs) can use our results to develop a catalogue of criteria for CEO characteristics congruent with the desired and aspired levels of risk-taking for their bank.

Appendix Section B

Table B5 provides further information in combination with Table B3, showing the classification of the papers and a specification of the variables used and the banks within the sample.

Author(s) (year of publication)	A/B/C logic by Pittaway et al.	Pay arrangements	Specification of upper echelons characteristics	Specification of risk-taking	Financial institutions
Nguyen et al. (2019)	B	Bonus, equity	Dominating culture in each bank, CEO age, Ivy League, experienced CEO	'Risky borrower' dummy variable, mortgage approval rate, loan growth, ratio of non-performing loans/total loans, Tier 1 ratio, conditional value at risk	Publicly listed U.S. banks
Berger et al. (2016)	A		CEO management level, chairman=CEO, ownership	Bank failure	Banks
Byrd et al. (2012)	A		Duality, ownership	Bank failure	28 conventional banks and 37 Islamic banks
Acrey et al. (2011)	B	Salary, Bonus, value of shares & value of options granted in current year, value of vested shares & value of unvested shares, value of vested options & unvested options, percentage of total outstanding shares of the firm owned by CEO excluding options	Age, tenure, change	Bank's interest-accruing loans, bank's delinquent loans, book value of foreclosed real estate, value of domestic certificates of deposit, bank's equity, net operating income before extraordinary items, less the gain (loss) on sale of securities, book value of investment securities, expected default frequency, distance to default, subprime mortgages, securitization income as a percentage of the bank's net income, trading assets, recourse	Indonesian banks
Skala and Weill (2018)	A		Female, age	Capital adequacy ratio, equity/assets, Z-score, ratio of non-performing loans/total loans, ratio of loan loss provisions/total loans	Banks
Berger et al. (2014)	A		Power	Capital adequacy ratio, ratio of risk-weighted assets/total assets, loan portfolio concentration	Publicly traded thrifts
Ho et al. (2016)	A		Overconfidence: CEOs who postpone exercising stock options that are more than 100% in the money at least twice during their tenure, age	Change in bank loans and leverage, bank loan quality, bank performances and insolvencies, dummy variable for CEO turnover, dummy variable for bank failure	Private, public and cooperative banks
Boyallian and Ruiz-Verdu (2018)	B	Vega of option portfolio, delta of option portfolio, wealth, total pay, termination payments, debt-like compensation	Autonomy, age, tenure	Dummy variable firm fails in 2007 to 2010, distance to default, expected default frequency	Banks, insurance, real estate, financial services companies

Author(s) (year of publication)	A/B/C logic by Pittaway et al.	Pay arrangements	Specification of upper echelons characteristics	Specification of risk-taking	Financial institutions
Faleye and Krishnan (2017)	B		CEO is chair, proportion of outside CEOs, golden parachute, ownership	Dummy variable if borrower's long-term S&P credit rating at loan origination is investment grade (i.e., BBB or higher)	399 bank holding companies, 998 commercial banks, 134 cooperative banks, 73 saving banks
Belkhir and Boubaker (2013)	B	Vega of option portfolio, delta of equity portfolio, cash compensation	Tenure, age	Dummy variable when the notional amount is positive, natural logarithm of the notional amount of interest rate derivatives held for risk management purposes/total assets	Commercial banks
Bennett et al. (2015)	B	Inside debt indicator, pension indicator, deferred compensation indicator, debt, equity, inside debt ratio, delta and vega compensation, residual compensation	Tenure	Expected default frequency, distance to default, total risk (defined here as insolvency risk), CAMELS composite ratings, actual failures occurred during 2007–2011	Banks
Akbar et al. (2017)	A		Duality, ownership	Idiosyncratic risk, market adjusted idiosyncratic risk, Z-score, industry adjusted Z-risk	Large U.S. bank holding companies
Zhou et al. (2019)	A		Chair-CEO age gap 20, Chair-CEO age difference, Chair-CEO age difference absolute, Chair-CEO age difference squared; As C.V.: Retirement, tenure, Ex-CEO, change, Chair-CEO joint tenure, Chair-CEO gender difference, Chair-CEO industry experience difference	Loan-loss reserves/total loans, ratio of impaired loans/gross loans, Z-score, standard deviation of banks' stock returns	Gulf Cooperation Council Islamic banks
Sun (2018)	B	Cash bonus, total annual equity compensation, delta, vega, salary	Tenure	Loan/income ratio, percentage of higher-priced loans among first liens and among junior liens	Commercial, savings, cooperative and mortgage banks
Buyl et al. (2019)			Narcissism: the prominence of the CEO's photograph in the annual report, cash compensation, total compensation, relative use of first-person singular pronouns vs. first-person plural pronouns in the letter to shareholders, number of signatures under the letter to shareholders (reversed), number of words in the CEO's Marquis Who's Who biography, duality, position tenure	Ratio of commercial and business loans/total assets, ratio of non-interest income/net operating income, derivatives and off-balance sheet items/total assets	70 major domestic banks, including the "big four" state-owned commercial banks, 12 joint-equity banks and 54 city commercial banks

Author(s) (year of publication)	A/B/C logic by Pittaway et al.	Pay arrangements	Specification of upper echelons characteristics	Specification of risk-taking	Financial institutions
Farag and Mallin (2017)	B		Duality	Ratio of impaired loans/total loans (defined here as total bank risk)	85 failed and 256 non-failed U.S. commercial banks
Mahdi and Abbes (2018)	A		Overconfidence proxies (loan growth rate, net interest margin, pre-provision income, profit margin)	Ratio of loan loss provisions/total loans	U.S. bank holding companies
Ooi et al. (2020)	A		CEO (Muslim)	Ratio of non-performing loans/total assets ratio, capital adequacy ratio, natural logarithm of the ratio between return on assets and the standard deviation of return on assets natural logarithm, Z-score	Commercial Tunisian banks listed on the Tunis Stock Exchange
Chen and Lin (2016)	A		Duality	Ratio of non-performing loans/total loans, earnings at risk, dollar amount of bank liquidity creation/total assets	Commercial banks, savings institutions and investment banks
Cerasi et al. (2020)	B	Fixed salary, annual compensation, variable compensation, bonus, stock option awarding	Age, sex, entry	Ratio of non-performing loans/total loans, standard deviation of banks' stock returns	37 Islamic and 96 conventional banks
Luu (2015)	A		Duality	Ratio of risk-weighted assets/total assets	European publicly listed banks
Ahmed et al. (2019) (a)	A	Annual compensation	Crisis experience, female, age, bank tenure, CEO/CFO, any executive, director, average age, average experience	Ratio of risk-weighted assets, real estate loan exposure (defined here as total bank risk), ratio of loan loss provisions/loans	U.S. commercial banks
Fabrizi (2018)	B	Delta, vega, salary	Tenure	Securitization, credit losses, subprime	Bank holding companies
King et al. (2016)	A	Vega, delta, cash compensation	UG education, MBA education, PhD education; additional checks: CEO turnover, tenure, ownership	Securitization, derivatives, real estate and mortgage loans, ratio of non-interest income/total assets, risk-weighted-assets growth	Publicly listed U.S. banks
van Bekkum (2016)	B	Value of shares, value of options, bonus, delta, vega, annual compensation	Age	Stock market losses, standard deviation of banks' stock returns, value at risk, expected shortfall, conditional value at risk, probability of financial distress	Cooperative banks, Bank Polskiej Spółdzielczości
Belkhir and Chazi (2010)	B	Vega, Delta, cash compensation, stock ownership	Tenure	Systematic risk, idiosyncratic risk, standard deviation of banks' stock returns	banks
Bharati and Jia (2018)	B	Vega of wealth, delta of wealth, cash compensation	Age, tenure	Systematic risk, idiosyncratic risk, standard deviation of banks' stock returns	Publicly listed U.S. banks

Author(s) (year of publication)	A/B/C logic by Pittaway et al.	Pay arrangements	Specification of upper echelons characteristics	Specification of risk-taking	Financial institutions
DeYoung et al. (2013)	B	Delta wealth, vega wealth, salary	Tenure	Systematic risk, idiosyncratic risk, standard deviation of banks' stock returns, ratio of private mortgage securitization investments (at fair value)/total assets, ratio of non-interest income/net operating income, ratio of commercial and industrial loans/total assets	Publicly listed U.S. banks.
Bushman et al. (2018)	A	Luxury asset ownership, delta, vega, wealth	Dummy variable if the CEO owns luxury assets (cars with purchase price greater than $75,000, boats greater than 25 feet in length, primary residences worth more than twice the average of the median home prices in the Core Based Statistical Area (CBSA) of his firm's corporate headquarters, or any additional residences worth more than twice the average home prices in that CBSA)	Tail risk, marginal expected shortfall	53 banks with unitary boards, 46 dual board banks
Anginer et al. (2016)	A	Total compensation, options, shares, portfolio, delta, vega	Chairman separation	Tier 1 ratio, total capital ratio, common equity ratio, tangible equity ratio, ratio of market value	M&A deals in the U.S. banking industry
Liu et al. (2017)	B	Salary, bonus, long term compensation, pay mix, duality, sit on the nomination committee, sit on the compensation committee, shareholding	Tenure, age	Standard deviation of banks' stock returns	Publicly listed U.S. banks
Pathan (2009)	A		Power, ownership	Standard deviation of banks' stock returns, idiosyncratic risk, systematic risk, asset-return risk, Z-score	80 unique banks
Sghaier and Hamza (2018)	A		Duality female CEO; As C.V.: duality	Standard deviation of banks' stock returns, idiosyncratic risk, systematic risks, distance to default	10 commercial banks, 13 investment banks, 10 insurance companies and 12 funds
Ahmed et al. (2019) (b)	A		Facial width-to-height ratio, Testosterone, turnover	Standard deviation of banks' stock returns, idiosyncratic risk, Z-score	Banks
Yang (2017)	B	Vega, delta, total compensation, salary, bonus, option grants, restricted stock grants, tenure, cash compensation	Tenure	Standard deviation of banks' stock returns, loan loss write-offs/total assets, non-interest income by the sum of interest income and non-interest income, ratio of private mortgage securitization investments/total assets	Banks

Author(s) (year of publication)	A/B/C logic by Pittaway et al.	Pay arrangements	Specification of upper echelons characteristics	Specification of risk-taking	Financial institutions
Aljughaiman and Salama (2019)	B		Duality	Standard deviation of banks' stock returns, ratio of impaired loans/total loans, standard deviation of the return on average assets, inverse ratio of cash and cash equivalent/total assets, Z-score	Publicly listed U.S. banks
Shah et al. (2017)	B	Bonus, restricted shares, options, total assets	Tenure, ownership	Standard deviation of banks' stock returns, systematic risk, idiosyncratic risk	173 publicly listed commercial banks and investment banks
Adhikari and Agrawal (2016)	A		Religiosity, vega of option holding	Standard deviation of banks' stock returns, tail risk, idiosyncratic risk, Z-score	U.S. financial institutions
Guo et al. (2015)	B	Total compensation, salary, bonus, long-term incentives, shareholding, CEO	Age, tenure	Standard deviation of banks' stock returns, Z-score, ratio of non-performing loans/equity	Banks
Delgado-Garcia et al. (2010)	A	Stock ownership	Affective traits by PANAS, tenure, education level, risk background	Variance in return on asset, ratio of non-performing loans/total loans, commercial loans and secured loans and finance leases correlation with the ratio of non-performing loans/total loans	156 U.S. bank holding companies and 544 industrial firms
Houston and James (1995)	B	Stock/total stock outstanding, value options granted/cash compensation	Age, years as CEO, years with company	Variance in stock returns	Banking firms, commercial banks and state-chartered saving institutions
Mourouzidou-Damtsa et al. (2019)	B		Domestic CEO	Standard deviation of banks' stock returns, Z-score, ratio of loan loss provisions/loans	Commercial banking companies
Al-Own et al. (2018)	B	Vega of CEO wealth, salary, bonus, stock grants	Ownership, age, tenure	Distance to default	Commercial banks
Hagendorff and Vallascas (2011)	B	Vega, delta	Tenure, age, duality	Distance to default	58 observations as TARP banks and 23 non-TARP banks
Jiang et al. (2019)	B	Total cash compensation, Change in total cash compensation, shareholding	Executive age, tenure	Z-score	Bank holding companies
Bai and Elyasiani (2013)	B	Salary, bonus, total annual compensation, stock holding, option holding, delta, vega, pay share	Duality, tenure	Z-score	Commercial banks
Dbouk et al. (2020)	A	Managerial holding, vega, high turnover	Degree, closeness, betweenness, chairman, age, tenure	Z-score	European publicly listed banks

Author(s) (year of publication)	A/B/C logic by Pittaway et al.	Pay arrangements	Specification of upper echelons characteristics	Specification of risk-taking	Financial institutions
Zeineb and Mensi (2018)	A		Duality	Z-score	U.S. banks
Uhde (2016)	B	Variable compensation, cash-based compensation, equity-based compensation, fixed compensation	Years, age, executives quality, male executives, female executives	Z-score, distance to default	Bank holding companies
Mollah and Liljeblom (2016)	A		Duality, internally recruited, age, tenure, banking experience, qualification	Z-score, non-performing loans (as proxy for asset quality ratio)	Private commercial banks (71%), government-owned banks, savings banks and cooperative banks (29%)
Pathan et al. (2016)	A		Ownership, outside ownership	Z-score, ratio of impaired loans/total loans, Standard deviation of banks' stock returns, idiosyncratic risk, systematic risk, asset-return risk	Commercial banks, bank holdings and saving banks
Hung et al. (2017)	A		Political connection, age, gender, MBA, education, tenure	Z-score, ratio of loan loss provisions/total loans	Commercial banks, federally chartered saving banks and non-federally chartered saving banks
Chen and Ebrahim (2018)	A	Wealth, total dollar value of stocks and stock options, compensation delta, compensation vega	Conditional termination propensity, tenure, ownership, duality	Z-score, ratio of non-performing loans/total assets	Spanish banks and savings banks
Altunbaş et al. (2019)	A		Tenure, duality, ownership, network size	Z-score, systematic risk, marginal expected shortfall	Largest banks in the U.S.
Bacha and Azouzi (2019)	A		Gender, age, overconfidence, optimism, loss aversion, financial literacy, experience, education level (Measure: Inspired from the questionnaires conducted and administrated for the purpose of determining the relevant confidence and optimism indexes concerning a number of Quebec-based SMEs.	Credit decisions of the CEOs	Large U.S. financial firms
Niu (2010)	B	Delta, cash	Number of confident articles, number of articles published in The American Banker, vega, age, tenure	Sensitivity of CEO wealth to equity risk	Bank holding companies

Author(s) (year of publication)	A/B/C logic by Pittaway et al.	Pay arrangements	Specification of upper echelons characteristics	Specification of risk-taking	Financial institutions
Switzer and Wang (2013)	A		Age, directors active CEO, duality	Distance to default	Bank holding companies
Total (58)					

Table B5: Specification of the variables

References Section B

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C. Bail-in Requirements and CoCo Bond Issuance

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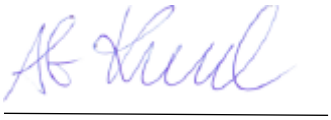
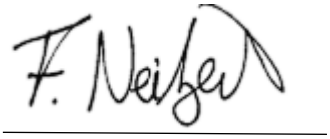
Paper´s status: This paper has been submitted to *Finance Research Letters*: Accepted.

We, the authors of the paper, hereby declare that this paper's second author, Patrick Hertrampf, was responsible for collecting and reviewing the unique research data and contributed in particular to the writing of the literature review. Furthermore, all authors contributed equally to the development of the regression model and the data analysis.



Arndt-Gerrit Kund

Patrick Hertrampf



Florian Neitzert

C.1. Introduction

With the U.S. housing market going strong until the global financial crisis that started in 2007, the ability to absorb losses had hardly been tested. However, when push came to shove and Lehman Brothers filed for bankruptcy, an era of enormous risk appetite came to an end (Acharya and Naqvi, 2012). Lehman's failure showed that the loss-absorbency of banks was not only constrained in terms of quantity, but also quality of capital (Koˇsak et al., 2015). For this reason, regulatory capital requirements were expanded and the eligibility of financial instruments that could be counted towards regulatory capital was constrained (Cao and Chou, 2022), when revisiting the Basel Accords after the financial crisis. From then on and based i.a. on the proposal of the Squam Lake Working Group on Financial Regulation (Squam Lake Working Group, 2009), CoCo bonds are the only remaining hybrid capital that will be included either as Additional Tier 1 (AT1) or Tier 2 (T2) in the regulatory capital (Oster, 2020). They are subordinated financial instruments that convert in times of crisis into Common Equity Tier 1 (CET1) or extraordinary gains by means of an ex ante contractually defined trigger. The lack of optionality, but rather contractual obligation to write down or convert CoCo bonds provides loss-absorbing capital within the bank contrary to previous hybrid capital (Ambrocio et al., 2020).

We will investigate in this paper an interesting design feature of CoCo bonds that relates to their accounting. While being considered regulatory capital in any case, they can be counted towards either debt or equity on the balance sheet. Against this background, the exact motives of banks when to include CoCo bonds in AT1 or T2, respectively debt or equity remain opaque (Rudolph, 2013). Generally speaking, the balance sheet treatment is a function of the design characteristics of the CoCo bond (e.g. its perpetuity and trigger design). In this sense, it is our assumption that the inclusion of CoCo bonds in AT1 or T2 capital is an exogenous decision of the bank that manages its capital structure and underpins the difference between the two forms

of regulatory capital. More specifically, AT1 is part of Tier 1 (T1) capital together with CET1, which consists mostly of shares and retained earnings.

The inclusion of CoCo bonds in AT1 is subject to the going-concern approach (Goncharenko et al., 2021). In this case, the conversion into CET1 capital is intended to ensure that the bank remains viable. In the event of bankruptcy, the capital is therefore subordinate to the T2 capital, which is in contrast subject to the gone-concern approach and intends to ensure the resolvability of the bank in the event that is failing or likely to fail (Flannery, 2014). Against this background, T2 capital can be used to meet regulatory requirements in terms of Total Loss-Absorbing Capacity (TLAC). TLAC as a global standard intends to ensure that G-SIBs hold sufficient bail-in eligible capital as required within the framework of the resolution mechanism (Markoulis et al., 2020). With this, a novelty was created by the banking regulator: Bail-in capital is intended to replace state support measures (bail-out) in the event of a bank being likely to fail or failing (Flannery, 2017). The innovation also allows non-subordinated debt capital to be held against losses outside of insolvency proceedings (Kupiec, 2016). The creation of bail-in-able capital thus reflects a lesson learnt from the financial crisis, in the sense that investors must not only benefit from generated profits, but also share the losses in the event of failure.

Against this background, the heterogeneity of CoCo bonds with regard to their eligibility as AT1 or T2 capital opens up an interesting research question. While AT1 eligible CoCo bonds improve both the going- and gone-concerns capital ratios (i.e. leverage ratio (LR) and TLAC), T2 eligible CoCo bonds exclusively improve the bail-in-able capital and hence TLAC of the issuing bank. Could it thus be, that the decision to issue AT1 or T2 eligibile CoCo bonds is taken in order to actively manage the LR or TLAC?

Based on a worldwide data set of 214 AT1 and 175 T2 CoCo bonds issuances of 49 publicly listed banks from 25 countries covering the period from 2012 to 2018, we address this gap in the literature. Our analysis shows that banks use CoCo bonds to optimize their regulatory capital

ratios in selected cases. While banks with a high LR headroom – that is the amount of percentage points above the regulatory required minimum – are less likely to issue AT1 eligible CoCo bonds, we inversely find that a high TLAC headroom does not influence the issuance of T2 eligible CoCo bonds. As such our results are important, as they shed further light on the capital management of banks.

The paper is structured as follows: the subsequent Section 2 presents the current literature and therefrom derives the research hypothesis of this study. Section 3 presents the data set and the empirical framework. The findings are reported in Section 4, while Section 5 concludes.

C.2. Development of the Research Question

The number of publications on CoCo bonds is growing constantly (Flannery, 2014; Oster, 2020). Relating to the issuance effects, Liao et al. (2017) show that banks record negative abnormal returns in the post-announcements period after the issuance of new CoCo bonds. Avdjiev et al. (2020) provide empirical evidence that in general larger and higher capitalized banks are more likely to issue CoCo bonds. Goncharenko et al. (2021) emphasize the impact of debt overhang on banks‘ decision to issue CoCo bonds. However, empirical research is lacking on banks’ specific motives for issuing CoCo bonds as AT1 (going concern) or T2 (gone concern) capital. Exemplary, Fiordelisi et al. (2020) and Abdallah and Fernandez (2022) investigate these mechanics but fail to reach a conclusive answer. Consequently, we tackle this blank spot on the research map with our study.

We investigate the drivers of AT1, respectively T2 CoCo bond issuance under the hypothesis that this is an active decision taken by banks in the course of their capital planning and management. More specifically, we test whether CoCo bonds are used to manage going- and/or gone-concern capital. To this end, we exploit that AT1 eligible CoCo bonds count towards both, the LR requirement, as well as the national transposition of TLAC, whereas T2 eligible CoCo bonds count exclusively towards the latter. We thereby focus on the transmission channel of

bail-in capital, where banks with a shortfall in such capital could explicitly issue T2 eligible CoCo bonds to address this deficit, while benefiting from the hybrid capital structure. Against this background, we posit:

Hypothesis *Banks use the design features of CoCo bonds to manage their going- or gone-concern capital ratios specifically.*

We test this hypothesis by looking to the capital headroom with regard to the regulatory minimums above the LR, respectively TLAC. While the literature has mostly focused on going-concern capital ratios (i.e. CET1, T1, and LR), gone-concern capital becomes ever the more important against the lessons learnt from the past financial crisis and the subsequent shift from bail-out to bail-in regimes. In particular the creation of T2 capital has been a challenge for banks, which is why the usage of CoCo bonds as one tool to this end is a focal point of our analysis.

C.3. Data

The analyzed data cover 49 publicly listed significant institutions from 25 countries over the period of 2012 to 2018. During this time 389 CoCo bonds were issued, of which the majority (214, i.e. 55 %) were AT1-eligible, with the remainder counting towards T2 capital. Our data set is hence representative to that of Avdjiev et al. (2020) and thereby disperses any concerns that crossholdings of financial institutions may constitute unaccounted for transmission channels. Similarly, our starting year in 2012 ensures a mostly level playing field with regard to the Basel Accords and the subsequent issuance incentives for banks in our sample. As the CoCo bonds in our sample have neither been called, nor written-down or converted, our sample remains free of a potential survivor bias.

We use this data on CoCo bonds to construct a panel data set by mapping the CoCo bond issuances to the corresponding banks. In doing so, we carry forth the differentiation between AT1 and T2 CoCos against the rational of our research question. However, where a bank has multiple issuances of either kind, they are aggregated to accommodate the panel data set. Taken together, our data set consists of 343 bank-year observations with the respective CoCo bond issuances. Table C2 gives an overview over the used variables, while Table C3 contains their summary statistics. Correlations can be obtained from Table C4.

C.4. Results

In order to test our hypothesis, we employ a regression model with bank (αi) and time (μt) fixed effects. We extend this model as described in Equation 1 in a step-wise approach in order to control for bank- and macro-specific variables that we denote for differentiation with β and γ, respectively.

$$\begin{aligned} CoCo\text{-}Issuance_{i,t}^{\,capital\ tier} = {} & \beta_1 capital\ headroom_{i,t} \\ & + \underbrace{\beta_2 ROA_{i,t} + \beta_3 Size_{i,t} + \beta_4 ROID_{i,t} + \beta_5 NPL_{i,t}}_{\text{bank controls}} \\ & + \underbrace{\gamma_1 ln(GDP)_{c,t} + \gamma_2 GDP^{growth}_{c,t} + \gamma_3 Inflation_{c,t} + \gamma_4 C2GDP_{c,t}}_{\text{macro controls}} \\ & + \alpha_i + \mu_t + \varepsilon_{i,t} \end{aligned} \qquad (1)$$

For the bank-specific variables we choose the profitability as measured by the Return on Assets (ROA), instead of the Return on Equity (ROE) in order to prevent any biases from the leverage, which is intrinsic to the ROE. The business model of the bank is proxied by its size as measured by the natural logarithm of its total assets (SIZE) in order to remediate distortions from few very large banks, and the revenue diversification (ROID) between interest and non-interest income as depicted in Equation 2 and originally used by Laeven and Levine (2007). Ultimately,

the ratio of non-performing loans over total loans (NPL) accounts for the risk profile of the bank.

$$ROID_{i,t} = 1 - \left|\frac{NII_{i,t} - NNII_{i,t}}{NOPI_{i,t}}\right| \qquad (2)$$

The macro-specific control variables are the natural logarithm of GDP, again to account for distortions from outliers, together with its year-on-year change (GDPGrowth). Inflation is measured by the level of CPI, while financial imbalances are accounted for the Credit to GDP gap (C2GDP). Banks are denoted by i, while c identifies countries and t time. The error term is denoted by E.

Table C1 shows the step-wise expansion of the basis model, which investigates the relationship between the LR headroom and the issuance of AT1 eligible CoCo bonds for the models labeled with A, and for the linkage between TLAC headroom and T2 eligible CoCo bond issuance for models referred to as B. Model 1 shows the univariate regression of the variable of interested, while Model 2 includes bank-specific controls, whereas Model 3 considers additional macroeconomic-controls. We find that lower levels of capital headroom regarding the leverage ratio make banks more susceptible to issue AT1 eligible CoCo bonds, likely in order to avert potential capital shortfalls. This observation is robust through all investigated models. To the contrary, banks with a potential deficit of bail-in capital as required by the TLAC requirements, do not respond thereto by issuing in particular T2 eligible CoCo bonds. Results are reported to the 95 % (∗), 99 % (∗∗), and 99.9 % (∗∗∗) confidence level. P-Values are indicated in parenthesis below the coefficients.

	AT1			T2		
	Model A.1	Model A.2	Model A.3	Model B.1	Model B.2	Model B.3
$LR_{headroom}$	-0.5880***	-0.5277**	-0.4031*			
	(0.0003)	(0.0034)	(0.0405)			
$TLAC_{headroom}$				0.2041	0.1557	0.1759
				(0.1588)	(0.3494)	(0.2930)
ROA		2.6914*	2.4834*		0.2249	0.2963
		(0.0312)	(0.0475)		(0.8924)	(0.8587)
Size		6.7324*	53.149		8.5303*	56.012
		(0.0117)	(0.0808)		(0.0178)	(0.1606)
ROID		73.063	52.307		98.324	77.712
		(0.1435)	(0.3065)		(0.1280)	(0.2465)
NPL		-31.198	-21.465		18.433	0.9517
		(0.0956)	(0.2821)		(0.4459)	(0.7127)
ln(GDP)			131.966			232.244
			(0.2620)			(0.0997)
GDP_{growth}			0.4022			-0.4857
			(0.2269)			(0.2632)
Inflation			-0.0326			-0.1523
			(0.8933)			(0.6305)
Cons	11.5789***	-83.6546*	-2.055.641	14.429	-115.3952*	-319.8984*
	(0.0000)	(0.0185)	(0.0648)	(0.2308)	(0.0169)	(0.0177)
N	343	309	309	333	306	306
R^2	*0.0429*	0.0933	0.1066	0.0070	0.0380	0.0499

Table C1: Results of the regressions on the nominal amounts of AT1 and T2 CoCo bond issuance

Table C1 shows the nominal issuance of AT1 (T2) CoCo bonds for models referred to as A (B) regressed on our variable of interest, the LR (TLAC) capital headroom. We find in the first univariate specification of the model a very strong relationship between how comfortably above the regulatory minimum requirements a bank operates, and how much additional capital is issued. More specifically, more AT1 eligible capital is nominally issued in the form of CoCo bonds, where the LR headroom is smaller, i.e., closer to breaching the regulatory minimum requirements. The addition of bank- and macro-specific control variables does not change this

observation. However, we do find that ROA is a significant indicator for the issuance of AT1 eligible CoCo bonds. This observation might be due to the fact that profitable banks can not only easier tap into the funding market, but also benefit from a tax-shield effect when issuing CoCo bonds (Petras, 2020). As the addition of the macro-specific control variables renders the intercept insignificant, we generate evidence against further unexplained variables that drive AT1 eligible CoCo bond issuance.

In contrast to that, we cannot establish a statistical significant link between potential shortfalls with regard to the TLAC requirements and the issuance of T2 eligible CoCo bonds, even in the univariate base case. Neither the addition of bank- nor macro-specific control variables changes this observation. Even more, the intercept remains statistically significant, in the ultimate specification of the model, suggesting the presence of unaccounted transmission mechanisms. This understanding is mirrored by the comparably low level of R2 vis-à-vis the AT1 model in the preceding columns. Taken together, we generate evidence that banks use CoCo bonds to manage their going-concern capital ratios, while it may not be the case for gone-concern requirements. Possible explanations for this observation can relate to the fact that banks rather issue debt instruments, over hybrid instruments.

C.5. Conclusion

In response to the financial crisis that started in 2007 numerous reforms concerning the financial system were enacted. Most prominently, standard setters required banks not only to increase the quantity of their minimum regulatory capital, but also restricted the eligible items to this end, in a push to also improve the quality of the regulatory capital and thereby ultimately expanding the loss-absorbing capacity of banks. In doing so, CoCo bonds have become de facto the only hybrid capital instrument eligible under the revised Basel III Accords. Crucially to this paper, CoCo bonds find themselves at yet another intersection of the lessons learnt from the financial crisis: in order to align incentives, investors must not only bear the fruit of their

investment, but also participate in potential losses therefrom. In this light, the previous bail-out regime, where banks were saved by governments at the expense of deteriorating public finances, has been revisited in favor of the bail-in principle. Because of this fundamental shift, banks are now required to hold sufficient bail-in-able capital under the national transposition of the TLAC standard. In this context, CoCo bonds fulfill a particular function as they can be used to precisely address funding shortfalls of bail-in-able capital while benefiting from the characteristics of hybrid capital. We investigate in this paper, whether CoCo bonds are indeed used with such surgical precision to address particular capital needs of a bank. To this end, we generate mixed results: while we substantiate our hypothesis that AT1 eligible CoCo bonds are used as one tool among others in the toolbox of going-concern capital management, we fail to demonstrate a similar mechanism in the instance of gone-concern T2 capital. A possible explanation for this observation may lie in the fact that banks mostly satisfy their gone-concern capital needs by issuing merely debt instruments, without making use of the hybrid possibilities of CoCo bonds. Our results are thus important for policy makers as they suggest that TLAC may be yet to achieve its full potential, as financial instruments of inferior quality are used over more resilient choices, such as hybrid capital in the form of CoCo bonds. Future research should further look into this interlinkage and in particular investigate the drivers of T2 CoCo bond issuance.

Appendix Section C

Table C2 describes the data sources and any calculations we derive therefrom. Size and GDP are logarithmized in order to account for outliers in the distributions. GDP^{growth} is computed as the ratio of the current over the previous USD GDP minus one.

Variable	Description	Source
AT1	Additional Tier 1 capital	Nominal issuance of AT1 eligible CoCo-bonds
T2	Tier 2 capital	Nominal issuance of T2 eligible CoCo-bonds
$LR^{headroom}$	Headroom Leverage Ratio	$LR_{i,t}^{headroom} = LR_{i,t} - 3.0\% - \text{SIB-add-on}_{i,t}$
$TLAC^{headroom}$	Headroom Total Loss Absorbing Capacity	$TLAC_{i,t}^{headroom} = TLAC_{i,t} - 18.0\%$
ROA	Return on Assets	$ROA_{i,t} = \frac{\text{Net Income}_{i,t}}{\text{Total Assets}_{i,t}}$
Size	Logarithm of Total Assets	$Size_{i,t} = \ln(\text{Total Assets}_{i,t})$
ROID	Income Diversification	$ROID_{i,t} = 1 - \left\lvert \frac{NII_{i,t} - NNII_{i,t}}{NOPI_{i,t}} \right\rvert$
NPL	Ratio of non-performing to total loans	$NPL_{i,t} = \frac{\text{Non-Performing Loans}_{i,t}}{\text{Total Loans}_{i,t}}$
ln(GDP)	Logarithm of GDP in USD	World Bank: NY.GDP.MKTP.CD
GDP^{growth}	Annual Change in GDP	Computed from NY.GPD.MKTP.CD
Inflation	Annual Inflation Rate	World Bank: FP.CPI.TOTL.ZG
C2GDP	Credit to GDP gap	BIS credit-to-GDP gap statistics

Table C2: Used variables and their sources

Table C3 provides the descriptive statistics of the variables used in this paper. A notable observation can be made with regard to the TLAC headroom, which is negative at its minimum, suggesting a shortfall of bail-in capital and therwith a regulatory non-compliance. We find these observations to cluster before the release of the final stance from the FSB in 2015. Untabulated results show that restricting the sample to the time after the final FSB stance does not alter the results.

	N	Min	$Q_{0.25}$	Median	$Q_{0.75}$	Max	σ
AT1	343	0.0000	0.0000	0.0000	667.1114	4,568.5950	741.7394
T2	343	0.0000	0.0000	0.0000	0.0000	10,979.0800	854.8243
$LR^{headroom}$	343	0.8620	9.4033	11.8059	15.2380	35.5339	5.0850
$TLAC^{headroom}$	333	-2.8404	1.2921	5.7912	10.2278	84.5455	11.6520
ROA	343	-0.3870	0.9861	1.3285	1.8829	4.1961	0.7119
Size	343	8.2788	12.2975	13.1796	13.7251	15.0222	1.3406
ROID	336	0.1397	0.5352	0.7189	0.8574	0.9997	0.2167
NPL	312	-0.0821	0.0776	0.1601	0.4626	1.5658	0.3652
ln(GDP)	343	9.3161	10.5014	10.6540	10.7157	11.4086	0.4256
GDP^{growth}	343	-3.4816	1.1490	2.0463	2.8590	9.3327	2.0345
Inflation	343	-8.8625	0.2938	1.1525	1.9673	16.1543	2.1737
C2GDP	343	36.0167	154.3932	173.9659	209.4000	348.6077	57.8021

Table C3: Descriptive statistics

Table C4 depicts the correlation between the used regressors throughout our analyses. The majority of correlations is rather small, such that multicollinearity appears unproblematic. The highest positive correlation can be observed between bank size and the LR headroom, suggesting that bigger banks are better capitalized. As this relationship is economically reasonable and not excessive in absolute terms, we deem it unproblematic. Furthermore, this explanation is consistent with the notion that better capitalized banks tend to be less profitable, as coincidentally displayed by the largest negative correlation between return on assets and the LR headroom. Against this background, it appears as if banks that hold more capital, fail to employ this economically meaningful, which is also consistent with diminishing returns of capital.

	AT1	T2	$LR^{headroom}$	$TLAC^{headroom}$	ROA	Size	ROID	NPL	GDP	GDP^{growth}	Inflation	C2GDP
AT1	1.0000											
T2	0.0861	1.0000										
$LR^{headroom}$	0.1385	0.0270	1.0000									
$TLAC^{headroom}$	-0.0396	0.1105	0.0123	1.0000								
ROA	-0.1594	-0.0268	-0.4218	-0.0384	1.0000							
Size	0.3797	0.2362	0.5403	-0.1198	-0.3158	1.0000						
ROID	0.1802	-0.0383	0.3324	0.0983	-0.3694	0.2535	1.0000					
NPL	-0.1861	-0.0743	-0.4430	-0.1215	0.1858	-0.2230	-0.1497	1.0000				
GDP	0.0959	-0.1012	0.1310	0.0678	-0.3424	-0.0523	0.0294	-0.4598	1.0000			
GDP^{growth}	-0.0398	0.1458	-0.3251	0.1389	0.4010	-0.1260	-0.3420	0.0373	-0.3348	1.0000		
Inflation	-0.1097	-0.0301	-0.2201	0.1058	0.2554	-0.1535	-0.0859	0.1635	-0.2934	0.1846	1.0000	
C2GDP	0.0732	0.1640	0.4016	0.1607	-0.2711	0.3642	0.2539	-0.0828	-0.1201	-0.2288	-0.2032	1.0000

Table C4: Correlation matrix of used variables

References Section C

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D. The Risk-Related Tone from the Top: Evidence from German Regional Banks

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Paper´s status: This paper has been presented at the Risk Governance Conference 2021 at the University of Siegen. The paper was submitted to *Journal of Risk Research*: Accepted.

We, the authors of the paper, hereby declare that this paper's third author, Christiane Bouten, the fourth author Patrick Hertrampf and fifth author, Nicolas Mues, were each equally responsible for collecting and analyzing most of the data and writing most of the paper.

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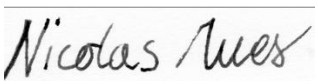

Nicolas Mues

D.1. Introduction

In the years following the financial crisis of 2007 and 2008, there have been many efforts by researchers, supervisory authorities, and practitioners to learn lessons from the past. While quantitative measures such as strengthening the capital base of banks are already well advanced, qualitative measures such as integrating norms and values within banks regarding risk are still evolving. But in particular the self-imposed norms and values promote a coherent risk awareness among employees. Related to their development, normative management is often emphasised as "tone from the top" (Palermo, Power and Ashby 2017). Risk-aware behaviour is thus directly related to top-down communication in banks (McConnell 2013).

A risk-related tone from the top is a core element of risk culture. Recommendations on how to design a risk-related tone from the top are, therefore, often found in risk culture frameworks. For example, the Institute of Risk Management (2012) suggested using questionnaires, interviews, or gap analyses to analyse the tone from the top of banks in more detail in order to subsequently optimise the decision-making processes of bank employees. The International Finance Corporation, a member of the World Bank Group (2015) also calls for a tone from the top that promotes risk competencies and communication. In 2014, the Financial Stability Board (FSB) presented with its "Guidance on Supervisory Interaction with Financial Institutions on Risk Culture" a first far-reaching description of how a risk-related tone from the top can be designed. The guideline provides one of the most comprehensive orientations for tone from the top. The aim of risk-aware communication is to empower employees to behave as responsible risk owners and to ensure that decisions are made in accordance with the bank's risk appetite (Cooper, Faseruk and Khan 2013). But how does risk-aware communication take place in practice? Researchers and supervisory authorities have so far only focused on formulating institutional requirements (Cohen 2015). What is yet missing is a status survey of how a risk-aware tone from the top is implemented by practitioners.

To substantiate this subject, we will first analyse the literature from academic research related to the tone from the top. Following, we will answer the question of how the tone from the top is realised within banks. Applying a sequential mixed methods approach, we will first conduct a representative survey among CEOs of 197 German regional banks. We will present how top managers perceive their tone from the top and what kind of communication they choose to disseminate it within the bank. We will also conduct eight interviews with CEOs of regional banks to analyse qualitative factors in addition to the quantitative assessment. The result will consist in a profile of characteristics that emerges from the components of the tone from the top of German regional banks. Finally, we will consolidate the results by combining the findings from the literature review with our empirical results on the communication behaviour, whereby we provide information on the design options for the risk-related tone from the top in regional banks.

D.2. Literature Review

Critically examining communicative roles and communication effectiveness of the top management, Hambrick and Mason (1984) show in their upper echelons theory that the characteristics of managers have a significant impact on the outcome of their organisation. Bertrand and Schoar (2003) point out that individual management styles affect management behaviour as well as corporate performance. Kaplan, Klebanov, and Sorensen (2012), by measuring the influence of general abilities and execution skills of top managers in the context of buyout and venture capital transactions, acknowledge the importance of communication skills in the context of firm performance. Research on risk culture has clearly shown that communication by top managers, as determinative part of their leadership style and leadership behaviour, is a critical factor in organisational performance (Denison, Nieminen, and Kotrba 2012).

Since for individual employees of a bank, a proactive and fully comprehensive risk identification is considered to be unattainable (Taleb, Goldstein, and Spitznagel 2009), information from top management is the precondition for a holistic approach to mastering risks and the tone from the top is the essential reinforcement of the related cultural norms. Effective communication in this context seems essential for a risk-related tone from the top. The Covid-19 crisis is one of the most recent examples of how difficult it is to proactively manage risks, in particular, when risk management courses of action are extremely ambiguous. Effective communication can lead to more clarity. In addition, there may even be a feedback effect. Normative management sets the tone and motivates employees. By setting an example of values, norms, beliefs and traditions (Braumann, Grabner, and Posch 2020), the behaviour of normative management itself can change in equal measure. Fahlenbrach, Prilmeier, and Stulz (2012) show that banks have not even been able to achieve the desired learning effects for their risk management from past crises. One explanation for this could be that learning effects from top management were not communicated intensively enough to each individual employee. Here, too, communication deficits arose. The tone from the top forms the starting point for the cultural direction of a company (Cong, Freedman, and Park 2014; Medcraft 2016), promoting risk awareness and the discussion of risk issues among employees (Detert and Treviño 2010; Cohen 2015; Agarwal and Kallapur 2018). As a result, individual employees are more independently able to deal with uncertainty against the backdrop of the bank's business model (Cormican 2014) and the corporate socio-cultural network around risk issues (Ellul 2015).

In terms of risk culture, Sheedy, Griffin, and Barbour (2017) recognise three critical factors that ensure that management expectations are better communicated: First, the tone from the top must transparently communicate the underlying values of the measures in order to generate understanding and acceptance among employees. Second, violations must be sanctioned, for this demonstrates the determination of the company's management. Finally, the tone from the

top must visibly exemplify the desired behaviour in the sense of a role model function. Cohen (2015) formulates an implementation plan, suggesting improved communication, incentive systems for employees, more intensive risk assessments, and an expanded error culture. Coluccia et al. (2017) recommend to implement risk committees in banks to strengthen the tone from the top by providing additional advice to senior management on risk issues.

Suh and Shim (2020) call for an ethical tone at the top in their paper. This is to develop a whistleblowing policy in banks, which is positively related to anti-fraud strategies. Conversely, a weak tone from the top ensures opportunistic behaviour among employees. This problem is particularly evident when employees are compensated based on performance and there are only few internal controls (Skaife, Veenman, and Wangerin 2013). Schwartz (2013), therefore, sees two other important points in order to strengthen the ethical functionality of the tone from the top: jointly held core values, and the establishment of ethical leadership, for example supported by an ethics officer.

Braumann, Grabner, and Posch (2020) illustrate that the tone from the top promotes risk awareness among employees. This effect is even strengthened if risk management consists of interactive and non-diagnostic control systems. Accordingly, a strong tone from the top, together with a strong risk management, cannot only increase risk awareness throughout the bank workforce, but also protects against fraudulent activities (Rubasundram 2015). Cong, Freedman, and Park (2014) show that the tone from the top is equally capable of influencing the awareness of employees regarding environmentally friendly behaviour. Sustainability is another value-related aspect apart from risk awareness that is receiving increased attention.

Focusing the individual top manager, Liu and Nguyen (2020) show that the language style used in the annual reports can be used to deduce top managers' characteristics. For example, overconfident managers tend to adopt a positive attitude of expectation in their annual reports, even in crisis-prone corporate phases.

To sum up, measures are available and can be taken to manage employee behaviour, such as whistleblowing policies or internal controls. However, the starting point for the manifestation of an adequate risk behaviour on the part of employees is a risk-related tone from the top, which can be implemented through effective communication. But how such a communication can be designed is currently a research gap. It is also open if and how different communication styles can support implementing the measures mentioned.

D.3. Methods and Response

D.3.1. Mixed methods

Mixed methods can be described as the third scientific paradigm aiming at combining the strengths of both qualitative and quantitative approaches. In contrast to separate studies, it is expected that more reliable and relevant findings will be obtained (Cronholm and Hjalmarsson 2011). The importance of separate, yet complementary results can be increased through convergence and corroboration (Ivankova, Creswell, and Stick 2006). For example, interviews as a major qualitative approach can reveal undiscovered heterogeneities in quantitative studies. One of the most popular mixed methods designs is the sequential combination of quantitative and qualitative investigations (Cronholm and Hjalmarsson 2011). Often, the quantitative study is carried out first. Ivankova, Creswell, and Stick (2006) explain that the qualitative part is used to explain or further elaborate the quantitative results.

The mixed methods sequential design, in which the quantitative study precedes the qualitative study, is particularly suited for the purpose of this article. As Teddlie and Tashakkori (2006) emphasise, the most far-reaching results can be achieved if qualitative and qualitative studies are carried out in an integrated manner. Using this methodology, it is possible to create an outside-in view: First, the contextual factors are considered before analysing the tone from the top within the bank. The aim of the research project is to create a comprehensive picture of the tone from the top. By comparing the quantitative with the qualitative data, the self-assessment

of the managers is contrasted with the actual situation as observed in the interviews. The upstream quantitative study enables us to see where bank managers view themselves on a scale of alternative communication options and how strongly selected communicative attributes apply. However, the focus is on the tone from the top, which includes the fundamental vibe that is deliberately used in risk-related communication. This makes in-depth expert interviews necessary, being able to unveil contextual reference variables from intentions up to concrete formulations. Furthermore, possible contradictions between the quantitative and the qualitative perceptions can be uncovered.

D.3.2. Quantitative analysis

D.3.2.1. Sample and response

A remarkable feature of the German banking sector is its three-pillar system meaning there are three types of banks that differ considerably in terms of their institutional structures. The first pillar is made up of private credit institutions. The second pillar are the savings banks, pillar three are the cooperative banks. Our study focuses on local savings banks belonging to the second pillar. The invitation to participate in the study was sent by mail to the predefined list of regional banks throughout Germany, followed by two reminders, reaching a sample of 379 respondents. Per bank, we asked one board member to fill out the one-page survey. The project contained valid responses from 197 respondents. The response rate of 52% was satisfactory and high enough to obtain representative results.

D.3.2.2. Structure and questionnaire

The survey consists of three parts: situational variables, semantic differentials and statements on risk culture and the enforcement of social norms. In the first part, situational variables were collected. The four initial questions refer to the respondent's profile. Another seven questions relate to the bank's key business figures. The variables are used to describe the economic

situation of the banks in the sample. This makes it possible to distinguish and compare the individual characteristics of the regional banks.

The second part consists of questions regarding the leadership and risk communication behaviour of the respective board member. This is measured through nineteen semantic differentials. These pairs of adjectives (e.g., conscious – unconscious; informal – official; transparent – non-transparent; hierarchical – participative; conservative – innovative; consistent – erratic; etc.) were measured within a seven-point scale to determine the main emphasis (see Appendix Figure D2). The semantic differentials relate to communication as well as leadership aspects. Both aspects cannot be separated. Communication skills are a prerequisite for leadership effectiveness (Flauto 1999). Since leadership can only be realised through communication, it is essential to integrate aspects of communication and leadership in the semantic differentials.

The semantic differentials depict four dimensions of the tone from the top in German regional banks. The corresponding communication style is influenced by several factors. On the one hand, leaders are influenced by their own personality and on the other hand by the organisation (de Vries et al. 2011). There is much overlap between communication styles and personality traits (de Vries et al. 2011). Among others, conscious, modest, intuitive or peace-loving communication styles can be traced back to personality. We count 11 pairs of opposites among the personality-related communication styles (first dimension). Communication styles that depend on the organisation are, for example, informal and official styles or cautious and risk-tolerant styles (second dimension). Duwe (2022) emphasizes that communication today should be ambidextrous. This highlights the importance of the semantic differentials for a deeper understanding of the tone from the top. The third dimension is, therefore, a management style-related communications style as management style and communication style interact (de Vries et al., 2010). Among others, this includes the pair of opposites of hierarchical and participatory

communication. Finally, the tone from the top depends on the managerial roles and the communication style associated with them (fourth dimension). Managerial roles, according to Grover et al. (1993), differ based on the location of the decisions, the direction of the information and the communication flow. The corresponding opposites include the contrasts between an initiative and a reactive role of top management and the contrasts between team responsibility and lone fighter.

The third part of questions refer to general statements on risk culture and the enforcement of social norms. The questions aim to query the integration of risk issues within a bank. The aim is to examine the extent to which employees regularly deal with risks and integrate risk-conscious actions into their daily work.

D.3.3. Qualitative analysis

Subsequent to the quantitative analysis, qualitative data were collected derived from eight expert interviews with members of the management board of regional banks. More information about the interviewees can be found in Appendix Table D1. The interviewees were selected on the basis of the willingness of the institutes to grant access to the researchers and to disclose confidential information. The interviews were evaluated using the qualitative content analysis (QCA), referring to the semantic differential items collected within the quantitative study.

One of the main advantages of expert interviews is their adaptability and proximity to the context relevant to the problem. Deduction and induction are combined in expert interviews (Snape and Spencer 2003). On the one hand, pre-structuring is carried out through the theoretical and quantitative foundation; on the other hand, the respondents have the freedom to reveal their own ideas (Trinczek 2009). According to Qu and Dumay (2011), the expert interview is a guided interview. An expert is someone who has special knowledge in the relevant research field that can only be made accessible by himself (Pfadenhauer 2009). Such knowledge, therefore, also requires a special methodical approach (Bogner, Littig, and Menz

2009). The tone from the top is a new field of research, particularly regarding regional banks. In this respect, only discussions with the relevant board members can provide instructive statements.

Our guideline for the expert interviews, preparing the process and ensuring a systematic approach (Qu and Dumay 2011), includes eight central questions which focus on risk culture in general, on the tone from the top, and the communication behaviour of the board member. When preparing the data, the central rule of transcription is that the transcript must be of such a level of accuracy that the interpretation can be executed effectively (Schilling 2006). In the case of our study, we focus on the content and its meaning rather than on linguistic details.

The QCA is a method for the systematic analysis of texts. It emphasizes a controlled and rule-based approach and aims to transfer the advantages of quantitative to qualitative methods. The central characteristic of the QCA is the category system, which is applied to the transcriptions of the interviews using MaxQDA in order to structure the collected texts. As a last step, the categorised statements are interpreted. With this systematic approach, the QCA fulfils the essential quality criteria of qualitative research methods such as intersubjectivity, and the triangulation of results (Mayring 2000).

D.4. Results / Data Analysis

D.4.1. Analysis of communication behaviour

D.4.1.1. Results from the quantitative analysis

The average age of the respondents is 56, with the age ranging from 36 to 67 years. The range of board experience of the respondents varies from half a year to 33 years, with a mean of 14.8 years. As expected, age and professional experience appear to be consistent in their statements.

To conceive the communication behaviour of the board members, the semantic differentials are taken to derive differentiated communication profiles. In the first step, related to the analysis of each single semantic differential, it becomes apparent that there are some pairs of adjectives for

which it is not possible to identify a clear notion. Therefore, the tone from the top is neither standardised nor flexible, neither hierarchical nor participative, neither monitoring nor trusting, neither conservative nor innovative, neither risk tolerant nor gently. On the contrary, some other semantic differentials result in a communicative focus: In the average of all respondents, the tone from the top occurs to be conscious, decisive and transparent. It is also characterised as consistent, thought-out and communicated in a team responsibility. It can further be described as dynamic, proactive, tranquil, visibly alive, assessing, and ambitious.

Based on this initial appraisal, in a next step, differences in the communicative behaviour are analysed by considering the situational variables. In that way, it can be shown how far the communication behaviour is dependent on those context-related variables such as the personal background of the respondent and the size and structure of the bank.

The results show that older board members (> 56 years) communicate more trustingly and that they tend to a rather peaceful tone from the top. Compared to their younger colleagues, they are more intuitive, but also more conservative in their tone from the top. Regardless of the department, in which the board member previously worked, the communication behaviour can be described as conscious, decisive, transparent and consistent. Board members with a professional background in a back office seem to focus on a more participative communication behaviour. A rather official and more formal tone from the top is adopted by board members who have worked in auditing.

Analysing the results with focus on the banks itself, it can be stated that the tone from the top in larger banks (> 500 employees and more than 100.000 clients) is more hierarchical and risk tolerant. The tone from the top in banks with a lower share of loans in total assets is more proactive but also more assessing. This comes along with the findings related to banks with high capital ratios. Banks with a higher risk appetite, i.e. interest rate coefficient above the supervisory threshold of 20 percent, tend to be more risk tolerant in their tone from the top.

Board members in banks with a higher operating profit measure tend to show a more ambitious and thought-out tone from the top. With regards to these findings on contrasting demographics, some figures are shown in Appendix (Figures D3, D4 and D5).

Appendix Table D2 gives detailed information concerning the tone from the top depending on the background of experience of the respondents, i.e. related to the business unit the surveyed board member used to work before becoming a member of the board. It is obvious that "conscious" communication has generally the highest priority for all board members, regardless of their background of experience. In addition, board members from all divisions want to communicate in a decisive, consistent and transparent manner in their risk-related "tone from the top". This result is particularly interesting because the respondents had a choice of 38 attributes and the same four attributes emerged quite homogeneously. This could be an indication of a specific "DNA of regional banks". With regard to differences, it becomes apparent that board members with prior back-office experience act more participatory than board members with other backgrounds of experience (back office 1.19 compared to internal audit 0.0, corporate banking 0.4 or retail banking 0.53). Board members who have previously worked in the internal audit department attach more importance to an official (1.5) and thus more formal communication approach than others, such as for example board members who used to work in the front office (0.99).

D.4.1.2. Results from the qualitative analysis

Based on the 197 completed questionnaires, it was possible to develop a reliable assessment of the essential characteristics of the tone from the top measured through semantic differentials. In this way, an overview of the tone from the top could be created. Now, the explanatory sequential mixed-methods design is applied. Overall, the communication behaviour shown in the quantitative analysis can be validated by the qualitative study. The findings show that the

tone from the top is important as it facilitates the desired risk culture through a common set of values, based on a clear direction initiated by the top management.

The relevance of consciousness regarding the tone from the top is captured via several expressions. Expert A points out that they sensitize their employees again and again for risk-related topics, e.g., in form of lectures. Additionally, a formalised risk dialog has been created to establish the institutional framework providing transparency among all employees and within the whole bank. Expert F describes the bank's reporting procedures and the communication between several parties, boards and committees in order to come to an agreement. The goal is to be able to communicate in a timelier manner. In those agreement processes it is also important to deliberately enter a discussion (expert B).

Another important aspect of the tone from the top is to visibly put it into practice which means to ensure visible behaviours and attitudes at all organisational levels. Many of the interviewed experts identify the importance of the board's behaviour and setting an example of how to comply with the standards. Expert C describes himself as a "demonstrator." In other words, top management can instruct binding compliance, but only by setting an example, and by experiencing and making positive events employees behave as desired (expert E). Having a risk strategy and an ethics guideline is one part of ensuring the implementation of the desired risk culture. However, it is more important that common values are established and lived through the active example of top management (expert A).

In the qualitative study, the relevance of communication in joint team responsibility has been particularly highlighted. Expert C states that there are many cases where discussions are inevitable so that the final result is based on the "community competence." Advancements of the communication formats are described, e.g. that established credit committee meetings are replaced by more participative meeting formats that enable the institutes to take decisions on a broader level. Expert F has established a kind of a good custom going through all the teams at

least once a year and showing presence in the individual departments on a regular basis. Moreover, it is highlighted that it is important that top management meets with small teams of employees, listens to them and discusses relevant questions from more than one single perspective. In that way, specialised teams are given more responsibility and have more involvement in the decision-making processes. This goes hand in hand with the shift towards network organisations (expert B). Expert D summarises "hierarchy is history" and supports working in overarching and interdisciplinary teams. Instead of building different "front lines," top management calls for open discussions and collegiality among all employees (expert B).

Both the quantitative and qualitative findings show that the tone from the top aims at transparency and consistency. The challenge is to create this transparency so that everyone can make the best possible decision for the institute (expert B). One possibility is thereby communication in form of an open dialogue. As a result, issues can be put in a greater context and communicating in an open and transparent manner helps to get a message through the entire organisation (expert H). Expert F puts it into a nutshell when emphasizing the relevance of an "ongoing, transparent, and direct" communication. The role of the top management can be summarised as follows: It is worth going to say it is clear what is expected and what the risk culture is (expert D).

This applies to the whole management board in which each member operates collectively. Only when consistency in the tone from the top is ensured, risk culture can be enforced consistently across different levels of the organisation. Based on the interviews, it seems to be of great importance to ensure a consensus concerning the desired risk culture to avoid possible irritations created by top management unsettling the employees. Expert H admitted that it is not possible to behave exactly the same as a board and use identical words but the main focus at the top management level needs to be consistent. This implies that the topics described in the strategy must be consistently communicated at all organisational levels. Additionally,

management must ensure that risk-related topics are regularly discussed whereby the establishment of an open, restriction-free error culture is beneficial (expert A).

Communication in terms of the tone from the top is something permanent and a board member always must weigh up all the aspects that he wants to get across (expert C). The importance of weighing is supported by expert F who says that they focus on the evaluation of single cases and of those issues that might endanger the system and its functioning. Therefore, it is important for the top management to have a total view, to be able to prioritize, and then adjust the communication behaviour accordingly (expert F).

The tone from the top that has been described so far could be derived from the qualitative findings that confirm the most significant tendencies shown in the quantitative analysis. Now, by taking the aspect of official communication, a component of the tone from the top is analysed which was identified as less important in the survey findings. Official communication as part of the semantic differentials was classified as the opposite of informal aspects of the tone from the top. In this context, "official" refers to clear previously established communication channels with unambiguous role allocations between the sender and recipient of information and that this expression of the tone from the top does not happen informally and spontaneously. While the degree of official communication was rated less relevant in the survey, the interviews emphasize the importance of a tone from the top that is brought across in an official manner. Expert D speaks of "formalistic approaches." Many of the interviewed experts describe the necessity that risk-related topics and aspects of risk culture are put into writing, e.g. a code of conduct (expert H). Furthermore, the risk strategy is an essential element of the official communication channels that in turn functions as a trigger to drive the behaviour for a strong risk culture (expert F).

The qualitative findings also highlight the relevance of standardisation in communication. This can for example be ensured through a formalised risk dialogue that has already been described

in the beginning. Expert H speaks about “formalised dialogues” and expert D mentions the use of “culture flyers.” Another example for a standardised communication behaviour is described by expert F who makes use of regular appointments (“jour fixe”), sitting down with his managers bilaterally for one hour a week.

Good risk management means that not only errors are analysed and adjusted in retrospect, but also that risks are correctly assessed using appropriate, previously communicated guidelines. This is reflected in the combination of proactive and reactive actions. Although proactive actions can be seen as the primary goal of a healthy risk culture and as a result from the tone from the top, expert G emphasizes that adjustments of the risk culture and risk management procedures are usually realised after retrograde analyses of previous abnormalities. Nevertheless, the interview with expert A shows that there is also proactive action, for example by setting up a regular risk dialogue or raising awareness in the form of presentations. While the quantitative study rather points towards initiative, i.e. proactive actions, within the qualitative interviews reactive methods are also emphasised. Combining the results of the quantitative and qualitative study lead to the suggestion of connecting proactive and reactive actions.

Similar can be observed regarding the antipodes readiness for conflict versus peace-loving attitude. The quantitative evaluation shows that the boards of directors are quite ready for conflict. This impression is confirmed in the interviews, but it is also evident that the board of directors and the involved employees strive for consensus when it comes to risk management issues. Expert D says that as a manager you have to “set very clear signals” and that you should not “fall over.” Hence, it is important that the board stands by its opinion and expresses consistency. Once there is a misbehaviour of an employee, one must be very clear, especially in the choice of words. However, as explained by expert B, it is not about building “two fronts.” Rather, it is important to “incorporate every decision” and to “choose the best possible path.”

In line with the impression that reactive behaviour is important, although proactive initiatives are preferred in advance, there is no clear trend regarding the contrast between control and trust in neither the quantitative nor in the qualitative study. On the one hand, expert B points out that a risk management is primarily ensured by the "management level," on the other hand, this expert also says: "For me, risk culture always means a matter of trust." In addition, expert B warns against lapsing into a "control madness."

It should, therefore, be noted that hierarchical functions within a bank are still important when it comes to managing and controlling risks. However, concerning the quantitative results of the opposites "hierarchically" and "participatively," no clear tendency can be seen. There is as well no clear picture in the qualitative study either. Expert B explains that competencies are always linked to the hierarchical position. However, elsewhere, expert B says that it does happen that, for example, the head of risk controlling warns the management board not to act too risky and that the board of directors follows this warning. This illustrates hierarchical permeability.

Nevertheless, the continuing existence of hierarchies is made clear by expert F, who states that "it is rather unlikely that frequent bilateral dialogues with employees take place." This contradicts the statement made by expert B, who describes that the "personal conversation" is the preferable type of communication regarding risk behaviour in banks. Expert B explains that a board member should communicate "cooperatively" with the aim "that people are more open." In clear contrast to a hierarchical risk culture, expert D points out as well that there is a need for a "participation culture." This suggests that there are differences between the banks of the surveyed experts and that every bank must find a balance between clearly formulated requirements from the top and participation from subordinate levels.

D.4.2. Tone from the top from a supervisory, research and practical perspective

So far, the quantitative analysis has provided a comprehensive picture of the communication behaviour of the board members. With the help of these results, individual board members can

classify their own behaviour and compare their tone-from-the-top profile with the derived comprehensive picture. In the following analysis we want to go one step further and to address the question how to implement a risk-related tone from the top as part of a risk culture.

This section presents a comparative consolidation of the relevant research, the results of our interviews and the supervisory guidelines. While the statements of the supervisors and the conclusions from the research findings address the banking landscape in general, the interviews reflect concrete forms of the tone from the top within German regional banks. By examining the supervision and research contributions, a currently prevailing picture of the tone from the top in connection with a risk culture for banks can be captured. The position of the supervisor can be found summarised in the "Guidance on Supervisory Interaction with Financial Institutions on Risk Culture" from the FSB 2014. This guidance is a central marking point for researchers. It provides detailed information on the form of the tone from the top in the context of a risk culture from the point of view of the supervisor. These three central areas are linked using a comprehensive figure. In this way, not only a comprising tabular overview is established, but blind spots in the three respective areas are identified and a deeper understanding of the importance of existing supervisory guidelines and previous scientific findings for German regional banks is developed. The results of the literature review show which supervisory requirements were already scientifically analysed and where complementary findings are still needed. For this purpose, we reviewed the papers from the literature review a second time and compared it with the FSB Guidelines for complementary content. The interviews, in turn, provide a first insight into how supervisory requirements and research results are already implemented in practice.

It is not our aim to make generally applicable recommendations for action at this point. Rather, based on our findings from German regional banks, our aim is to generally raise awareness and sensitize for the role of the tone from the top regarding specific risk culture topics. In a previous

step, we compared the statements from the interviews with the semantic differentials. While the differentials provided quantitative insights, the interviews included in-depth everyday aspects of the tone from the top in German regional banks. These statements by the experts are compared with the theoretical considerations from research and guidelines from supervision to uncover gaps and differences between the instances. Risk culture is a comprehensive field of action for German regional banks within which we only focus on the tone from the top. Thus, regarding the framework for assessing risk culture from the FSB, we only refer to section 3.1 of the framework. In doing so, it should be noted, that the tone from the top interacts with the other three aspects of risk culture described in the FSB framework, accountability, effective communication and challenge and incentives. In particular, it can be assumed that there are overlaps between the tone from the top and effective communication.

Figure D1 will show, the tone from the top includes values as well as behaviour and, in some cases, concrete actions. This is shown, for example, by the fact that the FSB guidelines state that senior management determines the “core values” and that these values must be expressed in the behaviour of the senior management. In the interviews the importance of setting examples by management is repeatedly emphasized. Our overarching goal is to examine the role of senior management within the risk culture of German regional banks. This is reflected by the tone from the top. Although there is a close link between an effective communication and the tone from the top, an effective communication involves more than just the tone from the top. The FSB names, among others, the "critical attitude among employees" as a central aspect of effective communication within a risk culture.

Figure D1 provides a comparison of the guidelines from the FSB, the statements from the experts and existing research. While the second chapter of our paper forms the basis for the findings from the literature, the results from Figure D1 reveal that in some cases different findings from those based only on the literature can be found. 14 elements for the tone from the

top could be extracted from the analysis of the requirements from research, supervision, and practice. These elements can, in turn, be consolidated into five attributes: leading the way, evaluation and monitoring, standardisation and institutionalisation, sense of unit, and realisation of tone from the top. These attributes may serve as a guide and give orientation for managers as well as the supervisor which areas are critical for the tone from the top to promote a risk culture. They might serve as umbrella terms for the requirements for an adequate tone from the top.

Requirements from Supervision (Guidance on Supervisory Interaction with Financial Institutions on Risk Culture, FSB 2014)	Requirements from research	Requirements from Practice (Interviews core statement)		Elements of the Tone from the Top	Attributes
"A key value that should be espoused is the expectation that staff act with integrity." (2)	"The board and senior management must promote the expectation that staff act with integrity and in the best interest of clients and all stakeholders." Cohen (2015)	*X*		Doing the right thing	Leading the Way
"Walking the talk" (3.1) “clear view, integrity and healthy scepticism and openness, establishing, monitoring, and adhering to an effective risk appetite framework” (3.1.4)	"A clear articulation by the Board of the firm’s culture, supported by senior management who, leading by example, demonstrate the values that support the culture." McCormack and Sheen (2013)	Exemplifying the risk culture Setting an example (Expert E) Demonstrater / front man (Expert C)		Exemplary function	
“The board and senior management (…) systematically monitor and assess the prevailing risk culture.” (3.1.1) "The board and senior management systematically monitor how promptly and effectively issues raised by the board, supervisors, and all control functions are addressed by management." (3.1.11)	"Interactive control systems promote the effect of Tone from the Top on risk awareness." Braumann, Grabner and Posch (2020)	Communication is something permanent and a board member always has to weigh up all the aspects that he wants to get across. (Expert C)		Control systems	Evaluation and Monitoring
"The board and senior management (…) proactively address any identified areas of weakness or concern." (3.1.1) "The board and senior management systematically assess whether the espoused values are communicated and proactively promoted by management and staff." (3.1.7)	“Top-down communication captures the extent to which top management (1) actively communicates risks and activities to be avoided by subordinates." Cormican (2014) "review and set the firm’s risk appetite and risk tolerances, set risk limits, action items for when risk limits are exceeded and to consider policies and procedures to hedge or mitigate against identified risks." Cohen (2015)	Setting up a regular risk dialogue; raising awareness in the form of presentations. (Expert A) Continuous adaptation of risk strategy, risk handbook and risk management. (Expert C)		Continuous proactive risk assessment	
"Senior management is subject to the same expectations for integrity, risk governance, and risk culture as all other employees; that is, mechanisms are in place to subject them to incentive structures, which may include impacts on compensation, role and responsibilities, or termination" (3.1.6) "... effective governance of compensation, alignment of compensation with prudent risk taking and effective supervisory oversight and stakeholder engagement in compensation." (1)	"Three key elements developing and sustaining an ethical corporate culture. (1) the existence of a set of core ethical values. (2) the establishment of a formal ethics program, including a code of ethics, ethics training, an ethics hotline, and an ethics officer; and (3) the continuous presence of ethical leadership–that is, an appropriate ‘tone at the top’ as reflected by the board of directors, senior executives, and managers." Schwartz (2013) "we find income-increasing earnings management to enhance the profitability of insider sales in firms with weak ‘‘tone at the top’’." Skaife, Veenman and Wangerin (2013)	*X*		Assessing senior management and its incentive structures	

Requirements from Supervision (Guidance on Supervisory Interaction with Financial Institutions on Risk Culture, FSB 2014)	Requirements from research	Requirements from Practice (Interviews core statement)		Elements of the Tone from the Top	Attributes
„(...) proportionate disciplinary actions“ p.1	*X*	our competencies were clearly linked to the hierarchical function. (Expert B)		Disciplinary actions	Standardisation and institutionalisation
X	"setting an ‘ethical tone at the top’ and implementing an effective ‘ethics training’ are necessary to develop a whistleblowing policy in an organization, which in return, positively affect the employees' perceived corporate anti-fraud strategies." Suh and Shim (2020)	*X*		Anti-fraud strategies	
"The board and senior management are committed to establishing, monitoring, and adhering to an effective risk appetite framework, supported by appropriate risk appetite statement(s) that underpin the financial institution’s risk management strategy, and is integrated with the overall business strategy." (3.1.4) "Appropriate mechanisms are in place to ensure the risk appetite, risk management strategy, and business strategy are effectively aligned and embedded in decisionmaking and operations at all appropriate levels of the institution." (3.1.9)	*X*	Having a risk strategy and an ethics guideline is one part of ensuring the implementation of the desired risk culture. (Expert A) This implies that those topics described in a strategy must be consistently communicated at all organizational levels. (Expert H)		Standardisation and formalisation	

Requirements from Supervision (Guidance on Supervisory Interaction with Financial Institutions on Risk Culture, FSB 2014)	Requirements from research	Requirements from Practice (Interviews core statement)	Elements of the Tone from the Top	Attributes
"The board and senior management promote healthy scepticism that encourages and supports openness to challenge" (3.1.3)	"signals to be accessible and interested in open communication." Detert and Treviño (2010)	Communicate "cooperatively" with the aim "that people are more open". (Expert B)	Openness	Sense of unity
X	"It posits that a system is more than the sum of individual parts (Ackoff, 1994); the system can have emergent properties that are not present in any of its parts. The relationships between the elements are more important than the elements themselves. These relationships constitute a network of reinforcing and balancing loops that interact with each other." Agarwal and Kallapur (2018)	Discussions are inevitable so that the result is based on the "community competence". (Expert C)	Team responsibility	
"Mechanisms are in place, such as talent development, succession planning, and confidential 360 degree review processes, to ensure that decision-making is not dominated by any one individual or small group of individuals in a manner that is detrimental to the interests of the institution as a whole" (3.1.5)	"talent management process that ensures that management and employees who are responsible for or influence material risk taking have the knowledge, skills and abilities to identify, measure, monitor and control the relevant risks." Cohen (2015)	*X*	Shared responsibility	
X	"Beyond this, this research shows that transparency and clear communication from the board can help drive appropriate risk behaviour." Osman and Lew (2020) There must also be ongoing communication, buy-in and consultation between senior individuals and their direct reports so that all individuals fully understand and feel part of the decisions that are made. Osman and Lew (2020)	The relevance of an "ongoing, transparent and direct" communication. (Expert F) It is worth going to say it is clear what is expected and what the risk culture is. (Expert D)	Transparency and consciousness	
"Processes are in place so that deficiencies in risk management (…) are reviewed (3.1.12) "Assessment and communication of lessons learnt from past events, both failures and successes" (3.1.13)	"Cognitive risk culture focuses on improving the understanding of risk and resolving the problems by addressing their root cause." Agarwal and Kallapur (2018) "Learn from the firm's own mistakes and the mistakes of others and be alert to market developments, including actions being brought against other firms." Cohen (2015)	Retrograde. Look at results and readjust in case of "abnormalities". (Expert G)	Learning from past experiences	
X	*X*	"Personal conversation" is always the type of communication regarding risk behaviour in banks. (Expert B) It is not about building "two fronts". (Expert B) ...one has to be very clear, especially in the choice of words. (Expert D)	Realisation of tone from the top	Realisation of tone from the top

Figure D1: Attributes of the tone from the top

The first identified requirement derives from the FSB guidelines. These require “doing the right thing” for an effective tone from the top. In this way, the supervisory authority places the integrity of all employees in the foreground. This is also what Cohen (2015) stresses: It is the task of the tone from the top to ensure integrity among all employees and to make it visible to the outside world for stakeholders and especially customers as a quality characteristic. The term is not explicitly addressed in the interviews, but integrity can nevertheless be seen as an important signal for the external stakeholders of German regional banks as well due to their local embeddedness and their proximity to customers. The board must be aware of its responsibility. The role model function in all areas is highlighted as central requirement for an effective tone from the top. The interviews equally emphasize that managers are “demonstrators” (expert C). They exemplify the values that are required of the employees. However, it should also have a signal effect. In this case for the employees.

The umbrella term for the link between role model function, integrity and risk culture is “ethical behaviour”. This not only refers to the tone from the top and thus the top management level, but as well to all management levels. Both the FSB and Braumann, Grabner and Posch (2020) highlight the importance of ethical behaviour. Similar to the sub-item of integrity, it is also the task of the tone from the top to promote this in the sense of the “walk the talk principle” in order to develop a sound risk culture. The implementation of ethical behaviour must be accompanied by quality assurance or control. In this context, the FSB calls for general systematic and rapid control measures across all management levels. Braumann, Grabner, and Posch (2020) even go one step further. They focus on interactive control systems. In doing so, they expand the typical monitoring and emphasize the importance of dialogues between all management levels to ensure ethical behaviour, integrity, and thus a sound risk culture. Expert H explains that in his institute, employee surveys are used for this purpose. This allows employees to communicate their impressions, developments in the bank and of course possible grievances. In this sense,

the employee survey serves as a bottom-up communicator towards the tone from the top. The board can pick up the mood of the workforce and check to which extent the desired ethical behaviour is to be implemented. Such interactive checks can be seen as proactive measures to ensure ethical behaviour and, consequently, a sound risk culture.

However, interactive control and proactive measures are not only reserved for employees. Top management must be controlled as well. This can be found in item 3.1.6 of the FSB guidelines. Incentive structures must be implemented to promote a tone from the top that is ethically correct and to ensure that the top management is aware of their role model function. The board of management has the duty to act ethically as a role model. In this sense, Schwartz (2013) refers to the importance of ethical leadership. Senior management should not only demand values, but also exemplify them themselves. Skaife, Veenman, and Wangerin (2013) find that a weak tone from the top can encourage criminal behaviour in the workforce. Without the threat of consequences, aspects such as opportunism, profit-seeking, and general self-interest maximisation are coming into greater focus.

According to the FSB, a good tone from the top must therefore also be prepared to take disciplinary actions against violations. In the best case, interactive controls or proactive measures are sufficient to reduce or in the best case prevent misconduct. However, it is clear from the interviews that, in addition to an open and tolerant communication, consequences for misconduct are crucial for a risk culture to be sustainable (expert B). Ethical behaviour acquires not only a pure diction, but also a legality that must be adhered to. Anti-fraud strategies and whistleblowing methods are suggested in the literature in this context (Suh and Shim 2020). These aspects open up new horizons for supervision and practice, as they are not found in this form neither in the interviews nor in the FSB guidelines.

Even if ethical behaviour in conjunction with a risk culture can only be qualitatively characterised, people often need a formal frame of reference that provides direction and to

which they can adhere. In order to be able to take disciplinary actions when neglecting the tone from the top, individual employees need to know specifically the expectations and, if necessary, the rules they have broken. Both points are related to standardisation and formalisation, which is addressed in the FSB guidelines through the discussion of frameworks (item 3.1.4) or the formal comparison of risk and business strategies (item 3.1.9). In the interviews, the importance of an institutional framework for risk-conscious behaviour is also emphasised (expert A). In literature, the aspects of standardisation and formalisation with respect to the tone from the top in regional banks have so far been neglected.

While the implementation of standardised and formalised frameworks still enjoys a very liberal character, the contents posed are clearly defined for it. For example, the tone from the top, as an important driving force for implementing a risk culture within a framework, should demand openness from the employees. This also includes a healthy scepticism in discussions and toward everyday operational business activities. This aspect is explicitly mentioned in the guidelines under item 3.1.3, described as a characteristic of a sound risk culture. In contrast, team responsibility is emphasised more in the interviews and in the literature than in the FSB guidelines. Expert C names the goal of community competence, and Agarwal and Kallapur (2018) state that an effective system is more than simply the sum of many individuals. Particularly, it depends on the relationship between the individuals. However, the FSB attaches great importance to ensuring shared leadership. Detailed measures such as talent development or succession planning are mentioned. Cohen (2015) also addresses these points, while in the interviews, there is a lack of such statements.

It is noticeable that the FSB guidelines do not address the topic of transparency regarding the tone from the top. In contrast, in the interviews, as well as in the research contributions, this attribute is particularly emphasised (expert F; Osman and Lew 2020). However, since not every risk can be foreseen, the guidelines, interviews and research findings agree that learning from

past experience is of great importance. Agarwal and Kallapur (2018) even demand that one should look as well at the experiences of other comparable institutes. The basic challenge of the guideline, however, is that it is aimed at a great variety of institutes. The aspect “realisation of tone from the top” therefore shows that in this respect there is a lack of clear guidelines regarding how top management should communicate in detail. Although the guidelines can form a good starting point, it must be adapted to the individual requirements of a bank. Expert B for example emphasizes that the personal conversation is mostly preferred in regional banks. Building “two fronts” should be avoided; cooperative interaction is preferred.

Integrating and combining the results of research, supervision, and practice, reveal a holistic view on the tone from the top with regard to a sound risk culture. In that way, Figure D1 can be read from left to right and vice versa. The comparison of the three sub-areas facilitates the systematic derivation of the five attributes representing the result of our methodological approach. By interpreting the figure from right to left, the attributes serve as a starting point for reassessing the tone from the top from the perspective of research, supervision, and practice. The elements show a more fine-grained breakdown of the attributes and are in turn the umbrella terms for the requirements. Thus, the requirements have a guiding function for the practical implementation of a sound risk culture and give concrete indications on how the individual attributes can be implemented.

It is noticeable that not all elements can be covered by all three perspectives. There is a need for further research and action here. Supervision shows blind spots, especially regarding soft factors and concrete formulations. Research neglects so far the aspects of standardisation and formalisation as well as concrete formulations. In the sub-area practice the lack of a discussion of incentive structures is striking, as it enables a fit between risk culture and managerial behaviour to be established. With regard to the realisation of a proper tone from the top, it is obvious that supervision and research lack on clear formulations, which is essential for concrete

manifestations of the tone from the top. More evidence from practice is desirable, which leads to the call for more empirical studies.

D.5. Discussion and Conclusion

The tone from the top represents the top management's philosophy, its attitude toward risk management, and the organisational core values. Within the scope of our quantitative study, we have used semantic differentials which a board member can use to compare its own tone from the top profile with the semantic differentials across all regional banks. In that way, deviations become visible. If a regional bank wants to go one step further, it could – in addition to the self-assessment carried out by the board members – also ask its employees for an external assessment of the tone from the top (which we did not cover in our study). By that, it would become clear at which points the sender and recipient of the communication have different perceptions. The results can be the starting point for a critical assessment of the own situation as well as for questioning and if necessary, adjustment of one's own risk-related tone from the top also in comparison with the competitors. However, the comparison with the competitors cannot and should not necessarily lead to an alignment of positions. Rather, an individual risk profile can also be deliberately derived from the results of the semantic differentials. Thus, our results can help to develop an independent risk-related tone from the top.

From the supervisory perspective, it is one essential indicator of a risk culture. Both the tone from the top and risk culture are topics that are increasingly attracting the attention of scholars and practitioners, especially in the banking sector. According to our two-tier aim, this article provides insights into the top-down communication behaviour of top management in German regional banks and presents new findings by comparing the interview statements from members of the board with the supervisory guidelines and relevant research implications.

In line with the explanatory sequential mixed-methods design of our study, at first the self-perception of the board members' communication behaviour was measured through our survey.

Subsequently, the QCA was applied to collate the findings from both the quantitative and qualitative study to create a deeper understanding of the tone from the top within the institutes. The tone from the top facilitates the desired risk culture through a common set of values, based on a clear direction initiated by the top management. In this context, conscious communication is of great importance to sensitize the employees for risk-related topics. The board's behaviour can serve as example for the employees underpinning the importance of transparency and consistency. Additionally, the community competence regarding the communication behaviour was highlighted.

While most results from the quantitative study could be validated by the interviews, we also find differing insights. The qualitative study highlights the fact that the tone from the top should be brought across in an official manner. With this finding in line, the relevance of standardisation in communication has been pointed out. The tone from the top is closely related to aspects of hierarchy for which the results are more difficult to grasp. On the one hand, it has become clear that hierarchical functions within a bank are of great importance when it comes to managing and controlling risk. On the other hand, the benefits of a more participative communication behaviour have been indicated in the interviews, aiming at fostering cooperation and creating a "participation culture." From our holistic, practical, supervisory, and research perspective, we were able to identify requirements and elements for tone from the top and to point out the connection's lines to specific risk culture topics. In addition, gaps and suggestions for further research have been uncovered.

Organisations and board members will benefit from this study in implementing a stronger risk culture that will assist and support them when making strategic decisions. It motivates top management to critically self-reflect its communication behaviour. As claimed by the supervisor, the process to embed the desired risk culture has to be initiated from and must be accompanied by the top of the organisation.

Limitations of our study result from the fact that interviews were conducted only in eight German regional banks. Further research should incorporate other banking types in order to be able to review multiple and diverse perspectives within the whole banking industry. Moreover, the study focused on the top-down communication behaviour. We recommend that future research examines the bottom-up perspective from lower to upper organisational levels as well.

Appendix Section D

Interview Partner	Sex	Origin	Position	Numbers of employees of the bank
A	Male	German	Member of the Executive Board responsible for Credit, Risk Management and Legal, Risk Controlling and Compliance	3699
B	Male	German	Seniormanager Credit Management	1100
C	Male	German	Chief Executive Officer	354
D	Male	German	Member of the Executive Board responsible for Retail Banking	746
E	Male	German	Member of the Executive Board responsible for Accounting and Back Office	499
F	Male	German	Member of the Executive Board responsible for Accounting, Compliance and Legal	1900
G	Male	German	Member of the Executive Board responsible for Organisation and Information Technology and Facility Management	4000
H	Female	German	Chief Executive Officer	1435

Table D1: Information about the interviewees

Table D2 shows the five most important adjectives the board members clustered in relation to risk-related communication according to their backgrounds of experience. It is striking that despite different backgrounds, the board members came up to an almost identical ranking.

	1. Rank	2. Rank	3. Rank	4. Rank	5. Rank
Corporate Banking	Conscious	Decisive	Transparent	Consistent	Thought-out
Retail Banking	Conscious	Transparent	Decisive	Consistent	Thought-out
Private Banking / Treasury	Conscious	Decisive	Consistent	Peaceful	Dynamic
Back Office	Conscious	Decisive	Consistent	Transparent	Team responsibility
Internal Audit	Conscious	Decisive	Consistent	Official	Transparent
Accounting	Conscious	Decisive	Transparent	Consistent	Team responsibility
Assistant to the Executive Board	Transparent	Conscious	Decisive	Consistent	Team responsibility

Table D2: Communication behaviour based on the background of experience of (business divisions) the surveyed board members

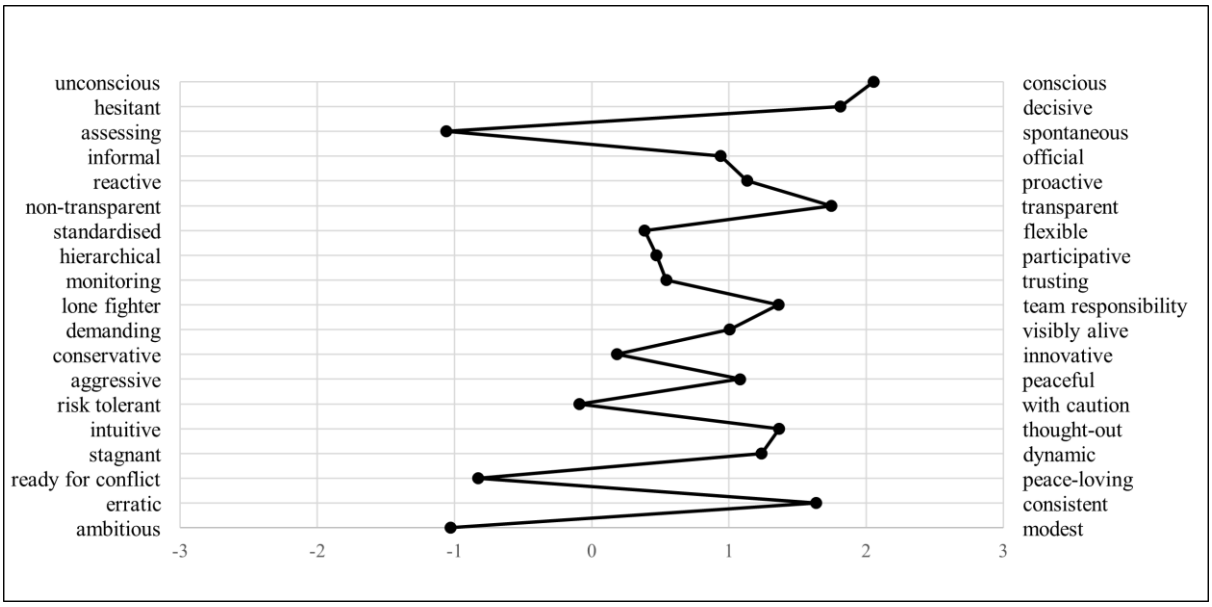

Figure D2: Polarity profile based on the average of 197 respondents

The analysis focusing on the situative variable age has shown interesting findings with regards to the semantic differential 'monitoring / trusting'. Comparing the average result of the cluster younger than 56 with the cluster older than 56, the delta is 0.4 (see Figure D2). For the semantic differential 'aggressive / peaceful' the delta is 0,24 (<56 years: 0,98, >56 years: 1,22).

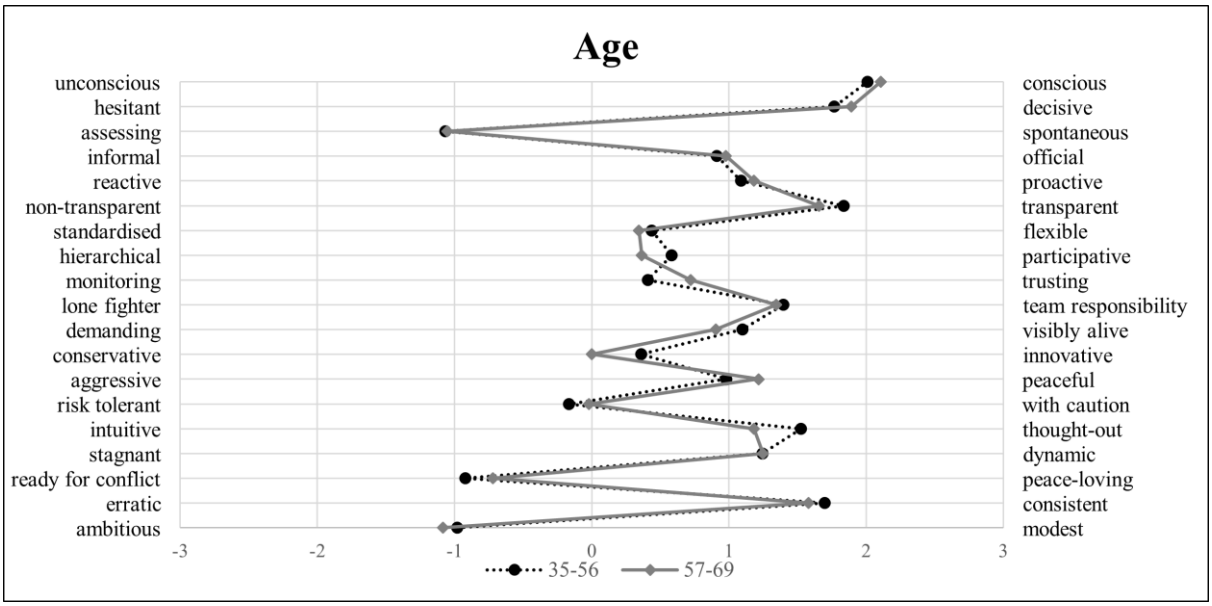

Figure D3: Polarity profile clustered by age

For the semantic differential 'hierarchical / participative', the delta of the average with regards to the cluster number of employees exceeds 0,5 (< 500 employees: 0,65, > 500 employees: 0,14, see Figure D4). This finding is validated by another situative variable indicating the size of the institute which is the number of clients (delta is 0,57 (< 100.000 clients: 0,80, > 100.000 clients: 0,23), see Figure D5). For the semantic differential 'risk tolerant / with caution' the delta of the average with regards to employees exceeds 0,3 (< 500 employees: 0,00, > 500 employees: -0,3), with regards to clients the delta is 0,21 (< 100.000 clients: 0,03, > 100.000 clients: 0,18).

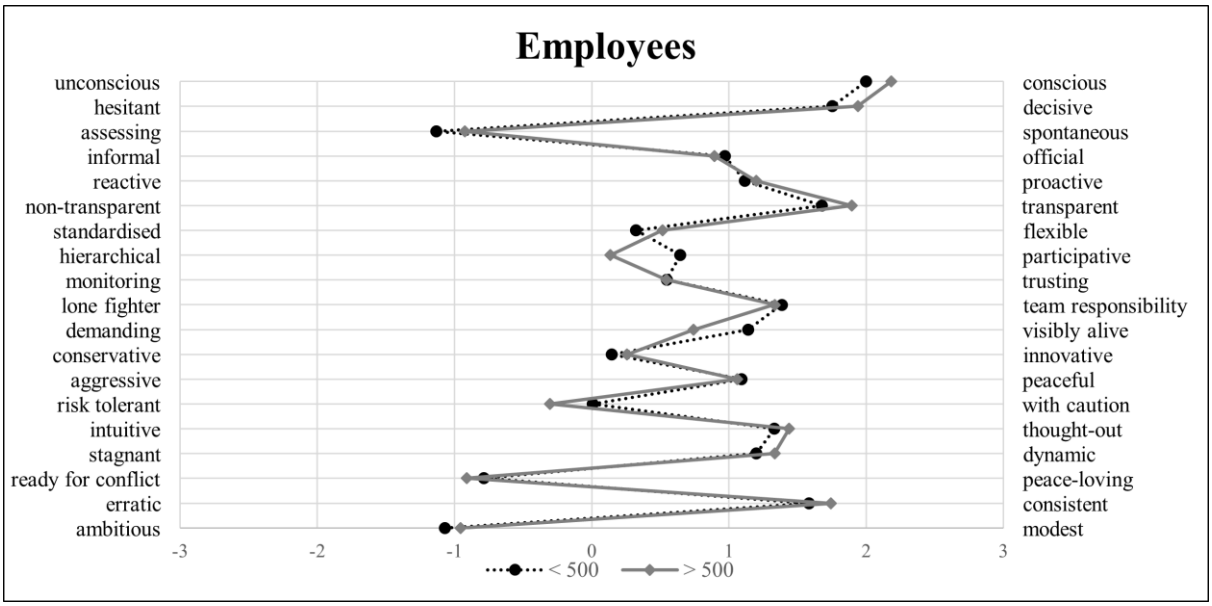

Figure D4: Polarity profile clustered by number of employees

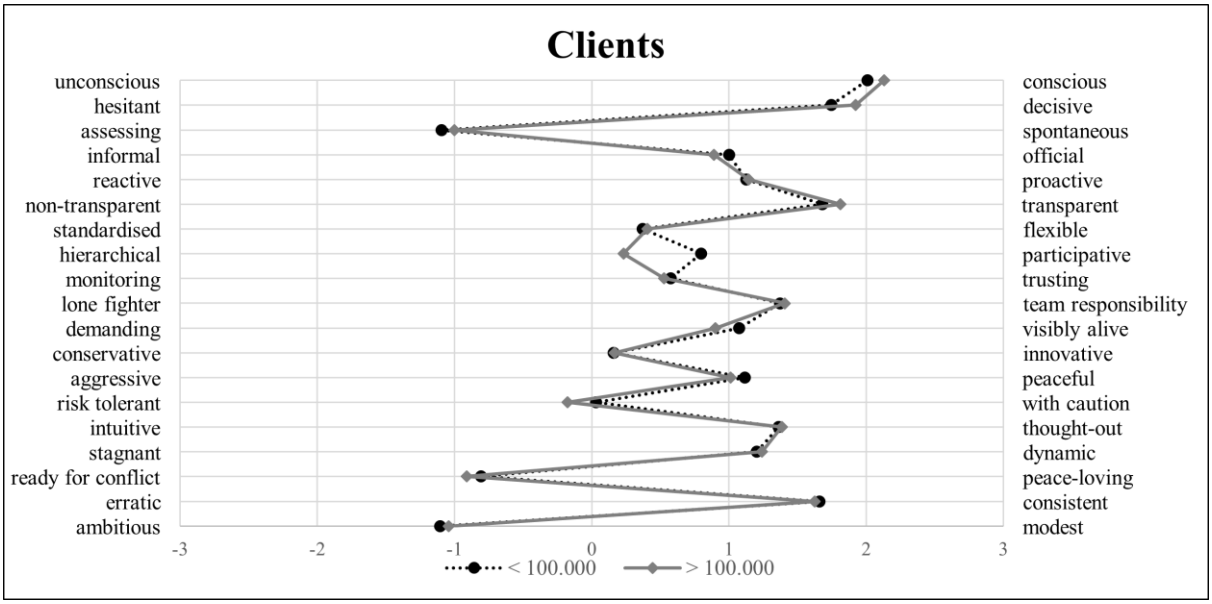

Figure D5: Polarity profile clustered by number of clients

References Section D

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E. Conclusion

E.1. Summary of the Findings and Practical Implications

More than 10 years after the financial crisis of 2007 and 2008, regulation, research, and practice can look back on the far-reaching changes in the regulatory requirements as well as the lessons learned. Nevertheless, despite recent regulatory initiatives, banking crises continue to emerge, often as a result of management decisions that perpetuate systemic risks. The focus of this dissertation is on the individual behavior of decision makers. The financial crisis proved that crises can be caused by many factors, especially misguided decisions. Because of the heavy interconnectedness of the banking sector, systemic risks have reached unprecedented levels. This process was last observed in 2007 and 2008 with irrationally high investments in mortgage-backed securities.

This dissertation added value to regulation, research, and practice by generating new steering impulses to sharpen decision makers' awareness of risk. The aim was not to further tighten the regulatory requirements, but rather to open a new perspective for regulation. To this end, the behavior of decision makers was examined at two levels. First, the CEO level was examined to determine whether continuous deficits in decisions ultimately distort the outcomes of banks. The second level investigated decision makers as group and examined whether they can make adequate decisions for their banks. Deficits in decision-making behavior at one or both levels would reveal a need for new steering impulses.

The first paper answers the first of the three research questions of this dissertation:

Research question 1: What is the influence of the individual characteristics of decision makers on a bank's risk-taking?

To answer this research question, the first paper creates a comprehensive framework that outlines the influence of CEO characteristics on banks' risk-taking. The results build the basis for a new regulatory governance impulse. The review shows that decision makers' decision

making is influenced by demographic, psychological, social psychological, and biological characteristics, which in turn have increasing, decreasing, or varying effects on banks' risk-taking and thus their strategic orientation. Environmental influences act as antecedents and pay arrangements serve as moderating effects.

The evaluation of the analyzed papers shows that the calculations of risk-taking are still partly arbitrary. The categorization of the indicators used reveals that the calculation is characterized by (i) changes in risk within a risk type, (ii) the combination of risk types, or (iii) specific indicators based on the regulatory requirements. The analyzed risk types are credit risk, equity risk, insolvency risk, liquidity risk, market risk, and operational risk. Variants (ii) and (iii) attempt to infer total bank risk rather than a single type of risk.

The first paper also specifies the variables used to describe and measure a certain risk type. Within a risk type, many measures are used to define risk. For example, the term "credit risk" is reflected by a multitude of risk measures. Therefore, the variables were reclassified to obtain a structure that mirrors such diversity. For example, credit risk was divided into an ex-post and an ex-ante view of credit defaults. This led to three superordinate categories to which measurement variables can be assigned: impaired loans, non-performing loans, and loan write-offs. Using that categorization, a more target-oriented statement can be made about credit risk. Suggestions for improvements are made for the other risk types as well.

The use of antecedents and CEO characteristics also shows deficits. Most of the ratios are measured using archival data, making them unrepresentative of the individual characteristics of a decision maker. Furthermore, a consistent computation of how the combination of characteristics influences risk-taking is lacking. For this reason, an interdisciplinary methodological approach was developed in the first paper to better measure and depict the desired effects in the future. A sequential mixed methods design was used to better represent the behavior of decision makers using questionnaires and interviews.

With the first paper, we show that decision maker heterogeneity impacts banks' risk-taking significantly. Although the variables and methods of measurement used are criticized, the results show clear differences. On a case-by-case basis, it could not be shown that decision makers are continuously too willing to take risks. That does not mean that the characteristics of decision makers lead to irrational decisions. However, individual behavior is significantly reflected in the outcomes of banks. Regulation should take this into account when formulating new rules because if a bank's risk-taking depends on the individual characteristics of decision makers, this also indicates that the regulatory requirements are interpreted differently depending on the decision maker. The starting point for analyzing the different degrees of risk-taking by banks should be their risk-bearing capacity and risk appetite. Accordingly, regulation should consider more the individual behavior of decision makers, even if irrational behavior could not be proven at this point. This aspect should be distinguished from observable variations in risk-taking due to different types of banks and risk-bearing capacities. For the latter purpose, regulation has introduced the proportionality principle. The design of the regulatory requirements and scope and intensity of a bank's risk management are already adjusted according to the systemic relevance of the bank (Deutsche Bundesbank 2017). In our paper, variations in risk-taking are attributed to the influence of the individual decision maker. They are thus not subject to the proportionality principle.

The results of the first paper apply to individual cases of decision makers by examining individual characteristics. The second research question goes one step further and examines the extent to which indicators for irrational decisions within the group of all decision makers can be found that limit the effectiveness of the regulatory requirements. Therefore, the second research question was as follows:

Research question 2: Are the decision making and decision-making quality of decision makers consistent with the desired implementation of the regulatory requirements?

To address this research question, the second paper examines the extent to which decision makers can continuously implement the regulatory requirements in accordance with the ideas of regulation. To investigate this aspect, the bail-in principle was examined in more detail. Specifically, whether decision makers consciously and actively manage their bank's going-concern capital through CoCo bonds and whether the decisions are in line with the regulatory requirements were investigated. The results show that AT1-eligible CoCo bonds are indeed used to compensate shortfalls in going-concern capital. However, the same effect could not be found for T2-eligible CoCo bonds or gone-concern capital. CoCo bonds are increasingly credited in AT1 when the headroom of the liquidity ratio is low and close to the regulatory minimum capital requirements. However, we do not find that more CoCo bonds are counted in T2 if the TLAC headroom is low and close to the minimum requirements, allowing us to conclude that decision makers do not always make the best decisions with respect to the regulatory requirements for their banks. They refrain from using resilient hybrid financial instruments such as CoCo bonds in T2 capital to compensate shortfalls in regulatory capital. Thus, TLAC is not yet exploiting its full potential.

This means that it is not only the heterogeneity of individual decision makers on a case-by-case basis that influences the outcomes of banks. The second paper shows that decision makers as a whole do not always make the best decisions for their banks. Thus, the hypothesis that decision makers collectively make decisions in the best possible way with respect to the regulatory requirements must be rejected. One reason for this may be that decision makers cannot implement the regulatory requirements in the sense of regulation due to their cognitive limits. This effect does not seem to be observable when analyzing the influence of individual decision makers on risks. However, when looking at decision makers as a group, the optimal management of the regulatory requirements is distorted. Although decision makers try to manage risks rationally, the heterogeneity of their decisions makes the banking sector unstable.

In this case, varying risk-taking as well as different interpretations of the regulatory requirements affect a bank's resilience. This may lead to the conclusion that further regulatory tightening is not necessary to make banks more resilient to crises. Instead, it could be helpful to include decision makers more in regulatory efforts. Therefore, the third research question is as follows:

Research question 3: How can decision makers communicate risk-related issues so that they are adequately implemented in the bank?

In this context, the third paper presents an implementation schedule with elements and attributes that guide how to implement a risk-related tone from the top as part of the risk culture within a bank. Five attributes, principally evaluation and monitoring, standardization and institutionalization, sense of unit, and the realization of tone from the top, are central for a successful implementation. Each attribute consists of elements that form subcategories of the attributes and serve as headings for individual recommendations for action. The latter are derived from the regulatory requirements, findings from research, and questionnaires or interviews in the field.

With the help of the third paper, a risk-related tone from the top, based on normative management, is intended to provide an initial impetus as well as accomplish two tasks. First, improved communication should sensitize decision makers at other hierarchical levels and all bank employees to risk issues and ensure a clear understanding of the bank's desired risk-taking approach. Second, normative management, as the initiator of the risk-related tone from the top, should encourage decisions to be made in the best interests of the bank. This aspect can be described as a feedback effect. The level of normative management should act as a role model and is accountable to all bank employees. Thus, employees should be encouraged to act in the best interests of the bank and control themselves by displaying a higher level of risk-appropriate behavior.

The third paper is not intended to define a new regulatory strand but rather intensify efforts to create a communication or behavioral approach. If decision makers are more sensitive to risk, this should increase decision quality. At the same time, the feedback effect ensures that banks improve steadily. For banks, when individual CEO characteristics are considered in regulatory efforts, a number of benefits arise, thereby leading the decisions of decision makers and regulatory requirements to adjust continuously. For example, better quality assurance can be gained through the feedback effect. Improved decision-making results in greater resistance to crises, and employees gain a better understanding and mindset about how to act responsibly during uncertainty.

Overall, this dissertation shows that decision makers make different decisions based on their individual characteristics. Furthermore, it is shown that decision makers as a whole cannot rationally make the best decisions for their bank. Instead of further tightening the regulatory requirements regarding capital ratios, this dissertation calls for directing the regulatory focus more toward the behavior of decision makers so that they are motivated and sensitized to make adequate decisions for their bank. For this purpose, a risk-related tone from the top is proposed, which assigns a role model function to decision makers. In this way, they can motivate their employees to improve their risk awareness as well as change their own behavior. This process can create a risk culture in the bank that proactively counteracts risks and potential crises.

E.2. Future Research

The results of this dissertation open up further research avenues. Figure E1 combines the potential for future research with the results of this dissertation. Bringing the process of decision making to the forefront of regulatory efforts provides a paradigm shift in regulation. Thus, in the context of both existing and upcoming regulatory requirements, the way decisions are made should be given greater consideration. This would evenly distribute the regulatory focus that

guides decision making on mathematical models and communication and behavioral approaches.

Figure E1 illustrates the suggestion for a future decision-making process of implementing the regulatory requirements in banks. The process covers the two regulatory strands of mathematical models and communication and behavioral approaches. Both the subcategories listed are topics covered in this dissertation. The feedback effect on the decision-making process resulting from the tone from the top is also integrated, which would be a new facet to regulation.

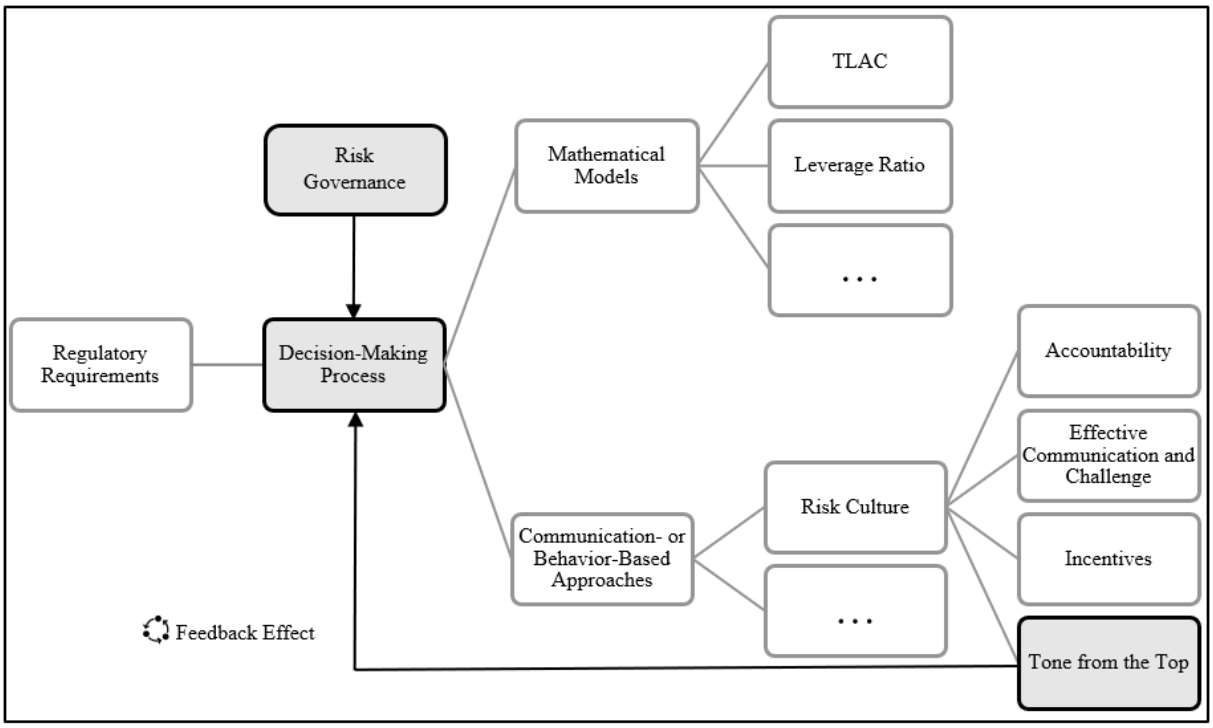

Figure E1: Decision-making process as a regulatory requirement

Regarding the decision-making process, the suggestions for future research contributions are threefold. The fact that the individual behavior of decision makers impacts banks seems to be confirmed. Accordingly, the decision-making process is presented in conjunction with the two regulatory strands of mathematical models and communication and behavioral approaches. It seems obvious in this context that decisions are not always subject to rational standards or made in the best sense of the regulatory requirements, as the second paper showed. This

aspect could be related to cognitive load limits, as highlighted in the outlook of the first paper in the context of upper echelons theory (Hambrick et al. 2005).

A decision process can be divided into three stages: information perception, information processing, and the final decision. Much research, including the work of (Tversky and Kahnemann 1981), shows that within this process, people are subject to behavioral anomalies when making decisions under uncertainty. Behavioral anomalies occur across individuals, affect the subconscious, and lead to irrational decisions. For example, when perceiving information, people often place more weight on the information that corresponds to their own view or opinion (selective perception). In information processing, decision makers are influenced by the way information is presented to them (framing effect). A negative or positive presentation of one and the same content can therefore cause individuals to make different decisions. In the context of the decision itself, it is easier to go along with the social view (herd instinct). Consequently, ideas can occasionally be abandoned to ensure conformity with the broad mass. Many behavioral anomalies can thus be assigned to these three stages of decision making (Tversky and Kahnemann 1981).

In the context of this dissertation, the behavioral anomalies build an intersection with the first and second paper. It can be assumed that all decision makers are subject to behavioral anomalies, which may explain why CoCo bonds are not adequately used for TLAC requirements. At the same time, the severity of behavioral anomalies varies depending on the individual characteristics of decision makers. Therefore, it seems worthwhile to examine them in combination with the results of the first paper. For example, a masculine decision maker may be less subject to the herd instinct, but more selective in their perceptions.

The second point for future research could be the continuation of existing research. The first paper provides suggestions for enhancements and points out that methodological procedures should be fundamentally questioned. Instead of archival data, observations of people's behavior

would be better represented by questionnaires or interviews (see the first paper, Sections 4 and 5). To better understand the way decisions are made, extensions should be made along the presented cluster of CEO characteristics. While the demographic variables have already been well studied, psychological variables can be assumed to have an especially large scope, as they explain human behavior. For example, the influence of more profound characteristics such as childhood trauma on risk-taking could be investigated (Tian et al. 2022). However, a distinctive interdisciplinary knowledge is required since economic ratios provide no explanatory content.

Upper echelons theory has also been extended over time to include effects overlooked in the studies comprising this dissertation. In the future, managerial discretion (Hambrick and Finkelstein 1987) and job demands (Hambrick et al. 2005) could be examined as moderating effects between CEO characteristics and risk-taking by banks. Both effects have already found their way into the management literature but have not yet been considered in studies of banks' risk-taking. Although many studies have already thematically addressed CEO characteristics, the methodological approach in future calculations must be improved.

While the first two points for future research address the question of how to further investigate the main topic of this dissertation (i.e., the extent to which a new behavior-based steering impulse can make banks more crisis-resilient), the third point refers to possible solutions. A feasible solution for common practice should be characterized by the extent to which it can be seamlessly embedded in business processes. The concept of risk governance seems to be a promising approach to moderate the decision-making process, as shown in Figure E1.

According to Wiedemann and Stein's (2016) conceptual understanding of risk governance, a bridge is built between corporate governance and risk management. Risk management, on the one hand, is very much a boundary-preserving model that follows the "logic of the audit trail". Corporate governance, on the other hand, seeks to assist decision makers with best practice guidelines for managing and controlling the institution's governing bodies. The two divisions

are important albeit isolated components of a bank's risk steering. To ensure all-encompassing risk governance, they must act in concert. This is where the bridging function of risk governance comes into play, which is accessed through four tasks and is intended to support the decision-making process of decision makers.

The tasks are initialized using risk governance circles. These are small groups of employees from different corporate functions that discuss their risk perceptions in regular workshops. This ensures cross-functional communication within a bank. One task, advising senior management, is of particular importance for future research contributions. The third paper suggests a top-down impulse toward employees and a feedback effect toward normative management via the tone from the top. Using risk governance circles, an additional bottom-up impulse can be created to support decision makers in the decision-making process.

E.3. Limitations

The following limitations should be noted. The critical systematic literature review is only one of the many ways to conduct a theory-based analysis. Other methodological approaches could have been used as well. The form of data collection alone can take a wide variety of forms (Adams et al. 2017; Massaro et al. 2016; Webster and Watson 2002). Similarly, only English-language papers listed in the ABS Guide were analyzed. However, journals in other languages and without rankings could also produce interesting results (McKinnon 2017). Further, while the first paper criticizes the datasets and variables used by the sample papers, it uses them later for its interpretive analysis.

The generalizability of the results of all the papers is limited to the criticism that different banks and bank types were studied within the three papers. For example, the second paper only examines G-SIBs, while the third paper refers exclusively to German regional banks. That could also be an approach for future research. In addition to different types of banks, the first and third paper refer to CEOs and board members, while the second paper does not specify the

decision makers. In this context, the second paper also raises the question of the extent to which the Minimum Requirement for Own Funds and Eligible Liabilities (MREL), as the European sister of the TLAC requirements for all banks, is managed by T2-enabled CoCo bonds, especially since both MREL and TLAC seek to strengthen banks' loss-absorbing capacity and their structural differences are only marginal. They differ slightly in the calculation of their minimum capital adequacy ratios. For instance, the TLAC ratio refers to risk-weighted assets, while the MREL ratio considers the share of total liabilities. However, the main difference is which banks are subject to TLAC and MREL. Due to the similarity of both rules, including MREL banks could have been considered to enlarge the sample.

Finally, the third paper is only based on interpretative analyses and descriptive statistics. In particular, with respect to the semantic differentials used, an exploratory factor analysis could have been placed upstream as a multivariate data-reducing analysis procedure. Examining the intercorrelations between the variables might have reduced the factors and led to a smaller number of superordinate factors. This could offer the advantage to form different types of risk-related communication in banks.

Appendix Dissertation

Questionnaire and structured questions for the interviews

Project Management: Univ.-Prof. Dr. Arnd Wiedemann and Univ.-Prof. Dr. Volker Stein

Project Team: Christiane Bouten, M.Sc., Patrick Hertrampf, M.Sc. and Nicolas Mues, M.Sc.

The aim of the project is to empirically record the risk culture of savings banks in the sense of the "Tone from the Top". This is done methodically on the one hand in the form of a quantitative analysis on the basis of a questionnaire and on the other hand in the form of a qualitative analysis on the basis of interviews.

	Questions
1.	What do you associate with risk culture?
2.	What is the relationship between risk strategy and risk culture for you?
3.	How do you personally communicate risk culture in your bank?
4.	What types of risk do you focus on when it comes to risk culture?
5.	How do you ensure that employees are committed to the topic of risk culture?
6.	Describe an event in which you were very pleased with your bank's risk culture.
7.	What do you see as your personal responsibility with regard to the topic of risk culture?
8.	How important is risk culture for your business model?

Table A2: Structured questions for the interviews

Questionnaire

Year of birth: _____ Years of board experience: _____

Department before board activity: _____

In how many institutes have you been a member of the Management Board so far? ____

Number of employees: ☐ < 250 ☐ 251-500 ☐ 501-750 ☐ 751-1000 ☐ > 1000

Total number of customers _____ Loans to total assets [in %]: _____

Is your business area more urban or rural? ☐ rather urban ☐ rather rural

Total capital ratio [in %]:	☐ < 14	☐ ≥ 14-16	☐ ≥ 16-18	☐ ≥ 18-20	☐ > 20
Interest rate risk coefficient [in %]:	☐ < 10	☐ ≥ 10-15	☐ ≥ 15-20	☐ ≥ 20-25	☐ > 25
Operating profit [in %]:	☐ < 0,4	☐ ≥ 0,4-0,6	☐ ≥ 0,6-0,8	☐ ≥ 0,8-1,0	☐ > 1,0

How would you rate your usual communication with employees regarding risk issues?

unconscious	○	○	○	○	○	○	○	conscious
hesitant	○	○	○	○	○	○	○	decisive
spontaneous	○	○	○	○	○	○	○	weighing
informal	○	○	○	○	○	○	○	official
proactive	○	○	○	○	○	○	○	reactive
transparent	○	○	○	○	○	○	○	non-transparent
flexible	○	○	○	○	○	○	○	standardized
hierarchical	○	○	○	○	○	○	○	participatory
controlling	○	○	○	○	○	○	○	trusting
as team worker	○	○	○	○	○	○	○	as an individual
claiming	○	○	○	○	○	○	○	visibly
conservative	○	○	○	○	○	○	○	innovative
peaceful	○	○	○	○	○	○	○	aggressive
careful	○	○	○	○	○	○	○	risk tolerant
intuitive	○	○	○	○	○	○	○	thoughtful
dynamic	○	○	○	○	○	○	○	stagnant
ready for conflict	○	○	○	○	○	○	○	peace-loving
consistent	○	○	○	○	○	○	○	erratic
ambitious	○	○	○	○	○	○	○	modest

Please indicate the extent to which you agree with the following statements.

	Do not agree								Fully agree
Our employees accept risk standards.	☐	☐	☐	☐	☐	☐	☐	☐	☐
Our employees accept my authority as a board member.	☐	☐	☐	☐	☐	☐	☐	☐	☐
Our employees implement our risk standards.	☐	☐	☐	☐	☐	☐	☐	☐	☐
In the teams, mutual attention is paid to compliance with risk standards.	☐	☐	☐	☐	☐	☐	☐	☐	☐
The concept of risk is omnipresent in teams.	☐	☐	☐	☐	☐	☐	☐	☐	☐
Our intended risk culture is lived in the bank.	☐	☐	☐	☐	☐	☐	☐	☐	☐
A code of conduct supports the implementation of an intended risk culture.	☐	☐	☐	☐	☐	☐	☐	☐	☐

Table A3: Questionnaire

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