Bank regulation, supervision and financial stability: An empirical study.

By

José Arias

Supervisors:

Dr Suman Lodh (DoS)

Dr Nitin Deshmukh

A thesis submitted to Middlesex University in partial fulfilment of the requirements for the degree of Doctor of Philosophy in Accounting and Finance

Middlesex Business and Law School

Middlesex University

EXCECUTIVE SUMMARY

This PhD thesis explores the relationship between banking regulations and supervision, and financial stability. In terms of the financial stability, I focus on the banking industry and, particularly, on the role of foreign banks in the transmission of shocks through the lending channel. Additionally, I investigate the banking stability through several indicators of a bank's stand-alone risk, such as the bank's z-score and the Merton's (1974) distance to default, among others. With respect to the banking supervision and regulations, I examine two underexplored topics: the role of supervisory cooperation agreements and bank culture for banking stability. Therefore, this study contributes to the banking literature by expanding the empirical evidence in three ways. These are briefly mentioned below.

Firstly, Chapter 2 expands the recent studies on bank lending (e.g., Allen et al. 2017; Adams-Kane et al., 2017) by investigating how lending behaviour of foreign banks is affected through cross-border banking supervision during the global financial crisis. I use a hand-collected data on bilateral and multilateral cooperation agreements at the country-level from central banks and supervisory authorities' websites, and apply a difference-in-differences (DiD) methodology. I find that a statistically significant relationship exists and that lending by foreign banks decreased in Central and Eastern Europe and Latin America during the crisis. In particular, the foreign banks whose home and host countries supervisors have an agreement on banking supervision reduced their lending less, between 3.6% and 9.9%, than the banks that did not have such type of agreement amid the crisis. This mitigating effect is positively related to the level of supervisory power and the number of on-site inspections, and negatively associated with the level of supervisory consolidation. My findings have important policy implications. My results suggest that to mitigate the international transmission of shocks, the national and international regulators need to enhance supervisory coordination and cooperation among central banks, supervisory authorities, and banking institutions.

Secondly, Chapter 3 expands the existing literature by examining how board attributes such as gender diversity, CEO power and CEO age influence the bank risk-taking behaviour through the bank's culture. To investigate the research question in this chapter, I create a culture dictionary using 5,813 quarterly earnings call transcripts and a machine learning technique (following Li et al., 2021a). I score the five cultural values of innovation, quality,

integrity, respect and teamwork for a sample of 180 US BHCs over the period 2006-2019. To answer the research question, I employ a system of simultaneous equations using the three-stage least squares (3SLS) estimation method among others panel data estimators (i.e., Ordinary Least Square, 2-Stage Least Square and GMM-system estimator).

The findings suggest that banks with cultures of *innovation, quality*, and *integrity* help mitigating the default risk for the banks. In addition, the results show that boards with higher gender diversity are positively associated with the *innovation,* quality*, and integrity*. It means that more gender-diverse boards exhibit and foster these cultural values in banks I also provide evidence of an economically significant influence of CEO age and CEO power on these culture variables. Thus, this study reveals that the board characteristics of banks influence their risk mitigation through the culture of *innovation, quality,* and *integrity.* My analysis in this chapter contributes to the practitioners, policy makers and regulators as it provides evidence to increase the gender diversity in banks, which in turn would improve the bank culture resulting in better bank stability.

Finally, Chapter 4 examines whether and how bank culture helps to mitigate the impact of COVID-19 on banks' default risk. As mentioned before, I use 2,328 quarterly earnings calls transcripts to measure the corporate culture for a sample of 161 US BHCs over the pre-pandemic period. The number of earnings calls transcripts used in this chapter differs from Chapter 3 due to differences in the sample period. Using a difference-in-differences (DiD) approach, I show that, although the COVID-19 shock increased banks' default risk, banks with a strong culture exhibit a lower default risk than their peers without a strong culture. In the next step, I group the five cultural values underlying a strong culture into two subcultures: technology-oriented culture comprised of innovation and quality, and people-oriented culture comprised of integrity, respect and teamwork. I find that banks with a strong technology-oriented culture show a lower default risk than their counterparts during the pandemic crisis. Among the three components of people-oriented culture*,* I find that only *integrity* helps to mitigate the impact of COVID-19*.* The results suggest that supervisors' assessment of culture should focus on encouraging and aligning technology-oriented cultural values with a bank's strategic goals.

DEDICATION

Dedicated to my son Juan Jose

ACKNOWLEDGMENT

First, I am grateful to my parents, my brother and sister, my uncles, my cousin Guido and, especially, to my girlfriend Grace. Second, I would like to thank to my supervisors Dr Suman Lodh and Dr. Nitin Deshmukh for their constant guidance, support and encouragement all through the period of this research. They always motivated me to develop innovative research, expand my knowledge to other areas in the field of business and go beyond my capabilities. Third, I would also like to thank to my colleagues and friends Dr. Orlando Llanos, Dr. Carlos Maquieira, Dr. Cristhian Mellado, Dr. Juan Gallegos, Dr. Mauricio Jara for their constant support throughout this process. Finally, I will thanks to my good friend Rodrigo Farias, Paulo Arenas, Jose Soto, Pablo Carvajal, Eduardo Vasquez and my group of friends called “Mutantes”.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 1: INTRODUCTION

Over the last two decades, global financial stability has suffered the consequences of the biggest economic crises since the Great Depression of 1929; the Global Financial Crisis of 2007-2009 (GFC) and the ongoing COVID-19 pandemic (Berger and Demirguc-Kunt, 2021). According to the European Central Bank (2007), financial stability can be defined as a condition in which the financial system - comprising financial intermediaries, markets and market infrastructure- is capable of withstanding shocks. As a result, it allows mitigation of the likelihood of disruptions in the financial intermediation process, which are severe enough to significantly impair the allocation of savings to profitable investment opportunities. So, financial stability is crucial for economic growth and the social welfare of individuals, households and public institutions. For instance, the GFC significantly reduced economic output during the 10-quarter recession as well as imposing losses on household wealth and costs on taxpayers (e.g., Atkinson et al., 2013). Therefore, this PhD thesis aims to provide new evidence related to the relationship between banking regulations and supervision and financial stability.

The GFC revealed a number of weaknesses in the supervision and regulation of cross-border banking (D'Hulster, 2012). Since then, there has been considerable discussion about the effectiveness of bank regulation and supervision for financial stability. In the same vein, bank culture has emerged as an important topic of discussion for regulators due to its importance for financial stability (Song and Thakor, 2019). Prior studies show a lack of effective cooperation among banking supervisors during and in the post-GFC period (e.g., De Hass and van Lelyveld, 2014). Additionally, researchers and financial regulators have argued that failures in corporate governance and, particularly, in bank culture were shortcomings of the financial system before and during the crisis (e.g., Berger et al., 2016; FSB, 2014).

On the one hand, an increasing number of cooperation agreements on cross-border banking supervision have been implemented around the world to enhance financial stability (Lang et al., 2020; Beck et al., 2021). Usually, these agreements take the form of a Memorandum of Understanding (MoU) on information sharing, on-site inspections, as well as the existence of a college of supervisors. A recent example of supervisory cooperation is the Vienna Initiative, in which the main banking groups of Western Europe agreed to sign commitment

letters to support the subsidiaries in Emerging Europe during the GFC. Similarly, the Financial Stability Board (FSB) with the support of the Group of Twenty (G20) and the Basel Committee on Banking Supervision (BCBS, 2010) established supervisory colleges for each of the largest international banking groups.[1]

On the other hand, bank culture has emerged as an important topic for financial stability and bank risk since the 2007-09 financial crisis (Song and Thakor, 2019). The Group of Thirty (2015) report argues that bank risk is an inevitable consequence of its culture and, in turn, it cannot be isolated from its overall culture. In this sense, regulators may influence bank culture by focussing on corporate governance and on existing regulations (Thakor, 2020). Among several governance mechanisms, an interesting approach would be to align compensation schemes with incentives for better capitalized banks instead of encouraging profitability indicators. Additionally, they may influence bank culture by using existing regulatory tools like capital and liquidity regulations, as well as deposit insurance (Song and Thakor, 2019; 2020).

Given the above-mentioned discussion in the recent literature in banking, the objective of this PhD thesis is stated as follows:

- This PhD research aims to contribute to the banking literature by expanding the empirical research on the relationship between bank regulation/supervision and financial stability.

According to the extant literature, financial stability can be assessed by several forms depending on the focus of the analysis; the real economy, corporate sector, household sector, external sector, financial sector and financial markets (e.g. IMF, 2006). So, in this study, I focus on the financial sector and, specifically, on the banking industry. Firstly, and in particular, I examine the role of foreign banks in the transmission of shocks through the lending channel, i.e., how shocks to the parent banks lead foreign bank subsidiaries to reduce the loans they make in host jurisdictions amid a financial crisis, affecting financial stability in host countries. Secondly, I study banking stability through accounting-and market-based

[1] The G20 members are: Argentina, Australia, Brazil, Canada, China, France, Germany, Japan, India, Indonesia, Italy, Mexico, Russia, South Africa, Saudi Arabia, South Korea, Turkey, the United Kingdom, the United States, and the European Union

indicators of a bank's stand-alone risk; the bank's z-score, the volatility of return on assets (ROA), the Merton (1974) distance to default and the Byström (2006) distance to default.

In terms of banking supervision and regulations, I test two underexplored topics: the role of supervisory cooperation agreements and bank culture for banking stability. First, I collect data by hand on bilateral and multilateral cooperation agreements at the country-level for countries in Central Eastern Europe (CEE) and Latin America (LA).[2] Then, I classify these agreements as three types: MoU for information sharing and on-site inspections, MoU for crisis management and resolution and colleges of supervisors (CS). Second, I address the topic of banking regulations and supervision by examining the effect of bank culture on banking stability. To this end, I use a machine learning technique - the word embedding model - to score the five cultural values of *innovation, quality, integrity, respect* and *teamwork.*

After positioning this study within the banking literature and identifying the gaps, three research objectives have emerged to reach the objective of this PhD research:

- **Objective 1**: To investigate how the lending behaviour of foreign banks is affected by cross-border banking supervision during the GFC.
- **Objective 2**: To explore how board attributes (such as gender diversity, CEO age, and CEO power) influence the bank risk-taking behaviour through bank culture.
- **Objective 3:** To investigate what is the role of bank culture in events of financial turmoil, specifically, the COVID-19 pandemic.

After identifying the objectives of this PhD thesis, I have developed three corresponding research questions to reach the objectives. The overarching research question that guides this PhD research is formulated as follows:

- **RQ:** How do banking regulations and supervision affect financial stability?

[2] These agreements are among host countries, i.e., CEE and LA countries where foreign subsidiaries operate, and the home countries, parent banks' countries.

Regarding the objective of how supervisory cooperation among different participants of the banking industry may help to mitigate the international transmission of shocks during the events of financial distress, I propose the first research question as follows:

- **RQ1:** How does cross-border cooperation in banking supervision affect foreign bank lending? If so, what is the impact of the global financial crisis on that relationship?

Concerning the need for more research on the link between bank culture, board attributes and bank risk-taking evidenced by the GFC and argued by previous studies and by international bodies (e.g., FSB, 2014 The Group of Thirty, 2015; Song and Thakor, 2019; Thakor, 2020), I divide the second research question into three parts:

- **RQ2a:** How does the corporate governance of banks influence their culture?
- **RQ2b:** How does bank culture affect bank risk-taking?
- **RQ2c:** How does corporate governance of banks impact their risk-taking behaviour through bank culture?

Finally, in relation to the role of bank culture in events of financial turmoil, I use the COVID-19 pandemic crisis to investigate the next questions:

- **RQ3:** How does the COVID-19 pandemic affect the banks' default risk? If so, what is the role of bank culture to mitigate the impact of COVID-19 on banks' risk?

This PhD research contributes to the banking literature by expanding the empirical evidence on the relationship between bank regulation/supervision and financial stability in three cohesive chapters. Chapter 2 of this PhD thesis expands the recent studies on bank lending (e.g., Allen et al., 2017; Adams-Kane et al., 2017) by investigating how the lending behaviour of foreign banks is affected by cross-border banking supervision during the global financial crisis. I use a difference-in-difference (DiD) methodology and find that foreign banks whose home and host countries supervisors have an agreement on banking supervision reduce their lending less than the banks that do not have such a type of agreement. Particularly, the results exhibit that the cooperation agreements help to mitigate the reduction in foreign lending

growth by between 3.6% and 9.9%, relative to their counterparts. This mitigating effect is positively related to the level of supervisory power and the number of on-site inspections and is negatively associated with the level of supervisory consolidation. Other arrangements are less strongly related to this matter. So, the results suggest more efforts to enhance supervisory coordination and cooperation among national and international regulators are needed to mitigate the international transmission of shocks.

Chapter 3 relates and contributes to three strands of literature by examining the unexplored link between bank culture, board attributes and bank risk-taking. First, it expands the emerging line of literature about bank culture (Song and Thakor, 2019; Bianchi et al., 2021; Tang et al., 2021). Other studies investigate the impact of national culture on bank risk-taking using international samples (e.g. Mourouzidou-Damtsa et al., 2019; Berger et al., 2021). The second strand of literature relates to the growing body of literature about how to measure corporate culture and its impact on different aspects of business operations (e.g., Guiso et al., 2015; Graham et al., 2019). Third, this essay also adds to the literature on corporate governance and bank risk-taking (e.g., Anginer et al., 2018) and, more specifically, to the existing research on the effects of manager/director attributes on bank risk (Sila et al., 2016; Nguyen et al., 2018; Hagendorff et al., 2021).

More specifically, Chapter 3 expands the existing literature by examining how board attributes influence bank risk-taking behaviour through bank culture. To this end, I first create a culture dictionary using a machine learning technique - the word embedding model- and earnings call transcripts. Then, I score the five cultural values of *innovation, quality, integrity, respect* and *teamwork* for a sample of the US BHCs over the period 2006-2019. To investigate how corporate governance of banks influence their risk-taking behaviour through culture, I employ a system of simultaneous equations using the three-stage least squares (3SLS) estimation method. Overall, this study reveals that boards characteristics can influence bank risk-taking through the cultural values of *innovation, quality, integrity*. In particular, I find that more gender-diverse boards, CEO's age and CEO's power are positively associated with the values of *innovation, quality* and *integrity*, which in turn increase banking stability. I also use other panel data estimators, such as OLS, 2SLS IV model and the dynamic GMM-system estimator, as well as several robustness checks.

Global financial stability is often hit by economic shocks arising from different sources (IMF, 2019). One driver of economic shocks is the recent coronavirus pandemic. It features the most unanticipated large and widespread exogenous economic shock of all time (Berger and Demirguc-kunt, 2021). The pandemic outbreak led to an unprecedented liquidity shock and crash of stock for banks (Li et al., 2020; Acharya et al., 2021). This unprecedented shock will no doubt leave its mark on banks. However little is known yet about how it may impact the resilience of the banking system (Duan et al., 2021). The extraordinary nature of this crisis makes the impacts on financial stability rather complicated to quantify and, thus, they must be urgently addressed. (Elnahass et al., 2021). Furthermore, it is imperative for researchers to study what makes some firms more resilient in the face of great uncertainty as the pandemic spreads (Li et., 2021).

Chapter 4 relates and contributes to the rapidly emerging literature on the impact of the COVID-19 shock on the banking sector in aspects such as bank lending (e.g., Colak and Oztekin, 2021), deposit growth (e.g., Levine et al., 2021), performance (e.g., Elnahass et al., 2021), bank systemic risk (e.g., Dual et al., 2021), among others. This chapter expands this line of research by exploring whether and how bank culture helps to mitigate the impact of COVID-19 on the default risk of banks. To the best of **my** knowledge, this is an unexplored question that deserves to be answered, as bank default risks are the ultimate risk that matter for banking stability and the risk that regulators are likely to care about the most (Anginer et al., 2017).

In this chapter, I first score the five cultural values of innovation, quality, integrity, respect and teamwork for a sample of the US BHCs from 2016 until the end of the first quarter of 2019. Using a difference-in-differences (DiD) methodology, I find that despite the COVID-19 shock increased default risk of banks, those with a strong culture exhibit lower default risk than their peers without a strong culture. Furthermore, the results show that banks with strong bank culture oriented towards innovation, quality and integrity show less default risk than their counterparts during the pandemic crisis. I also find low bank exposure to COVID-19 through its branches, as well as high non-interest income help to mitigate the negative impact of the health crisis on banks' default risk. To check the robustness of **my** results, I

also use a DiD approach augmented with entropy balancing, as well as a Propensity Score Matching procedure.

My findings have several implications for policymakers and market participants alike, which can be summarized as follows. First, with increasing financial integration more efforts to enhance supervisory coordination and cooperation between home and host country supervisors are needed to mitigate the international transmission of financial shocks. Second, the results of this research reveal that gender diversity and CEO power encourage a bank culture oriented towards innovation, quality and integrity, which reduces bank risk-taking. These factors should be considered in approaches to assess the management factor in the third component in the CAMELS rating.[3] Third, regulators should create incentives for banks to develop a culture oriented toward innovation, quality and integrity, which will reduce the future burden on regulators in case of adverse events.

The rest of this PhD thesis is arranged as follows. In chapter 2 I investigate how lending behaviour of foreign banks is affected by cross-border banking supervision during the global financial crisis. Chapter 3 examines how board attributes influence bank risk-taking behaviour through bank culture. In chapter 4 I test whether and how bank culture helps to mitigate the impact of COVID-19 on banks' default risk. Chapter 5 presents the conclusions of this PhD thesis.

[3] CAMELS is an international supervisory rating system used by banking regulators to assess the strength of bank based on six factors represented by its acronym. The CAMELS acronym stands for: Capital adequacy, Asset quality, Management, Earnings, Liquidity, and Sensitivity.

CHAPTER 2: DOES CROSS-BORDER COOPERATION IN BANKING SUPERVISION AFFECT FOREIGN BANK LENDING? EVIDENCE FROM THE GLOBAL FINANCIAL CRISIS

2.1 Introduction

The recent Global Financial Crisis (GFC) has revealed several weaknesses in the supervision and regulation of international banking and has highlighted the importance of cross-border cooperation among banking supervisors in the transmission of shocks. As a result, recent studies have examined the crisis transmission through the lending behaviour of banks, arguing that shocks to the parent banks negatively affect the lending behaviour of their foreign subsidiaries (e.g., Cull and Martinez-Peria, 2013b; Allen et al., 2017). Anginer et al. (2017) find that the correlation between the default risks of global banks and their foreign subsidiaries' increased during the GFC, this highlights the need for cross-border cooperation agreements between banking supervisors. This chapter aims to fill this gap by examining the underexplored link between cross-border cooperation agreements and foreign bank lending.

Cooperation among national and international regulators is crucial for financial stability. According to Berger et al. (2021), international cooperation, including information sharing and other related topics among regulators and central banks, has ensured effective and timely responses to the short-term financial challenges associated with the COVID-19 health crisis. This process has intensified in some countries and can help the financial industry to overcome any future economic shock. Similarly, new risks arising from the global financial activities of Fintechs and big techs (such as peer-to-peer lending and Amazon), which require enhancing cooperation between regulators in different sectors and jurisdictions at the international level (European Systemic Risk Board, 2022). Furthermore, an increasing number of cooperation agreements have been signed among international banking regulators to improve cybersecurity in the banking industry and, in turn, ensure financial stability (Hitchens and Goren, 2017). Despite the importance of cross-border cooperation among banking authorities, there is a lack of empirical evidence about its effectiveness on mitigating the transmission of shocks (e.g., De Hass and van Lelyveld, 2014). This study aims to fill this gap by providing evidence on the role played by cross-border cooperation agreements on foreign bank lending during the GFC.

Although cross-border regulation and supervision have long been discussed, mainly among advanced economies' banking authorities, these have mainly focussed on enhancing the effectiveness of the Basel accords as well as on advising a set of principles for effective banking supervision (Beck, 2016). In this context, international banking authorities have developed and employed three instruments for dealing with the cross-border transmission of shocks: consolidated supervision, Memorandum of Understanding (MoU) and Colleges of Supervisors (CS). In this Chapter, I examine the issue of cooperation agreements and their impact on the lending behaviour of foreign banks in general and more specifically, in greater detail, during the GFC.

I collected data by hand on bilateral and multilateral cooperation agreements at the country-level for countries in Central Eastern Europe (CEE) and Latin America (LA).[4] I classify these agreements as three types: MoU for information sharing, MoU for crisis management and resolution, and colleges of supervisors (CS).[5] This is one of the first studies to examine in detail the link between bank lending behaviour and cooperation agreements; I also examine the same in the presence of a financial shock, the GFC. Related studies on this topic have examined foreign bank lending amid financial crises (e.g., Adams-Kane et al., 2017; Allen et al., 2017); however, the role of supervisory cooperation is not incorporated into their analysis. On the other hand, Beck et al. (2019) have examined the role of cooperation agreements but they focus on bank risk-taking.

The closest work on this topic by De Haas et al. (2015), which limits the discussion to the Vienna Initiative of 2008, in which country-specific commitment letters were signed by western European banks through which they pledged to maintain exposure to support their

[4] These agreements are among host countries, i.e., CEE and LA countries where foreign subsidiaries operate, and the home countries, parent banks' countries.

[5] First, following Beck (2016), I do not to consider consolidated supervision to measure cross-border banking supervision because it requires a minimum degree of cooperation between supervisors of home and host countries. Specifically, consolidated supervision entails the supervision of the banking group's financial statements and activities only by the home country supervisor. Thus, consolidated supervision requires a minimum degree of cooperation between supervisors of home and host countries; the home supervisor should consider the effectiveness of supervision conducted in the host country where the bank has material operations and make periodic visits to the bank's foreign offices, meeting the host supervisor at the same time (Beck, 2016). Furthermore, consolidated supervision is one of the purposes of the College of Supervisors (BIS, 2010; Beck et al., 2013). Second, the essential elements of the Memorandum of Understanding are (i) MoU for information sharing and (ii) MoU for crisis management and resolution (BCSB, 2001). Thus, we follow the extant literature and classify MoUs in these two categories (Beck et al., 2021).

subsidiaries in emerging Europe.[6] These commitment letters were a response to the GFC and thus more about crisis support. On the other hand, cooperation agreements are signed at the country level and tend to be much more comprehensive. For instance, over the last decade, MoUs have addressed topics related to money laundry, cybersecurity, technological support, among others. I can assert this point after a thorough examination and comparison of cooperation agreements and the agreements signed under the Vienna Initiative. In this Chapter, I cover a wide range of cooperation agreements, which allows for generalisation of the findings and close examination of the issue of whether and how cross-border cooperation in banking supervision affects the transmission of shocks – this is lacking in the present literature.

Cull and Martinez-Peria (2013b) highlight the importance of foreign banks in CEE and LA particularly during the GFC[7]; the stronger impact of the GFC on the banking system in CEE compared to LA can be explained by the lending behaviour of foreign banks. They find that in CEE countries foreign bank lending fell more than domestic bank lending while in LA countries there were no significant differences. Secondly, countries in CEE and LA have become the main hosts for multinational banks. This ownership transformation of the banking system in these two areas from **state banks** towards private and particularly **foreign banks**, as well as the more market-based financial system, were key to achieving macroeconomic stability in the late 1990s (Demirguc-Kunt and Maksimovic, 2002). I also contribute to this strand of the literature by closely examining the role of cooperation agreements in the lending behaviour of foreign banks in CEE and LA countries.

My study provides several new facts. First, I find that cooperation agreements in cross-border banking supervision lead to more lending by foreign banks. I also find that the lending decreases during the GFC.[8] On average, foreign banks cut back their lending by 25.9 per cent as a result of the global financial crisis. However, I find that the foreign banks whose home and host countries supervisors have an agreement on banking supervision reduce their lending less than the banks that do not have such type of agreements. In particular, the results

[6] De Haas et. al. (2015) find that during the GFC foreign banks that signed the Vienna Initiative commitment letters were more stable in their lending behaviour and thus the crisis transmission was mitigated.
[7] Other significant papers on this region are by Jeon et. al. (2013) and Allen et. al. (2017)
[8] This finding is in line with recent studies (Adams-Kane, et al., 2017; Allen et al., 2017)

show that cooperation agreements help to mitigate the reduction in foreign lending by between 3.6% and 9.9%, relative to their counterparts. Therefore, the existence of cooperation agreements in cross-border banking supervision aids financial stability (Anginer et al., 2017). This stabilising effect is positively related to the level of supervisory power and the number of on-site inspections and negatively associated with the level of supervisory consolidation. I conduct several thorough robustness tests which reveal that my findings are consistent.

My findings have several implications for policymakers and market participants alike. First, with increasing financial integration, more efforts to enhance supervisory coordination and cooperation between home and host country supervisors are needed to mitigate the international transmission of financial shocks. Second, better supervisory cooperation among national authorities would strengthen the tools of colleges of supervisors and encourage the development of *ex-ante* burden-sharing agreements (De Haas and Van Lelyveld, 2014). Third, an integrated supervisory mechanism would allow foreign banks to allocate their resources in a better way to mitigate the transmission of shocks. However, considering the heterogeneity of home and host countries this would entail a huge effort from local economies and international organisations, such as the Bank of International Settlements (BIS).

The next section of this Chapter provides an overview of the developments in cross-border banking supervision. Section 3 discusses the literature review and formulates the hypotheses. Section 4 describes the empirical strategy. Section 5 reports and discusses the results. In the last section, I provide concluding remarks.

2.2 Cross-border cooperation in banking supervision

The recent financial crisis has revealed a number of weaknesses in the supervision and regulation of cross-border banking. In particular, prior studies show a lack of effective cooperation among banking supervisors during and in the post-financial crisis period (D'Hulster, 2012; De Hass and van Lelyveld, 2014). Consequently, international bodies such as the Financial Stability Board (FSB), the Basel Committee on Banking Supervision (BCBS) and the G20 advocate and publicly promote the use of supervisory colleges as a measure of enhancing financial stability. Also, the FSB with the support of the G20

established supervisory colleges for each of the largest international banking institutions, and the BCBS defined a set of principles for good practices in supervisory colleges (BCBS, 2010).

There exists a long tradition of conversations on cross-border regulation and supervision, mainly among the banking authorities in advanced economies. However, they mostly focus on enhancing the effectiveness of the Basel accords and advising a set of principles for effective banking supervision (Beck, 2016). The first effort of the Basel Committee related to cross-border banking goes back to 1975 with the publication of the *"Concordat"* or the "*Report on the Supervision of Bank's foreign Establishments*" (BCBS, 1975).[9] The goal of this report was to define certain guidelines for cross-border cooperation in the supervision of banks' foreign establishments (e.g. branches, subsidiaries and joint ventures) and to suggest ways of improving its efficacy in terms of liquidity, solvency and foreign exchange operations.

In 1996, BCBS released another report titled "*Supervision of Cross Border Banking*" (BCBS, 1996), which proposed several recommendations to remove obstacles in the implementation of effective consolidated supervision. In this report, the Basel Committee introduced the possibility of developing a Memorandum of Understanding (MoU) for the first time to formalize some specific aspects of cross-border cooperation in banking supervision. During the following years, many countries advocated for a statement setting out the essential elements of a MoU as a reference for establishing bilateral agreements between banking supervisory authorities in different countries. As a result, the Basel Committee released the "*Essential Elements of a Statement of Cooperation between Banking Supervisors"* in 2001 (BCBS 2001), which states the essential elements such as information sharing, onsite inspections, protection of information and ongoing coordination.

Finally, and as a result of the global financial crisis, the FSB with the support of the G20 established the supervisory colleges for each of the largest international banking institutions and in 2010 the Basel Committee published a report titled "*Good practice principles on*

[9] The Basel Committee was established by the central bank Governors of the Group of Ten countries at the end of 1974 in the context of the cross-jurisdictional impacts of the failure of the cross-border activities (foreign exchange exposures) of the German Herstatt Bank in 1974 (See: https://www.bis.org/bcbs/history.htm).

supervisory colleges" (BCBS, 2010). Among the eight principles argued, Principle N°3 is related to information sharing and mentions that "*College members should make their best efforts to share appropriate information with respect to the principal risks and risk management practices of the banking group. Mutual trust and relationships are key for effective information sharing. Nonetheless, formal confidentiality agreements, such as contained in Memoranda of Understanding (MoUs), among college members facilitate this process".*[10] In the same vein, the Principle N°6 related to the crisis management states that *"Colleges should facilitate effective crisis management for the banking group concerned, by assisting in planning the crisis management meeting, encouraging the banking group to produce appropriate information for crisis management and serving as a conduit for information sharing".*[11] In Appendix A, I summarize the chronological development of the main BCBS reports and their goals in terms of cross-border banking supervision and regulation.

In this context, international banking authorities have developed and employed three instruments to deal with the cross-border transmission of shocks such as financial crises, namely, consolidated supervision, Memorandum of Understanding (MoU) and Colleges of Supervisors (CS). A recent example of supervisory cooperation is the Vienna Initiative, in which the main banking groups of Western Europe agreed to sign commitment letters to support the subsidiaries in Emerging Europe during the GFC. A MoU is a legally non-binding declaration of intent to cooperate on certain aspects related to banking supervision. The MoUs are typically established between countries' supervisory authorities. They cover issues related to foreign bank subsidiaries and/or branches that can negatively affect the financial stability of home and host countries. Besides, the MoUs also address issues related to information exchange, onsite inspections, license applications to open branches or subsidiaries, crisis management and resolution, to name a few. These can be time-limited, refer to a specific topic and take the form of bilateral or multilateral agreements.

The Colleges of Supervisors (CS) are multilateral working groups of relevant supervisors that are formed for a collective purpose of enhancing effective consolidated supervision of

[10] Page N° 6.
[11] Page N°13.

an international banking group (BCBS, 2010). Instead of decision-making, the colleges act as the mechanisms for increasing cooperation, coordination, and flow of information to enhance the effectiveness of consolidated supervision of cross-border banking institutions. They are typically established between countries with significant cross-border bank integration which is observed in case of most of the European banking groups. According to the Basel Committee (2010), supervisory colleges should be structured to allow the home supervisor to exercise meaningful oversight of groups on a consolidated basis. These colleges allow host country authorities to be sufficiently represented in the supervision process and enable the home supervisor to benefit from their in-depth assessment of local subsidiaries.

2.3 Literature review and hypotheses development

My study is motivated by two relevant strands of literature within the field of the banking industry. One that concentrates on examining the lending behaviour of foreign banks during financial crises (e.g., Allen et al., 2017), and another related to a small but increasing number of studies on cross-border banking supervision, developed mainly from a theoretical perspective (e.g., Calzolary et al., 2019).

2.3.1 Foreign bank lending

A common finding in the case of multinational bank subsidiaries is that the transmission of shocks through the lending channel depends on the internal capital markets within the banking groups (see Jeon et al., 2013; Houston et al., 1997). For instance, Morgan et al. 2004) show that multinational banks use their internal capital market to re-allocate funds between states in the US in response to external shocks. This is to ensure the initial return on capital that stabilises growth fluctuations. In addition, there exists a strong relationship between bank lending behaviour and ownership structure (e.g., foreign, state, etc.) during an external shock, such as a financial crisis. Allen, et al. (2017) show that the above-mentioned relationship is conditional upon the type of financial crisis. De Haas and Van Lelyveld (2010) argue that the subsidiaries of financially strong parent banks can provide faster access to loan supply in the period of a crisis in the host-country than their counterparts (‘support effect’).

The extant literature has also indicated a ‘substitution or diversification effect’. In particular, when the economic conditions in the home country are less favourable, parent banks reallocate their loans portfolio towards subsidiaries in more profitable and safer countries

(Adams-Kane et al., 2017). In the same spirit, a strand of literature has examined the impact of the GFC on cross-border lending (Cetorelli and Goldberg, 2011; De Haas and Van Horen, 2012). Giannetti and Laeven (2012a, b) provide evidence that during a financial turmoil in the home-country, international banks tend to rebalance their loan portfolio by repatriating capital from foreign markets to their home countries (this has been termed as 'flight home effect'). In addition, De Haas and Van Horen (2013) suggest that this effect is heterogeneous among banks and depends on certain characteristics related to the markets and banks, such as geographic distance, bank experience and whether the bank is integrated into the domestic credit market.

Therefore, internal capital markets may favour the transmission of shocks by affecting the subsidiaries' funding structure (Jeon et al., 2013). The foreign banks in Latin America are financed mostly by domestic deposits, while in CEE (Central and Eastern European) foreign banks depend on the financing of parent banks. So, the transmission of shocks through internal capital markets in international banking groups is the largest among subsidiaries in CEE countries, followed by subsidiaries in Asia and Latin America (LA). Similarly, De Haas and van Lelyveld (2014) suggest that the excessive reliance on parent bank financing and wholesale funding became a liability when these funding sources dried up during the GFC, which can explain the cut back on lending by multinational bank subsidiaries.

The empirical evidence on the impact of ownership structures on bank lending during the GFC suggests that lending by foreign banks reduces during the crisis, however, the role of the internal capital markets is not conclusive. Given the relevance of foreign banks in emerging economies, CEE and LA provide an interesting case to study the lending behaviour by foreign banks. Cull and Martinez-Peria (2013b) find that **foreign banks** contracted their loan growth during the crisis and that foreign bank lending in Eastern Europe fell more than domestic private banks. These results are consistent with the 'flight home effect' and are in line with extant literature (e.g., Jeon et al., 2013) as foreign bank lending in Eastern Europe is driven by the current financial situation of parent banks, while subsidiary solvency in Latin America was the main driver.

Recent studies expand the analysis of the GFC on bank lending behaviour by including the effect of banking crises in home and host countries. In this line, Allen, et al. (2017) study the

bank lending in CEE countries, reporting that during the GFC the lending by foreign banks contracted severely compared to their counterparts. Also, when a parent bank is hit by a home crisis, the affected foreign bank subsidiaries decrease their lending. However, lending by foreign banks remains constant or increases during the banking crisis in host countries. Similarly, Adams-Kane et al. (2017) provide strong evidence that during the GFC, foreign banks that underwent a home crisis cut back their lending by between 13% and 42% relative to foreign banks that did not experience such a crisis in their home countries. Overall, these findings tend to provide support to a 'flight home effect'.

2.3.2 Cooperation agreements and its impact

A closer concept to cooperation agreements can be explained by the Vienna Initiative (VI) introduced in 2008 as a result of the GFC. A number of multinational banks signed country-specific commitment letters in which they pledged to maintain exposures and continue to provide credit in the host countries. De Haas et al. (2015) examined how bank ownership and participation in the VI impacted bank lending during the GFC. They argue that while both foreign and domestic banks cut back lending during the 2008-09 crisis, foreign banks that signed the VI were relatively stable lenders. This is one of the first attempt to explore how cooperation among different participants of the banking industry may help to mitigate the international transmission of shocks during the events of financial distress. However, to the best of my knowledge, the question of whether and how cross-border cooperation in banking supervision affects the transmission of shocks remains unanswered.

The above-mentioned arguments allow me to conclude that cross-border cooperation in banking supervision leads to higher financial stability, which is reflected through foreign bank lending stability. On the one hand, the cooperation provides supervisors with new, useful and valuable information that should help in better decision-making in license applications to open branches or subsidiaries. Consequently, this should favour cross-border banking integration between countries that have an agreement on banking supervision and, in turn, boost foreign bank lending. On the other hand, supervisory cooperation can diminish information asymmetries and improve the effectiveness of supervisory mechanisms, such as monitoring or enforcement actions. These mechanisms can reduce the likelihood and costs of bank failures, for instance, by promoting strong risk management. So, this would favour

cross-border banking integration and foreign bank lending in those countries whose home and host countries' supervisors have an agreement on banking supervision. Therefore, it is expected that cross-border cooperation in banking supervision can lead to higher financial stability as reflected through the lending behaviour of foreign banks, more so during the period of a financial crisis. This allows us to propose the following hypothesis:

H1: There is a positive relationship between cross-border cooperation in banking supervision and the lending behaviour of foreign banks.

According to another set of studies on banking supervision, more cooperation does not necessarily lead to higher financial stability. Firstly, Niepman and Schmidt-Eisenlohr (2013) argue that decisions of national regulators and governments on recapitalizing failing banks are inefficient if banking systems are linked through the interbank markets. Secondly, Calzolary et al. (2019) suggest that in the case of multinational banks there is a coordination problem among national supervisors, thus, supranational supervisors may implement more efficient monitoring. However, multinational banks can respond by adjusting their structure to this new supervisory environment, which may lead to less supervisory monitoring (Fiordelisi et al., 2017). Furthermore, a line of literature has examined the incentives of national supervisors to cooperate in cross-border banking supervision. Calzolari and Loranth (2011) suggest that the presence of foreign banks through branches leads to higher incentives for the host country regulator to intervene, as the home country regulator can draw on all assets. However, it can reduce intervention incentives if the regulator is responsible for repaying all deposits included in foreign branches. Thus, there exists a large variation in the propensity and intensity of cooperation by regulators in the supervision of banks, which can be explained by differences in cooperation gains (Beck et al., 2018).

The presence of **foreign banks** may make domestic regulators excessively strict, in which case cooperation is expected to reduce banking stability (Beck et al., 2013). Moreover, supervisors face many constraints in practice that can affect the effectiveness of cross-border cooperation in banking supervision, such as limited legal powers, imperfect information and political pressure. Therefore, supervisory cooperation may not result in higher financial stability, which leads us to propose the next alternative hypothesis:

*H2: Greater cross-border cooperation in banking supervision **enhances** the adverse impact of the financial crisis on bank lending.*

2.4 Data set and methodology

2.4.1 Sample selection

The main data used in this study is based on an extensive data collection effort on supervisory cooperation agreements and the evolution of bank ownership in Central and Eastern Europe and Latin America for the period of 2003-2018. I focus on these two regions for two reasons. First, since 2000 these countries have become the main host for foreign banks. Second, the participation of foreign banks positively contributes to the development of these economies and plays a key role in their financial systems. I manually collect data on bilateral and multilateral cooperation agreements on cross-border banking supervision at the country-level and parent bank-level. I derive this information from central banks' and supervisory authorities' websites.

As the BankScope database has not been available since 2016, I track the year-by-year ownership status of each bank in my sample using several databases. First, I check the ownership status in the S&P Global Market Intelligence database which records the ownership information for some banks in recent years. Second, for each bank I review its historical profile on its website and find its controller shareholder and any important events regarding its ownership structure. Third, I obtain banks' mergers and acquisitions (M&A) information from the S&P Global Market Intelligence database and from banks' annual reports to track the time and nationality of the acquirer. Finally, I complement my bank ownership database with the database compiled by Claessens and van Horen (2015), which provides the nationality of the majority shareholder for sample banks operating in 137 countries over the period 1995-2013.[12] My bank ownership database is similar to these authors in terms of the nationality of the foreign bank subsidiaries employed in my sample.

Following common practice in the literature, a bank is defined as foreign if 50% or more of its capital is directly held by a foreign bank, firm, individual or any other entity (e.g., Allen

[12] It is worth mentioning that Claessens and van Horen's (2015) database does not provide the identity of the parent bank company, which is needed to control for the internal capital markets within a banking group.

et al., 2017). Nationality of ownership is assessed annually based on direct ownership of the largest foreign shareholder, that is, I do not consider indirect ownership. However, in certain cases, I use the country of nationality of the ultimate ownership to define the country of a foreign bank. These criteria have been well established in the literature (e.g. Adams-Kane et al., 2017) and suggest that nationality of the ultimate ownership should be used when: i) the controller shareholder is an entity with residence in a country classified as a tax haven by the OECD, ii) the direct owner is a holding company that operates purely for the purpose of ownership and not as an operational bank and, iii) in the year that the ownership of a subsidiary is transferred from the parent bank to another subsidiary for the purpose of absorption by that other subsidiary.[13] However, there are still exceptional cases in which the foreign shareholder is not the largest but the bank is still defined as a foreign bank.[14,15]

The M&As are common within the banking industry, which entails a big problem in data collection and processing. Following Claessens and Van Horen (2014) on bank lending, I control for banks' M&As over the sample period, as such transactions may lead to distortions in total lending both in the acquirer and/or in the resulting merged bank. I correct this by making sure that only the merged entity or the acquirer bank remains in the sample after the completion date. For instance, the merger between "Santander Consumer Bank" and "AIG Bank Polska SA" during 2010-11 in Poland. Furthermore, following De Haas and Van Lelyveld (2010), I remove all the outliers regarding the bank lending variable from this sample, specifically, the observations where the absolute loan growth exceeds 75 per cent.

Additionally, I derive financial variables at the subsidiary and parent bank levels from S&P Global Market Intelligence database when available, complemented by the data obtained either from banks' annual reports or from the Central Banks' and Supervisory authorities' websites. Finally, macroeconomic statistics are collected from the World Bank's World Development Indicators (WDI).

The final dataset is an unbalanced panel of 3,665 bank-year observations comprising 276 foreign banks over the period of 2003-2018 and operating in 24 emerging economies from

[13] See Adams-Kane et al. (2017), Appendix A, for a detailed description of the rules for ownership determination.
[14] See page 301 in Claessens and van Horen (2014).
[15] In my sample, these were the cases of "Podravska Banka" and "Primorska banka d.d." in Croatia, and "Prva Stavebna Sporitelna as" in Slovakia, among others.

two regions: Central and Eastern Europe (Albania, Bulgaria, Bosnia and Herzegovina, Croatia, Czech Republic, Estonia, FYR Macedonia, Hungary, Latvia, Lithuania, Moldova, Montenegro, Poland, Romania, Serbia, Slovak Republic, Slovenia, Ukraine) and Latin America (Argentina, Brazil, Chile, Colombia, Mexico, Peru).

2.4.2 Variables

The dependent variable is the real growth rate in total loans of foreign bank i during the year t in the host country j and from the home country h defined by $\Delta Loans_{i\,t\,jh}$.[16] I adjust the growth in total loans by inflation because it may alter the lending dynamics of the bank. Besides, to avoid the discretionary effects of bank loan loss provisions and write-offs, the dependent variable reflects only the growth rate of total gross loans. Therefore, if certain banks provisioned their loan loss more during the global financial crisis compared to other banks, this should not bias the dependent variable (De Haas and Van Lelyveld, 2010; Cull and Martines-Peria, 2013b; Cao et al., 2018).

Regarding the key explanatory variable on cross-border cooperation in banking supervision, I manually identify whether cooperation agreements exist and create a binary variable on supervisory cooperation agreements at the country-pair level. These cross-border cooperation agreements can take three different forms: a MoU for information sharing and on-site inspections, a MoU on crisis management and resolution at the country-levels as well as the existence of a college of supervisors. I define a dummy variable indicating the existence of any type of these three forms of cooperation in cross-border banking supervision between the host country j and the home country h in year $(Cooperation_{jht})$. A fourth type of cross-border banking supervision is the existence of a supranational supervisor among the banking systems. However, because the countries of this sample do not share a common banking supervisor, I do not consider this type of banking cooperation at the country-pair level.

[16] This variable has been widely used in previous studies about the transmission of shocks (e.g., De Haas and Van Lelyveld, 2010; Cull and Martines-Peria, 2013; Allen et al., 2017). Particularly, this variable allows us to capture the transmission of shocks through the lending channel, i.e., how shocks to the home country lead foreign bank subsidiaries to reduce the loans they make in host jurisdictions during a crisis. Likewise, previous studies have examined how shocks to host countries lead foreign bank subsidiaries to increase the loans they make in home countries during financial turmoil. This affects the banking stability of either the home or the host country and, thus, the financial stability.

Following De Haas et al. (2015), I create a dummy financial crisis variable that takes the value of one in the years 2008, 2009, 2010 and 2011 and zero for the other years (denoted as $Crisis_t$). This time period includes the global financial crisis[17] as well as the partially overlapping eurozone crisis of 2010–2011.

I control for a set of variables related to the subsidiary characteristics, parent bank characteristics, as well as macroeconomic indicators of the host and home country. First, I control for the following bank characteristics, which may influence the bank lending behaviour by foreign banks: *Size* – measured by the natural logarithm of total assets; *Capital* ratio of equity to total assets; *Profitability* – measured by return on assets; *Liquidity* – measured by liquid assets to total assets; *Funding* – measured by total deposits to total liabilities. I also construct the above-mentioned variables for the parent banks to control for the lending dynamics of its foreign subsidiaries. In addition, I control for host and home country's macroeconomic characteristics that explain the subsidiaries' loan growth ratio in a host and home country. These indicators are the *GGDP* (GDP growth rate) and *INFLATION* (CPI growth rate). Refer to Appendix B for variable definition.

2.4.3 Descriptive statistics

Table 2.1 presents the summary statistics for the variables used in the study. Panel A shows the descriptive statistics for the full sample. Panel B exhibits the mean (standard deviation) and the test of difference in means for each variable to do the comparative analysis between foreign banks whose home and host countries supervisors have an agreement on banking supervision (Cooperation) relative to those banks that do not have such agreements (NonCooperation). My focus is on the bank lending variable ($\Delta Loans_{itjh}$) and its relationship with the variable about cross-border cooperation in banking supervision ($Cooperation_{jht}$). Due to the main goal of this study is to examine the impact of supervisory cooperation on foreign bank lending in emerging markets, I do not carry out a comparative analysis between CEE an LA.

[17] I have also checked Laeven and Valencia (2013) for the definition of GFC.

Table 2.1: Summary Statistics for main variables

Variables	Obs	Mean	Std Dev.	P(25)	P(50)	Max	VIF
Subsidiary characteristics							
ΔLoans	3,665	0.128	0.317	-0.064	0.071	0.750	
Cooperation	4,383	0,504	0,500	0	1	1	1.39
Size	3,853	14.14	1.834	12.83	14.25	17.960	1.84
Capital	3,846	0.154	0.127	0.087	0.116	0.679	1.31
ROA	3,839	0.005	0.032	0.002	0.009	0.098	1.15
Funding	3,806	0.696	0.265	0.573	0.784	0.980	1.16
Liquidity	3,853	0.258	0.227	0.100	0.192	0.889	1.18
Host country characteristics							
GGDPj	3,911	0.030	0.038	0.014	0.034	0.106	1.50
INFLATIONj	3,624	0.042	0.036	0.018	0.035	0.155	1.29
Home country characteristics							
GGDPh	3,834	0.015	0.027	0.006	0.018	0.085	1.69
INFLATIONh	3,715	0.023	0.023	0.011	0.020	0.116	1.23
Parent bank characteristics							
Sizep	3,905	19.76	1.84	18.59	20.44	21.69	1.43
Capitalp	2,982	0.138	0.062	0.103	0.122	0.370	1.15
ROAp	3,187	0.006	0.014	0.003	0.006	0.070	1.22

	Type of Firm		***Difference of means***
	Cooperations	***NonCooperations***	***Cooperations** Vs **NonCooperation** (Statistic t)*
Subsidiary characteristics			
ΔLoans	0.057 (0.003)	0.071 (0.071)	-2.499***
Size	7.695 (0.121)	6.447(0.109)	7.651***
Capital	0.070 (0.002)	0.084 (0.002)	-5.241***
ROA	0.003 (0.001)	0.001(0.001)	3.858***
Liquidity	0.126(0.003)	0.131(0.003)	-1.116
Funding	0.384 (0.007)	0.312(0.006)	8.051**
Host country characteristics			
GGDPj	1.463(0.047)	1.559(0.051)	-1.368*
INFLATIONj	1.740 (0.043)	2.507(0.065)	-9.845***
Home country characteristics			
GGDPh	0.647 (0.033)	0.883 (0.033)	-5.048***
INFLATIONh	1.058(0.027)	1.292(0.037)	-5.057***
Parent bank characteristics			
Sizep	10.221(0.158)	9.541(0.160)	3.016***
Capitalp	0.077(0.001)	0.062(0.002)	6.818***
ROAp	0.002(0.001)	0.004(0.001)	-5.785***

Notes: This table reports selected descriptive statistics for all the main variables of this study. Panel A shows the descriptive statistics for the full sample as well as the variance inflation factor (VIF). Panel B exhibits the mean (standard deviation) and the test of difference in means for each variable to do the comparative analysis between countries with cooperation agreements and their counterparts. ΔLoans is the yearly gross loans growth. Size is Logarithm of total assets. Capital is ratio of total equity to total assets. Profitability is measured by return of net results to total assets (ROA). Liquidity is ratio of liquid assets to total assets. Funding is ratio of total deposits to total liabilities. GGDP is GDP growth and Inflation is growth rate of consumer price index. The sub-indexes j, h and p indicate host and country an parent bank, respectively. For detailed variable description see Appendix B. Asterisks denote the statistical significance level, wherein (***) indicates a significance level below 1%, (**) less than 5%, and (*) and less than 10%.

From Panel A, it can be observed that the lending by foreign banks ($\Delta Loans_{itjh}$) increased by 12.8% on average. This result is consistent with those reported by Cull and Martinez-Peria

(2013b), who reported an average lending growth in total gross loans by foreign banks of 25% for Eastern Europe and 18% for Latin America over the period 2004-2009 and the high dependence to domestic borrowers to international banking (De Haas et al., 2015).[18]

Regarding the control variables, the capital ratio shows a mean equal to 15.4%, a minimum and maximum value of 5.1% and 67.9%, respectively. Bank profitability, measured as the return on assets (ROA), presents a mean equal to 0.5%, a minimum and maximum value of -17% and 9.8%, respectively. These statistics might reflect the negative impact of the GFC and the Eurozone crisis both on the profitability and capitalization of foreign banks. In the same line, it is worth noting that during the period 2004-2011, the host countries experienced better economic performance than the home countries. The latter finding may be because home countries, which are mainly developed economies, were more hit by the GFC in economics terms. I check the presence of multicollinearity by calculating the variance inflation factor (VIF) of all independent variables. The VIFs of these variables remain less than 5, indicating non-existence of multicollinearity.

Table 2.2 displays correlations among the variables of the study. With subsidiary characteristics, it can be observed a negative and statistically significant correlation between lending growth by foreign banks and their capital ratios (*Capital*), funding ratios (*Funding*) and positively related to *Profitability*. Additionally, with parent bank' characteristics, Table 2.2 shows a negative and statistically significant correlation between foreign bank lending and parent bank's capital ratio, but which is positively and significantly related to the parent bank's return on assets. These results are consistent with the empirical evidence provided by previous studies (e.g., Allen et al., 2017).

[18] See Fig.1, page 4864 in Cull and Martinez Peria (2013b).

Table 2.2: Pearson Correlation Matrix

	ΔLoans	Size	Capital	ROA	Liquidity	Funding.	GGDP	INFLATION	GGDP	INFLATIONp	Sizep	Capitalp
Size	-0.011											
Capital	-0.091***	-0.564***										
ROA	0.127***	0.195***	-0.033**									
Liquidity	-0.087***	-0.046***	0.166***	0.049***								
Funding	0.034**	0.032**	-0.163***	-0.008	-0.190***							
GGDP	0.340***	-0.065***	0.052***	0.130***	0.009	0.054***						
$INFLATION_j$	0.110***	-0.157***	0.088***	-0.083***	0.098***	-0.227***	-0.076***					
GGDPj	0.219***	-0.121***	0.099***	0.093***	0.047***	-0.020	0.514***	0.058***				
$INFLATION_h$	0.092***	-0.213***	0.160***	-0.071***	0.011	0.021	0.109***	0.255***	0.207***			
$Size_p$	0.001	0.159***	0.007	0.066***	0.139***	-0.104***	-0.002	-0.027	-0.019	-0.122***		
$Capital_p$	-0.099***	-0.138***	0.189***	0.069***	0.236***	-0.031*	-0.052***	-0.007	0.158***	0.126***	-0.049***	
ROA_p	0.188***	-0.082***	0.127***	0.101***	-0.016	-0.019	0.148***	0.356***	0.301***	0.166***	-0.045**	0.241***

Notes: This table reports the Pearson correlation coefficients for all the variables. . ΔLoans is the yearly gross loans growth. Size is Logarithm of total assets. Capital is ratio of total equity to total assets. Profitability is measured by return of net results to total assets (ROA). Liquidity is ratio of liquid assets to total assets. Funding is ratio of total deposits to total liabilities. GGDP is GDP growth and Inflation is growth rate of consumer price index. The sub-indexes j", h and p indicate host and country an parent bank, respectively. For detailed variable description see Appendix B. Asterisks denote the statistical significance level, wherein (***) indicates a significance level below 1%, (**) less than 5%, and (*) and less than 10%.

2.4.4 Methodology

I first explore the time and cross-sectional dimensions of my dataset by estimating a number of panel regressions, to analyse whether lending by foreign banks is affected by cross-border cooperation in banking supervision. Then, I use a Difference-in Differences (DiD) approach to examine the effect of supervisory cooperation on lending by foreign banks during the global financial crisis. To this end, I analyse the difference in the average change in foreign bank lending between home and host countries that had any type of cooperation agreement in cross-border banking supervision (treated group) and those that did not have (control group) during the global financial crisis. I also estimate a Matching Difference-in Differences on several covariates to support the previous results. Due to the main goal of this study is to examine the impact of supervisory cooperation on foreign bank lending in emerging markets, I do not carry out a comparative analysis between CEE an LA. Finally, several falsification and robustness checks are conducted.

2.4.4.1 Panel regressions

I start examining whether lending by foreign banks is affected by cross-border cooperation in banking supervision. Additionally, I am also interested in confirming the negative effect of the global financial crisis on foreign bank lending documented by recent studies (e.g., Cull and Martinez-Peria, 2013b) and, particularly, the effect of supervisory cooperation during the GFC. Thus, in this setup the main variables of interest are $Cooperation_{j,h,t}$ and $Crisis_t$ and its interacted term. I include the control variables related to bank characteristics, parent bank characteristics, as well as macroeconomic indicators of the host and home country in a stepwise manner.

Following are my baseline panel specifications. To examine the effect of supervisory cooperation on bank lending, the next baseline model is proposed:

$$\Delta Loans_{i\ t\ jh} = \alpha_0 + \beta_0 Cooperation_{jht} + \beta_1 B_{it} + \beta_2 J_{it} + \beta_3 H_{it} + \beta_4 P_{it} + \eta_i + \varepsilon_{it} \quad (1)$$

To analyse the effect of supervisory cooperation on lending by foreign banks during the GFS, the next econometric specification is proposed:

$$\Delta Loans_{i\,t\,jh} = \alpha_0 + \beta_0 Cooperation_{jht} + \beta_1 Crisis_t + \beta_2 Cooperation_{jht} * Crisis_t + \beta_3 B_{it} + \beta_4 J_{it} + \beta_5 H_{it} + \beta_6 P_{it} + \eta_i + \varepsilon_{it} \quad (2)$$

Where $\Delta Loans_{i\,t\,jh}$ is the real loan growth rate of bank i during the year t in the host country j from the home country h. $Cooperation_{jht}$ and $Crisis_t$ are the key independent variables related to the cross-border cooperation in banking supervision and the crisis dummy variable, respectively. In Equation (2), the main interest is the effect of cooperation, captured by $Cooperation_{jht} * Crisis_t$, which allows me to find evidence to support Hypothesis H2. Thus, the estimated coefficient on this interaction term is expected to be negative. Vector "B_{it}" represents the variables controlling for specific characteristics of foreign bank i in year t. The vectors J_{it} and H_{it} include the variables controlling for macroeconomic conditions of the host and the home country, respectively. P_{it} reflects the variables controlling for parent bank fundamentals in this analysis. η_i represents bank fixed effects and ε_{it} is the idiosyncratic error term. I estimate this specification using OLS with bank-specific fixed effects and with robust standard errors clustered simultaneously by the host country, home country and time.[19] Finally, I follow the extant literature and take a one year lag for all independent variables to minimise endogeneity issues, except the key variables i.e. Cooperation and Crisis (Rajan and Zingales, 1995; Alves and Ferreira, 2011; Mc Namara et al., 2017).[20] I am aware of potential issues related to this estimation approach (e.g. potential endogeneity) which is addressed in details in the next sections.

[19] I checked the presence of cross-sectional dependence of errors. In general, the results discard dependence between cross-sectional units.

[20] Alves and Ferreira (2011) employ independent variables lagged one year to avoid issues of reverse causality whilst Rajan and Zingales (1995) lag their explanatory variables one period to minimise endogeneity concerns.

2.5 Results

2.5.1 Foreign bank lending, crisis and cross-border supervision

I start reporting a set of panel regressions over the period 2003-2018 to analyse whether lending by foreign banks is affected by cross-border cooperation in banking supervision. Table 2.3 presents the results for the different estimations of Equation (1) considering as the dependent variable the real growth rate in total loans ($\Delta Loans_{i\ t\ jh}$), the main variable of interest ($Cooperation_{jht}$), and the set of control variables related to the bank characteristics, parent bank characteristics as well as macroeconomic indicators of the host and home country. In the first specification, I do not include any control variables (Column 1). In Columns (2) to (6), I include separately the control variables for the foreign bank's characteristics. Columns (7) and (8) exhibit the results after controlling for macroeconomics conditions of the host country while in columns (9) and (10) I include the same indicator for the home country. Finally, I incorporate the controls for the parent's characteristics (Columns 11-13).

Table 2.3: Foreign bank lending and cross-border supervision

This table shows panel regressions to estimate the impact of the cross-border cooperation in banking supervision on foreign bank behaviour. The sample period is 2003-2018. The regressions in all columns include foreign banks in CEE and LA. The dependent variable is the yearly gross loans growth. Size is Logarithm of total assets. Capital is ratio of total equity to total assets. Profitability is measured by return of net results to total assets (ROA). Liquidity is ratio of liquid assets to total assets. Funding is ratio of total deposits to total liabilities. GGDP is GDP growth and Inflation is growth rate of consumer price index. The sub-indexes j, h and p indicate host and country and parent bank, respectively. For detailed variable description see Appendix B. All the estimations include lagged control variables and bank and year fixed effects. Robust standard errors are clustered at the home-host-year level. Asterisks denote the statistical significance level, wherein (***) indicates a significance level below 1%, (**) less than 5%, and (*) and less than 10%.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Cooperation	0.038*	0.042*	0.041*	0.043**	0.049**	0.048**	0.058***
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.022)
Subsidiary characteristics							
Size $_{(t-1)}$		-0.101***	-0.106***	-0.116***	-0.119***	-0.122***	-0.119***
		(0.015)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Capital $_{(t-1)}$			-0.073	-0.112	-0.126	-0.120	-0.112
			(0.112)	(0.115)	(0.115)	(0.116)	(0.116)
Profitability $_{(t-1)}$				1.270***	1.254***	1.276***	1.105***
				(0.256)	(0.255)	(0.256)	(0.259)
Liquidity $_{(t-1)}$					0.182***	0.171***	0.173***
					(0.046)	(0.045)	(0.045)
Funding $_{(t-1)}$						0.045	0.030
						(0.041)	(0.040)
Host country characteristics							
GGDP $_{j(t-1)}$							0.014***
							(0.002)
Inflation $_{j(t-1)}$							
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters:							
Host-Home-Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,665	3,665	3,659	3,652	3,652	3,621	3,610
No. of Clusters	2,432	2,432	2,431	2,425	2,202	2,415	2,405
Within R Squared	0.2763	0.2941	0.2962	0.3065	0.3112	0.3144	0.3285
No. of Banks	276	276	276	276	276	275	275

Table 2.3: (*continued*)

Variables	(8)	(9)	(10)	(11)	(12)	(13)
Cooperation	0.048**	0.044**	0.037*	0.036*	0.034	0.034
	(0.021)	(0.021)	(0.022)	(0.021)	(0.028)	(0.028)
Subsidiary characteristics						
Size $_{(t-1)}$	-0.117***	-0.114***	-0.123***	-0.121***	-0.125***	-0.126***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.021)	(0.020)
Capital $_{(t-1)}$	-0.172	-0.096	-0.164	-0.169	-0.284	-0.274
	(0.133)	(0.138)	(0.142)	(0.142)	(0.222)	(0.220)
ROA $_{(t-1)}$	1.129***	1.041***	0.898***	0.872***	1.106***	1.065***
	(0.305)	(0.302)	(0.309)	(0.309)	(0.361)	(0.355)
Liquidity $_{(t-1)}$	0.134***	0.144***	0.121**	0.120**	0.058	0.061
	(0.050)	(0.051)	(0.053)	(0.052)	(0.060)	(0.060)
Funding $_{(t-1)}$	0.023	0.023	0.153	0.012	0.122*	-0.122**
	(0.042)	(0.041)	(0.042)	(0.042)	(0.054)	(0.054)
Host country characteristics						
GGDP $_{j(t-1)}$	0.014***	0.014***	0.014***	0.014***	0.012***	0.012***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Inflation $_{j(t-1)}$	0.004	0.003	0.003	0.003*	0.004**	0.004*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Home country characteristics						
GGDP $_{h(t-1)}$		0.009***	0.009***	0.009***	0.013***	0.010***
		(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
Inflation $_{h(t-1)}$			-0.002	-0.003	0.005	0.002
			(0.003)	(0.003)	(0.004)	(0.004)
Parent bank characteristics						
Size $_{p(t-1)}$				0.010**	-0.014	-0.020
				(0.005)	(0.011)	(0.011)
Capital $_{p(t-1)}$					0.351*	0.225
					(0.207)	(0.213)
ROA $_{p(t-1)}$						1.593**
						(0.630)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Clusters:						
Host-Home-Year	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,341	3,261	3,148	3,148	2,481	2,481
No of Clusters	2,243	2,168	2,068	2,068	1,692	1,692
Within R Squared	0.3487	0.3536	0.3555	0.3555	0.3519	0.3543
No of Banks	257	254	251	251	210	210

In regard to the main variable of interest, all the estimation results reported in Table 2.3 show a positive and statistically significant effect of $Cooperation_{jht}$ on lending by foreign banks. However, the coefficient on $Cooperation_{jht}$ in columns (10) to (13) becomes weak significant and insignificant.[21] These results support the H1 prediction suggesting that the existence of cooperation agreements in cross-border banking supervision between host and home-countries should favour the lending of those foreign banks with residency and activities in the same home and host countries, respectively. Consequently, these findings shed light about the potential effect of supervisory cooperation on lending by foreign banks during the GFC which is analysed in the next estimations.

Table 2.4 exhibits the results for the different estimations of equation (2) examining the effect of the main variables interest($Cooperation_{jht}$ and $Crisis_t$) as well as its interacted effect on foreign bank lending ($\Delta Loans_{i\ t\ jh}$). All the estimation results reported in Table 2.4 show a positive and statistically significant effect of $Cooperation_{jht}$ as well as a negative and statistically significant effect of $Crisis_t$ on lending by foreign. Additionally, the interacted term on $Cooperation_{jht} * Crisis_t$ exhibits a negative and significant effect on $\Delta Loans_{i\ t\ jh}$ in all columns of Table 2.4.

[21] This could be explained due to a "confounding" effect. This means that in the estimations where I omit parent bank characteristics (Columns 10-13), the parameter estimate for "Cooperation" absorbs the effect of variables associated with the parent bank. That is, parent bank characteristics are significantly associated with "Cooperation" and the dependent variable related to foreign bank lending. Furthermore, failing to control for these variables would bias the parameter estimate of "*Cooperation*" upward and make it more strongly statistically significant than it really is. However, further estimations allow for discarding a "confounding" effect.

Table 2.4: Foreign bank lending, crisis and cross-border supervision.

This table shows panel regressions to estimate the impact of the cross-border cooperation in banking supervision on foreign bank behaviour during the GFC. The sample period is 2003-2018. The regressions in all columns include foreign banks in CEE and LA. The dependent variable is the yearly gross loans growth. Crisis is a dummy variable equal to one for the years 2008-2011 and zero otherwise. For detailed variable description see Appendix B. All the estimations include lagged control variables and bank and year fixed effects. Robust standard errors are clustered at the home-host-year level. Asterisks denote the statistical significance level, wherein (***) indicates a significance level below 1%, (**) less than 5%, and (*) and less than 10%.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Cooperation	0.027*	0.030*	0.029*	0.035*	0.040*	0.039*	0.044**
	(0.022)	(0.021)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
Crisis	-0.285***	-0.139***	-0.141***	-0.106***	-0.101**	-0.092**	-0.083**
	(0.035)	(0.039)	(0.039)	(0.040)	(0.040)	(0.042)	(0.040)
Cooperation*Crisis	-0.041**	-0.039**	-0.036*	-0.039**	-0.042**	-0.038*	-0.044**
	(0.021)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.023)
Subsidiary characteristics							
Size $_{(t-1)}$		-0.101***	-0.105***	-0.116***	-0.118***	-0.121***	-0.119***
		(0.015)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Capital $_{(t-1)}$			-0.075	-0.116	-0.131	-0.124	-0.115
			(0.112)	(0.115)	(0.115)	(0.116)	(0.116)
ROA $_{(t-1)}$				1.277***	1.262***	1.284***	1.116***
				(0.256)	(0.255)	(0.256)	(0.256)
Liquidity $_{(t-1)}$					0.181***	0.169***	0.171***
					(0.046)	(0.045)	(0.045)
Funding $_{(t-1)}$						0.045	0.029
						(0.040)	(0.041)
Host country characteristics							
GGDP $_{j(t-1)}$							0.014***
							(0.002)
Inflation $_{j(t-1)}$							
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters:							
Host-Home-Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,665	3,665	3,659	3,652	3,652	3,621	3,610
No of Clusters	2,432	2,432	2,431	2,425	2,425	2,415	2,405
Within R Squared	0.2764	0.2940	0.2961	0.3065	0.3113	0.3143	0.3277
No of Banks	276	276	276	276	276	275	275

Table 2.4: (*continued*)

Variables	(8)	(9)	(10)	(11)	(12)	(13)
Cooperation	0.034*	0.032*	0.018	0.020	0.032	0.033
	(0.020)	(0.021)	(0.021)	(0.021)	(0.025)	(0.025)
Crisis	-0.079*	-0.096**	-0.060**	-0.064	-0.025	-0.014
	(0.041)	(0.042)	(0.046)	(0.046)	(0.052)	(0.053)
Cooperation*Crisis	-0.041**	-0.039*	-0.039*	-0.024	-0.032	-0.037
	(0.020)	(0.020)	(0.020)	(0.020)	(0.023)	(0.023)
Subsidiary characteristics						
Size $_{(t-1)}$	-0.117***	-0.114***	-0.123***	-0.121***	-0.124***	-0.126***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.021)	(0.021)
Capital $_{(t-1)}$	-0.174	-0.100	-0.167	-0.175	-0.288	-0.279
	(0.133)	(0.138)	(0.143)	(0.143)	(0.222)	(0.219)
ROA $_{(t-1)}$	1.140***	1.052***	0.909***	0.881***	1.122***	1.080***
	(0.305)	(0.302)	(0.310)	(0.309)	(0.359)	(0.353)
Liquidity $_{(t-1)}$	0.134***	0.143***	0.121**	0.122**	0.059	0.062
	(0.050)	(0.051)	(0.053)	(0.053)	(0.061)	(0.060)
Funding $_{(t-1)}$	0.024	0.023	0.016	0.013	-0.120*	-0.119**
	(0.042)	(0.041)	(0.042)	(0.042)	(0.054)	(0.054)
Host country characteristics						
GGDP $_{j(t-1)}$	0.014***	0.013***	0.014***	0.013***	0.012***	0.012***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Inflation $_{j(t-1)}$	0.004	0.003	0.003	0.003	0.005**	0.005*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Home country characteristics						
GGDP $_{h(t-1)}$		0.009***	0.009***	0.009***	0.013***	0.010***
		(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Inflation $_{h(t-1)}$			-0.002	-0.003	0.005	0.002
			(0.003)	(0.003)	(0.004)	(0.004)
Parent bank characteristics						
Size $_{p(t-1)}$				0.010**	-0.013	-0.020*
				(0.004)	(0.011)	(0.011)
Capital $_{p(t-1)}$					0.358*	0.225
					(0.206)	(0.213)
ROA $_{p(t-1)}$						1.680***
						(0.631)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Clusters:						
Host-Home-Year	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,341	3,261	3,148	3,148	2,481	2,481
No of Clusters	2,243	2,168	2,068	2,068	1,692	1,692
Within R Squared	0.3487	0.3532	0.3549	0.3558	0.3523	0.3549
No of Banks	257	254	251	251	210	210

Concerning the key variable of banking supervision, the results exhibited in Table 2.3 and 2.4 support the hypothesis H1 that cross-border cooperation in banking supervision should lead to higher financial stability reflected through the lending behaviour of foreign banks. For the $Crisis_t$ dummy variable, the results show that foreign banks both in CEE and LA

contracted their lending during the global financial crisis, which is in line with the extant literature (e.g., Cull and Martinez-Pería, 2013; Allen et al., 2017).

Regarding the effect of supervisory cooperation on lending by foreign banks during the GFC, the results reported in Table 2.4 show the potential effect of cross-border cooperation in banking supervision. The estimated coefficient on $Cooperation_{jht} * Crisis_t$ is negative and statistically significant but lower than the coefficient on $Crisis_t$. This finding suggests cross-border cooperation in banking supervision helps **to enhance** the cut back in lending by foreign banks during the GFC, which is in line with the Hypothesis H2. This issue will be deeply analysed in the DiD approach developed in the following sections.[22]

Turning to the analysis of the control variables, I first analyse the effect of bank characteristics on loan growth by foreign banks. Tables 2.3 and 2.4 report a negative and statistically significant effect of bank size on loan growth, which suggest that bigger banks tend to increase their lending more slowly. This result is in line with findings reported by previous studies, which argue that this effect could be explained by the flight home effect (e.g., Jeon et al., 2013; De Haas et al., 2015). Additionally, the results show that bank profitability is positively and significantly related to loan growth, suggesting that profitable foreign banks expand their credit faster (e.g., De Haas and Van Lelyveld, 2010). I also find evidence of a positive and statistically significant effect of deposit funding ratio on loan growth, which indicates that bank's funding stability allows banks to expand loan more quickly (De Haas and Van Lelyveld, 2014). Contrary to my expectations, however, I do not find evidence that a bank's capital influences the loan growth.

Concerning the macroeconomic environment, I include host and home-country GDP growth and inflation rates as proxy variables for the business cycle and macroeconomic stability, respectively. Tables 2.3 and 2.4 show that loan growth by foreign banks is positively and strongly influenced by the host country business cycle (De Haas and Van Lelyveld, 2010). In the same line, the results show a negative and statistically significant effect of host country inflation rate on loan growth. This is in line with Boyd et al.'s (2001) argument which

[22] Due to the main goal of this study which is to examine the impact of supervisory cooperation on foreign bank lending in emerging markets, I do not carry out a comparative analysis between CEE an LA. However, in results not reported here I do not find significant differences between these two regions.

suggests that inflation may exacerbate market frictions and force banks to cut back lending. Contrary to my expectations, I do not find evidence that home country GDP growth influences the loan growth of banks with foreign activities. However, this result is in line with Jeon et al. (2013).

2.5.1.1 Addressing potential endogeneity

The results can be subject to endogeneity issues due to reverse causality, because higher foreign bank lending may lead to greater cross-border cooperation in banking supervision. Additionally, the level of banking integration can also determine the extent and type of supervisory cooperation as well as bank lending stability.

To mitigate this endogeneity problem, I use an instrumental variable approach following Lewbel (2012) who relies on heteroscedasticity in the errors to achieve suitable identification. The main advantages of this approach are (1) no external instruments are necessary and (2) the associated estimator commonly takes the standard form of the generalized method of moments (GMM), improving the efficiency of the IV estimator. In the first stage, each of the endogenous variables is regressed on all exogenous variables using ordinary less squares (OLS). The generated predicted residuals at this stage are then multiplied by the exogenous variables that are mean-centred to construct an internal instrument for each exogenous variable given by $Z_j = (X_j - \bar{X})\varepsilon$, where ε is a vector of residuals from this first stage regression of each endogenous variable on all the exogenous regressors, including a constant term. In the second stage, the endogenous variables are instrumented by the aforementioned internally generated instruments, in addition to external instruments.

Within the second stage, I consider the $Cooperation_{jht}$ variable as endogenous and is instrumented by the internally generated instruments. In addition to those instruments, I employ two external instruments- national culture and language.[23] Then, these variables are included at 't' and '(t-1)' as exogenous instruments of each one of the endogenous variables. In Table 2.5, I can observe the estimation results for Equation (1) by applying the IV estimation using heteroskedasticity-based instruments (*ivreg2h*)[24]. The results remain equal

[23] Specifically, I use Hofstede national cultural dimensions and same language.

[24] See Kuzman et al. (2018), Loy et al. (2016), Bremus and Buch (2015).

to those presented previously and the Hansen over-identification test fails to reject the hypothesis that the instruments are exogenous as well as the Under-identification test. The results qualitatively remain the same as the baseline result.

Table 2.5. Foreign bank lending, crisis and cross-border supervision: IV estimations

This table shows instrumental variable regressions to estimate the impact of the cross-border cooperation in banking supervision on foreign bank behaviour during the GFC. The included instruments are national culture and language. The sample period is 2003-2018. The regressions in all columns include foreign banks in CEE and LA. The dependent variable is the yearly gross loans growth. Crisis is a dummy variable equal to one for the years 2008-2011 and zero otherwise. For detailed variable description see Appendix B. All the estimations include lagged control variables and bank and year fixed effects. Robust standard errors are clustered at the home-host-year level. Asterisks denote the statistical significance level, wherein (***) indicates a significance level below 1%, (**) less than 5%, and (*) and less than 10%.

Variables	(1)	(2)	(3)	(4)
Cooperation	0.022*	0.039**	0.023*	0.015
	(0.015)	(0.0155)	(0.014)	(0.016)
Crisis	-0.208***	-0.177***	-0.157***	-0.116***
	(0.045)	(0.045)	(0.047)	(0.059)
Cooperation*Crisis	-0.051**	-0.048**	-0.035*	-0.021*
	(0.024)	(0.023)	(0.022)	(0.024)
Subsidiary characteristics				
Size $_{(t-1)}$	-0.017***	-.018***	-.017***	-.011***
	(0.004)	(0.003)	(0.003)	(0.004)
Capital $_{(t-1)}$	-0.106	-.013	-.009	-0.128
	(0.071)	(.089)	(0.103)	(0.122)
ROA $_{(t-1)}$	0.827***	.535**	0.430*	1.057***
	(0.242)	(0.273)	(0.285)	(0.287)
Liquidity $_{(t-1)}$	0.015	.013	0.015	0.007
	(0.028)	(0.028)	(0.029)	(0.030)
Funding $_{(t-1)}$	0.050**	.024	0.020	-0.024
	(0.024)	(0.024)	(0.024)	(0.027)
Host country characteristics				
GGDP $_{j(t-1)}$		0.016***	0.015***	0.013***
		(0.002)	(0.002)	(0.002)
Inflation $_{j(t-1)}$		0.003**	0.004**	0.004**
		(0.002)	(0.002)	(0.002)
Home country characteristics				
GGDP $_{h(t-1)}$			.004*	0.008**
			(0.002)	(0.003)
Inflation $_{h(t-1)}$			-0.005	-0.003
			(0.003)	(0.003)
Parent bank characteristics				
Size $_{p(t-1)}$				-0.004
				(0.003)
Capital $_{p(t-1)}$				-0.234**
				(0.108)
ROA $_{p(t-1)}$				1.119**
				(0.490)
Bank FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Clusters:				
Host-Home-Year	Yes	Yes	Yes	Yes
Observations	3,156	2,976	2,828	2,272
No of Clusters	2,059	1,942	1,814	1,518
R Squared	0.2611	0.3062	0.3132	0.3192
Under-identification	0.000	0.000	0.000	0.0000
Hansen	0.1082	0.1202	0.3192	0.3233

2.5.2 Foreign bank lending, crisis and cross-border supervision-Difference-in-Differences approach

A difference-in differences (DiD) approach is used to investigate whether lending by foreign banks during the recent global financial crisis is affected by cross-border cooperation in banking supervision. Specifically, I analyse the difference in the average change in foreign bank lending between home and host countries for the above-mentioned treatment and control groups during the global financial crisis.

The treated group in the DiD approach are those banks operating in host countries that had signed any forms of cooperation agreements with their home country. For observations where the key variable of cross-border cooperation in banking supervision $Cooperation_{jht}$ is equal to one. The control group is represented by banks operating in host countries that had not signed any forms of cooperation agreements with their home country, specifically, for observation with $Cooperation_{jht}$ is equal to zero. Considering the sample period (2003-2018), I apply the conventional DiD approach to two sub-sample periods: the first sub-sample ("first wave") considers the period 2003-2011 and the second sub-sample ("second wave") encompasses the period 2008-2018. In the "first wave" the crisis dummy variable distinguishes between observations in the pre-crisis period (pre-treatment) 2000-2007 and crisis period (treatment) 2008-2011(e.g., De Haas et al., 2015). In the "second wave" the crisis dummy variable distinguishes between observations in the crisis period (treatment) 2008-2011 and the post-crisis period (post-treatment) 2012-2018.

The specification of the baseline DiD model is given by Equation (2) developed in section 2.4.4.1. I first apply the conventional DiD approach to find the average treatment effect. As equation (2) exhibits, the DiD method is implemented by the interaction term between $Cooperation_{jht}$ and $Crisis_t$ in both sub-sample periods. The estimated coefficient on the interaction term β_2, will allow us to examine whether cross-border cooperation in banking supervision **enhances** the cut back in lending by foreign banks during the crisis.

Table 2.6 reports the baseline results for the DiD approach, which examine the effect of supervisory cooperation on lending by foreign banks during the global financial crisis. In this regression, $Cooperation_{jht}$ is the treatment variable and $Crisis_t$ states the treatment period

as previously defined, therefore the main interest is the cooperation effect captured by $Cooperation_{jht} * Crisis_t$. I start with a simple version of the baseline equation (2), to check the reliability of the estimated coefficient on $Cooperation_{jht} * Crisis_t$, under several combinations of bank-specific and time-specific fixed effects as well as a set of covariates at the firm and country level.

Table 2.6: Cross-border cooperation and bank lending during the crisis.

This table presents difference-in-differences regressions to estimate the impact of cross-border cooperation in banking supervision on foreign bank lending during the GFC. The sample period is 2003-2018. The regressions in all columns include foreign banks in CEE and LA. Columns (1) to (3) report the estimations results for the baseline DiD approach given by equation (2) for the first sub-sample period ("first wave") 2003-2011.Columns (4) to (6) present the estimations results for the second sub-sample period ("second wave") 2008-2018. The dependent variable is the yearly gross loans growth. Crisis is a dummy variable equal to one for the years 2008-2011 and zero otherwise. For detailed variable description see Appendix B. All the estimations include lagged control variables and bank and year fixed effects. Robust standard errors are clustered at the home-host-year level. Asterisks denote the statistical significance level, wherein (***) indicates a significance level below 1%, (**) less than 5%, and (*) and less than 10%.

	First wave			Second wave		
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Cooperation	0.134	0.104	0.085**	0.036	0.008	0.021
	(0.036)	(0.030)	(0.035)	(0.034)	(0.033)	(0.038)
Crisis	-0.174 ***	-0.152***	-0.108**	-0.263***	-0.202***	-0.213***
	(0.029)	(0.031)	(0.038)	(0.032)	(0.045)	(0.057)
Cooperation*Crisis	-0.074**	-0.064**	-0.099***	-0.035*	-0.0127	-0.024
	(0.030)	(0.031)	(0.037)	(0.021)	0.020	(0.024)
Subsidiary characteristics						
Size $_{(t-1)}$	-0.131***	-0.119***	-0.165***	-0.101***	-0.107***	-0.118***
	(0.023)	(0.021)	(0.026)	(0.021)	(0.022)	(0.027)
Capital $_{(t-1)}$	-0.134	-0.163	-0.488*	0.029	0.001	-0.014
	(0.173)	(0.182)	(0.262)	(0.156)	(0.178)	(0.233)
ROA $_{(t-1)}$	1.904***	1.532***	1.982***	0.873***	0.607**	0.688**
	(0.446)	(0.537)	(0.650)	(0.285)	(0.305)	(0.333)
Liquidity $_{(t-1)}$	0.297***	0.224***	0.239***	0.149***	0.089	0.011
	(0.072)	(0.075)	(0.087)	(0.052)	(0.059)	(0.068)
Funding $_{(t-1)}$	0.138**	0.134**	-0.029	0.003	-0.008	-0.167***
	(0.067)	(0.067)	(0.077)	(0.049)	(0.050)	(0.063)
Host country characteristics						
GGDP $_{j(t-1)}$		0.013***	0.012***		0.010***	0.008***
		(0.002)	(0.002)		(0.002)	(0.002)
Inflation $_{j(t-1)}$		-0.005*	-0.004		0.004	0.006
		(0.003)	(0.003)		(0.002)	(0.002)
Host country characteristics						
GGDP $_{h(t-1)}$		0.001	0.002		0.010***	0.011***
		(0.003)	(0.003)		(0.003)	(0.004)
Inflation $_{h(t-1)}$		-0.017	-0.019**		-0.002	-0.001
		(0.004)	(0.007)		(0.004)	(0.005)
Parent bank characteristics						
Size $_{p(t-1)}$			0.053**			-0.013
			(0.021)			(0.011)
Capital $_{p(t-1)}$			0.946***			0.260
			(0.346)			(0.221)
ROA $_{p(t-1)}$			4.589***			1.430**
			(1.497)			(0.628)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Clusters:						
Host-Home-Year	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,920	1,735	1,340	2,932	2,565	2,074
No of Clusters	1,232	1,110	894	1,633	1,669	1,398
Adj R-Squared	0.2196	0.3378	0.3542	0.2484	0.3170	0.3346
No of Banks	270	250	203	276	250	210

In Table 2.6, columns (1), (2) and (3) report the estimations results for the baseline DiD specification proposed in equation (2) for the first sub-sample period ("first wave"). Similarly, columns (4), (5) and (6) present the estimations results for the baseline model given by equation (2) for the second sub-sample period ("second wave"). I include a set of covariates regarding the foreign bank's characteristics, the host and home country's characteristics as well as related to the parent bank's characteristics in a stepwise manner. In relation to the impact of $Crisis_t$ on the lending behaviour by foreign banks, all columns in Table 2.6 show a negative and statistically significant effect of $Crisis_t$ on foreign bank lending ($\Delta Loans_{i\,t\,jh}$). In other words, during the global financial crisis, the lending by foreign banks decreased by 18.5 per cent, on average.

Concerning the effect of supervisory cooperation on foreign bank lending during the GFC, in the "first wave" I can observe that the coefficient on the cooperation effect ($Cooperation_{jht} * Crisis_t$) is, on average, equal to -0.079 and statistically significant at the conventional levels, which provide evidence of a negative cooperation effect. In other words, columns (1) to (3) in Table 2.6 show that the average treatment effect on the treated group is equal to -0.079 and statistically significant. In the "second wave", the results exhibited in columns (4) to (6) provide less support about the negative cooperation effect on foreign bank lending during the GFC. Specifically, only column (4) reports an estimated coefficient on ($Cooperation_{jht} * Crisis_t$) which is equal to -0.035 and statistically significant. The estimations results exhibited in the "second wave" deserve a deeper analysis due to might be explained for new supervisory/regulatory arrangements or foreign bank decisions that effected the observations in the post-crisis period.[25] Overall these results are in line with the previous findings and provide support to the Hypothesis H2. Specifically, this finding suggests cross-border cooperation in banking supervision helps to enhance the cut back in lending by foreign banks during the GFC, which is in line with the Hypothesis H2.

In Table 2.6, I incrementally introduce a set of covariates regarding the foreign bank's characteristics, the host and home country's characteristics as well as related to the parent bank's characteristics. These variables are included in the baseline model (2), to control for

[25] For example, De Haas et al. (2015) point out foreign banks started to deleverage in CEE after the subprime and Eurozone crisis.

the observable heterogeneity among the banks and countries in the sample that may potentially affect the lending behaviour of foreign bank. The inclusion of these covariates allows us to capture the possibility that these variables may be time specific as well as the result of past events, therefore, I include the covariates in their one period lagged value. Despite the inclusion of additional covariates allows us to control for time-varying factors, the indiscriminate inclusion of additional controls might lead us to two potential problems. The problems are (a) the violation of the common trends assumption and (b) the violation of the exogeneity assumption (Lechner, 2010; Adams-Kane et al., 2017). Another important consideration is related to the SUTVA condition, which states that there should be no spillovers from treatment units to control units.[26]

The main results exhibited in Table 2.6 can be summarised as follows. Firstly, and in the same line to the estimations reported in Table 2.3, I find evidence of a positive and significant effect of $Cooperation_{jht}$ on lending growth by foreign banks. In other words, the existence of cooperation agreements in cross-border banking supervision between host and home country supervisors tends to favour the lending of those foreign banks with residency and activities in those countries, respectively. Again, these results support the hypothesis H1 prediction that cross-border cooperation in banking supervision should lead to a higher financial stability reflected through the lending behaviour of foreign banks. Secondly, I observe a strong negative impact of $Crisis_t$ on the lending growth by foreign banks in CEE and LA. Specifically, during the global financial crisis, foreign banks cut back their lending by 18.5 per cent, on average. Thirdly, the coefficient on the cooperation effect exhibits an average value equal to -0.079 which is statistically significant at the conventional levels. This coefficient represents the difference in the average change in foreign bank lending between the treated and the control group, which is in line with the Hypothesis H2.

So far, the results reported in Tables (2.4), (2.5) and (2.6) validate the hypothesis H2 argument that during the global financial crisis those foreign banks whose home and host countries supervisors had an agreement on banking supervision reduced their lending more than those the banks that did not have any such agreement. It is important to mention that in

[26] I do not find evidence of any spillover effect. This supports the stable unit treatment value assumption (SUTVA). The results are available upon request.

general and compared to the baseline panel specification in Table 2.4, the magnitude and significance of the cooperation effect hold, and are accompanied by similar standard errors as reported in Table 2.6. Furthermore, this allows us to argue that the treatment effect is well identified in the baseline specification (2), which remain unchanged to the incremental inclusions of several covariates at different levels. According to Adams-Kane et al. (2017), a more powerful way to control for covariates is to follow a matching difference in differences approach, which will be carried out in the following subsection.

Concerning the control variables related to the bank characteristics, the parent bank's characteristics as well as macroeconomic indicators of the host and home country, the results displayed in Tables (2.3), (2.4) and (2.5) show the same effect on the dependent variable as reported in Table (2.6) and are examined in the previous section. Therefore, and considering that the main interest is to investigate the effect of cross-border cooperation in banking supervision on lending by foreign banks during the recent global financial crisis, I do not explore on these variables.

2.5.3 Matching difference-in-Differences

Since the banks share similar observables characteristics, a matching DiD approach can further improve the quality of the previous results on the cooperation effect (Abadie and Imbens, 2006). I use the matching DiD estimator of Abadie and Imbens with the nearest-neighbour (Mahalanobis) metric. In particular, I estimate this matching estimator following the procedure suggested in Abadie et al. (2004), which executes matching with replacement and with the bias correction argued in Abadie and Imbens (2011).[27]

Table 2.7 shows the estimation results for the key variable of the study, the cooperation effect measured by $Cooperation_{jht} * Crisis_t$ in the baseline model (2) and for the first sub-sample period ("first wave"), estimated by DiD approach matched on the set of covariates at the bank level as well as at the host and home country level. I also check for additional covariates including the parent bank characteristics. According to Imbens and Wooldridge (2009), there is no consensus on an optimal number of matches to be chosen, thus, I present results for one,

[27] According to Adams-Kane et al. (2017), in contrast to propensity score matching DiD, the estimator of Abadie and Imbens (2006) is not affected by the selection bias in the treatment effect. Indeed, the algorithm ensures comparability between the treated and control group.

two and three matches in Panel A, B and C, respectively.[28]

I start the analysis by introducing incrementally different levels of covariates and matching them at different levels. Firstly, I proceed by matching only on the set of bank-level covariates for different numbers of matching, as is reported by column (1) in Panel A, B and C. Secondly, in column (2) I incorporate into the analysis a set of host country covariates. Thirdly, in column (3) I include home country covariates and, finally, in column (4) I incorporate an additional set of covariates given by parent bank-level characteristics.

The results presented in Panel A, B and C of Table 2.7 show a negative and statistically significant impact of cooperation effect, the average treatment effect on the treated group, on lending growth by foreign banks during the crisis. The qualitative results remain unchanged and the coefficients on cooperation effect range from -0.137 to -0.175, which are in line with those reported previously.

[28] I use the nearest-neighbour matching method to match foreign banks that are similar in a set of home and host country-specific covariates, a set of bank subsidiary's and parent bank's characteristics, but that show a different bank lending behaviour. Using the control and treatment groups, in Figure 1, I compare the lending growth of these two groups. The kernel density plots employing the matched data seem to be balanced.

Table 2.7: Matching Difference-in-Differences Regressions for Bank Lending with Bank, Country and additional controls

Panel A				
Variables	(1)	(2)	(3)	(4)
Cooperation*Crisis	-0.175***	-0.157***	-0.154***	-0.137***
	(0.019)	(0.018)	(0.018)	(0.019)
Core bank covariates	Yes	Yes	Yes	Yes
Core host covariates	No	Yes	Yes	Yes
Core home covariates	No	No	Yes	Yes
Additional covariates:				
Parent bank level	No	No	No	Yes
Estimation	Matching	Matching	Matching	Matching
Matches	1	1	1	1
Observations	1,891	1,738	1,656	1,283
Panel B				
Variables	(1)	(2)	(3)	(4)
Cooperation*Crisis	-0.188***	-0.176***	-0.158***	-0.149***
	(0.017)	(0.017)	(0.017)	(0.018)
Core bank covariates	Yes	Yes	Yes	Yes
Core host covariates	No	Yes	Yes	Yes
Core home covariates	No	No	Yes	Yes
Additional covariates:				
Parent bank level	No	No	No	Yes
Estimation	Matching	Matching	Matching	Matching
Matches	2	2	2	2
Observations	1,891	1,738	1,656	1,283
Panel C				
Variables	(1)	(2)	(3)	(4)
Cooperation*Crisis	-0.191***	-0.178***	-0.162***	-0.156***
	(0.016)	(0.016)	(0.016)	(0.017)
Core bank covariates	Yes	Yes	Yes	Yes
Core host covariates	No	Yes	Yes	Yes
Core home covariates	No	No	Yes	Yes
Additional covariates:				
Parent bank level	No	No	No	Yes
Estimation	Matching	Matching	Matching	Matching
Matches	3	3	3	3
Observations	1,891	1,738	1,656	1,283

As I mentioned previously, the matching DiD may offer a more specific and clearer estimate of the cooperation effect. Considering a comprehensive set of covariates, it is expected that the matching DiD estimator is not affected by any selection bias and thus provides a better comparison.

2.5.4 The influence of the supervisory and financial system

Although the sample considers foreign bank lending operating in emerging countries from Central and Eastern Europe and Latin America, I am aware of the heterogeneity of the countries in terms of banking supervision and regulations as well as the financial systems. In this sense, I want to check whether the impact of cross-border cooperation in banking supervision on foreign bank behaviour during the crisis period depends on these specific features related to the countries' supervisory and regulatory environment as well as to their financial systems.

Based on previous studies, I construct four indicator variables related to the characteristics of banking supervision and regulations in each country (e.g., Anginer et al., 2017). Using data from the World Bank Regulation and Supervision Survey (III, IV and V surveys), I include the level of supervisory powers (*Supervisory Power*), the level of consolidation of supervisory power (*Consolidation*), the degree of activity restriction (*Activity Restrictions*) and the number of on-site inspections (*On-site inspections*). Additionally, using data from the World Bank Global Financial Development Database (2019), I also include the degree of foreign bank participation (*Foreign bank Participation*). These variables are described in detail in Appendix B.

Table 2.8 displays the results for the different estimations of equation (2) splitting the sample by the higher and lower level of these variables and for the first sub-sample period ("first wave"). Panels A, B, C, D and E report the estimation results splitting the sample by *Supervisory Power*, *Consolidation*, *Foreign banks Participation*, *Activity Restrictions* and *On-site inspections*, respectively. Each panel reports the estimation results considering the key variables of study: $Cooperation_{jht}$, $Crisis_t$ and $Cooperation_{jht} * Crisis_t$, respectively. For simplicity, I do not report the results for the control variables.

In each panel, Columns (1), (3) and (5) report the regression results for the subsample where

the variable *Supervisory Power*, *Consolidation*, *Foreign banks Participation*, *ActivityRestrictions* and *On-site Inspections* is greater than the sample median, respectively. Similarly, columns (2), (4) and (6) report the regression results for the subsample where these variables are lower than the sample median.

Table 2.8: Cross-border cooperation in banking supervision and bank lending during the crisis: The influence of the supervisory and financial system

This table presents difference-in-difference regressions to estimate the impact of cross-border cooperation in banking supervision on foreign bank behaviour during the crisis period conditional upon the characteristics of the countries' supervisors and financial systems. The sample period is 2003-2011. The regressions in all columns include foreign banks in CEE and LA. The dependent variable is the yearly gross loans growth. All the estimations include lagged control variables. Columns (1), (3) and (5) report the regression results for the subsample where each of the characteristics of the countries' supervisors and financial systems is greater than the sample median. Columns (2), (4) and (6) report the regression results for the subsample where each of the characteristics of the countries' supervisors and financial systems is greater than the sample median. Robust standard errors are clustered at the home-host-year level.

Panel A: Supervisory Power						
	High Supervisory Power	Low Supervisory Power	High Supervisory Power	Low Supervisory Power	High Supervisory Power	Low Supervisory Power
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Cooperation	0.221***	0.141*	0.221***	0.141*	0.223***	0.142
	(0.074)	(0.079)	(0.075)	(0.080)	(0.085)	(0.098)
Crisis	-0.110*	-0.221***	-0.110*	-0.221***	-0.107*	-0.214***
	(0.062)	(0.045)	(0.063)	(0.046)	(0.066)	(0.048)
Cooperation*Crisis	-0.158**	-0.024	-0.158**	-0.024	-0.167**	-0.016
	(0.068)	(0.049)	(0.069)	(0.050)	(0.075)	(0.055)
Observations	594	724	594	724	590	722
No of Clusters	355	474	355	474	351	473
Adj. R Squared	0.1392	0.3232	0.1188	0.3061	0.0554	0.2896
Within R Squared	0.1766	0.3591	0.1766	0.3591	0.1667	0.3233
No of Banks	111	147	111	147	110	146
Panel B: Consolidation						
	High Consolidation	Low Consolidation	High Consolidation	Low Consolidation	High Consolidation	Low Consolidation
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Cooperation	0.034	0.194***	0.034	0.194***	-0.022	0.188**
	(0.058)	(0.062)	(0.059)	(0.062)	(0.073)	(0.074)
Crisis	-0.142**	-0.193***	-0.142**	-0.193***	-0.152***	-0.194***
	(0.055)	(0.040)	(0.056)	(0.040)	(0.056)	(0.042)
Cooperation*Crisis	-0.084	-0.103**	-0.084	-0.103**	-0.090*	-0.110**
	(0.053)	(0.043)	(0.053)	(0.043)	(0.054)	(0.047)
Observations	670	1,211	670	1,211	666	1,210
No of Clusters	436	780	436	780	432	779
Adj. R Squared	0.3545	0.2406	0.3426	02292	0.3652	0.2134
Within R Squared	0.3306	0.2781	0.3306	0.2781	0.3678	0.2505
No of Banks	110	193	110	193	109	193
Controls:						
Subsidiary	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects:						
Bank	Yes	Yes	Yes	Yes	Yes	Yes
Host country	No	No	Yes	Yes	Yes	Yes
Home country	No	No	No	No	Yes	Yes
Clusters:						
Host-Home-Year	Yes	Yes	Yes	Yes	Yes	Yes

Table 2.8: (continued)

Panel C: Foreign banks Participation						
	High Number Foreign banks	Low Number Foreign banks	High Number Foreign banks	Low Number Foreign banks	High Number Foreign banks	Low Number Foreign banks
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Cooperation	0.069	0.188**	0.069	0.188**	0.065	0.194*
	(0.045)	(0.085)	(0.045)	(0.085)	(0.052)	(0.101)
Crisis	-0.271***	-0.091*	-0.271***	-0.091*	-0.273***	-0.075*
	(0.048)	(0.048)	(0.048)	(0.048)	(0.051)	(0.051)
Cooperation*Crisis	-0.011	-0.110*	-0.011	-0.110*	-0.004	-0.126*
	(0.048)	(0.061)	(0.048)	(0.061)	(0.053)	(0.065)
Observations	819	751	819	751	816	749
No of Clusters	557	453	557	453	554	452
Adj. R Squared	0.4225	0.1598	0.4112	0.1461	0.3984	0.1136
Within R Squared	0.4457	0.1001	0.4457	0.1001	0.4314	0.0907
No of Banks	132	119	132	119	132	118
Panel D: Activity Restrictions						
	High Activity Restrictions	Low Activity Restrictions	High Activity Restrictions	Low Activity Restrictions	High Activity Restrictions	Low Activity Restrictions
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Cooperation	0.079	0.160*	0.079	0.160*	0.064	0.124
	(0.061)	(0.096)	(0.062)	(0.097)	(0.077)	(0.103)
Crisis	-0.114**	-0.261***	-0.114**	-0.261***	-0.117**	-0.246***
	(0.049)	(0.065)	(0.050)	(0.065)	(0.052)	(0.069)
Cooperation*Crisis	-0.042	-0.187***	-0.042	-0.188***	-0.049	-0.186**
	(0.053)	(0.069)	(0.054)	(0.069)	(0.056)	(0.078)
Observations	830	559	830	559	829	558
No of Clusters	553	354	553	354	552	353
Adj. R Squared	0.2193	0.3376	0.1995	0.3270	0.1764	0.2993
Within R Squared	0.1994	0.3907	0.1994	0.3907	0.1941	0.3634
No of Banks	174	106	174	106	174	106
Controls:						
Subsidiary	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects:						
Subsidiary	Yes	Yes	Yes	Yes	Yes	Yes
Host country	No	No	Yes	Yes	Yes	Yes
Home country	No	No	No	No	Yes	Yes
Clusters:						
Host-Home-Year	Yes	Yes	Yes	Yes	Yes	Yes

Table 2.8: (continued)

Panel E: On-site inspections						
	High Number On-site inspections	Low Number On-site inspections	High Number On-site inspections	Low Number On-site inspections	High Number On-site inspections	Low Number On-site inspections
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Cooperation	0.093	0.074	0.093	0.074	0.101	0.084
	(0.074)	(0.054)	(0.075)	(0.054)	(0.109)	(0.065)
Crisis	-0.110**	-0.178***	-0.110**	-0.178***	-0.111*	-0.181***
	(0.054)	(0.064)	(0.054)	(0.065)	(0.057)	(0.068)
Cooperation*Crisis	-0.192***	-0.012	-0.192***	-0.012	-0.194***	-0.022
	(0.056)	(0.063)	(0.057)	(0.063)	(0.061)	(0.066)
Observations	795	760	795	760	793	757
No of Clusters	509	473	509	473	507	470
Adj. R Squared	0.2491	0.3091	0.2297	0.2961	0.4312	0.2776
Within R Squared	0.2882	0.2966	0.2882	0.2966	0.4613	0.3041
No of Banks	150	153	150	153	150	118
Controls:						
Subsidiary	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects:						
Subsidiary	Yes	Yes	Yes	Yes	Yes	Yes
Host country	No	No	Yes	Yes	Yes	Yes
Home country	No	No	No	No	Yes	Yes
Clusters:						
Host-Home-Year	Yes	Yes	Yes	Yes	Yes	Yes

Overall, all the estimations results exhibited in Table 2.8 show a positive and statistically significant effect of $Cooperation_{jht}$ and a negative and statistically significant effect of $Crisis_t$ on bank lending by foreign banks. These results suggest that regardless of the specific features related to the countries' supervisory and regulatory environment as well as financial systems, the effect of $Cooperation_{jht}$ and $Crisis_t$ remain similar to those reported previously.

Now, when I focus on the cooperation effect given by $Cooperation_{jht} * Crisis_t$ I find that this effect is conditional upon the countries' supervisory and regulatory characteristics as well as their financial systems. Firstly, from column (1), (3) and (5) of Panel A in Table 2.8, we find that the cooperation effect during the crisis period on lending by foreign banks is negative and economically significantly only for higher levels of supervisory power. In contrast, from Column (2), (4) and (6), I do not find significant results for low levels of

supervisory power. Therefore, the findings suggest that greater power of banking supervisors should decrease the effectiveness of cross-border cooperation in banking supervision on financial stability.

Secondly, I split the sample by the level of consolidation of the supervisory power (*Consolidation*) exhibited by a country's banking supervisory authority, i.e., the number of financial markets in which the banking authority exerts a supervisory role. Panel B of Table 2.8 shows a significant effect only for a lower level of *Consolidation*. Specifically, column (2), (4) and (6) of Panel B, presents a negative and significant effect of $Cooperation_{jht} * Crisis_t$ on lending by foreign banks during the crisis periods only when the number of financial markets in which the banking authority exert supervisory role is lower. These results suggest that a lower number of financial markets under the supervision of the banking supervisor may lead to a higher supervisory attention, which can negatively affect the effectiveness of cross-border cooperation in banking supervision.

Thirdly, from Table 2.8 Panel C I find a weak effect on $Cooperation_{jht} * Crisis_t$ in favour of higher numbers of foreign banks. This suggests that a higher number of foreign banks should lead to a higher dilution in supervisory attention, which negatively affects the effectiveness of cross-border cooperation.

Fourthly, from Table 2.8 Panel D, I find that the cooperation effect during the crisis period on lending by foreign banks is negative and economically significantly only for lower levels of activity restrictions. Therefore, the findings suggest that a lower level of restrictions for banks to engage in activities different from lending should deteriorate the effectiveness of cross-border cooperation in banking supervision and hence financial stability.

Finally, when I split the sample by the average number of on-site examinations per bank, column (1), (3) and (5) of Panel E provide strong evidence of a negative and significant effect of $Cooperation_{jht} * Crisis_t$ for a higher number of on-site inspections. This suggests that a higher number of on-site inspections should decrease the access to quality information and therefore deteriorate the effectiveness of cross-border cooperation.

In conclusion, the estimates show that the **enhancing** effect of cross-border cooperation in banking supervision on foreign bank lending during the crisis period remains unchanged after

controlling by specific features related to the countries' supervisory and regulatory environment as well as their financial systems.

2.5.5 Falsification tests

In this subsection, I introduce two distinct placebo tests to rule out the possibility that the estimated cooperation effect may either be explained by non-crisis related trends in the treatment and control groups, or by other distinct types of similarities between home and host countries. Following the extant literature, I first modify the crisis dummy variable to an earlier period, specifically, I choose the period 2005-2008 as an alternative crisis period. The main goal of this falsification test is to rule out the possibility that trends in lending behaviour in the treatment and control groups may already have been diverging before 2008. In other words, if the coefficient estimates for cooperation effect are insignificant, I can assert that the effect of the global financial crisis is well defined and captured by the *Crisis* dummy variable.

Table 2.9 shows the estimation results for equation (2) derived from this first placebo test and considering different combinations of the set of control variables. Similar to Table 2.4 and 2.6, I incrementally introduce different levels of covariates. In column (1) I incorporate bank-specific covariates, in column (2) and (3) I include home and host country covariates, respectively. Finally, in column (4) I incorporate an additional set of covariates given by parent bank level covariates. The insignificant and positive estimated coefficients indicate that the baseline estimations of the cooperation effect in the DiD equation (2) are capturing the unique effect of the cooperation agreements during the financial crisis.

Table 2.9: Falsification Test for Difference-in-Differences Regressions: Crisis period 2005-2008.

This table reports the estimation results for equation (2) derived from the first falsification test and considering different combinations of the set of control variables. In this first placebo test, I modified the crisis period to the years 2005-2008

Variables	(1)	(2)	(3)	(4)
Cooperation	0.027	0.039	-0.005	-0.031
	(0.038)	(0.036)	(0.039)	(0.044)
Crisis	0.017	-0.009	-0.024	-0.048
	(0.028)	(0.029)	(0.033)	(0.043)
Cooperation*Crisis	-0.038	-0.051	-0.019	0.036
	(0.043)	(0.041)	(0.043)	(0.051)
Observations	1,378	1,263	1,138	822
No of Clusters	925	853	758	575
Adj. R Squared	0.1596	0.1594	0.1603	0.1640
Within R Squared	0.0532	0.0515	0.0521	0.0571
No of Banks	243	226	216	165
Controls:				
Subsidiary	Yes	Yes	Yes	Yes
Home	No	Yes	Yes	Yes
Host	No	No	Yes	Yes
Parent	No	No	No	Yes
Fixed Effects:				
Host country	Yes	Yes	Yes	Yes
Home country	Yes	Yes	Yes	Yes
Clusters:				
Host-Home-Year	Yes	Yes	Yes	Yes

The second falsification test considers the possibility that the negative effect of cooperation treatment is not explained by the existence of cooperation agreements in cross-border banking supervision between host and home country supervisors, but instead due to other similarities between the host and home countries that would explain this effect. Therefore, I replace the treatment variable $Cooperation_{jht}$ by $LegalOrigin_{jht}$ that takes the value of one if the home and host country have the same legal origin as defined by Laporta et al. (2002). Similar to the first falsification test, Table 2.10 reports insignificant and positive coefficients on the new treatment variable, which rule out that the foreign bank behaviour during the crisis period is explained by same legal origins between host and home countries. These results indicate that the baseline estimations of the treatment effect in DiD equation (2) are capturing the unique effect of cross-border cooperation in banking supervision.

Table 2.10: Falsification Test for Difference-in-Differences Regressions: Treatment Variable

This table reports the estimation results for equation (2) derived from the second falsification test and considering different combinations of the set of control variables. In this second placebo test, I modified the treatment variable $Cooperation_{jht}$ by $LegalOrigin_{jht}$.

Variables	(1)	(2)	(3)	(4)
Same Legal Origin	-0.016	-0.008	-0.005	0.026
	(0.027)	(0.028)	(0.029)	(0.033)
Crisis	-0.276***	-0.253***	-0.250***	-0.232***
	(0.023)	(0.023)	(0.024)	(0.028)
Same Legal Origin*Crisis	0.008	0.011	0.007	-0.018
	(0.030)	(00.030)	(0.030)	(0.035)
Observations	1,888	1,735	1,654	1,281
No of Clusters	1,217	1,127	1,050	849
Adj. R Squared	0.2339	0.2844	0.2922	0.2975
Within R Squared	0.2185	0.2684	0.2768	0.2916
No of Banks	268	250	242	199
Controls:				
Subsidiary	Yes	Yes	Yes	Yes
Home	No	Yes	Yes	Yes
Host	No	No	Yes	Yes
Parent				Yes
Fixed Effects:				
Host country	Yes	Yes	Yes	Yes
Home country	Yes	Yes	Yes	Yes
Clusters:				
Host-Home-Year	Yes	Yes	Yes	Yes

2.5.6 Controlling for aggregate lending

In this subsection, I run the DiD approach given by equation (2) to rule out the possibility that those foreign banks whose home and host country supervisors have an agreement on banking supervision reduce their lending less than the banks that do not have such type of agreement because their host countries exhibited a slowdown in aggregate domestic lending. I measure this variable as the ratio between the domestic bank credit to GDP ($DLending_{jt}$), which is obtained from Lending World Bank Global Financial Development Database (2019).

I first include the aggregate domestic lending as an individual control variable (Columns 1-4) and then I interacted with the treatment variable given by $Cooperation_{jht} * Crisis_t$ (Columns 5-8). Similar to previous estimates, Table 2.11 shows the estimation results for

equation (2) considering different combinations of the set of control variables and I incrementally introduce different levels of covariates. Again, the main focus is the cooperation effect given by the coefficient estimate on $Cooperation_{jht} * Crisis_t$. The results of these estimations suggest that the baseline results for cooperation effect are robust after controlling for changes in aggregate domestic lending in the host countries (Columns 1-4) and to the triple interaction of $DLending_{jt} * Cooperation_{jht} * Crisis_t$ (Columns 5-8). Interesting, the results in columns (5) to (8) show a positive and significant effect of $DLending_{jt} * Cooperation_{jht} * Crisis_t$ that would suggest that the cooperation effect in those host countries that reduce their domestic lending foreign banks increase their lending.

Table 2.11: Controlling for Domestic Aggregate Lending

This table reports the estimation results for equation (2) but controlling for aggregate lending measured behas the ratio between the domestic bank credit to GDP

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cooperation	0.056*	0.053*	0.047	0.085**	0.053*	0.049*	0.042	0.077**
	(0.030)	(0.029)	(0.030)	(0.034)	(0.030)	(0.029)	(0.030)	(0.033)
Crisis	-0.236***	-0.209***	-0.215***	-0.198***	-0.237***	-0.216***	-0.222***	-0.208***
	(0.024)	(0.025)	(0.026)	(0.033)	(0.024)	(0.025)	(0.026)	(0.034)
Cooperation*Crisis	-0.078**	-0.080**	-0.069**	-0.085**	-0.118***	-0.115***	-0.105***	-0.118***
	(0.031)	(0.031)	(0.031)	(0.036)	(0.031)	(0.031)	(0.031)	(0.036)
DLending	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
DLending *Cooperation*Crisis					0.877***	0.696***	0.726***	0.688***
					(0.165)	(0.162)	(0.163)	(0.174)
Observations	1,888	1,735	1,654	1,281	1,888	1,735	1,654	1,281
No of Clusters	1,217	1,127	1,050	849	1,217	1,127	1,050	849
Adj. R Squared	0.2378	0.2888	0.2959	0.3029	0.2494	0.2957	0.3034	0.3103
Within R Squared	0.2229	0.2733	0.2810	0.2976	0.2352	0.2808	0.2892	0.3056
No of Banks	268	250	242	199	268	250	242	199
Controls:								
Subsidiary	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Home	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Host	No	No	Yes	Yes	No	No	Yes	Yes
Parent	No	No	No	Yes	No	No	No	Yes
Fixed Effects:								
Host country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Home country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters:								
Host-Home-Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

2.6 Conclusion

This Chapter examines how the lending behaviour of foreign banks is affected by cross-border banking supervision in general and more specifically during the global financial crisis (GFC). In particular, using hand-collected data on bilateral and multilateral cooperation agreements at country level, this Chapter analyses the effect of supervisory cooperation in the lending behaviour of foreign banks in emerging markets; Central Eastern Europe (CEE) and Latin America (LA). These two emerging regions are selected because of the importance of foreign banks in them and particularly during the GFC (e.g., Cull and Martinez-Peria, 2013a, b).

I find that cross-border cooperation in banking supervision leads to greater financial stability reflected through the lending behaviour of foreign banks. Firstly, cooperation agreements lead to more foreign bank lending. Secondly, although the lending decreased during the GFC, the foreign banks whose home and host countries supervisors had an agreement on banking supervision reduce their lending more than banks that do not have such type of agreements. Thus, I find evidence for both the flight home effect and the support effect. Thirdly, this negative effect is positively related to the level of supervisory power and the number of on-site inspections. Thus, greater power to banking supervisors and frequent on-site inspections should lead to lower financial stability. Finally, the negative effect is negatively associated with the level of supervisory consolidation, where more consolidation implies less supervisory attention. In other words, more supervisor attention should lead to lower stability. This is in line with Hirtle et al. (2020) who also find that more supervisory attention leads to banks holding less risky and hence more stable loan portfolios.

This research could be extended to consider the effect of the single supervisory mechanism on the financial stability of the euro area and its spillover effect on other countries such as those located in emerging Europe and Latin America. In addition, foreign banks have continued to transfer funds in Eastern Europe to decrease the financial leverage until very recent years. So, a future research can examine the effect of supervisory cooperation during 2012-2018 as, in the Eastern European countries 2012-18 was still part of the crisis period as the GFC more or less seamlessly merged into the eurozone crisis.

CHAPTER 3: BOARD ATTRIBUTES AND BANK RISK-TAKING: THE ROLE OF BANK CULTURE

3.1 Introduction

Over the last decade, bank culture has been at the centre of the public debate as one of the root causes that triggered the collapse of the banking systems in 2007 (Song and Thakor, 2019). Popular press, practitioners, researchers and financial regulators have argued that failures in corporate governance and culture were shortcomings of financial system before and during the crisis (e.g., FSB, 2014; Group of Thirty, 2015; Thakor, 2016). Several studies have provided evidence about the role played by corporate governance in bank failures during the crisis and its impact on bank risk-taking (e.g., Berger et al., 2016; Anginer et al., 2018). However, and perhaps because culture is a somewhat nebulous concept, the theoretical and empirical literature on bank culture is much less voluminous (Song and Thakor, 2019). This Chapter aims to fill this gap by examining how corporate governance of banks impacts their risk-taking behaviour through bank culture.

As Grennan (2020) points out, corporate culture is a significant transmission channel for the governance-firm's outcome link. I argue this channel based on two strands of literature. First, the existing studies provide evidence on how corporate governance affects bank risk-taking and performance, among other dimensions (e.g., Pathan and Faff, 2013; Srivastav and Hagendorff, 2016; Hangendorff et al., 2021). Secondly, the previous literature suggests that the corporate governance and top management team can influence a firm's current culture (e.g., Guiso et al., 2015; Graham et al., 2019). In a study in the same area, Thakor (2020) concludes that regulators can improve bank culture by strengthening corporate governance and focusing on capital and liquidity regulations. However, details and empirical evidence about the role of corporate culture as a transmission mechanism of corporate governance remain unanswered.

A common question in the literature is what is corporate culture? According to O'Reilly and Chatman (1996), corporate culture is "a system of shared values (that define what is important) and norms that define appropriate attitudes and behaviours for organizational members (how to feel and behave)". Bank culture is an important topic for regulators and

supervisors as it may affect bank stability. The Group of Thirty (2015) argues that a bank's risk is an inevitable consequence of its culture and states: "First, a bank's risk culture cannot be isolated from its overall culture". Hence, banking failures that increase the systemic risk cannot be viewed as isolated events attributable to a group of employees who took unsanctioned risks, rather, these could be the result of systematic practices encouraged by the culture in these banks (Song and Thakor, 2019). The way in which banks communicate their cultural values is also important. A recent paper by Grennan (2020) documents that those banks that communicated their values consistently before the period 2007-09 experienced better results during the crisis.

Measuring corporate culture is challenging possibly because its definition opens up a debate and thus raises numerous measurement issues in empirical research (Zingales, 2015). Prior studies have used CEO attributes and behaviours to proxy for corporate culture based on surveys or interviews (Guiso et al., 2015; Graham et al., 2018). Lately, some studies have used text analysis techniques to measure different dimensions of corporate culture (e.g., Fiordelisi and Ricci, 2014; Bianchi et al., 2021). Recently, Li et al. (2021a) use a novel machine learning technique; the word embedding model (Mikolov et al., 2013) and companies' earnings call transcripts, to create a culture dictionary and to score the five cultural values proposed by Guiso et al. (2015): *Innovation, Integrity, Quality, Respect and Teamwork.* One of the main novelties of this technique is the fact that through a neural network, the method can quantify the semantics of words and phrases in an earnings call transcript based on their immediate contexts. Further, by using the question-and-answer section of a call, which is more spontaneous and therefore offers less opportunity for managers to engage in "window dressing", the method also mitigates concerns about capturing "cheap talk" by managers. I rely on this methodology to score bank culture in this study.

In this vein, Tang et al. (2021) develop a measure of bank safety-oriented culture based on a bank's persistence in stock performance during the 1998 Long-Term Capital Management (LTCM) crisis. Specifically, the authors regress bank's stock returns during the LTCM crisis on risk-taking characteristics and obtain a residual component which is likely to represent the safety-oriented culture. The empirical findings show that banks with a safety-oriented culture are more likely to sign contracts with low-risk borrowers and that they charge lower

loan spreads. Bianchi et al. (2021) use Quantitative Text Analysis to develop a Sound Risk Culture Indicator (SRCI) based on the Financial Stability Board (2014) risk culture framework. The authors show that higher SRCI improves bank performance. A closer study to my research is carried out by Grennan (2019) which documents that stronger governance changes culture: it focuses more on "*results orientation*" but less on customer-focus, integrity and collaboration and, as a result, it decreases firm value. The quantitative attributes of corporate culture are measures of textual similarity applying computational techniques similar to previous studies (e.g., Loughran and McDonald, 2011) and use employee surveys from different industries.[29] Nguyen et al. (2019) examine the impact of the standard Competing Value Framework (CVF) cultural values on the probability to grant risky loans.[30] This study differs from these papers by scoring bank culture using a novel machine learning technique and examining how corporate governance of banks impact their risk-taking behaviour through bank culture.

This Chapter extends and contributes to several strands of literature. First, it relates to the important ongoing discussion on culture and bank performance. A close study on this issue by Bianchi et al. (2021) only examines the impact of a sound risk culture on performance, omitting the role played by corporate governance. Tang et al. (2021) analyse the effect of bank safety-oriented culture on lending decisions. Other studies investigate the impact of national culture on bank risk-taking using an international sample (e.g., Mourouzidou-Damtsa et al., 2019; Berger et al., 2021c). Second, this study also adds to the literature on corporate governance and bank risk-taking (e.g., Anginer et al., 2018) and, more specifically, to the existing research on the effects of manager/director attributes on bank risk (Sila et al., 2016; Nguyen et al., 2018; Hagendorff et al., 2021). I extend this literature by documenting the underexplored link between bank culture, board attributes and bank risk-taking. Third, this research relates to the existing literature on corporate culture (Guiso et al., 2015; Graham et al., 2019), which suggest that corporate culture correlates with all aspects of business operations. However, there is no evidence of which cultural value is more important for a

[29] In simple terms, the goal is to compute how close tow piece of text are in meaning (sematic similarity) or surface closeness (lexical similarity). The measure is computed as the normalized dot product between two vectors, which are weighted in a manner that captures each unique concept in two texts.

[30] The CVF was developed by Quinn and Rohrbaugh (1983) and identifies four corporate culture dimensions: compete, create, control and collaborate.

specific corporate outcome (Li et al., 2021a). This study fills this gap by providing evidence of a negative impact of the cultural values of innovation, quality and integrity on bank risk-taking

This study also provides a number of new facts. First, the findings suggest that bank culture influences the risk-taking behaviour of banks. The results provide evidence that a bank culture oriented toward innovation, quality, and integrity improves bank stability. These findings remain unchanged after being subject to several endogeneity and other robustness checks. Second, the results reveal an economically significant influence of gender diversity, CEO age and CEO power on the cultural values of *Innovation, Quality,* and *Integrity*. On the one hand, board gender diversity positively affects the bank cultural values of *Innovation, Quality and Integrity*. On the other hand, CEO Age negatively impacts the cultural values of *Innovation* and *Quality.* Indeed, *CEO Age* has a stronger effect in explaining an innovation-oriented culture rather than a quality-oriented culture. Furthermore*, CEO Power* is a strong determinant of the cultural value of *Integrity* and plays an important role in explaining the cultural value of *Innovation* with a positive and statistically significant effect. Third, this study provides evidence that board attributes of banks impact their risk-taking behaviour through bank culture. Specifically, this study reveals that gender diversity, CEO age and CEO power decreases bank risk through the cultural values of *innovation, quality,* and *integrity.*

These findings have several implications for policymakers and market participants alike. Bank risk is an inevitable consequence of its culture and, therefore, bank regulators should (and do) care about it (Group of Thirty, 2015; Song and Thakor, 2019). For instance, Thakor (2020) concludes that we need to strengthen capital ratios and corporate governance to improve culture and ethics in banks. In this sense, the results suggest that banks in the US should encourage female participation in boards and regulators should provide legal instruments to boost gender diversity, which would improve bank stability. These findings provide support to regulations implemented in EU countries such as France, Italy, Sweden and Norway regarding mandatory gender quota for boards. Furthermore, in assessing the third component in the CAMELS rating, Federal Reserve examiners focus on the capabilities of the board of directors and executive officers, for instance, to implement policies and a culture that promote the safety and operation of a bank. The results of this research reveal that gender diversity and CEO power encourage a bank culture oriented towards innovation,

quality and integrity, which contribute to effective risk management and, in turn, to a competitive advantage. These factors should be considered in approaches to assess the management factor.

The next section of this Chapter discusses the literature review and formulates the hypotheses. In Section 3 I explain in detail the methodology to score culture. Section 4 describes the empirical strategy. Section 5 reports and discusses the results. In the last section, I conclude the study.

3.2 Literature review

3.2.1 Corporate governance and bank risk-taking

Analysing the relationship between corporate governance and bank risk-taking is important to clarify what makes the governance of banks different from non-financial firms. Based on the extant literature on bank governance (John et al., 2016; Srivastav and Hagendorff, 2016), I conclude the reasons in two key themes, i.e., the multitude of stakeholders and the complexity of their business. Firstly, besides shareholders we find many other stakeholders in banks such as depositors, debtholders, the deposit insurance authority and the government as residual claimants on systemic externalities. Secondly, the business of banks is highly leveraged, opaque, and complex. All these special features influence the bank's corporate governance structures that differ from those of non-financial firms in the reconciliation of conflicts of interests among their diverse and numerous stakeholders. The predominant theoretical framework to analyse these conflicts of interests is agency theory, in which utility-maximising managers are risk-averse and lack the incentives to pursue risky but positive net present value (NPV) projects (see Jensen and Meckling, 1976).

Among these several conflicts of interests, a feature of banks that is frequently used as one of the main sources of agency costs is their high leverage, which is provided mainly by depositors. On the one hand, if the management is closely aligned with equity interests, they have incentives to undertake high-risk investments shifting their risks to debtholders. This conflict of interests has consequences in the governance of banks, due to the rise of agency costs of debt both in terms of monitoring and managerial incentives (Laeven, 2013). On the other hand, the state-funded safety net protects depositors from suffering heavy losses in the event of bank insolvency (John et al., 2016). Thus, deposit insurance reduces the incentives

of debtholders to monitor banks and enhances the moral hazard by incentivizing shareholders and managers to engage in excessive risk taking (Ferrarini, 2015). Additionally, the opaqueness and complexity of banking assets have been pointed to as the cause of informational asymmetries in the banking industry, which tend to increase the agency cost of debt (Becht et al., 2012). Therefore, bank governance should be analysed not only in terms of equity governance but also in terms of how equity governance interacts with debt governance in order to reduce the agency costs and assure the stability of the financial system (John et al., 2016).

The risk-taking problem in banking arises when shareholders along with managers decide to assume excessive risks. This risk-taking behaviour by banks becomes a problem as it benefits bank shareholders at the expense of other stakeholders. Moreover, shareholders should not have the appropriate incentives to control bank risk-taking (Bolton et al., 2015). As result of the 2007-08 crisis, an increasing body of literature has examined the extent to which governance failures have contributed to the risk exposures of banks. Existing research has examined the impact of several governance characteristics on bank risk-taking, such as board attributes, compensation and risk management, providing mixed results. Other papers have also examined the relationship between corporate governance and bank performance, among other dimensions.[31] In this section, I review the main findings on how board attributes impact bank risk.

In broad terms, board attributes relate to the several competencies and skills that board members possess and the role that these attributes play in influencing bank risk and other bank policies (Srivastav and Hagendorff, 2016). Among these attributes, previous studies have examined the impact of gender diversity on boards (e.g., Palvia et al., 2015; Cardillo et al., 2020), the power of a CEO (e.g., Pathan, 2009), financial expertise (e.g., Minton et al., 2014), board size (e.g., Wang and Hsu, 2013), among others on bank-risk taking behaviour. Further, a growing body of literature has focused on analysing how specific manager attributes influence bank stability and risk-related policies (e.g., Hangendorff et al., 2021). For instance, studies on this topic have examined the influence of attributes such as age and

[31] See Srivastav and Hagendorff (2016) for an extensive literature review on the role of corporate governance on bank risk-taking, and John et al (2016) for an extensive literature review on corporate governance in banks both in the in the US and international settings.

educational background (e.g., Berger et al., 2014), CEO overconfidence (Ho et al., 2016), CEO tenure (Altunbas et al., 2018) as well as CEO's social networks (Dbouk et al., 2020).

Gender diversity in boards can benefit corporate outcomes by encouraging an effective corporate governance. As Arnaboldi et al. (2021) point out, gender diversity can improve boards' functioning in aspects such as attendance (Adams and Ferreira, 2009), quality of discussion (Terjesen et al., 2009), better oversight of disclosures (Gul et al., 2011) and dividend policy (Ye et al., 2019), thereby mitigating agency problems. Gender diversity can improve board effectiveness in terms of decision making, problem solving and information flow (Pathan and Faff 2013). Given the "glass ceiling" phenomenon, women must demonstrate additional competencies to reach directorship positions, which implies that females are quite likely to be highly proficient and diligent as directors (Eagly and Carli, 2003). This suggests that women expend more effort on their tasks, come better prepared for board meetings and, hence, this improves board effectiveness. In addition, female board members have better communications and public relations skills in contrast to men, as well as promoting lively boardroom discussion, which help better information flow (Letendre, 2004; Zelechowski and Bilimoria, 2004). Thus, gender diversity improves the skills and expertise of the boards.

Along similar lines, earlier works consider that women are, on average, more risk averse in financial decision making (Jianakoplos and Bernasek, 1998; Schubert et al., 1999).[32] This argument is consistent with the empirical evidence that suggests women are less overconfident than their male counterparts (Barber and Odean, 2001; Niederle and Vesterlund, 2007; Price, 2012). In addition, Sapienza et al. (2009) show that women who work in the financial industry tend to be less risk-averse compared to women in other sectors. More recently, Egan et al. (2017) examine gender differences in misconduct punishment in the financial advisory industry. The authors provide evidence of a "gender punishment gap" in which following an incident of misconduct, female advisers are 20% more likely to lose their jobs and 30% less likely to find a new one relative to their male counterparts. This

[32] Other researchers such as Francis et al. (2014) and Francis et al. (2015) find that female CFOs provide more conservative tax and accounting reporting than do their male counterparts. These studies are consistent with the argument that women tend to be more risk-averse than men.

suggests that misconduct is more highly penalised for women and therefore is less likely, which also would explain a risk aversion channel.

The empirical literature on the impact of board diversity on bank risk-taking is inconclusive. For instance, Palvia et al. (2015) and Farag and Mallin (2017) document that gender diversity decreases bank risk, while Berger et al. (2014) find that more gender-diverse boards increase risk-taking by banks, and Adams and Ragunathan (2017) and Sila et al. (2016) do not report significant results. Other related studies conducted by Agarwal and Wang (2009), Beck et al. (2013), report that default rates for loans granted by female loan officers tend to be lower than those granted by male loan officers. More recently, Cardillo et al. (2020) have shown that gender diversity on banks' boards reduces the probability that banks need a public bailout. The authors believe this phenomenon is driven by the positive impact of gender diversity on bank performance.

Gender diversity can also impact bank risk through performance, i.e., a higher bank performance would result in less risk. In the banking industry, for instance, Pathan and Faff (2013) find that that more gender-diverse boards improve performance. Using a sample of large US bank holding companies over the period 1997-2011, the authors document that female participation on boards increases performance in the pre-Sarbanes-Oxley-Act (SOX) period (1997-2002) and then decreases during the post-SOX (2003-2006) and in the crisis period (2007-2011). Similarly, Garcia-Meca et al. (2015), using a sample of banks operating in nine countries during the period 2004-2010, provide evidence of a positive impact of gender diversity on bank performance. For non-financial firms, a positive link between female participation on boardrooms and financial performance has also been documented by studies such as Campbell and Minguez-Vera (2008), Francoeur et al. (2008) and Liu et al. (2014). In contrast, Adams and Ferreira (2009) and Ahern and Ditmar (2012) provide evidence of a negative relationship between gender diversity and performance. Nonetheless, Arnaboldi et al. (2018) investigate whether board heterogeneity affects the performance of EU-listed banks in the wake of the global financial crisis.

Given that the existing literature about the impact of gender diversity on bank risk lacks consensus, I derive our first hypothesis as follows:

H1a: *Higher gender diversity of bank boards is associated significantly (positively or negatively) with bank risk-taking.*

Regarding CEO power, this is often measured considering whether a CEO acts as chairman of the board and, as such, is an important element that affects the board's monitoring ability. CEOs chairing the board may restrict the information flow to other directors and, in turn, undermine board independence to oversight managers (Adams, et al., 2005; Pathan, 2009). Adams et al. (2005) report that those firms with CEOs also performing as chairman exhibit higher performance volatility, reflecting that powerful CEOs may pursue riskier policies which increase risk exposure. However, Pathan (2009) suggests that if managers are compensated through fixed-wages instead of stock option programmes, managers behave in a risk-averse manner and, thus, are unlikely to exploit "moral hazard" incentives. Hence, CEOs' ability to control board decisions affect negatively bank risk-taking.

Based on the discussion above, I propose the following testable hypotheses as follows:

H1b*: CEOs power significantly influence (positively or negatively) bank risk-taking.*

Concerning CEO age, the conventional wisdom and the empirical evidence suggest that risk taking decreases with an individual's age. In terms of investment behaviour, Campbell (2001) reports a negative effect of individual's age on participation in equity investments. Grable et al. (2009) and Sahm (2012), using survey evidence argue that older individuals are less risk tolerant. Similarly, MacCrimmon and Wehrung (1990) provide evidence on self-ratings about executives and suggest that older executives take fewer risks. Similarly, Bucciol and Miniaci (2011) examine the risk attitudes of households, reporting that risk tolerance declines in age. Grable et al. (2009) attribute this result to an increase in attained knowledge of risk and risky situations relative to younger people. This is consistent with the empirical evidence provided by Agarwal et al. (2009), who suggest that younger individuals make more mistakes than older people, e.g., they are less able to value properties, they exceed the use of credit card, and they pay excessively high fees. These findings are also consistent with the empirical evidence provided by Berger et al. (2014), who show that younger executive teams increase portfolio risk. In contrast to previous studies, Dbouk et al. (2020) document a positive effect of the age of bank CEOs on bank risk-taking for a sample of US banks over the period 2000-2012.

Based on the discussion above, I propose the following testable hypotheses as follows:

***H1c**: CEOs age significantly influence (positively or negatively) bank risk-taking.*

3.2.2 Board attributes and corporate culture

Organizational leaders are key determinants of organizational culture (Schein, 1992). Top-executives' styles and individual characteristics (such as experiences, values, beliefs, personalities) significantly influence a wide range of corporate decisions as well as financial and corporate practices (Hambrick and Manson, 1984; Bertrand and Schoar, 2003; Francis et al., 2015). Leadership styles inspire and motivate employees to go above and beyond expectations and self-interest as well as work for the good of the organization (Kuhnert and Lewis, 1987). A consensus in the literature is that men exhibit a more transactional leadership style whereas women tend to be associated with a transformational style (Eagly et al., 2003; Bono and Judge, 2004). Masculine transactional style tends to be characterized as top-down, command, control and task-oriented, while the feminine transformational style tends to be more democratic, encouraging communication, collaboration and cooperation (Eagly and Johnson, 1990; Eagly and Johannesen-Schmidt, 2001).

Female board members offer innovative ideas to the boardroom as they are likely to have different viewpoints, a broader set of skills in terms of educational and professional background leading to better decision making (Robinson and Dechant, 1997; Anderson et al, 2011). They are also more likely to possess non-business backgrounds such as law, human resources and communications, and to hold advances degrees (Hillman et al., 2002; Zelechowski and Bilimoria, 2004). Consequently, women directors help firms to gain a competitive advantage by dealing more effectively with diversity in their product and labour markets (Bilimoria and Wheeler, 2000). Therefore, by creating and sustaining an organizational culture that encourages creative efforts and facilitates diffusion of learning, leaders can promote creativity and innovation (Yukl, 2001). For instance, managers can implement a system that values risk-taking behaviour and rewards innovation through compensation and other mechanisms so that employees feel motivated to involve themselves in creative activities and, in turn, increase innovation (Mumford and Gustafson, 1988; Jung, 2001)

Regarding the impact of board gender diversity on innovation, literature in the field of management area provide us some empirical evidence. Miller and Triana (2009) using a sample of Fortune 500 firms in 2003 and publicly traded over the period 2002-2005, examine the linkages of board diversity, reputation, innovation and performance. The authors find a positive effect of board gender diversity on innovation (in the form of R&D expenditures), which would be explained by the richness of ideas and information in the decision-making process. In the same line, Dezso and Ross (2012) using 15 years (1992-2006) of panel data on the top management team of the S&P 1500 firms 1992-2006, find that female representation in top management teams improves firm performance only a firm's strategy is focused on innovation. A recent paper by Wu et al. (2021) expands the analysis of women in top management teams to the impact of female Chief Technology Officers (CTOs) on corporate innovation (measured by both the number of patents and patents citations). The authors report that firms with female CTOs are more innovative that firms with male CTOs. An interesting finding of this study is that the effect of female CTOs on innovation is more pronounced for firms with an innovation-supportive culture, firms with female CEOs and when female CTOs are more powerful.

The "*gender socialization theory"* argues that males and females are taught different appropriate behaviours; women are generally socialised to be caring, compassionate and attentive to others' needs. Consequently, this would result in greater attention to stakeholders' needs such as depositors, investors and employees (Arnaboldi et al., 2021). Previous studies suggest that female directors are likely to be more stakeholder oriented. For instance, Adams et al. (2011) find that female directors tend to exhibit a more stakeholderist orientation (in contrast to shareholderist). Matsa and Miller (2013) report that firms with female participation in top management teams were less likely to lay off employees during the GFC and contribute positively to employment rate. Post et al. (2011) document that firms with more female board representation also spend more on environmental and corporate social responsibility, resulting in more corporate social responsibility and in a more ethical perspective (Byron and Post, 2016; McGuinness, 2017).

A growing body of literature has examined whether board gender diversity impacts on a wide variety of corporate outcomes. Cumming et al (2015) examine the effect of female participation in the boardroom on securities fraud and find that it reduces both the frequency

and severity of fraud. Similarly, Wahid (2019) report that board gender diversity reduced the number of financial reporting mistakes and, in turn, this firms engage in less fraud. Along the same lines, Richardson et al. (2016) report that more gender-diverse boards decreases tax avoidance by firms. Garcia-Lara et al. (2017) find that firms with higher percentage of female directors are associated with fewer incidences of account misreporting. Liu (2018) investigates the impact of board gender diversity on corporate environmental violations reporting that firms with more female participation in the boardrooms receive fewer sanctions. Recently, Arnaboldi (2021) show that greater female representation in boardrooms reduces the frequency of misconduct fines of European banks, equivalent to saving of $7.48 million per year.

As Wu et al. (2021) point out, the power-dependence theory suggests that an executive's power is an important element for his authority within the organizations. Prior studies suggest that considering that usually strategic decisions are unstructured and made under uncertainty, power is a key variable for top managers to gain the authority to make decision for the firms (Finkelstein, 1992). Moreover, prior literature argues that structural power, which is based on formal organizational structure and hierarchical authority, is strongly associated with executives' overall power level (Daily and Johnson, 1997). Particularly, the authority of the CEO resides in his position within the formal structure and such authority provides the CEO a legitimate basis for him to influence the organization (Ocasio, 1994).

The CEO power (defined as CEOs also chairing the board) can impact negatively the organization values, beliefs and, thus, culture of a firms. For instance, Khanna et al. (2014) suggest that corporate misconduct may be another potential outcome when CEOs possess to much authority within the firm. Moreover, CEO power can impact negatively on firm financial performance (Adams et al., 2005) and credit ratings of a firms' debt (Liu and Jiraporn, 2010), reduce risk exposure (Pathan, 2009), increase the likelihood of the firm engaging in earnings management (Ali and Zhang, 2015), influence the composition of boards of directors to prevent a dilution of CEO power (Combs et. al, 2007)

CEO age is another important individual characteristic that can shape leadership styles and influence culture on organizations. Older CEOs may have more experience in managing different activities of the firm, for instance innovation, however, older CEOs may be too risk

averse to engage in such activities (Wu et al., 2021). In the lines, Adams et al. (2011) find that older directors are likely to be more stakeholder-oriented than younger ones, which is consistent with the idea that shareholders may prefer to nominate young directors and keep them longer on the board.

To sum up, the theoretical and empirical findings allow us to hypothesise that board attributes and individual characteristics are key determinants of organizational culture. I consider personal characteristics of board members (e.g., age, education, etc) as part of board attributes. Specifically, I expect that board gender diversity, the power that possess the CEO and the CEO's age influences the cultural values of innovation, quality, integrity, respect, and teamwork within banks. Therefore, I state the second hypotheses in the next general form:

H2: *Board attributes (gender diversity, CEOs' power and CEOs' age) significantly influence the bank cultural values of innovation, quality, integrity, respect and teamwork*

3.2.3 Culture and risk-taking

I address the analysis of bank culture using the often-mentioned cultural values by the S&P500 firms on their corporate websites (Guiso et al., 2015): *Innovation, Integrity, Quality, Respect and Teamwork*. To the best of my knowledge, there is no solid theory to explain the relationship between each one of the five cultural values and risk-taking. It is difficult to argue which cultural value is more conducive to the different set of corporate outcomes, such operational efficiency, risk-taking, firm value and so forth (Li et al., 2021a). In this sense, Graham et al. (2019)'s survey evidence provide examples of how effective culture facilitates risk-taking by firms. Nguyen et al. (2019) examine the impact of the four cultural values-based on the Competing Value Framework (CVF): compete, create, control and collaborate on the probability to grant risky loans. The authors document that those banks with corporate culture oriented towards aggressive competition are associated with riskier lending practices, while the opposite behaviour is observed among banks with a control-oriented culture.

Li et al. (2021a) use a measure of strong culture which takes the value of one if the sum of a firm's five cultural values is in the top quartile across all firms in a given year and zero otherwise. The authors document a positive association between firms with a strong culture and corporate risk-taking measured by the standard deviation of monthly stock returns.

Additionally, the authors show that corporate culture correlates with all aspects of business operations, including operational efficiency, risk-taking, earnings management and firm value. Finally, they find that the culture-performance link is more pronounced in bad times such as the global financial crisis. These findings are consistent with the survey/interview evidence provided by previous studies such as Guiso et al. (2015) and Graham et al. (2018; 2019). Therefore, I propose the final hypothesis as follows:

H3: *The bank cultural values of innovation, quality, integrity, respect and teamwork significantly influence bank risk-taking*

3.3. Measuring bank culture

One of the most challenging tasks of this study is the computation of the bank cultural values. To do this, I follow the methodology developed by Li et al. (2021a) which measures corporate culture by using a novel machine learning technique; the word embedding model (Mikolov et al., 2013, specifically *word2vec*).[33] In summary, Li et al. (2021a) starts with the often-mentioned cultural values by the S&P500 firms on their corporate websites (Guiso et al., 2015): *Innovation, Integrity, Quality, Respect and Teamwork*. Then, using the *word2vec* method the authors train a neural network model to learn the meaning of all words and phrases in earnings call transcripts based on their respective contexts. Consequently, the authors create a culture dictionary of words and phrases that are in close association with each cultural value. Finally, each of the five cultural values is measured at the firm-year level using the weighted count of the number of words associated with each value divided by the total number of words in the document.

3.3.1 Word embedding and *word2vec*

Researchers in the area of business and economics have been increasingly relying on automated textual analysis to extract information from corporate disclosures. A popular method is counting word occurrences from word list in dictionaries that share common meanings. Dictionaries such as Harvard's General Inquirer, among others, have been widely used to measure tone of documents. However, developing such dictionaries for measuring corporate culture can be a daunting task. The goal of the word embedding model is to

[33] As part of a Google project, Mikolov et al. (2013) created a code (*word2vec*) for training the word and phrase vectors available as an open source at code.google.com/p/word2vec.

represent semantics, i.e., the meaning of a word, using a numeric vector. A word vector allows to determine similarity between words using simple vector arithmetic, for instance, the cosine similarity between any-two-word vectors can determine whether the two words are synonymous. Based on the learned similarity relationship to "seed word" describing a particular cultural value, a broad set of words and phrases that describe that cultural value can be identified and can be used to score firms.[34]

In simple terms, the word embedding model is based on the assumption that words that co-occur with the same neighbouring words have similar meanings (Harris 1954). Thus, the model identifies synonyms from common neighbouring words. A simple way to embed a word could be to construct a count vector that tallies the number of times other words appear near (e.g., no more than a certain number of words away from) the focal word in the corpus. Once I construct such a vector for each word by counting its neighbours, I can theoretically compute the association between any pair of words using the cosine similarity of their underlying vectors. Finally, when such a vector is constructed for each word by counting its neighbours, I can theoretically compute the association between any pair of words using the cosine similarity of their underlying vectors. However, the number of combinations of all words and their possible neighbouring words is enormous, making the count-based word embedding model difficult to carry to out in reality. Mikolov et al. (2013) provide a solution to this problem by using a neural network to efficiently learn dense and low dimensional vectors that can represent the meaning of words. Specifically, *word2vec* "learns" the meaning of a specific word via a neural network that "reads" through the textual documents and thereby learns to predict all its neighbouring words.

3.3.2 Earnings calls for scoring corporate culture

To quantify corporate culture, Li et al. (2021a) use earnings calls of 7,501 US firms and, specifically, the questions and answer section (QA). According to previous studies, the use of earnings calls can be argued for the following reasons. First, Guiso et al. (2015) and Graham et al. (2019), among others argue that a firm's current culture is most significantly influenced by its top management team. Besides, to promote and enforce a particular value, corporate leaders must live by the value and, in turn, leading by example. Therefore, if

[34] See words are unit of meaning or words that define a specific cultural value

managers "walk the walk", would be expectable that their words during earnings calls reflect the values in the firms they lead. Second, unlike press releases or management presentation, the QA sections in earnings calls help to mitigate concerns about capturing "cheap talk" by managers. Besides, QA section is more spontaneous and offers far less opportunities for managers to engage in window dressing (Lee, 2016).

Third, *word2vec* helps to mitigate concerns that what we could be capturing is simply "cheap talk" by managers. For instance, a valid assumption is that managers who engage in "cheap talk" are more likely to use common words. However, the method assigns lower weights on more frequently occurring words/phrases in calls when scoring corporate culture. In this sense, the method is capable of learning the meaning of thousands of words and phrases related to specific cultural values and, consequently, a firm's cultural score is determined by a combination of all these words and phrases, not just the value words that managers are more likely to mention.

3.3.3 Developing culture dictionary and scoring bank culture

As I mentioned previously, I follow the methodology developed by Li et al. (2021a) to generate a culture dictionary and to score the bank cultural values. Specifically, I use the *word2vec* code for text processing and model training provided by the authors.[35] Using 5,813 quarterly earnings calls transcripts from S&P Capital IQ over the period 2006-2019, I first create a culture dictionary and then obtain the cultural values for 180 US BHCs. Table 3.1 presents the most representative and most frequently occurring words/phrases in my culture dictionary. After generating the culture dictionary, I score each one of the five cultural values at the firm level as the weighted-frequency count of each value-related words averaged over a 1-year window.

35 Python code for text processing and model training can be downloaded from the authors' GitHub repository, which is available at https://github.com/MS20190155/Measuring-Corporate-Culture-Using-Machine-Learning.

Table 3.1: Culture dictionary

(1) Innovation	(2) Quality	(3) Integrity	(4) Teamwork	(5) Respect
innovative	dedication	responsibility	collaboration	talent
improve_client_experience	customerservice	accountability	cooperation	employee
innovation	customer	integrity	teamwork	team_member
make_banking_easier	service_level	corporate_governance	work_together	teammate
digital_capability	hard_work	transparency	work_closely	experienced_banker
technology_platform	take_care_customer	responsible	strengthen_relationship	team_banker
leverage_technology	quality	oversight	finance_team	banker
technology_enhance	relationshipbanking	supervisory	employee_shareholder	commercial_banker
service_client	service_level	communication	community_banking_model	branch_staff
world-class	hard_work_dedication	manage_risk	dedicated_team	commercial_lender
digital_transformation	reputation	regulate_bank	collaboration_banking	well-respected
global_network	build_relationship	credit_culture	executive_management_team	sale_team
use_technology	safety	safety_soundness	banking_experience	talented_banker
financial_solution	ensure_safety	investment_community	decision-making	thankful
attract_new_customer	quality_relationship	ourinvestor	integrated_approach	Im_grateful

3.4 Sample selection

The dataset comprises of bank-level information two main sources. First, as mentioned in the previous section, I use earnings calls transcripts from S&P Capital IQ. Second, I also employ bank-level financial statement data from S&P Capital IQ. Finally, information about bank corporate governance, specifically, board composition and directors' personal traits was obtained from Boardex database and collected by hand from annual reports when necessary.

The final dataset is an unbalanced panel comprising of 1,685 bank-year observations from 180 banks for the 2006-2019 period. Data is limited to this period of time because of data availability about corporate governance and financial statements.

3.5 Identification strategy

Turning to the empirical approach, I break down the effect of bank's corporate governance on their risk-taking behaviour through bank culture using a three-step procedure. First, I examine how bank culture influence the risk-taking behaviour of the US bank holding companies. Second, I study how certain features of the board and the top management are associated with the bank cultural values. Finally, I employ a system of simultaneous

equations to investigate how corporate governance of banks influence their risk-taking behaviour through culture.

3.5.1 How bank culture influences the risk-taking behaviour of banks?

My first research assumption is the presence of an economically significant association between bank culture and bank risk-taking, specifically, bank culture influence risk taking. To study the relationship between the five banking cultural values and risk-taking behaviour of banks, the Model (1) in Eq. (1) is proposed:

$$Bank\ Risk_{i,t} = \alpha + \beta(Bank\ Culture)_{j,i,t-1} + \gamma(Bank\ Control\ Variables)_{i,t-1} + Year\ FE + Bank\ FE + \varepsilon_{i,t}$$

Eq. (1)

where the bank risk for the bank holding company i at year t is measured using the banks' z-score. As a measure of a bank's distance from insolvency or distance to default, z-score has been widely used in the literature (e.g., Houston et al., 2010). In particular, the z-score measures the distance from insolvency in standard deviations and is calculated as the average return on assets (ROA) ratio plus the average capital asset ratio (CAR) divided by the standard deviation of ROA, on a five-year rolling window basis (e.g. Garcia-Kuhnert et al., 2015). To deal with extreme values, I have log transformed z-score. Higher z-score values imply lower probability of insolvency, so to facilitate exposition I have multiplied the log transformed z-score values by minus 1 (e.g., Mourouzidou-Damtsa et al., 2019). Hence, higher z-scores imply higher risk-taking behaviour by banks and, consequently, lower bank stability.

Vector β captures the effect of the main variables of interest, i.e., the five bank cultural values of innovation, integrity, quality, respect, and teamwork indexed by j for bank i at year t as defined previously. Vector γ reflects the effect of a set of control variables at the bank-level that have been considered important as determinants of bank risk-taking by previous literature (e.g., Houston et al., 2010; Garcia-Kuhnert et al., 2015). To control for bank's funding structure, I use *Deposits* measured as the ratio between total deposits and total assets (e.g., Dbouk et al., 2020). As a stable source of funding, I would expect that more deposit (less fragile funding) should have a positive effect on bank stability. However, in the presence of a deposit insurance scheme, more deposit could induce to moral hazard problem affecting

positively on bank risk (Demirguc-Kunt and Detragiache, 2002; Brunnermeier et al., 2012; Beltratti and Stulz, 2012).

In the same line, I include CAR to account for bank fragility and is defined as the ratio of total equity to total assets. I could expect that more capital should have a positive effect on bank stability (Garcia-Kuhnert et al., 2015). However, in the presence of moral hazard problem I would expect that the highly capitalized banks are subject to take more risk (Pathan, 2009). As is suggested in most existing literature, I control for bank size (Size) measured as the logarithm of bank total assets (e.g,, Boyd et al., 1993; Houston et al., 2010; Dbouk et al., 2020). However, the empirical evidence on this issue is inconclusive, providing opposite results (Boyd and Runkle, 1993; Garcia-Kuhnert et al., 2015; Anginer et al., 2018). The ambiguous relation between bank size and risk could reflect those larger banks face greater incentives to take on risks on account of their too-big-to-fail status, while they can face lower risks due to better diversified asset portfolios. I also include *Provisions*, which defined as the ratio of loan loss provisions to total assets and is a proxy for the quality of a bank's loan portfolio (Laeven and Levine, 2009)

Furthermore, *Bank Growth* represents the growth rate of total loans and is a proxy for bank growth strategy or banks' business model. On the one hand, a higher growth rate of loans for a bank may impact positively on bank stability. Particularly, banks engaging more strongly in core banking activities, i.e., deposit taking and lending functions, should possess and contribute less to bank risk (Brunnermeier et al., 2012; Bostandzic and Weib, 2018).[36] On the other hand, a higher growth rate may reflect an aggressive expansion strategy by the bank, and may thus lead to taking more risks (Foos et al., 2010).[37] Furthermore, banks that grant more loans could have a higher exposure to credit contagion and a higher likelihood of becoming insolvent (Jorion and Zhang, 2007; Bartram et al., 2007).[38] All the variables are defined in detail in Appendix C.

[36] Specifically, the notion of bank diversification suggests that banks that engage more in non-core banking activities, such as investment banking, have a higher contribution to systemic risk and a higher default probability (Brunnermeier et al., 2012; DeYoung and Torna, 2013).

[37] Foos et al., (2010) find that loan growth leads to a peak in loan loss provisions during the three years after a bank's credit expansion, to a decrease in relative interest income, and to lower capital ratios.

[38] See Appendix A for a detailed explanation of all variables.

Finally, to handle the omitted variables problem, such as risk management ability, financial crisis and macroeconomic shocks, I include both the year-fixed effect and the bank fixed-effect.[39] To manage the reverse causality problem, all independent variables are lagged by one period (Bianchi et al., 2021; Pathan et al., 2021). Finally, I am aware of potential issues related to this estimation approach (e.g., potential endogeneity), which are addressed in detail in the robustness check section below.

3.5.2 How corporate governance of banks influence their culture?

My second research assumption is the existence of a strong connection between corporate governance and corporate culture (e.g., Guiso et al., 2015). Specifically, some specific features of the board of directors and top management may influence culture in banks (Song and Thakor, 2019; Thakor, 2020). To this end, I propose the Model (2) in Eq. (2) to study how certain characteristics of the board and the top management are associated with the bank cultural values:

$$Bank\ Culture_{j,i,t} = \alpha + \delta(Governace\ Variables)_{i,t-1} + \gamma(Bank\ Control\ Variables)_{i,t-1} + Year\ FE + \varepsilon_{i,t} \quad \text{Eq. (2)}$$

where j represents one of the five bank cultural values of innovation, integrity, quality, respect, and teamwork for bank i at year t as defined previously. Vector δ captures the influence of the main variables related to the board of directors and top management for bank i at year t. These variables are: Gender Diversity, CEO Age and CEO Power. Vector γ captures the effect of the set of control variables at the bank-level and board-level, which are comprised of Bank Size, return on assets (ROA), Bank Age, Board Size and CEO Tenure.

Gender Diversity is defined as the participation of female directors on the board, specifically, the ratio between the number of female directors and the total number of directors (Cardillo et al., 2021). CEO Age is measured as the logarithm of CEO age (Dbouk et al., 2020) and CEO power is a dummy variable that equals to one if a CEO is also the chairman of the board (Pathan, 2009). These characteristics of the board are expected to be significantly related to

[39] The strength and Independence of the risk management team is comprehensively examined by Ellul and Yerramilli (2013).

the five bank cultural values of innovation, integrity, quality, respect, and teamwork (Guiso et al., 2015; Graham et al., 2019).

I control for a set of bank-level characteristics that may be related to bank culture, such as *Bank Size* measured by taking the logarithm of bank total assets, return on assets (*ROA*) measured as net profit over total assets and *Bank Age* calculated as the logarithm of bank age. I also include a set of board-level controls such as *Board Size* and *CEO Tenure,* defined as the logarithm of both the number of board members and the number of years that a CEO has been working for a specific bank, respectively. Appendix C provides a detailed explanation of all variables.

Culture is dynamic and contagious. On the one hand, culture defined as a set of ideas, beliefs, customs, and social behaviour of a particular people or society, experience changes over time. On the other hand, regulators can influence a change in culture focussing on just few visible banks, the largest banks, which will have a ripple effect on the culture at other banks. (Song and Thakor, 2019).[40] Therefore, I control for the unobservable time-invariant fixed effect in each year of the sample period. In addition, standard errors are clustered at bank-years to account for correlation both across banks and time (see Thompson, 2011). To manage the reverse causality problem, all independent variables are lagged by one period (Bianchi et al., 2021; Pathan et al., 2021). Likewise, I am aware of potential issues related to this estimation approach (e.g., potential endogeneity), which are addressed below in detail in the robustness check section.

3.5.3 Bank culture, corporate governance and bank-risk taking

The major goal of this study is to examine how the corporate governance of banks impacts their risk-taking behaviour through bank culture. Specifically, this work examines the channel through which corporate governance impacts bank risk taking, i.e., how certain characteristics of the board of directors and CEO affect bank risk through their culture. Prior literature in corporate finance has highlighted the inter-relationships between corporate policies, such as, performance, governance, risk, ownership, among others (Pathan, 2009; Bhagat and Bolton, 2008; 2013; Onali et al., 2016; Castro et al., 2020). The authors suggest

[40] As result of the GFC, and particularly in the post-crisis era, bank culture has been in the centre of the debate by financial regulators, practitioners, researchers, among others, who have analysed the damage done by failures in culture and argued measures to achieve tangible improvements in outcomes and reputation in the banking sector (Group of Thirty, 2015).

that these relationships should be simultaneously determined through a system of equations. Several studies have used a three stage least squares model (3SLS) to control for endogeneity and, particularly, to study the channel through which these policies are related (e.g., Gungoraydinoglu et al., 2017).[41] The next system of simultaneous equations is estimated using three-stage least squares (3SLS) estimation method:

$$Bank\ Culture_{j,i,t} = \alpha + \varphi\, Bank\ Risk_{i,t-1} + \delta(Governace\ Variables)_{i,t-1} + \gamma(Bank\ Control\ Variables)_{i,t-1} + Year\ FE + \varepsilon_{i,t}$$

Eq. (3)

$$Bank\ Risk_{i,t} = \alpha + \beta(Bank\ Culture)_{j,i,t-1} + \gamma(Bank\ Control\ Variables)_{i,t-1} + Year\ FE + Bank\ FE + \varepsilon_{i,t}$$

Eq. (4)

In the system of equations, both equations are the same as defined previously for Model (1) and Model (2), however, to eliminate the endogeneity problem (if any) derived by a reverse causality between bank culture and bank risk, I endogenize bank culture by including bank risk lagged by one period as an explanatory variable in equation (3). I hypothesize that past risk-taking behaviour reflects an aggressive growth business strategy adopted by banks, which may influence the shared values and norms that define appropriate attitudes and behaviours for organizational members and, in turn, bank culture.[42] All right-hand side variables are lagged by one period and are employed as instruments for the endogenous variables in these regressions (Gungoraydinoglu et al.,2017). The definition of all the variables remains the same as defined previously.

[41] For instance, Gungoraydinoglu et al. (2017) use a 3SLS system to examine the channel through which policy uncertainty-financial intermediation costs- affects firms' financial decision, specifically, leverage, investment and cash policies

[42] According to O'Reilly and Chatman (1996), corporate culture is "a system of shared values (that define what is important) and norms that define appropriate attitudes and behaviours for organizational members (how to feel and behave)."

3.6 Summary statistics

Table 3.2 reports descriptive statistics of variables used in the regression analyses. I present the number of observations, mean, standard deviation as well as the 25th, 50th and 75th percentile for each variable. I group the variables into dependent, cultural, governance and financial variables at bank-level.

The mean (Std. Dev.) values of *Z-Score* are -1.248 (1.218) and -1.180 (1.180), respectively. The negative mean values rely on their specific definition, which are similar to those reported in previous studies and in which are based this definition (e.g., Mourouzidou-Damtsa et al., 2019). To facilitate interpretation, I multiplied the log transformed z-score values by minus 1and I also transformed logarithmically the standard deviation of ROA as explained in detail in Appendix C.

Table 3.2 also presents the summary statistics for the five bank cultural variables, which are comparable to the numbers reported by Li et al., (2021a). I find that, on average, *Quality* is the most frequently mentioned cultural value, followed by *Innovation,* whereas *Teamwork* is the least frequently mentioned cultural value, based on earnings calls. These findings are contrary to those reported by Guiso et al. (2015) and Li et al. (202a), who find that the most cited cultural value is *Innovation.* However, this comparison might be misleading given that they use wider sample, and I only focus on bank holding companies.

Regarding the governance variables, the sample exhibits an average value of female participation on boardrooms of 16.2%, which is higher than those reported by previous studies focussing on US banks but for a different time period (Pathan and Faff, 2013; Pathan et al., 2021).[43] In addition, around one third of banks in the sample present CEOs performing also as chairman of the board. Finally, total deposits represent, on average, a 71.1% of total assets, loan loss provision a 43.8% of total assets and bank capital an 11.7% of total assets.

[43] Pathan and Faff (2013) use a sample of US banks from 1997 to 2011 and Pathan et al. (2021) from 1991 to 2013.

Table 3.2: Descriptive Statistics

	(1) NºObs	(2) mean	(3) Std.Dev	(6) p25	(7) p50	(8) p75
Dependent variables						
Z-score	1,310	-1.248	1.218	-2.037	-1.453	-0.700
ROA Volatility	1,409	-1.180	1.004	-1.867	-1.368	-0.551
Bank cultural variables:						
Innovation	1,672	1.794	0.957	1.203	1.871	2.463
Quality	1,685	2.126	0 .766	1.609	2.140	2.656
Integrity	1,668	1.413	0.755	0 .916	1.466	1.945
Respect	1,675	1.672	0.798	1.179	1.705	2.252
Teamwork	1,612	0.778	0.767	0.223	0.810	1.321
Bank governance variables:						
Gender Diversity	1,389	0.162	0.096	0.091	0.154	0.222
CEO Age	1,413	4.092	0.383	3.989	4.060	4.143
CEP Power	1,350	0.481	0.500	0	0	1
Board Size	1,388	2.458	0.237	2.302	2.485	2.639
CEO Tenure	1,322	1.236	1.140	0.588	1.423	2.086
Bank financial variables:						
Deposits	1,413	0.711	0.159	0.691	0.756	0.807
Provisions	1,395	0.438	0.722	0.080	0.180	0.440
CAR	1,413	0.117	0.345	0.099	0.114	0.130
Bank Growth	1,387	0.099	0.153	0.016	0.057	0.131
Bank size	1,456	16.730	1.827	15.423	16.334	17.941
ROA (%)	1,395	0.878	0.832	0.660	0.960	1.22

Notes: This table presents descriptive statistics for the key variables used in the analysis. Detailed definitions for all variables are provided in Appendix C.

3.7 Results discussion

3.7.1 How bank culture influences the risk-taking behaviour of banks?

Table 3.3 reports the results for the different estimations of Model (1). In Columns (1) to (5) I examine separately the impact of each one of the five bank cultural values on banks' z-score, and Column (6) displays the results considering the principal component from these five cultural values. As regards to the five key variables of bank culture, Table 3.3 reports that only the cultural values of *Innovation, Quality* and *Integrity* are negative and significantly associated with banks' z-score. These results provide support to out Hypothesis H3. Conversely, I do not find statistically significant effects for the cultural variables of *Respect* and *Teamwork* on bank risk-taking. In other words, I find that banks scoring high on the cultural dimensions of *Innovation, Quality* and *Integrity* tend to take more on risk.

Columns (1) shows that the cultural value of innovation is associated with less bank risk. In economics terms, I find that when the cultural value of innovation increases by one standard

deviation in year t-1, the banks' z-score diminishes by 9.9% in year t. In particular, those banks that promote the cultural value of innovation tend to take less on bank risk. This relationship between an innovation-oriented culture and risk-taking behaviour of banks is statistically significant at the 5% confidence level. Similarly, Column (2) shows that a bank culture oriented towards quality results in less bank risk. Specifically, the results suggest that if the cultural value of quality increases by one standard deviation in year t-1, the banks' z-score diminishes by 11% in year t. The relationship between a quality-oriented culture and bank risk-taking is the strongest among the five cultural dimensions, which is statistically significant at the 1% confidence level. Column (3) displays a negative and statistically significant link between an integrity-oriented culture and bank risk. This allows us to infer that when the cultural variable of integrity increases by one standard deviation in year t-1, the banks' z-score diminishes by 7.8% in year t. As it is pointed out previously, Column (4) and (5) show that the effect of the cultural variables of *Respect* and *Teamwork* on bank risk-taking is negative but not statistically significant at the conventional levels.

In Column (6) I use principal component analysis to construct a common index across the five cultural variables. In Table 3.3, Column (6) reports the estimation results for the first component from *Innovation, Quality, Integrity, Respect* and *Teamwork* (PC1). The results exhibit the same relationship with bank risk as in the Columns (1), (2) and (3), i.e., a negative and statistically significant effect.

Concerning the control variables, *Provisions* exhibits a positive and statistically significant effect on bank risk in all six columns, suggesting that a low quality of a bank's loan portfolio increases bank risk and, in turn, lower bank stability. This finding is in line with empirical evidence provided by previous studies, e.g., Garcia-Kuhnert et al. (2015). In particular, the magnitude of the coefficient estimates on *Provisions* ranges from 0.346 to 0.483, with an average value equal to 0.378, and statistically significant at 1% confidence level. This suggests that an increase of 10 percentage points in provisions for loan losses over total assets would lead to an increase by 3.8 percentage points in bank's z-score. Table 3.3 also displays a positive and statistically significant effect of *Deposits* on bank risk-taking, which may be explained by moral hazard problems due to the presence of a deposit insurance scheme (Demirguc -Kunt and Detragiache, 2002; Beltratti and Stulz, 2012).

Additionally, Table 3.3 exhibits a positive and statistically significant effect of Bank Size and CAR on bank's z-score. On the one hand, I find evidence of a positive and significant association between bank size and bank risk-taking, providing evidence in support to the argument that larger banks could pursue riskier strategies if they are deemed to be too big to fail (Anginer et al., 2018) On the other hand, bank capital (CAR) is positively associated with more bank risk, indicating that those highly capitalized banks are subject to more bank risk-taking (Pathan, 2009). Regarding the Bank Growth variable, all the estimations results reported in Table 3.3 show a negative and statistically significant effect on bank risk. This allows us to infer those banks engaging more strongly in core banking activities, i.e., a higher proportion of interest-earning banking activities, are able to implement more conservative portfolio choices and contribute less to systemic risk in financial systems (Demirgüç-Kunt and Huizinga, 2010; Bostandzic and Weib, 2018).

Finally, I can mention that the regression equation (1) is well-fitted with an over R-squared that ranged from 63.4% to 67.4%. However, I am aware of potential issues related to this estimation approach (e.g., potential endogeneity), which are addressed in detail in the next robustness check section.

Table 3.3: Bank risk and culture: Z-score

VARIABLES	(1) Z-score	(2) Z-score	(3) Z-score	(4) Z-score	(5) Z-score	(6) Z-score	(6) Z-score
Innovation(t-1)	-0.103**						-0.091**
	(0.053)						(0.066)
Quality(t-1)		-0.144***					-0.145**
		(0.055)					(0.069)
Integrity(t-1)			-0.103*				-0.165**
			(0.060)				(0.069)
Respect(t-1)				-0.035			0.012
				(0.046)			(0.055)
Teamwork(t-1)					-0.065		-0.042
					(0.054)		(0.065)
PC 1(t-1)						-0.043*	
						(0.028)	
Deposits(t-1)	1.353*	1.328*	0.967	1.297*	1.338*	1.315*	1.310*
	(0.692)	(0.686)	(0.740)	(0.687)	(0.699)	(0.703)	(0.717)
Provisions(t-1)	0.346***	0.348***	0.483***	0.349***	0.369***	0.372***	0.379***
	(0.070)	(0.070)	(0.073)	(0.070)	(0.072)	(0.072)	(0.073)
CAR(t-1)	0.032**	0.033**	0.030*	0.033**	0.032**	0.033**	0.029**
	(0.014)	(0.013)	(0.016)	(0.013)	(0.013)	(0.013)	(0.014)
Bank Growth(t-1)	-0.002**	-0.003**	-0.003**	-0.002**	-0.002*	-0.002*	-0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Size(t-1)	0.325**	0.342***	0.254*	0.321**	0.327**	0.347**	0.309**
	(0.130)	(0.129)	(0.148)	(0.132)	(0.133)	(0.135)	(0.134)
Observations	1,066	1,076	1,062	1,070	1,023	1,012	1,012
R-squared	0.673	0.674	0.634	0.671	0.670	0.670	0.674
Bank and Year FE?	YES	YES	YES	YES	YES	YES	YES

Notes: This table presents the results from several regressions of Model (1), Eq. (1), on the relationship between bank risk and the five cultural values Innovation, Quality, Integrity, Respect and Teamwork. I also include the first principal component (PC1) from these five cultural values. In all the estimations the dependent variable is bank's z-score as defined in Appendix C. All independent variables are lagged by one year. I use an ordinary least squares (OLS) regression with standard errors clustered at the firm-year level. All the regressions include year and bank fixed effects. Detailed definitions for all variables are provided in the Appendix C. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

3.7.1.1 Robustness checks

I extend the analysis by exploring the robustness of the main results for Model (1) in Eq (1). First, I use an alternative accounting-based variable for bank risk which is defined as the bank's return on assets volatility. Second, to further mitigate endogeneity concerns, I use an instrumental variable approach employing a 2SLS IV model (Wooldridge, 2010). Finally, considering that firms could stress the importance of their cultural values that are not followed in practice, I control for abnormal changes in the main cultural variables.

3.7.1.1.1 Alternative bank risk proxy

To assess the degree to which cross-bank differences in bank stability are accounted for differences in asset composition, I also employ the bank's return on assets volatility as an alternative proxy for risk (e.g., Laeven and Levine, 2009). ROA volatility is calculated as the standard deviation of the ratio of net profit to total assets over a five-year window, that is, *ROA Volatility* at time t is estimated using the ROA values during t-4 to t. To deal with extreme values, I have logarithmically transformed *ROA volatility* (e.g., Mourouzidou-Damtsa et al., 2019). Similar to z-score, a higher volatility in ROA implies a higher banks' risk-taking behaviour and, in turn, lower bank stability.

Table 3.4 exhibits the results for the different estimates of equation (1), considering as dependent variable to *ROA volatility*. Overall, the results remain similar to those reported in Table 3.3. Columns (1)-(3) exhibit a negative and statistically significant effect of the cultural variables *Innovation, Quality* and *Integrity* on *ROA volatility,* respectively. Column (1) of Table 3.4 suggests that an innovation-oriented culture decreases bank risk, specifically, the volatility of bank's return on assets. In particular, when the cultural value of *Innovation* increases by one standard deviation in year t-1, bank's return on assets volatility diminishes by 5.8% in year t. Column (2) suggests that those banks that promote the cultural value of quality are exposed to less bank risk. In other words, the results reported in Column (2) suggest that if the cultural value of *Quality* increases by one standard deviation in year t-1, the volatility of bank's return on asset decreases by 5% in year t. In the same line, Column (3) exhibits a negative and statistically significant effect of the integrity-oriented culture on bank risk. This allows us to infer that when the cultural value of *Integrity* increases by one standard deviation in year t-1, the volatility of bank's return on asset decreases by 6.4% in year t. Similar to Table 3.3, Column (4) and (5) of Table 3.4 show that the effect of the

cultural variables of *Respect* and *Teamwork* on *ROA volatility* is negative but not statistically significant at the conventional levels. Additionally, Column (6) presents the estimation results for the first component from the five cultural values (PC1), reporting a negative and statistically significant effect on *ROA Volatility*. Finally, Table 3.4 shows the same relationship between the control and bank risk (ROA Volatility) as reported in Table 3.3. These result support the Hypothesis H3.

Table 3.4: Bank risk and culture: ROA Volatility

VARIABLES	(1) ROA Volatility	(2) ROA Volatility	(3) ROA Volatility	(4) ROA Volatility	(5) ROA Volatility	(6) ROA Volatility	(7) ROA Volatility
Innovation(t-1)	-0.061*						-0.074*
	(0.035)						(0.045)
Integrity(t-1)		-0.066*					-0.120***
		(0.037)					(0.043)
Quality(t-1)			-0.085**				-0.115**
			(0.037)				(0.047)
Respect(t-1)				-0.008			0.008
				(0.032)			(0.038)
Teamwork(t-1)					-0.007		0.006
					(0.035)		(0.041)
Scores for component 1(t-1)						-0.014	
						(0.019)	
Deposits(t-1)	1.473***	1.409***	1.467***	1.450***	1.383**	1.382**	1.369**
	(0.515)	(0.515)	(0.508)	(0.510)	(0.553)	(0.554)	(0.558)
Provisions(t-1)	0.155***	0.157***	0.155***	0.155***	0.158***	0.159***	0.160***
	(0.036)	(0.037)	(0.036)	(0.037)	(0.038)	(0.038)	(0.038)
CAR (t-1)	0.048***	0.048***	0.050***	0.050***	0.050***	0.050***	0.046***
	(0.012)	(0.012)	(0.011)	(0.012)	(0.012)	(0.012)	(0.012)
LoanGrowthRate (t-1)	-0.002*	-0.002	-0.002*	-0.002*	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Size(t-1)	0.180**	0.140	0.199**	0.179*	0.165*	0.175*	0.151
	(0.091)	(0.093)	(0.091)	(0.091)	(0.093)	(0.094)	(0.094)
Observations	1,144	1,142	1,154	1,148	1,096	1,085	1,085
R-squared	0.729	0.727	0.729	0.727	0.728	0.728	0.732
Bank and Year FE?	YES	YES	YES	YES	YES	YES	YES

Notes: This table presents the results from several regressions of Model (1), Eq. (1), on the relationship between bank risk and the five cultural values Innovation, Quality, Integrity, Respect and Teamwork. I also include the first principal component (PC1) from these five cultural values. In all the estimations the dependent variable is bank's ROA volatility as defined in Appendix C. All independent variables are lagged by one year. I use an ordinary least squares (OLS) regression with standard errors clustered at the firm-year level. All the regressions include year and bank fixed effects. Detailed definitions for all variables are provided in the Appendix C. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

3.7.1.1.2 Dealing with endogeneity: IV estimations

The main results presented in section 3.7.1 may be subject to endogeneity issues, which arise from three main sources. The first is omitted variables, which refers to explanatory variables that are likely to influence bank risk and should be included in the baseline Model (1) but they are not because they are not directly observable. The second source is the reverse causality. In the case of this study, for instance, banks likely decide to take less risk when they expect a deterioration in the quality of their loan portfolios and, in turn, banks might promote and encourage certain cultural values. The third source is measurement error, which occurs when a study incorporates explanatory variables that are difficult to measure perfectly because they are not directly observable.

In specifying Model (1), Section 3.5.1, I include both the bank-fixed effect and the year-fixed effect which allow us to manage the omitted variables problem. Additionally, all independent variables are lagged by one period to mitigate the reverse causality problem (e.g., Pathan, 2021). Nevertheless, to allow for a more robust analysis I use an instrumental variable approach employing a 2SLS IV model (Wooldridge, 2010). The IV approach allows us to examine the exogenous impact of the cultural variables on bank risk-taking, solving the problem of endogenous preferences.

With ever more people structurally "on the move", migrants import customs and traditions from their sending regions (Baycan and Nijkamp, 2011; Weiss et al., 2019), and, thus, influence traditions and beliefs of the receiving regions (Ditlmann et al., 2011). This shock affects the cultural diversity of the local regions which, in turn, could affect the economic performance of receiving regions (Dohse and Gold, 2013), change perceptions of risk and uncertainty (Bianchi et al., 2021), and modifies the size and skills of the labour force (Pandey and Chaudhuri, 2017). Therefore, diversity as an integral part of the culture in many regions (Cummings and Leung, 2018), may influence the bank cultural values and, as result, the risk-taking behaviour of banks.[44]

In developing the instruments, I use data about the diversity by race and ethnicity at each US state-level where each BHCs is headquartered. National statistics on this topic are available

[44] According to Bianchi et al. (2021), these elements alter culture at the regional-level and indirectly impact the different bank's stakeholders, who face the challenge of re-assessing their cultural values that guide the firm after each cultural shock.

by the Kaiser Family Foundation (KFF) estimates based on the 2008-2019 American Community Survey, 1-Year Estimates. The Census Bureau's American Community Survey defines five racial/ethnic groups, which enable us to study the cultural diversity present in each state.[45]

I calculate two indices of cultural diversity, which will be employed as exogenous instruments in the IV estimations and will enable us to examine the exogenous impact of the five cultural variables on bank risk. These indices are the inverse Herfindahl fractionalization index and the Theil index. According to Dohse and Gold (2013), the stock of foreign population is a prerequisite for cultural diversity, but its distribution among cultural groups is probably more informative when a region's cultural diversity is under analysis. The inverse Herfindahl fractionalization index takes the following form:

$$Herf_{s,t} = 1 - \sum_{n=1}^{n=5} (P_{n,s,t})^2 \tag{5}$$

Where P represents the population share of each one of the n racial/ethnic groups, n=1, 2….., 5, observed in the US state s in the year t. The higher $Herf_{s,t}$, the less concentrated and, accordingly, the more diverse population by race and ethnicity in the state s in the year t.

The Theil index belongs to a group of indices commonly used as diversity measures, i.e., the Generalized Entropy Indices.[46] The Theil index following form:

$$Theil_{s,t} = \sum_{n=1}^{n=5} (P_{n,s,t}) \ln\left(\frac{1}{P_{n,s,t}}\right) \tag{6}$$

The Theil index gives a stronger weight to the tails of the distribution as it considers the logarithm in its computation. By this way, the index controls for non-linearities in the contribution of the racial/ethnic groups to states' cultural diversity. This is suitable under the assumption that the marginal contribution of some foreign culture to a region's cultural

[45] The five racial/ethnic groups are: White, Black, Hispanic, Asian, American Indian/Alaska Native, Hawaiian/other Pacific Islander, Multiples Races.
[46] See Dohse and Gold (2013) and Bickenbach and Bode (2008) for a detailed discussion.

diversity diminishes with group size. As Dohse and Gold (2013) exemplify, would be reasonable to assume that the first Indonesian moving to a specific region has a stronger effect on cultural diversity than the thousandths Korean, however, it is impossible to validate this assumption ex ante.

Next, Model (1) is modified as follows:

$$\begin{aligned} Bank\ Culture_{j,i,t-1} &= \alpha + \beta(Cultural\ Diversity)_{s,i,t-1} + \gamma(Bank\ Control\ Variables)_{i,t-1} \\ &+ Year\ FE + Bank\ FE \\ &+ \varepsilon_{i,t} \end{aligned} \tag{7}$$

$$Bank\ Risk_{i,t} = \alpha + \beta(Bank\ Culture)_{j,i,t-1} + \gamma(Bank\ Control\ Variables)_{i,t-1} + Year\ FE + Bank\ FE + \varepsilon_{i,t} \tag{8}$$

Where $Cultural\ Diversity_{s,i,t-1}$represents the two proxy variables for cultural diversity exhibited in the state s in the time t-1 where the bank i is headquartered. $Bank\ Culture_{i,t-1}$ represents the five bank cultural variables. The two-stage approach is implemented as follows. In the first stage, Eq.(7), $Bank\ Culture_{i,t-1}$ is regressed against $Cultural\ Diversity_{s,i,t-1}$. Specifically, the analysis is executed regressing separately each one of the bank cultural variables against each proxy variable for cultural diversity at the time.

In the second stage, Eq. (8), I use the predicted values estimated from each regression carried out in the first stage and use them as a proxy variable for each one of the bank cultural dimensions. In both stages, I include all the control used in the baseline specification in Model (1) of Table (3.3) and (3.4).[47] For the IV approach we need instruments that satisfies the criteria of relevance (i.e., correlated with the bank culture) and exclusion (i.e., no direct effect on bank risk except through the bank culture) from a theoretical and econometric

[47] For simplicity, the results are not reported here but they are available upon request.

perspective (Florackis and Sainani, 2018; Pathan et al., 2021). From a theoretical point view, studies from different disciplines argue a relationship between corporate culture and the presence of foreign cultures (e.g., Bianchi et al., 2021). Thus, I expect a statistically significant association between bank culture and cultural diversity.[48] Turning to the econometric perspective, I assess the validity of the instruments by conducting several standard diagnostic tests as reported in Table 3.5.

Table 3.5 displays the outcomes for the different estimations carried out by Model (1) applying a 2SLS-IV approach, as explained above, and including separately in each estimation each one of the five cultural values. The estimation results for the variables of innovation, quality, integrity, respect and teamwork are reported in Panel A, B, C, D, and E, respectively. In each Panel, Columns (1) and (2) report the outcomes for the first and second stage, respectively, using as instrument to $Herf_{s,t}$. Likewise, Columns (3) and (4) present the results for the first and second stage but using as instrument to $Theil_{s,t}$.

Concerning the cultural value of *Innovation*, Columns (1) and (3) of Panel A show that the coefficient estimates on the two proxy variables for cultural diversity, $Herf_{s,t}$ and $Theil_{s,t}$, are positive and statistically significant in the first stage regression. This would suggest that those banks headquartered in regions characterized by a diverse population in terms of race and ethnic, tends to exhibit or promote an innovation-oriented culture. To further assess the validity of the instruments, I report the Kleibergen-Paap rk Wald F-statistic for the weak instruments test. The values of the F-statistics are above the cut-off value, which suggests that I can reject the null hypothesis that the instruments are weak. I also report the p-value for the Kleibergen-Paap rk LM statistic for the under-identification test. The p-values are below the 10% critical value, which allows us to reject the null hypothesis that the equation is under-identified. In the second stage regression, Columns (2) and (4), I find that the predicted effect of the cultural value of Innovation on bank risk-taking continues to remain negative and statistically significant.

With respect to the cultural variable of *Quality*, Columns (1) and (3) of Panel B exhibit that the coefficient estimates on the two proxy variables for cultural diversity are positive and

[48] Given that I do not know of theoretical models nor empirical evidence about the specific association between the five cultural values with cultural diversity, I cannot hypothesize neither a positive nor negative relationship, but I do expect a statistically significant relationship.

statistically significant in the first stage regression. This suggests that cultural diversity is an important determinant of a bank culture oriented toward quality. The weak instrument tests reported in Panel B show that the two instruments are valid. In the second stage regression, Columns (2) and (4), show that the effect of the cultural value of Quality on bank risk-taking continues to remain negative and statistically significant. Similarly, regarding the cultural value of Integrity, Columns (1) and (3) of Panel C show a positive and statistically significant effect of $Herf_{s,t}$ and $Theil_{s,t}$, on *Integrity* in the first stage regression. Likewise, the weak instrument tests reported in Panel B show that the two instruments are valid. In the second stage regression, Columns (2) and (4), show that the effect of the cultural value of Integrity on bank risk-taking continues to remain negative and statistically significant.

Concerning to the cultural variables of *Respect* and *Teamwork,* Columns (1) and (3) of Panel D and E do not report statistically significant results concerning the relationship between cultural diversity and the cultural values of *Respect* and *Teamwork.* In line with the previous findings (Table 3.3 and 3.4), Panels D and E, Columns (4) and (5), show that the effect of these cultural variables on bank risk-taking is negative but not statistically significant at the conventional levels.

Table 3.5: Bank risk and culture: IV estimations

Panel A: Innovation	(1) Innovation(t-1)	(2) Z-score	(3) Innovation(t-1)	(4) Z-score
Innovation(t-1)		-0.368***		-0.363***
		(0.095)		(0.101)
Herf(t-1)	0.638***			
	(0.171)			
Theil(t-1)			0.679***	
			(0.196)	
Observations	1,052	1,052	1,050	1,052
R-squared		0.432		0.421
Rk LM p-value		0.000		0.000
Rk F-statistics		13.954		11.954
Firm and Year FE?	YES	YES	YES	YES
Panel B: Quality	**(1) Quality (t-1)**	**(2) Z-score**	**(3) Quality**	**(4) Z-score**
Quality (t-1)		-0.102**		-0.098*
		(0.053)		(0.051)
Herf(t-1)	0.024**			
	(0.013)			
Theil(t-1)			0.028*	
			(0.020)	
Observations	1,059	1,059		1,059
R-squared		0.356		0.224
Rk LM p-value		0.000		0.005
Rk F statistics		12.323		10.231
Firm and Year FE?	YES	YES	YES	YES
Panel C: Integrity	**(1) Integrity (t-1)**	**(2) Z-score**	**(3) Integrity(t-1)**	**(4) Z-score**
Integrity (t-1)		-0.051**		-0.058**
		(0.024)		(0.031)
Herf(t-1)	0.036**			
	(0.017)			
Theil(t-1)			0.037*	
			(0.020)	
Observations	1,047	1,047	1,047	1,047
R-squared		0.313		0.264
Rk LM p-value		0.000		0.000
Rk F statistics		11.965		10.054
Firm and Year FE?	YES	YES	YES	YES

This table displays the results for the different estimations carried out by Model (1) applying a 2SLS-IV approach as represented by Eqs (7) and (8). The estimation results for the variables of innovation, quality, integrity, respect and teamwork are reported in Panel A, B, C, D, and E, respectively. In each Panel, Columns (1) and (2) report the outcomes for the first and second stage, respectively, using as instrument to $Herf_{s,t}$. Likewise, Columns (3) and (4) present the results for the first and second stage but using as instrument to $Theil_{s,t}$. All independent variables are lagged by one year. Detailed definitions for all variables are provided in Appendix C. I report the Kleibergen-Paap rk Wald F-statistic for the weak instruments test. I also report the p-value for the Kleibergen-Paap rk LM statistic for the under-identification test. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 3.5: Bank risk and culture: IV estimations *(continued)*

Panel D: Respect	(1) Respect (t-1)	(2) Z-score	(3) Respect (t-1)	(4) Z-score
Respect (t-1)		-0.688*		-0.389
		(0.391)		(0.239)
Herf(t-1)	0.312*			
	(0.191)			
Theil(t-1)			0.396	
			(0.251)	
Observations	1,052	1,052	1,052	1,052
R-squared		0.203		0.182
Rk LM p-value		0.075		0.138
Rk F statistics		2.666		2.253
Firm and Year FE?	YES	YES	YES	YES
Panel E: Teamwork	(1) Teamwork (t-1)	(2) Z-score	(3) Teamwork (t-1)	(4) Z-score
Teamwork (t-1)		-0.428		-0.271
		(0.387)		(0.283)
Herf(t-1)	0.294			
	(0.281)			
Theil(t-1)			0.301	
			(0.317)	
Observations	1,009	1,009	1,009	1,009
R-squared		0.3872		0.3533
Rk LM p-value		0.188		0.123
Rk F statistics		1.094		0.901
Firm and Year FE?	YES	YES	YES	YES

This table displays the results for the different estimations carried out by Model (1) applying a 2SLS-IV approach as represented by Eqs (7) and (8). The estimation results for the variables of innovation, quality, integrity, respect and teamwork are reported in Panel A, B, C, D, and E, respectively. In each Panel, Columns (1) and (2) report the outcomes for the first and second stage, respectively, using as instrument to $Herf_{s,t}$. Likewise, Columns (3) and (4) present the results for the first and second stage but using as instrument to $Theil_{s,t}$. All independent variables are lagged by one year. Detailed definitions for all variables are provided in the Appendix C. I report the Kleibergen-Paap rk Wald F-statistic for the weak instruments test. I also report the p-value for the Kleibergen-Paap rk LM statistic for the under-identification test. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

3.7.1.1.3 Addressing abnormal bank culture changes

One challenge in measuring corporate culture is the fact that the primary data sources could be subject to manipulations (e.g., banks' disclosures). For instance, firms and managers could stress the importance of values that are not followed in practice (Guiso et al., 2015). In particular, during earnings calls managers may attempt to window dress their corporate culture and the measures of bank culture may simply capture "cheap talk" by manager (Li et al., 2021a).[49] Despite corporate culture is scored by applying the machine learning technique

[49] As I mention in section 7.3, the QA section during earnings calls is more spontaneous and offers less opportunities for top executives to engage in window dressing (Lee, 2016)

to Q&A section of the earnings calls which helps to mitigate the above concern, I follow to Bianchi et al. (2021) to check for abnormal cultural changes.[50]

To implement this robustness check, I first compute the yearly variation of the cultural variables of *Innovation*, *Quality* and *Integrity* ($Var\_BankCulture_{j,i,t}$), respectively. Second, I create a dummy variable ($High\_BankCulture_{j,i,t-1}$) that takes the value of one if the change in the cultural value j of the bank i in the time t is in the fourth quartile of the overall $Var\_BankCulture_{j,i,t}$ distribution. Then, I replace $BankCulture_{j,i,t}$with $High\_BankCulture_{j,i,t-1}$ in the Model (1), Eq. (1), to examine the effect of a high increase in the promotion of bank cultural values on bank risk-taking. So far, previous findings reported in Tables (3.3), (3.4) and (3.5), exhibit not statistically significant results for the cultural values of *Respect* and *Teamwork* and, conversely, statistically significant effect of Innovation, Quality and Integrity. Thus, Table (3.6) reports the estimations results of these latter cultural values in Panel (A), (B) and (C), respectively.[51]

Column (1) of table (3.6) reports that the highest changes in the cultural value of *Innovation*, *Quality* and *Integrity* do not have a statically significant effect on bank risk-taking, respectively. These results indicate that abnormal increases of theses cultural values do not affect bank risk. Along the same lines, Column (2) displays the estimation results of Model (1), Eq. (1), on the subsample of observations in which $High\_BankCulture_{j,i,t-1}$ equals to one. The results exhibited in Panels (A), (B) and (C) show that the coefficient estimates on *Innovation*, *Quality* and *Integrity* are negative but not statistically significant. This suggests, for instance, that in cases of abnormal increases in the cultural value of *Innovation*, a higher score in the value of innovation do not impact on bank risk-taking.

Finally, I also run the IV estimation approach for the subsample of observations in which $High\_BankCulture_{j,i,t-1}$ equals to zero, i.e., excluding those observations with high $High\_BankCulture_{j,i,t-1}$ (no abnormal cultural changes). In each Panel, Column (3) report the outcomes for the first stage regression and Column (4) present the results for the second

[50] As Li et al. (2021) argue, another important concern is the problem of self-promotion. Top executives might be tempted to engage in excessive self-promotion during conference calls and, in turn, the measures of bank culture might be susceptible to managers' responses loaded with emotional words.

[51] The results for the cultural value of Respect and Teamwork remains the same to those reported previously, i.e., these cultural dimensions do not influence the risk-taking behaviour of banks.

stage. For simplicity I only use the instrument $Herf_{s,t}$. Column (3) of Table (3.6) (Panels A, B and C) shows a positive and statistically significant association of cultural diversity with the cultural values under analysis. As reported in previous estimations, Column (4) reports that the cultural values of *Innovation, Quality* and *Integrity* are negatively and significantly associated with banks' z-score. Likewise, the weak instrument tests reported in Column (4) of all panels reported in Table 3.6 show that the two instruments are valid.

So far, the main findings suggest that bank culture influences the risk-taking behaviour of banks. In particular, the different estimations of Model (1) suggest that a bank culture oriented toward innovation, quality and integrity improve bank stability. These findings remain unchanged after being subject to several robustness checks.

Table 3.6: Abnormal Culture Changes

	(1)	(2)	(3)	(4)
Panel A: Innovation	Z-score	Z-score	Innovation(t-1)	Z-score
High_Innovation(t-1)	0.037			
	(0.057)			
Innovation(t-1)		-0.154		-0.436***
		(0.165)		(0.123)
Herfst(t-1)			0.599***	
			(0.178)	
Deposits(t-1)	1.243*	1.184	9.492***	3.359*
	(0.683)	(1.967)	(3.713)	(2.225)
Provisions(t-1)	0.355***	0.445***	-1.269***	-0.137
	(0.072)	(0.165)	(0.402)	(0.279)
CAR(t-1)	0.032**	0.068	0.024	0.020
	(0.015)	(0.046)	(0.088)	(0.035)
LoanGrowthRate (t-1)	-0.002	-0.003	-0.003	-0.004
	(0.002)	(0.003)	(0.010)	(0.004)
Size(t-1)	0.313**	0.331	2.846***	1.099*
	(0.129)	(0.342)	(0.789)	(0.575)
Observations	1,077	250	760	760
R-squared	0.6715	0.6766		
Firm FE/Year FE	YES	YES	YES	YES
Rk F statistics				11.309
Rk LM p-value				0.000

Table 3.6 reports the estimations results of Model (1), Eq. (1) using as independent variables the cultural values of *Innovation, Quality and Integrity* in Panel (A), (B) and (C), respectively. In all panels, Column (1) reports the effect of highest changes in the cultural value of Innovation, Quality and Integrity on bank risk-taking, respectively. Along the same lines, Column (2) displays the estimation results of Model (1), Eq. (1), on the subsample of observations in which $High\_BankCulture_{j,i,t-1}$ equals to one. I also run the IV estimation approach for the subsample of observations in which $High\_BankCulture_{j,i,t-1}$ equals to zero, i.e., excluding those observations with high $High\_BankCulture_{j,i,t-1}$ (no abnormal cultural changes). In each Panel, Column (3) report the outcomes for the first stage regression and Column (4) present the results for the second stage. For simplicity I only use the instrument $Herf_{s,t}$. All independent variables are lagged by one year. Detailed definitions for all variables are provided in Appendix C. I report the Kleibergen-Paap rk Wald F-statistic for the weak instruments test. I also report the p-value for the Kleibergen-Paap rk LM statistic for the under-identification test. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 3.6: Abnormal Culture Changes (*continued*)

Panel B: Quality	(1) Z-score	(2) Z-score	(3) Quality(t-1)	(4) Z-score
High_Quality(t-1)	0.047			
	(0.059)			
Quality (t-1)		-0.277		-0.919**
		(0.147)		(0.459)
Herfst(t-1)			0.031*	
			(0.016)	
Deposits(t-1)	1.236*	2.913	.384	3.238
	(0.685)	(2.256)	(0.036)	(2.998)
Provisions(t-1)	0.354***	0.209	-.031	-0.711
	(0.070)	(0.253)	(.030)	(.256)
CAR(t-1)	0.032**	0.069	.002	.002
	(0.013)	(0.046)	(0.009)	(.078)
LoanGrowthRate (t-1)	-0.002**	0.004	-.001**	0.009
	(0.001)	(0.004)	(0.001)	(.008)
Size(t-1)	0.317**	0.462	0.197***	1.024***
	(0.130)	(0.482)	(0.065)	(.707)
Observations	1,077	157	851	851
R-squared	0.6715	0.7955		
Firm FE/Year FE	YES	YES	YES	YES
Rk F statistics				3.486
Rk LM p-value				0.0269

Table 3.6 reports the estimations results of Model (1), Eq. (1) using as independent variables the cultural values of *Innovation, Quality and Integrity* in Panel (A), (B) and (C), respectively. In all panels, Column (1) reports the effect of highest changes in the cultural value of Innovation, Quality and Integrity on bank risk-taking, respectively. Along the same lines, Column (2) displays the estimation results of Model (1), Eq. (1), on the subsample of observations in which $High\_BankCulture_{j,i,t-1}$ equals to one. I also run the IV estimation approach for the subsample of observations in which $High\_BankCulture_{j,i,t-1}$ equals to zero, i.e., excluding those observations with high $High\_BankCulture_{j,i,t-1}$ (no abnormal cultural changes). In each Panel, Column (3) report the outcomes for the first stage regression and Column (4) present the results for the second stage. For simplicity I only use the instrument $Herf_{s,t}$. All independent variables are lagged by one year. Detailed definitions for all variables are provided in Appendix C. I report the Kleibergen-Paap rk Wald F-statistic for the weak instruments test. I also report the p-value for the Kleibergen-Paap rk LM statistic for the under-identification test. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 3.6: Abnormal Culture Changes (*continued*)

Panel C: Integrity	(1) Z-score	(2) Z-score	(3) Integrity(t-1)	(4) Z-score
High_Integrity(t-1)	0.115			
	(.064)			
Integrity (t-1)		0.105		-0.439**
		(0.167)		(0.195)
Herfst(t-1)			.043**	
			(0.019)	
Deposits(t-1)	1.101	2.422	.099	-1.903
	(0.729)	(2.098)	(0.478)	(2.064)
Provisions(t-1)	0.464***	.496***	.001	0.741***
	(0.073)	(0.189)	(.047)	(.195)
CAR(t-1)	0.031**	0.034	.021*	.072
	(0.015)	(0.041)	(0.012)	(.060)
LoanGrowthRate (t-1)	-0.003**	-0.005	.002**	0.006
	(0.001)	(0.004)	(0.001)	(.006)
Size(t-1)	0.307**	.581	0.271***	1.253***
	(0.144)	(0.334)	(0.087)	(.435)
Observations	1,075	222	851	843
R-squared	0.6348	0.7378		
Firm FE/Year FE	YES	YES	YES	YES
Rk F statistics				4.962
Rk LM p-value				0.013

Table 3.6 reports the estimations results of Model (1), Eq. (1) using as independent variables the cultural values of *Innovation, Quality and Integrity* in Panel (A), (B) and (C), respectively. In all panels, Column (1) reports the effect of highest changes in the cultural value of Innovation, Quality and Integrity on bank risk-taking, respectively. Along the same lines, Column (2) displays the estimation results of Model (1), Eq. (1), on the subsample of observations in which $High\_BankCulture_{j,i,t-1}$ equals to one. I also run the IV estimation approach for the subsample of observations in which $High\_BankCulture_{j,i,t-1}$ equals to zero, i.e., excluding those observations with high $High\_BankCulture_{j,i,t-1}$ (no abnormal cultural changes). In each Panel, Column (3) report the outcomes for the first stage regression and Column (4) present the results for the second stage. For simplicity I only use the instrument $Herf_{s,t}$. All independent variables are lagged by one year. Detailed definitions for all variables are provided in Appendix C. I report the Kleibergen-Paap rk Wald F-statistic for the weak instruments test. I also report the p-value for the Kleibergen-Paap rk LM statistic for the under-identification test. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

3.7.2 How corporate governance of banks influence their culture?

In this section I explore how certain characteristics of the board and the top management influence bank culture. The results for the different estimations carried out by the Model (2) in Eq (2), are reported in Tables (3.7), (3.8) and (3.9), using as dependent variables the bank cultural values of *Innovation, Quality and Integrity*, respectively. As it is explained in previous section, I narrow the analysis to the cultural values of *Innovation*, *Quality* and *Integrity* due to their economically significant effect on bank risk-taking.[52]

[52] The estimation results considering as dependent variable the cultural values of Teamwork and Respect in Model (2) are reported in Appendix D and E.

Table 3.7 displays the results for Eq (2) using as dependent variable the cultural dimension of *Innovation* and introducing sequentially the impact of *Gender Diversity*, *CEO Age* and *CEO Power* in Columns (1), (2) and (3), respectively. Column (4) shows the results considering simultaneously the effect these three variables on the bank cultural value of *Innovation*. Concerning the female participation in bank board composition, Column (1) exhibits a positive and statistically significant effect of *Gender Diversity* on *Innovation.* This would suggest that banks with more gender-diverse boards tend to exhibit or promote a bank culture oriented toward innovation. Specifically, an increase of 10 percentage points in the presence of females on the board in year t-1 would lead to an increase by 5.7 percentage points in the cultural value of Innovation in year t. This relationship between gender diversity of the boards and an innovation-oriented culture in banks is statistically significant at the 5% confidence level.

Table 3.7: Bank culture and board of directors

	(1)	(2)	(3)	(4)
VARIABLES	Innovation	Innovation	Innovation	Innovation
Gender Diversity(t-1)	0.568**			0.665***
	(0.278)			(0.279)
CEO Age (t-1)		-0.469**		-0.593***
		(0.215)		(0.223)
CEO Power (t-1)			0.084*	0.124**
			(0.047)	(0.049)
Board Size (t-1)	-0.049	-0.033	-0.038	-0.018
	(0.106)	(0.105)	(0.105)	(0.104)
CEO Tenure(t-1)	-0.036*	-0.025	-0.037*	-0.021
	(0.022)	(0.023)	(0.022)	(0.023)
Size (t-1)	0.260***	0.273***	0.264***	0.254***
	(0.016)	(0.016)	(0.016)	(0.017)
ROA (t-1)	0.084**	0.084**	0.077**	0.077**
	(0.033)	(0.033)	(0.032)	(0.032)
Bank Age (t-1)	-0.001	-0.001	0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Observations	1,115	1,115	1,115	1,115
R-squared	0.351	0.351	0.350	0.358
Year FE	YES	YES	YES	YES
Clusters	Firm-Year	Firm-Year	Firm-Year	Firm-Year

Notes: This table presents the results from several regressions of Model (2), Eq. (2), on the relationship between bank culture and board attributes. In all the estimations the dependent variable is the cultural value of Innovation. The main explanatory variables are the board attributes of gender diversity, CEO power and CEO age. All independent variables are lagged by one year. I use an ordinary least squares (OLS) regression with standard errors clustered at the firm-year level. All the regressions include year fixed effects. Detailed definitions for all variables are provided in the Appendix C. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Regarding the influence of CEO's age on an innovation-oriented culture, Column (2) shows a negative and statistically significant relationship between *CEO Age* and *Innovation*. In other words, I find that banks with older CEOs are associated with a less innovation-oriented culture. In economics terms, the findings show that if *CEO Age* increases by one standard deviation in year t-1, the bank cultural value of Innovation would decrease by 18% in year t. This relationship is also statistically significant at the 5% confidence level. With respect to the influence of the CEO over bank board decisions, Column (3) reports a positive and statically significant coefficient estimate on *CEO Power.* This would indicate that banks in which CEO chairs the board are associated with a culture oriented towards innovation. This link is statistically significant at the 10% confidence level.

The full model is presented in Column (4), which displays the estimations results incorporating simultaneously the effect of *Gender Diversity*, *CEO Age* and *CEO Power* as well as the control variables. It is worth pointing out that economic magnitude and statistical significance of the key variables increased compared to those reported in Columns (1)-(3). Moreover, the effect of *Gender Diversity* is the largest in size, followed by *CEO Age* and, ultimately, *CEO Power.* In conclusion, after controlling for other governance and bank characteristics, these findings provide evidence of a significant influence of *Gender Diversity*, *CEO Age* and *CEO Power* on a bank culture oriented toward innovation.

Table 3.7 also provide some important insights on other bank characteristics. Across all the columns of Table 3.7 I can observe a positive and statistically significant effect of *Size* and *ROA* on *Innovation*. These findings would suggest that bigger and more profitable banks tend to promote an innovation-culture oriented. Their economic significances are also important. For instance, an increase of 10 percentage points in bank size in year t-1 would lead to, on average, an increase by 2.63 percentage points in the cultural value of Innovation in year t. Similarly, an increase of 10 percentage points in return on assets in year t-1 would lead to, on average, an increase by 0.81 percentage points in the cultural value of Innovation in year t.[53] However, I do not find statically significant effect for the rest of the control variables.

As regards to the cultural value of *Quality*, Table 3.8 reports estimates from Eq (2) in which I introduce the key variables related to CEO and board characteristics sequentially in

[53] In these figures, I considered an average coefficient of 0,263 and 0,081 for Size and ROA, respectively

Columns (1) to (3) and present the full model in Column (4). Column (1) shows a positive and statistically significant link between the presence of females in bank board and a quality-oriented culture. This suggests that more gender-diverse boards exhibit and foster the cultural value of *Quality* in banks. In economic terms of economic significance, an increase of 10 percentage points in *Gender Diversity* in year t-1 would lead to an increase by 6.26 percentage points in the cultural value of Innovation in year t. This link is statistically significant at the 1% confidence level.

Table 3.8: Bank culture and board of directors

VARIABLES	(1) Quality	(2) Quality	(3) Quality	(4) Quality
Gender Diversity(t-1)	0.626***			0.683***
	(0.212)			(0.216)
CEO Age (t-1)		-0.245*		-0.326*
		(0.173)		(0.179)
CEO Power (t-1)			0.048	0.076*
			(0.039)	(0.040)
Board Size (t-1)	-0.165*	-0.156*	-0.158*	-0.147*
	(0.085)	(0.085)	(0.085)	(0.084)
CEO Tenure(t-1)	-0.036**	-0.030*	-0.037**	-0.028
	(0.017)	(0.018)	(0.017)	(0.018)
Size (t-1)	0.216***	0.229***	0.224***	0.212***
	(0.013)	(0.013)	(0.013)	(0.014)
ROA(t-1)	0.091***	0.090***	0.086***	0.087***
	(0.026)	(0.026)	(0.025)	(0.025)
Bank Age (t-1)	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Observations	1,121	1,121	1,121	1,121
R-squared	0.316	0.312	0.311	0.320
Year FE	YES	YES	YES	YES
Clusters	Firm-Year	Firm-Year	Firm-Year	Firm-Year

Notes: This table presents the results from several regressions of Model (2), Eq. (2), on the relationship between bank culture and board attributes. In all the estimations the dependent variable is the cultural value of Quality. The main explanatory variables are the board attributes of gender diversity, CEO power and CEO age. All independent variables are lagged by one year. I use an ordinary least squares (OLS) regression with standard errors clustered at the firm-year level. All the regressions include year fixed effects. Detailed definitions for all variables are provided in the Appendix C. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Column (2) shows that *CEO Age* is negatively and significantly associated with the bank cultural value of *Quality*. This means that banks with older CEOs are associated with lower scores in the cultural value of *Quality,* which suggest that older banks' CEOs tend to dampen a quality-oriented culture. For instance, if *CEO Age* increases by one standard deviation in year t-1 would lead banks to score 9.4% higher in the cultural value of *Quality* in year t. With

respect to the third key variable *CEO power,* Column (3) shows that CEOs chairing the board have no significant effect on *Quality.* Column (4) presents the outcomes for the full model in which it can be observed that qualitatively the results remain unchanged, however, the economic magnitude of the key variables increased compared to those reported in Columns (1)-(3). Additionally, I note that participation of female directors on the boards is a strong determinant of a bank culture oriented toward quality, with the coefficient positive and statistically significant at less than 1% level (Columns 1 and 2).

Turning to the control variables, Table 3.8 shows some important findings on other governance and bank characteristics. On the one hand, all columns of Table 3.8 report a negative and statistically significant effect of *Board Size* on the cultural value of *Quality*. This negative relationship between board size and a culture oriented towards quality is consistent with the common finding in the literature about the inverse relationship between bank performance and board size (e.g., Pathan and Faff, 2013). On the other hand, and similar to Table 3.7, I find evidence of a positive and significant effect of both *Size* and *ROA* on *Quality*. In terms of economic significance, using the specification in column (4), I find that an increase of 10 percentage points in bank size in year t-1 would lead to an increase by 2,12 percentage points in the cultural value of Innovation in year t. Similarly, if *ROA* increases by one standard deviation in year t-1 would lead banks to score 7.2% higher in the cultural value of *Quality* in year t.

In Table 3.9, I report the regression results for Eq. (5) using as dependent variable the bank cultural value of Integrity. Like Tables 3.8 and 3.9, I introduce sequentially the governance variables in columns (1) to (3) and present the full model in column (4). In column (1) I observe that *Gender Diversity* is a strong determinant of the cultural value of *Integrity*, with a coefficient estimate positive and statistically significant at 1% confidence level. In particular, a higher participation of female directors on the boards tend to exhibit and encourage a bank culture oriented toward to integrity. Specifically, one standard deviation increase in *Gender Diversity in year t*-1 results in scoring 7.2% higher in the bank cultural value of *Integrity*. This finding is supported by the argument that firms with more gender-diverse boards enhance an ethical perspective and corporate social responsibility (Byron and Post, 2016; McGuinness et al., 2017).

Table 3.9: Bank culture and board of directors

VARIABLES	(1) Integrity	(2) Integrity	(3) Integrity	(4) Integrity
Gender Diversity(t-1)	0.748***			0.664***
	(0.235)			(0.239)
CEO Age (t-1)		-0.017		-0.120
		(0.168)		(0.173)
CEO Power (t-1)			0.141***	0.136***
			(0.039)	(0.042)
Board Size (t-1)	-0.407***	-0.415***	-0.401***	-0.396***
	(0.088)	(0.091)	(0.090)	(0.090)
CEO Tenure(t-1)	-0.004	0.005	0.004	0.006
	(0.017)	(0.018)	(0.017)	(0.018)
Size (t-1)	0.228***	0.218***	0.208***	0.221***
	(0.013)	(0.012)	(0.013)	(0.013)
ROA(t-1)	0.055**	0.056**	0.047*	0.046*
	(0.026)	(0.027)	(0.026)	(0.026)
Bank Age (t-1)	0.000	-0.000	-0.001	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Observations	1,113	1,113	1,113	1,113
R-squared	0.273	0.262	0.270	0.276
Year FE	YES	YES	YES	YES
Clusters	Firm-Year	Firm-Year	Firm-Year	Firm-Year

Notes: This table presents the results from several regressions of Model (2), Eq. (2), on the relationship between bank culture and board attributes. In all the estimations the dependent variable is the cultural value of Integrity. The main explanatory variables are the board attributes of gender diversity, CEO power and CEO age. All independent variables are lagged by one year. I use an ordinary least squares (OLS) regression with standard errors clustered at the firm-year level. All the regressions include year fixed effects. Detailed definitions for all variables are provided in the Appendix C. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

With respect to the influence of CEO's age on a bank culture oriented toward integrity, the results presented in Column (2) do not show statistically significant results concerning the effect *CEO Age* on the cultural value of *Integrity*. This is in line with the empirical evidence provided by Arnaboldi et al. (2021) who do not find a significant link between *CEO Age* and bank misconduct. Conversely, results presented in column (3) allow us to note a strong effect of CEO Power on an integrity-oriented culture, with a coefficient positive and statistically significant at less than 1% level. This would indicate that banks in which CEO chairs the board are associated with higher scores in the bank cultural value of *Integrity*. Specifically, if *CEO Power* increases by one standard deviation in year t-1 would lead to an increase by 7.0 percentage points in the cultural value of Integrity in year t. This finding contrasts with the conventional argument that corporate misconduct is a potential outcome when CEOs have

too much power (e.g., Khanna et al., 2015). The outcomes for the full model are exhibited in Column (4) in which I can observe that the results remain equal to those estimated previously (Columns 1-3).

Table 3.9 also reports other interesting findings. On the one hand, across all the estimations it can be observed a negative and statistically significant effect of *Board Size* on *Integrity*. Specifically, using the specification in column (4), I find that if *Board Size* increases by one standard deviation in year t-1 would lead to an increase by 9.4 percentage points in the cultural value of *Integrity* in year t. This effect is statistically significant at the 1% confidence level. On the other hand, Table 3.9 also shows a negative and statistically significant effect of both *Size* and *ROA* on the cultural value of *Integrity*. For instance, an increase of 10 percentage points in bank size in year t-1 would lead to an increase by 2.18 percentage points in the cultural value of *Integrity* in year t. Similarly, an increase of 10 percentage points in return on assets in year t-1 would lead to, on average, an increase by 0.51 percentage points in the cultural value of *Integrity* in year t.[54]

Taken together, the main result from Tables 3.7, 3.8 and 3.9 is that bank board characteristics influence bank culture. Specifically, the results can be summarized as follows. First, board gender diversity affects positively the bank cultural values of *Innovation, Quality and Integrity*. Second, CEOs Age impact negatively the cultural values of *Innovation* and *Quality.* Indeed, *CEO Age* has a stronger effect in explaining an innovation-oriented culture rather than an integrity-oriented culture. *CEO Power* is a strong determinant of the cultural value of *Integrity*, with a positive and statistically significant effect at less than 1% level. *CEO Power* also play an important role on explaining the cultural value of *Innovation* with a positive and statistically significant effect. These results are consistent with the hypothesis H2.

3.7.2.1 Robustness checks: Managing endogeneity

I apply several econometric methods to address endogeneity concerns about the results presented in section 3.7.2. First, I reduce the probability of omitted-variables bias by augmenting the Model (2), Eq. (2), with variables that are likely to affect the main bank cultural values. To this end, I include two additional variables related to bank governance

[54] In these figures, I considered an average coefficient of 0,218 and 0,051 for Size and ROA, respectively

characteristics, specifically, *Nationality Mix* and *CEO Network Size*. These variables are obtained from Boardex which defines *Nationality Mix* as the proportion of foreign directors on the board and *CEO Network Size* as the number of overlaps through employment, other activities and education. On the one hand, the literature suggests that more nationality-diverse boards contribute to increase creativity and innovation as well as to bring heterogeneity of ideas, experiences and point of views (Garcia-Meca et al., 2015, among others).[55] On the other hand, personal and professional connections may affect executives' decision-making, i.e., the actions of others can influence the individual preferences, ideas and decisions (Dbouk et al., 2020, among others). As it can be observed in Table 3.10, the previous results exhibited in Table 3.7 to 3.9 remain robust to the inclusion of *Nationality Mix* and *CEO Network Size*.

Table 3.10: Bank culture and board of directors: Omitted Variables

	(1)	(2)	(3)
VARIABLES	Innovation	Quality	Integrity
Gender Diversity(t-1)	0.641**	0.673***	0.515**
	(0.292)	(0.233)	(0.254)
CEO Age (t-1)	-0.454**	-0.352*	-0.210
	(0.238)	(0.197)	(0.184)
CEO Power (t-1)	0.097**	0.051	0.134***
	(0.051)	(0.043)	(0.044)
Board Size (t-1)	-0.084	-0.204	-0.410***
	(0.105)	(0.090)	(0.095)
CEO Tenure(t-1)	-0.010	-0.020	0.019
	(0.024)	(0.019)	(0.019)
Nationality Mix (t-1)	-0.299	-0.141	-0.059
	(0.182)	(0.155)	(0.148)
CEO Network Size(t-1)	0.113***	0.079***	0.023
	(0.029)	(0.022)	(0.023)
Size (t-1)	0.266***	0.192***	0.214***
	(0.015)	(0.016)	(0.016)
ROA(t-1)	0.080**	0.073***	0.034
	(0.033)	(0.027)	(0.028)
Bank Age (t-1)	-0.001	-0.001*	-0.001
	(0.001)	(0.001)	(0.001)
Observations	1,155	1,044	1,038
R-squared	0.347	0.327	0.281
Year FE	YES	YES	YES
Clusters	Firm-Year	Firm-Year	Firm-Year

[55] Several studies have documented the benefits and costs of cultural-diverse boards on firms providing inconclusive results. For instance, Carter et al. (2003), Oxelheim and Randøy (2003), Masulis et al. (2012), Garcia-Meca et al., (2015).

Second, to further mitigate endogeneity concerns, I use a 2SLS instrumental variable approach. The 2SLS-IV approach allows us to explore the exogenous impact of *Gender Diversity, CEO Age* and *CEO Power* on the bank cultural values of *Innovation*, *Quality* and *Integrity*, solving the problem of reverse causality. In the first stage, I consider separately each one of the governance variables as endogenous and is instrumented by an external instrument. Following prior studies, I compute an external instrument for each one of the governance variables (Jiang et al., 2017; Pathan et al., 2021). Specifically, I calculate each external instrument as the average value of *Gender Diversity, CEO Age* and *CEO Power* at all other banks in the same year. Then, each instrumental variable is included in one lagged value as exogenous instruments of each one of the endogenous variables. In the second stage, I use the predicted values estimated from each regression carried out in the first stage and use them as a proxy variable for each one of the bank governance variables. In both stages, I include all the control used in the baseline specification in Model (2), Eq (2).

The 2SLS-IV approach relies on the assumption that, after controlling for bank characteristics, each instrument is significantly associated with *Gender Diversity, CEO Age* and *CEO Power* (relevance condition), respectively, but do not directly with the bank cultural values except through their effect on the governance variables (exclusion condition). Table 3.11 reports the 2SLS-IV model estimation results using as dependent variable the bank cultural value of *Innovation* (Panel A), Quality (Panel B) and Integrity (Panel C), respectively. In each Panel, Columns (1) and (2) exhibit the regression results for *Innovation*, Columns (3) and (4) for the value of *Quality* and Columns (5) and (6) for the cultural dimension of *Integrity.* Additionally, columns (1), (3) and (5) show the first-stage estimations and, similarly, Columns (2), (4) and (6) present the second-stage regressions, respectively.

I verify the relevance condition in the first-stage estimations as shown in columns (1), (3) and (5) in all panels of Table 3.11. The coefficient estimates on each instrumental variable are positive and statistically significant at the conventional levels. Besides, the weak instrument tests reported in all panels show that the instruments are valid and, thus, give us confidence that the model is neither under identified neither weakly identified. Similarly, Columns (2), (4) and (6) also allow us to verify exclusion condition, providing similar results

to those reported previously. For brevity, I only report the results for the key variables, which again remain equal to those estimated previously.

Table 3.11: Bank culture and board of directors. IV estimations

Panel A: Innovation	(1) Gender Diversity(t-1)	(2) Innovation	(3) CEO Age (t-1)	(4) Innovation	(5) CEO Power (t-1)	(6) Innovation
Gender Diversity(t-1)		0.753***				
		(0.152)				
CEO Age (t-1)				-0.138**		
				(0.554)		
CEO Power (t-1)						0.246***
						(0.722)
Instrumental Variable	0.120***		0.887***		0.953***	
	(0.158)		(0.322)		(0.237)	
Observations	1,156	1,156	1,163	1,163	1,136	1,136
R-squared		0.7584		0.1305		0.4701
Rk LM p-value		0.000		0.007		0.000
Rk F statistics		57.409		7.585		16.103
Year FE	YES	YES	YES	YES	YES	YES
Panel B: Quality	(1) Gender Diversity(t-1)	(2) Quality	(3) CEO Age (t-1)	(4) Quality	(5) CEO Power (t-1)	(6) Quality
Gender Diversity(t-1)		0.274**				
		(0.123)				
CEO Age (t-1)				-0.483*		
				(0.261)		
CEO Power (t-1)						0.248
						(0.591)
Instrumental Variable	0.126***		0.905***		0.811***	
	(0.126)		(0.321)		(0.262)	
Observations	1,162	1,162	1,169	1,169	1,142	1,142
R-squared		0.1320		0.1285		0.1046
Rk LM p-value		0.000		0.005		0.004
Rk F statistics		42.881		7.948		9.574
Firm FE/Year FE	YES	YES	YES	YES	YES	YES

This table displays the results for the different estimations carried out by Model (2) applying a 2SLS-IV approach as represented by Eq (2). Table 3.11 reports the 2SLS-IV model estimation results using as dependent variable the bank cultural value of *Innovation* (Panel A), Quality (Panel B) and Integrity (Panel C), respectively. In each Panel, Columns (1) and (2) exhibit the regression results for *Innovation*, Columns (3) and (4) for the value of *Quality* and Columns (5) and (6) for the cultural dimension of Integrity. Additionally, columns (1), (3) and (5) show the first-stage estimations and, similarly, Columns (2), (4) and (6) present the second-stage regressions, respectively. I calculate each external instrument as the average value of *Gender Diversity, CEO Age* and *CEO Power* at all other banks in the same year All independent variables are lagged by one year. Detailed definitions for all variables are provided in the Appendix C. I report the Kleibergen-Paap rk Wald F-statistic for the weak instruments test. I also report the p-value for the Kleibergen-Paap rk LM statistic for the under-identification test. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 3.11: Bank culture and board of directors. IV estimations *(continued)*

Panel C: Integrity	(1) Gender Diversity(t-1)	(2) Integrity	(3) CEO Age (t-1)	(4) Integrity	(5) CEO Power(t-1)	(6) Integrity
Gender Diversity(t-1)		0.349***				
		(0.128)				
CEO Age (t-1)				-0.442*		
				(0.224)		
CEO Power (t-1)						0.739**
						(0.364)
Instrumental Variable	0.123***		0.859***		0.931***	
	(0.194)		(0.261)		(0.254)	
Observations	1,154	1,154	1,161	1,161	1,134	1,134
R-squared		0.8018		0.7098		.6998
Rk LM p-value		0.000		0.001		0.000
Rk F statistics		40.397		10.860		13.425
Firm FE/Year FE	YES	YES	YES	YES	YES	YES

This table displays the results for the different estimations carried out by Model (2) applying a 2SLS-IV approach as represented by Eq (2). Table 3.11 reports the 2SLS-IV model estimation results using as dependent variable the bank cultural value of *Innovation* (Panel A), Quality (Panel B) and Integrity (Panel C), respectively. In each Panel, Columns (1) and (2) exhibit the regression results for *Innovation*, Columns (3) and (4) for the value of *Quality* and Columns (5) and (6) for the cultural dimension of Integrity. Additionally, columns (1), (3) and (5) show the first-stage estimations and, similarly, Columns (2), (4) and (6) present the second-stage regressions, respectively. I calculate each external instrument as the average value of *Gender Diversity, CEO Age* and *CEO Power* at all other banks in the same year All independent variables are lagged by one year. Detailed definitions for all variables are provided in the Appendix C. I report the Kleibergen-Paap rk Wald F-statistic for the weak instruments test. I also report the p-value for the Kleibergen-Paap rk LM statistic for the under-identification test. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Finally, another potential concern is that the relationship between bank culture and corporate governance among other bank-specific characteristics, may be dynamically endogenous. For example, past gender diversity on boards may influence current bank culture. Similarly, past bank performance (ROA) may impact the current cultural values. Therefore, a dynamic panel system, the Generalized Method of Moments (GMM-SYS) estimator, is used to control for lagged bank governance and use the banks' past information as instruments. The appropriateness of this set of instruments is formally evaluated by the Hansen test for overidentifying restrictions and the Arellano-Bond tests for error autocorrelation.

Despite the system GMM approach often being regarded as more efficient among other dynamic panel data estimators, such as the difference GMM approach or three-stage least squares, there remain potential problems with over-instrumentation and with the extent to which endogeneity is adequately addressed. Regarding the consequences of instrument proliferation or over-instrumentation in GMM estimation, several studies have documented

potential distortions in the estimated parameters due to the overfitting of the endogenous regressors and on weakening the power of the over-identification tests. As a result, recent studies have suggested the use of principal components analysis (PCA) as a way to reduce the number of instruments and improve the GMM estimator's properties.

Consequently, I have applied a principal components analysis to deal with the potential problem of instrument proliferation in the estimation of the GMM-Sys. In Table 3.12, I report the results for the different estimations of Model (2), Eq. (2), using in each estimation as dependent variables the cultural values *Innovation, Quali*ty and *Integrity*, exhibited in Column (1), (2) and (3), respectively. In all the estimations, the Hansen and Arellano-Bond AR (2) tests show that the instruments are appropriate and that there is no detectable second-order serial correlation. Therefore, I conclude that the results of Model (2) presented in this work are robust.

Table 3.12: Bank culture and board of directors: GMM-System estimations

	(1)	(2)	(8)
VARIABLES	Innovation	Quality	Integrity
Gender Diversity(t-1)	1.620***	0.964**	0.815**
	(0.555)	(0.503)	(0.417)
CEO Age (t-1)	-0.324*	-0.292**	-0.210
	(0.189)	(0.121)	(0.184)
CEO Power (t-1)	0.237***	0.142*	0.134***
	(0.088)	(0.078)	(0.044)
Board Size (t-1)	0.240	0.018	-0.410***
	(0.202)	(0.090)	(0.095)
CEO Tenure(t-1)	-0.011	-0.004	0.019
	(0.026)	(0.021)	(0.019)
Size (t-1)	0.213**	0.232***	0.214***
	(0.102)	(0.078)	(0.016)
ROA(t-1)	0.049	0.059*	0.034
	(0.036)	(0.031)	(0.028)
Bank Age (t-1)	-0.011	-0.008	-0.001
	(0.008)	(0.006)	(0.001)
Observations	1,265	1,275	1,038
F-test	17.65	10.15	14.38
AR(2)	0.868	0.942	0.725
Hansen J	0.711	0.842	0.614

This table reports the results for the different estimations of Model (2), Eq. (2) using the dynamic panel system Generalized Method of Moments estimator (GMM-Sys). I use as dependent variables the cultural values *Innovation, Quali*ty and *Integrity*, exhibited in Column (1), (2) and (3), respectively. For detailed variable description see Appendix C. I control for unobservable bank-invariant and time-invariant fixed effects. Hansen is the Hansen J statistic (p-value reported) and AR (2) is the test of second-order autocorrelation (p-value reported). Robust standard errors are in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% levels respectively.

3.7.3 How corporate governance of banks impact their risk-taking behaviour through bank culture?

So far, I can summarize the main findings in two groups. First, results for Model (1), Eq (1), provide evidence of a statistically significant relationship between bank culture and risk taking by banks. Specifically, I find that the cultural values of *Innovation*, *Quality* and *Integrity* decrease bank risk. Second, the outcomes form Model (2) show that some bank governance characteristics influence bank culture. In particular, *Gender Diversity*, *CEO Age* and *CEO Power* influence the cultural values of *Innovation*, *Quality* and *Integrity.*

With these results in mind, I now examine how corporate governance of banks impact their risk-taking behaviour through bank culture Specifically, I examine how certain characteristics of the board of directors and CEO affect bank risk through their culture, i.e., I investigate the channel through which corporate governance impact bank risk-taking. To this end, I estimate a system of simultaneous equations using three-stage least squares (3SLS) estimation method represented by Eqs. (3) and (4) in Section 3.5.3. Tables 3.13, 3.14 and 3.15 present the results from such 3SLS estimation analysis using the cultural value of *Innovation*, *Quality* and *Integrity*, respectively. In these tables, columns (1), (3) and (5) show the estimations results from the first equation of the system of equations given by Eq. (3) in which I examine the impact of bank governance on bank culture. Similarly, columns (2), (4) and (6) exhibit the outcomes of the second equation from the system of simultaneous equations given by Eq. (4), which explores the effect of bank culture on bank risk-taking. Finally, columns (7) and (8) display the result for the full model incorporating simultaneously to *Gender Diversity*, *CEO Age* and *CEO Power* in the first equation.

In Table 3.13, I can note four important findings. First, I can observe a positive and statistically significant effect of *Gender Diversity* on the cultural value of *Innovation* (Column 1). Second, results reported in Column (3) show that banks with older CEOs are associated with a less innovation-oriented culture. Third, I find that banks in which CEO chairs the board are associated with a culture oriented towards innovation as reported in Column (5), however, this effect is statistically significant at the 10% confidence level. Four, columns (2), (4) and (6) report a negative and statistically significant effect of *Innovation* on bank risk-taking. Specifically, those banks that promote the cultural value of innovation tend to take less on bank risk. Besides, the results for the full model remain equal as reported in

Columns (7) and (8). Therefore, our results suggest that governance characteristics such as *Gender Diversity*, *CEO Age* and *CEO Power* influence the bank cultural value of *Innovation* and, in turn, a bank culture oriented toward innovation decreases bank risk-taking.

Table 3.14 provides similar results to those reported previously. On the one hand, Column (1) shows a positive and statistically significant effect of *Gender Diversity* on the value of *Quality*. This suggests that more gender-diverse boards exhibit and foster the cultural value of *Quality* in banks. On the other hand, Column (3) shows a negative and statistically significant effect of *CEO Age* on the cultural value of *Quality.* This would indicate that banks with older CEOs tend to discourage a culture oriented toward quality. Conversely, the estimation results exhibited in Column (5) fail to provide evidence of a statistically significant effect of *CEO Power* on a quality-oriented culture. Furthermore, across Table 3.14 I find evidence of a negative and statistically significant effect of the cultural value of *Quality* on bank risk-taking. The results for the full model remain similar as reported in Columns (7) and (8). Thus, these findings indicate that governance characteristics such as *Gender Diversity* and *CEO Age* influence the cultural value of *Quality* and, consequently, a quality-oriented culture help to improve bank stability. These results support the hypotheses H1a, H1b and H1c.

In Table 3.15, I can highlight the positive and statistically significant effect of both *Gender Diversity* (Column 1) and *CEO Power* (Column 5) on the cultural value of *Integrity*. However, the outcomes shown in Column (3) do not provide evidence of a statistically significant effect of *CEO Age* on the cultural value of *Integrity*. Additionally, Columns (2), (4) and (6) report a negative and statistically significant effect of *Integrity* on bank risk-taking. However, this effect is statistically significant at the 10% confidence level. Again, the findings remain equal for the full model as reported in Columns (7) and (8). Therefore, the results suggest *Gender Diversity* and *CEO Power* influence the cultural value of *Integrity* and, as result, a bank culture oriented toward integrity diminishes bank risk.

Table 3.13: Bank culture, corporate governance and bank risk taking: 3SLS system of equations

VARIABLES	(1) Innovation	(2) Z-score	(3) Innovation	(4) Z-score	(5) Innovation	(6) Z-score	(7) Innovation	(8) Z-score
Innovation(t-1)		-0.103**		-0.104**		-0.102**		-0.103**
		(0.043)		(0.045)		(0.043)		(0.043)
Gender Diversity(t-1)	0.534**						0.602**	
	(0.275)						(0.275)	
CEO Age(t-1)			-0.312**				-0.429**	
			(0.206)				(0.211)	
CEO Power(t-1)					0.075*		0.110**	
					(0.049)		(0.051)	
Z-score (t-1)	0.094***		0.094***		0.098***		0.095***	
	(0.022)		(0.023)		(0.022)		(0.022)	
Bank Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	998	998	998	998	1,015	1,005	998	998
R-squared	0.3687	0.6954	0.3678	0.6955	0.3677	0.6954	0.3730	0.6954
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm-FE	NO	YES	NO	YES	NO	YES	NO	YES

This table shows the results for the different estimations of Model (3), employing a system of simultaneous equations using three-stage least squares (3SLS) estimation method represented by Eqs. (3) and (4). Columns (1), (3) and (5) show the estimations results from the first equation of the system of equations given by Eq. (3) in which I examine the impact of bank governance on the cultural value of innovation. Similarly, columns (2), (4) and (6) exhibit the outcomes of the second equation from the system of simultaneous equations given by Eq. (4), which explores the effect of the cultural value of innovation on bank risk-taking. Finally, columns (7) and (8) display the result for the full model incorporating simultaneously to *Gender Diversity*, *CEO Age* and *CEO Power* in the first equation. All independent variables are lagged by one year. All the regressions include year and bank fixed effects. Detailed definitions for all variables are provided in the Appendix C. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 3.14: Bank culture, corporate governance and bank risk taking: 3SLS system of equations

VARIABLES	(1) Quality	(2) Z-score	(3) Quality	(4) Z-score	(5) Quality	(6) Z-score	(7) Quality	(8) Z-score
Quality(t-1)		-0.139***		-0.140***		-0.139***		-0.139***
		(0.051)		(0.051)		(0.051)		(0.051)
Gender Diversity(t-1)	0.733***						0.764***	
	(0.225)						(0.226)	
CEO Age(t-1)			-0.101**				-0.157*	
			(0.1698)				(0.173)	
CEO Power(t-1)					0.029		0.052	
					(0.040)		(0.041)	
Z-score (t-1)	0.068**		0.059**		0.050**		0.041**	
	(0.021)		(0.022)		(0.022)		(0.019)	
Bank Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012
R-squared	0.3335	0.6961	0.3268	0.6961	0.3269	0.6961	0.3348	0.6961
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm-FE	NO	YES	NO	YES	NO	YES	NO	YES

This table shows the results for the different estimations of Model (3), employing a system of simultaneous equations using three-stage least squares (3SLS) estimation method represented by Eqs. (3) and (4). Columns (1), (3) and (5) show the estimations results from the first equation of the system of equations given by Eq. (3) in which I examine the impact of bank governance on the cultural value of quality. Similarly, columns (2), (4) and (6) exhibit the outcomes of the second equation from the system of simultaneous equations given by Eq. (4), which explores the effect of the cultural value of quality on bank risk-taking. Finally, columns (7) and (8) display the result for the full model incorporating simultaneously to *Gender Diversity*, *CEO Age* and *CEO Power* in the first equation. All independent variables are lagged by one year. All the regressions include year and bank fixed effects. Detailed definitions for all variables are provided in the Appendix C. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 3.15: Bank culture, corporate governance and bank risk taking: 3SLS system of equations

VARIABLES	(1) Integrity	(2) Z-score	(3) Integrity	(4) Z-score	(5) Integrity	(6) Z-score	(7) Integrity	(8) Z-score
Integrity (t-1)		-0.065*		-0.064		0.071*		0.076*
		(0.048)		(0.039)		(0.058)		(0.059)
Gender Diversity(t-1)	0.873***						0.789***	
	(0.233)						(0.233)	
CEO Age (t-1)			-0.064				-0.057	
			(0.174)				(0.177)	
CEO Power(t-1)					0.145***		0.132***	
					(0.042)		(0.042)	
Z-score (t-1)	0.045**		0.047**		0.056***		0.053***	
	(0.018)		(0.018)		(0.018)		(0.018)	
Bank Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	995	995	995	995	995	995	995	995
R-squared	0.2953	0.6434	0.2854	0.6434	0.2939	0.6658	0.3021	0.6434
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm-FE	NO	YES	NO	YES	NO	YES	NO	YES

This table shows the results for the different estimations of Model (3), employing a system of simultaneous equations using three-stage least squares (3SLS) estimation method represented by Eqs. (3) and (4). Columns (1), (3) and (5) show the estimations results from the first equation of the system of equations given by Eq. (3) in which I examine the impact of bank governance on the cultural value of integrity. Similarly, columns (2), (4) and (6) exhibit the outcomes of the second equation from the system of simultaneous equations given by Eq. (4), which explores the effect of the cultural value of integrity on bank risk-taking. Finally, columns (7) and (8) display the result for the full model incorporating simultaneously to *Gender Diversity*, *CEO Age* and *CEO Power* in the first equation. All independent variables are lagged by one year. All the regressions include year and bank fixed effects. Detailed definitions for all variables are provided in the Appendix C. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

3.8 Conclusion

This chapter examines how the bank culture affects the bank risk-taking behaviour through board attributes such as gender diversity, CEOs' power and CEOs' age. To this end, I create a culture dictionary using a novel machine learning technique-the word embedding model- and 5,813 earnings call transcripts. I score the five cultural values proposed by Guiso et al. (2015) -innovation, quality, integrity, respect and teamwork for a sample of US BHCs over the period 2006-2019. The research design is based on three steps. I start examining how bank culture influence the risk-taking behaviour of banks. Then, I study how certain features of the board and the top management are associated with the bank cultural values. Consequently, a system of simultaneous equations is used to investigate how corporate governance of banks influence their risk-taking behaviour through culture.

The results can be summarized as follows. First, the findings suggest that bank culture influences the risk-taking behaviour of banks. In particular, the results provide evidence that a bank culture oriented towards innovation, quality, and integrity improves bank stability. These findings remain unchanged after being subject to several endogeneity and other robustness checks. Second, the results reveal an economically significant influence of gender diversity, CEO age and CEO power on the cultural values of *Innovation, Quality and Integrity*. On the one hand, board gender diversity affects positively the bank cultural values of *Innovation, Quality and Integrity*. On the other hand, CEOs Age impact negatively the cultural values of *Innovation* and *Quality.* Indeed, *CEO Age* has a stronger effect in explaining an innovation-oriented culture rather than an integrity-oriented culture. Furthermore*, CEO Power* is a strong determinant of the cultural value of *Integrity* and also play an important role on explaining the cultural value of *Innovation* with a positive and statistically significant effect. Third, I provide evidence that corporate governance of banks impacts their risk-taking behaviour through bank culture. Specifically, this study reveals that Gender diversity, CEO's age and CEO's power decrease bank risk through the cultural values of *innovation, quality,* and *integrity.*

The results of this work have several implications for policymakers and market participants alike. These findings suggest that banks in the US should encourage female participation in boards and regulators should provide legal instruments to boost gender diversity, which would improve bank stability. These findings provide support to regulations implemented in

EU countries such as France, Italy, Sweden and Norway regarding mandatory gender quota for boards. Furthermore, in assessing the third component in the CAMELS rating, Federal Reserve examiners focus on the capabilities of the board of directors and executive officers, for instance, to implement policies and a culture that promote the safe and operation of a bank. The results of this research reveal that gender diversity and CEO power encourage a bank culture oriented toward innovation, quality and integrity, which contribute to an effective risk management and, in turn, to a competitive advantage. These factors should be considered in approaches to assess the management factor.

CHAPTER 4: CULTURAL IMMUNITY AND BANKS' DEFAULT RISK DURING THE COVID-19: EVIDENCE FROM THE US

4.1 Introduction

The COVID-19 crisis stands for the largest liquidity shock to the banking system ever observed and has put US banks under severe pressure which has meant a real-life test (Li et al., 2020; Acharya et al., 2021). During late March 2020, firms drew funds from bank credit lines and loan commitments on an unprecedented scale fearing financial disruptions and massive declines in future cash flow (Acharya and Steffen, 2020a; Li et al., 2020). This sharp increase in liquidity demand was accompanied by a sharp reduction of bank stocks prices, which underperformed those of non-financial firms (Acharya et al., 2021). Drawdowns require additional bank capital as they emerge as loans on bank balance sheets, which may bring banks closer to default (Acharya and Steffen, 2020b). Default risk is the ultimate risk that matter for banking stability and is the risk that regulators are likely to care the most about (Anginer et al., 2017). I address this topic by examining whether and how bank culture helps to mitigate the impact of COVID-19 on banks' distance to default.

Several studies have examined the impact of COVID-19 on the US banking sector. Acharya et al. (2021) examine the crash on US banks stock prices during the first phase of the pandemic crisis. The authors develop a measure of balance-sheet liquidity risk and report that stock prices of banks with high liquidity risk exposure underperformed relative to banks with low exposure. However, this effect is mitigated by bank capital buffers. In the same lines, Acharya and Steffen (2020b) use stress tests to evaluate how COVID-19 has affected the US banks' liquidity provider function, arguing that the pandemic-induced liquidity shock should be manageable due to the healthier capitalisation of banks after the GFC. Furthermore, Sedunov (2021) examines the effectiveness of the Federal Reserve emergency interventions in containing systemic risk during the GFC and the COVID-19. Although the author finds that during the GFC the lender of last resort and the liquidity provisions were effective in reducing systemic risk in the US, these policies do not exhibit a significant effect during the pandemic crisis. **This** study contributes to this literature by studying the unexplored link between banks' distance to default and bank culture during the COVID-19 shock. I choose Merton's distance to default as the main indicator of default risk and, for robustness check,

it's modified version developed by Byström (2006). These measures have been shown to be a good predictor of defaults, outperforming accounting-based models (e.g., Campbell et al., 2008)

A closer paper to this study by Li et al. (2021b), develop a set of measures of firm-level exposure and response to COVID-19 for 3,019 US firms during the first quarter of 2020. The authors show that firms with a strong corporate culture exhibited better stock price performance than firms without a strong culture. Additionally, and as a response to the health crisis, findings suggest that firms with a strong culture are more likely to put emphasis on community engagement and adopt digital technology and are less likely to engage in cost cutting than firms without a strong culture. However, the authors do not focus on the banking industry, and have not explored how bank culture may insulate banks' default risk during the health crisis. Another related work by Ding et al. (2021), explore whether and how corporate characteristics before COVID-19 help to insulate the impact of the pandemic shock on stock returns. An interesting finding documented by the authors is that more corporate social responsibility activities prior to the pandemic led to better stock price performance in response to the health crisis. This is in line with this study, as it also find that corporate characteristics before COVID-19, such as bank culture, impact bank risk during the pandemic.

I use a difference -in-differences (DiD) framework to investigate the link between bank culture and banks' distance to default during COVID-19 turmoil. To this end, I use the COVID-19 shock which has been argued as a better quasi-natural experiment than previous crises, such as the GFC, mainly for two reasons (Berger et al., 2021a). First, prior crises often had origins in the banking sector and, consequently, directly affected bank stability. Conversely, COVID-19 is exogenous to the banking industry and had its origins as a public health crisis. Second, prior crises were often predictable to some extend and thus were not plausibly exogenous shocks (e.g., Acharya and Naqvi, 2012; Berger and Bouwman, 2017). In contrast, banks were not able to anticipate the COVID-19 crisis. Thus, COVID-19 provides a plausibly exogenous shock to examine the link between banks' distance to default and bank culture during financial turmoil.

This study provides several new facts. First, I show that COVID-19 shock impacts negatively on banking stability, i.e., the pandemic crisis increases banks' default risk by reducing the distance-to-default of banks. Specifically, the findings show that during the pandemic crisis the Merton's distance-to-default decreases by 3.182 and, alternatively, the Bystrom's distance-to-default diminishes by 3.210. Second, during the COVID-19 turmoil a strong bank culture allows banks to exhibit a lower default risk (higher distance-to-default) compared to those without a strong culture. Further, banks with a strong culture on the cultural values of *Innovation, Quality and Integrity* before the health crisis tend to show less default risk during COVID-19. Finally, I find that low bank exposure to COVID-19 through its branches as well as a high non-interest income helps to mitigate the negative impact of the health crisis on banks' default risk

These findings have implications for supervisors and bank managers alike. John C. Williams, President and CEO of the New York Fed, noted that *"We must stay vigilant around the "softer" side of supervision. Strong culture and robust corporate governance are our first lines of defense. They're a critical part of the tool kit when it comes to protecting people, banks, and the economy from risk, scandal, and harm"* (Williams, 2018).[56] The results support this statement and suggest that supervisors' assessment of culture should focus on encouraging and aligning technology-oriented cultural values and incentives with a bank's strategic goals.

The next section of this study discusses the literature review. In Section 3 I explain the data, sample and variables and in Section 4 I describe the empirical strategy. Section 5 reports and discusses the results. In the last section, I conclude the study.

4.2 Related literature and contributions

This study relates to the rapidly emerging literature on the impact of the COVID-19 shock on the banking sector and, to a lesser extent, on the corporate sector. On the one hand, a strand of literature has examined the impact of the health crisis on the banking sector in aspects such as bank lending (Colak and Oztekin, 2021), deposit growth (Levine et al., 2021), performance (Elnahass et al., 2021), and bank systemic risk (Duan et al., 2021), among

[56] https://www.newyorkfed.org/newsevents/speeches/2018/wil180618

others. On the other hand, a growing body of literature has examined how the impact of the COVID-19 crisis on stock returns depends on firm characteristics such as firms' financial conditions before the crisis, such as ownership structure, corporate governance, financial flexibility, and corporate social responsibility (Ding et al., 2021; Fahlenbrach et al., **2020**; Bae et al., 2021). This study contributes by providing evidence on how bank culture helps to mitigate the impact of pandemic shock on banks' default risk.

As a result of the "Great Lockdown", firms have faced significant operational margin declines and households have suffered job losses and declines in income. These negative effects are likely to spread to banks. For instance, firms and households may not be able to repay their debt, leading to a surge in non-performing loans which negatively affects bank performance, risk, and solvency. Additionally, lower demand for bank services may negatively impact incomes from non-traditional banking activities and non-interest income, which in turn deteriorates bank profitability (Beck and Keil, 2020; Ozili and Arun, 2020; Duan et al., 2021). However, banks may be more resilient to the COVID-19 pandemic crisis due to they have significantly increased their capital ratios after the GFC (Carletti et al., 2020; Acharya and Steffen, 2020b; Acharya et al., 2021).

Elnahass et al. (2021) document that the COVID-19 outbreak has significantly harmed bank financial stability across 116 countries worldwide in the first two quarters of 2020. The authors report a detrimental impact on accounting-based and market-related performance indicators as well as a substantial increase in accounting-based risk indicators. Regarding a bank's stand-alone risk, the results show a higher insolvency risk (LogZscore), a lower credit risk (NPL/Loan), and a higher assets risk (ROA/SDROA) as result of the pandemic shock. These findings are consistently observed for individual countries, countries' income classifications, and bank sizes, among other characteristics. Another international study of bank stability during COVID-19 conducted by Duan et al. (2021), finds that the pandemic increased the systemic riskof banks across 64 countries. This negative effect is more severe for large, highly leveraged, less diversified banks, and undercapitalised banks, among other bank-level features. However, this effect is moderated by bank regulations (e.g., deposit insurance), ownership structures (foreign- and state-owned) and informal institutions such as national culture dimensions.

A number of cross-country studies find that COVID-19 affected both the bank lending growth and credit conditions for borrowers. Colak and Öztekin (2021) provide evidence that bank loan growth decreased across 125 countries in response to the pandemic shock and this effect depends on the country's pandemic intensity. Moreover, this effect depends on bank's financial conditions, market structure, regulatory environment, and the response of the public health sector to the crisis, among others. Özlem Dursun-de Neef and Schandlbauer (2021), using a bank-level exposure COVID-19 measure for European banks, show that a higher COVID-19 exposure led to an increase in lending by worse-capitalised banks, whereas their better-capitalised peers reduced their lending growth. On the other hand, some studies document that the pandemic crisis resulted in tougher credit conditions for borrowers, such as higher loan spreads according to how COVID-19 affected credit risks (Hasan et al., 2021). Recent papers also suggest that firms CDS spreads reactions to the pandemic, which reflect credit risks, are related with firm, debt, and industry characteristics as well as national policies (Liu et al., 2021; Hasan et al., 2021).

Berger et al. (2021a) investigate the effect of relationship lending in loan contracts for the US market during the pandemic crisis, such as whether relationship borrowers fare better or worse in their loan contract terms than other borrowers. In contrast to previous studies (e.g., Bolton et al., 2016), the authors find evidence consistent with the dark side of relationship lending during COVID-19; relationship borrowers are more likely to suffer harsher loan contract terms than non-relationship borrowers during this time of need. Along the same lines, James et al. (2021) suggest that community bank loan officers have greater incentives to grant loans under the Paycheck Protection Program (PPP) to preserve lending relationships compared to loan officers at large banks during the pandemic crisis in the US. The authors find that community banks reacted faster to PPP loan requests and lent more intensively to small businesses than larger banks.[57,58]

Other studies about the impact of COVID-19 on the resilience of the banking system highlight the importance of bank liquidity position. Acharya et al. (2021) examine the crash

[57] The authors define community banks as smallest 85 percent of banks ranked by assets.

[58] For a description of the PPP program, see https://home.treasury.gov/policy-issues/coronavirus/assistance-for-small-businesses/paycheck-protection-program

on US banks stock prices during the first phase of the pandemic crisis (from Januaty 01, 2020 to March 23, 2020) as well as its causes, consequences, and policy implications. Using a novel measure of balance-sheet liquidity risk, the authors report that stock prices of banks with high liquidity risk exposure underperformed relative to those banks with low exposure. Specifically, stock prices of banks with large ex-ante exposures to undrawn credit lines as well as large ex-post gross drawdowns decline more, and this effect is mitigated by bank capital buffers. Further, these banks reduced term loan lending even after FED policies measures were implemented. Acharya and Steffen (2020b) use stress tests to evaluate how COVID-19 has affected the US banks' liquidity insurance function, arguing that pandemic-induced liquidity shock should be manageable due to the healthier capitalisation of banks after the GFC. In this sense, extant literature suggests that US banks met this unprecedented liquidity demand as a result of the substantially more robust bank liquidity and bank capital buffer compared to the GFC, and due to the aggregate liquidity supply from both the FED and depositors (Li et al., 2020; Levine et al., 2020).

Several studies also show the importance of the government's response to the pandemic. On the one hand, Norden et al. (2021) show that the credit supply decreased in Brazil during COVID-19 and suggest that "soft interventions" such as social distancing and mass gathering restrictions mitigate the credit supply shocks and "hard interventions" such as closures of public venues and non-essential services worsen the pandemic shocks. On the other hand, studies such as Sedunov (2021) examine the effectiveness of the Federal Reserve emergency interventions in containing systemic risk during the GFC and the COVID-19 in the US banking system. Although the author finds that during the GFC the lender of last resort and liquidity provisions were effective in reducing systemic risk in the US, there was no relation found between Federal Reserve actions and systemic risk in the first quarter of the COVID-19 crisis.

A related strand of literature has focussed on the impact of COVID-19 on non-financial firms. Ding et al. (2021), explore whether and how corporate characteristics prior to COVID-19 help to insulate the impact of the pandemic shock on stock returns. Using an international sample on more than 6,700 firms, authors report five interesting findings for my study. First, the decline of stock returns was milder for corporations with stronger financial conditions before the crisis, i.e., more liquidity, less debt and more profitability. Second, the study shows

that the decline in stock prices is larger for firms whose suppliers and customers were more exposed to COVID-19. Third, more social corporate responsibility activities prior to the pandemic experience better stock price performance in response to the health crisis. This finding is stronger in countries with social norms that encourage and reward a higher priority on environmental and social issues.[59] Fourth, firms with less entrenched executives perform better in response to pandemic shock, as well as firms with certain specific ownership structures (e.g. family firms perform better than non-family firms).

However, Bae et al. (2021) use a sample of 1,750 US firms and finds no evidence that CSR affected stock returns during the health crisis period between February 18, 2020 and March 20, 2020. Moreover, the authors expand the analysis to examine the Business Roundtable member firms, which publicly committed to protecting stakeholder interest prior to the crisis, reporting that these firms do not perform better during the COVID-19 pandemic.[60] Finally, authors conclude that CSR is ineffective at protecting shareholder wealth during the economic crisis triggered by the COVID-19, as well as how investors can distinguish between genuine CSR and firms engaging in cheap talk.

Along the same lines, Li et al. (2021b) develop a set of measures of firm-level exposure and a response to COVID-19 for 3,019 US firms during the period January 1, 2020 to April 30, 2020. The authors show that firms with a strong corporate culture exhibited better stock price performance than firms without a strong culture. Additionally, and as response to the health crisis, the findings suggest that firms with a strong culture are more likely to place an emphasize on community engagement and adopt digital technology and are less likely to engage in cost cutting than firms without a strong culture. Finally, the authors conclude that corporate culture is an intangible asset designed to meet unpredicted contingencies as they arise (Kreps, 1990).

This chapter adds and expands this literature by studying the unexplored link between banks' default risk and bank culture during the COVID-19 shock. Specifically, **It** investigates

[59] According to Ding et al. (2021), these results are consistent with the view that CSR enhances loyalty and strengthens bonds with stakeholders, which makes workers, suppliers, and customers more willing to making adjustments to support the business in times of distress.

[60] For more details about Business Roundtable see https://www.businessroundtable.org/about-us

whether and how bank culture helps to mitigate the impact of the COVID-19 pandemic crisis on banks' distance to default.

4.3 Data, sample and variables

The main variable of interest are banks' distance to default and the indicators related to bank culture. To compute these variables, I first obtain bank-level financial statement data for 161 US bank holding companies (BHCs) from S&P Capital IQ/SNL Financials. Second, I use stock market prices from Datastream database. Third, to score bank culture I use information from earnings calls transcripts, specifically, the questions and answer section (QA) from S&P Capital IQ. The period of analysis covers the period between 2016 and the end of the first quarter of 2021. The number of BHCs is limited due to the availability of earnings calls transcripts. However, these BHCs accounted for about 70% of US banking system' assets as of 2019.[61] I explain the construction of main variables in turn.

4.3.1 Measuring distance to default

The main indicator of default risk is the distance to default provided by the structural credit risk model of Merton (1974). Distance to default is measured as the difference between the market asset value of the bank (V_A) and the face value of its debt (X) maturing at time T, divided by the standard deviation of the bank's asset value (S_A). This measure has been shown to be a good predictor of defaults, outperforming accounting-based models (Hillegeist et al., 2004; Campbell et al., 2008; Bharath and Shumway, 2008). In the Merton (1974) model, the market equity value (V_E) of a bank is modelled as a call option on the firm's assets:

$$V_E = V_A e^{-DivT} N(d_1) - X e^{-rfT} N(d_2) + (1 - e^{-DivT}) V_A$$

$$d_1 = \frac{\log\left({V_A}/{X}\right) + \left(r - Div + {S_A^2}/{2}\right)T}{S_A\sqrt{T}};\ d_2 = d_1 - S_A\sqrt{T} \qquad (1)$$

[61] Despite the filters are different, the number of BHCs in this sample is similar to those used in studies such as Acharya et al. (2021).

Where r is the risk-free rate and Div is the dividend rate expressed in terms of V_A. S_A is related to equity volatility (S_E) through the following equation:

$$S_E = \frac{V_A e^{-DivT} N(d_1) S_A}{V_E} \tag{2}$$

I simultaneously solve equations (1) and (2) to obtain the values of V_A and S_A. To this end, I employ the market value of equity for V_E and total liabilities as proxy for the face value of debt X. Since the accounting date in on an annual basis, I follow Anginer et al. (2017) to interpolate linearly the values for all dates over the sample period, using beginning and end year values for accounting items. The interpolation method has the advantage of generating a smooth implied asset value process, avoiding jumps in the implied default probabilities at the end of each period (Bartram et al., 2007). Based on Anginer et al. (2017), I compute S_E as the standard deviation of daily equity returns over the past three months. $T$is the time period over which the distance to default is measured and is set to one year. R_f is the risk-free for which I use the one-year US treasury yield. After obtaining the Bank's asset value, V_A, I assign asset return m to be equal to the equity premium of 6% (Campbell et al., 2008). Finally, Merton's distance to default is computed as follow:

$$DD = \frac{\log\left({}^{V_A}/_{X}\right) + (m - Div - {}^{S_A^2}/_{2})T}{S_A\sqrt{T}} \tag{3}$$

As robustness check, I also use an alternative measure of default risk provided by Byström (2006). This measure is a modified version of the Merton formula, which does not rely on distributional assumptions and makes the default risk less sensitive to the leverage ratio at a very high level equity volatility (Anginer et al., 2017). The Byström's distance to default is given by:

$$DD = \frac{\log({}^{X}/_{(V_E + X)})}{({}^{X}/_{(V_E + X)} - 1)S_E}$$

(4)

A higher value of DD indicates a greater distance to default and therefore a lower default risk.

4.3.2 Measuring bank culture.

As mentioned previously in Section 3.3.3 of Chapter 3, I follow the methodology developed by Li et al. (2021a) to generate a culture dictionary and to score the bank cultural values. Using 2,328 quarterly earnings calls transcripts from S&P Capital IQ over the period 2016-2019, I first create a culture dictionary and then obtain the cultural values for 161 US BHCs. Table 4.1 presents the most representative and most frequently occurring words/phrases in my culture dictionary. After generating the culture dictionary, I score each one of the five cultural values at the firm level as the weighted-frequency count of each value-related words averaged over a 1-year window.

Following Li et al. (2021b), I group the five cultural values underlying a strong culture into two subcultures: technology-oriented culture comprised of innovation and quality, and people-oriented culture comprised of integrity, respect, and teamwork. Then, I compute strong culture indicators represented by $StrongCulture_{i,j}$ which is an indicator variable for each bank i that takes the value of one if the cultural value $j = 1, \dots, 5$ is in the top quartile across all banks in the same year, and zero otherwise.

Table 4.1: Culture dictionary

(1) Innovation	(2) Quality	(3) Integrity	(4) Teamwork	(5) Respect
innovative	dedication	responsibility	collaboration	talent
improve_client_experience	customerservice	accountability	cooperation	employee
innovation	customer	integrity	teamwork	team_member
make_banking_easier	service_level	corporate_governance	work_together	teammate
digital_capability	hard_work	transparency	work_closely	experienced_banker
technology_platform	take_care_customer	responsible	strengthen_relationship	team_banker
leverage_technology	quality	oversight	finance_team	banker
technology_enhance	relationshipbanking	supervisory	employee_shareholder	commercial_banker
service_client	service_level	communication	community_banking_model	branch_staff
world-class	hard_work_dedication	manage_risk	dedicated_team	commercial_lender
digital_transformation	reputation	regulate_bank	collaboration_banking	well-respected
global_network	build_relationship	credit_culture	executive_management_team	sale_team
use_technology	safety	safety_soundness	banking_experience	talented_banker
financial_solution	ensure_safety	investment_community	decision-making	thankful
attract_new_customer	quality_relationship	ourinvestor	integrated_approach	Im_grateful

4.3.3 COVID-19 variables

The main indicator of COVID-19 crisis is defined by the dummy variable COVID-19 that takes a value of one since the first COVID-19 case was confirmed in the US, i.e., from January 22, 2020 to the March 31, 2021. Our alternative variable for the COVID-19 crisis is measured as the natural logarithm of one plus the cumulative number of confirmed cases each week represented by $Ln(cases)$.

4.3.4 Control variables

Following the literature that has examined the link between bank stability and bank characteristics (Brunnermeier et al., 2012; Anginer et al., 2014; 2017; 2018), I include the next set of control variables. I include *Bank* Size defined as the logarithm of total assets. Larger banks could pursue riskier business models or strategies as they are considered too big to fail. On the other hand, they could be less risky as a result of better diversification (Anginer et al., 2018). I include a profitability measure represented by the return on assets, *ROA,* that is measured as the ratio of net profit to average total assets. It is expected that more profitable banks tend to exhibit lower default risk (Anginer et al., 2017). I also include a leverage ratio, *Leverage*, specifically the Tier 1 leverage ratio computed according to regulatory guidelines, which is usually defined as Tier 1 capital over tangible assets. I expect

that more capitalised banks tend to have a lower insolvency risk. However, Zhang et al. (2021) report that capital adequacy ratio and capital over risk-weighted assets increases systemic risk. Besides, I include the ratio of total liquid assets to total assets, *Liquid Assets,* which exhibits a positive effect on systemic risk (Brunnermeier et al., 2012)

Non-Interest Income is a proxy for diversification and is computed as the ratio of non-interest income (excluding only gains from securities transactions and nonrecurring items) to average total assets. Previous studies argue that banking activities different to the traditional deposit taking and lending functions lead to a higher contribution of individual banks to systemic risk (Brunnermeier et al., 2012; Bostandzic and Weiss, 2018). In the same lines, DeYoung and Torna (2013) show that higher non-interest income from non-traditional activities that require banks to make asset investments significantly increases a bank's default probability. Finally, as a proxy variable for asset quality, I include *Non-Performing Assets* calculated as the ratio of non-performing assets (nonaccrual loans and leases, renegotiated loans and leases, and real estate owned) as a percent of assets. According to the empirical evidence, it would be reasonable to expect that the higher non-performing assets, the higher the default risk (Brunnermeier et al., 2012). All the variables are explained in detail in Appendix F.

4.3.5 Summary statistics

Table 4.2 presents summary statistics for variables employed in the study. It also presents the mean value for each variable before and during the crisis period as well as the test of difference in means. The main focus is on banks' default risk measures as other bank-specific variables are computed before the pandemic crisis. First, I can observe that banks' distance to default decreased sharply in the pandemic crisis period. Specifically, Merton's distance to default diminished from an average value of 6.922 in the pre-COVID-19 period to an average value of 3.887 during the COVID-19 period. Similarly, Byström's distance to default reduced from an average value of 7.533 to an average value of 3.926 between the pre-COVID-19 and the COVID-19 crisis period. These findings are evident by the significant test of difference in means. The negative impact of pandemic shock on bank stability, particularly on banks' default risk, is quite noticeable, as shown in Figure 1.

Figure 1 shows the behaviour over time of Merton's distance to default. Panel A shows the dynamics over time of Merton's distance to default, both mean and median, from January,

2017 until the end of March, 2021. Panel B exhibits the mean value Merton's distance to default before and during the pandemic crisis. These preliminary results reveal the weakening of bank stability through the increasing banks' default risk as result of the COVID-19 shock.

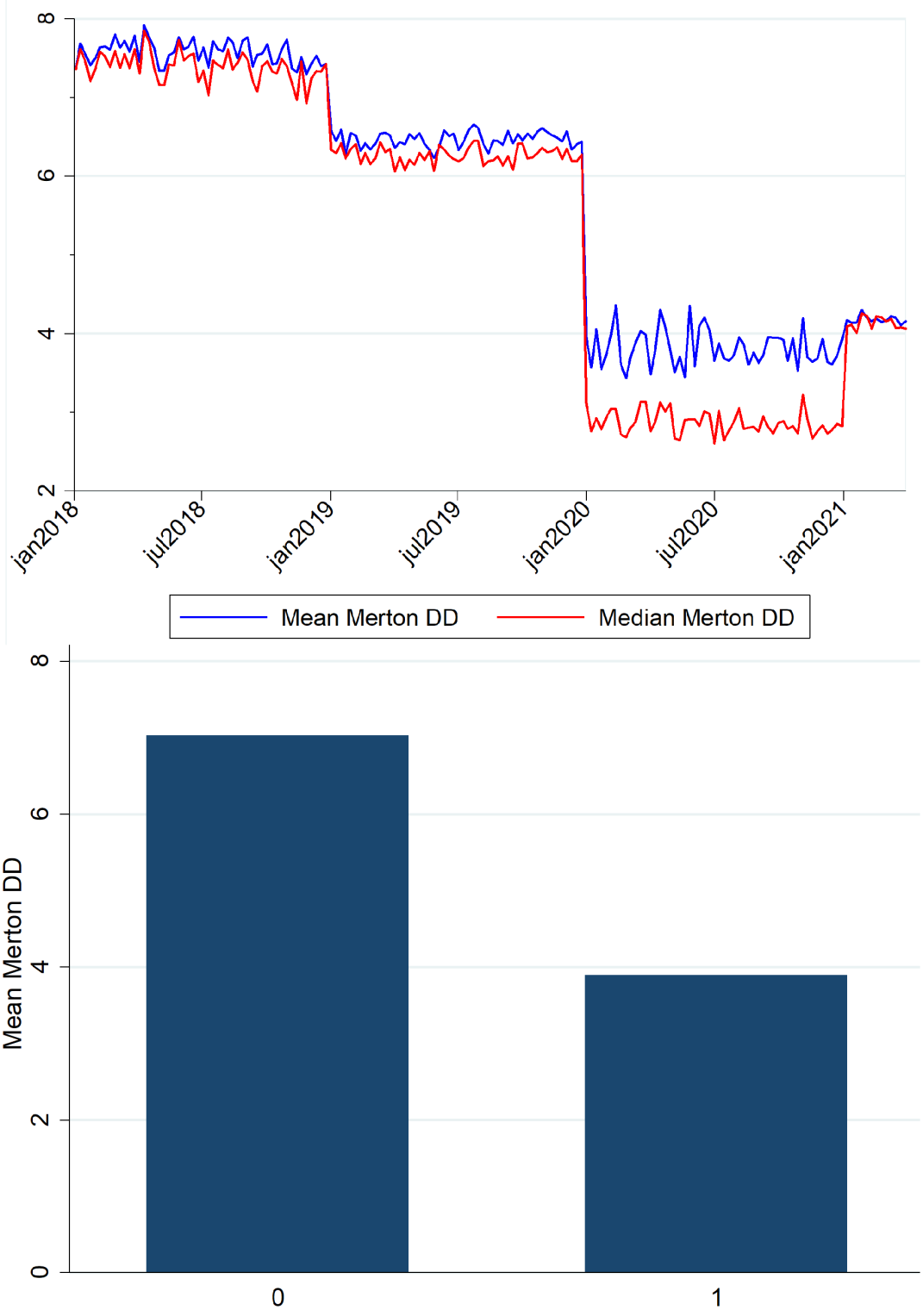
Table 4.2: Descriptive Statistics

VARIABLES	N°Obs	Mean	S.D.	P25	P50	P75	Pre-Covid Mean	Covid Mean	t-test
Merton DD	26,974	5.786	2.651	3.691	5.853	7.523	6.922	3.887	102.3***
Bystrom DD	26,974	6.184	2.750	4.051	6.245	7.964	7.533	3.926	129.2***
Covid19	26,995	0.374	0.484	0	0	1			
LN(Cases)	26,995	5.447	7.306	0	0	14.619	0	14.545	460.00***
Innovation	25,082	1.850	1.041	1.252	1.871	2.602	1.770	1.977	-15.727***
Quality	25,370	2.052	0.757	1.609	2.079	2.564	0.373	0.836	-33.24***
Integrity	25,187	1.246	0.782	0.693	1.321	1.749	1.207	1.307	-9.964***
Teamwork	23,961	0.602	0.877	0.223	0.693	1.252	0.534	0.703	-14.53***
Respect	25,201	1.823	0.815	1.386	1.909	2.397	1.785	1.881	-8.872***
Bank Size	26,983	9.505	1.675	8.400	9.194	10.320	9.499	9.514	-0.702
ROA	26,720	0.011	0.006	0.009	0.011	0.013	0.011	0.012	-9.674***
Leverage Ratio	26,983	0.099	0.017	0.090	0.100	0.110	0.099	0.100	-2.25**
Liquid Assets	26,639	0.225	0.123	0.151	0.190	0.258	0.225	0.225	0.001
Non-Interest Income	26,720	0.016	0.031	0.006	0.009	0.015	0.017	0.014	5.511***
Non-Performing Assets	26,983	.007	0.009	0.003	0.006	0.010	0.007	0.006	4.919***

Notes: This table reports selected descriptive statistics for all the main variables of this study. Merton DD is the Merton's (1974) distance-to-default measure computed as the difference between the market asset value of the bank and the face value of its debt scaled by the standard deviation of the bank's asset value. Bystrom DD is the Bystrom's (2006) distance-to-default measure computed as the simplified version of Merton's (1974), The cultural values of Innovation, Qulaity, Integrity, Respect, and Teamwork are computed as the weighted-frequency count of each value-related words in the QA section of earnings calls averaged over a 1-year window. Bank Size is the Logarithm of total assets. ROA is the ratio of net profit to average total assets. Leverage is the Tier 1 leverage ratio according to regulatory capital guidelines. Liquidity is defined as the ratio of total liquid assets to total assets. Non-Interest Income Noninterest is computed as non-interest income (excluding only gains from securities transactions and nonrecurring items) as a percent of average assets and Non-Performing Assets is the ratio of nonperforming assets (nonaccrual loans and leases, renegotiated loans and leases, and real estate owned) as a percent of assets. For detailed variable description see Appendix F.

Figure 1

Figure 1 shows the behaviour over time of Merton's distance to default. Panel A shows the dynamics over time of Merton's distance to default, both mean and median, from January, 2017 until the end of March, 2021. Panel B exhibits the mean value Merton's distance to default before and during the pandemic crisis.



4.4 Empirical strategy

To assess whether and how bank culture helps to mitigate the impact of COVID-19 on banks' distance to default, I use a three-step procedure. First, I examine the impact of COVID-19 pandemic on banks' default risk. Second, I evaluate how bank characteristics, including bank cultural values, shape banks' distance to default during the COVID-19. Third, I use a DiD approach to further analyse how bank culture helps to mitigate the impact of the pandemic crisis on banks' default risk. Additionally, I conduct several robustness checks.

4.4.1 COVID-19 and banks' distance to default: Panel regressions

I start examining whether the COVID-19 outbreak impact banking stability by testing the hypothesis that the health crisis diminishes the banks' distance to default. To study the impact of COVID-19 pandemic on banks' distance to default, I propose the next Model (1) given by Eq. (7):

$$DD_{i,t} = \alpha + \beta COVID19_t + \gamma X_i + \delta_i + \omega_t + \varepsilon_{i,t} \quad (7)$$

where $DD_{i,t}$ represents the distance to default of bank i in week t. The main measure of default risk is Merton's distance to default, as explained previously. I also include an alternative measure of default risk, specifically the Bystrom's distance to default. $COVID19_t$ is a dummy variable that equals one during the pandemic, since the first COVID-19 case was confirmed in the U.S., and zero otherwise. Additionally, I also compute an alternative indicator measured as the natural logarithm of one plus the cumulative number of confirmed cases each week represented by $Ln(cases)$. Vector X_i is a set of control variables for bank i computed as of December of each previous year, respectively. This vector contains the *Bank Size, ROA, Leverage, Liquidity, Non-Interest Income and Non-Performing Assets*. I include these control variables in a stepwise manner.

I also include a set of fixed effects at different aggregation levels to control for unobservable firm-invariant and time-invariant fixed effects. In particular, fixed effects are included at the bank-level (δ_i) and week-level (ω_t). In this line, bank fixed effects allow us to handle problem of omitted variables, and time fixed effects allow us to capture how the pandemic evolves and other unobserved trends. Finally, $\varepsilon_{i,t}$ is the error term.

Consequently, equation (7) is estimated employing the ordinary least squares (OLS) panel data estimator with robust standard errors. To manage the reverse causality problem, all independent variables are lagged by one period (Bianchi et al., 2021; Pathan et al., 2021). I am aware of potential issues related to this estimation approach (e.g. potential endogeneity). This point is addressed in detail in the robustness check section below.

4.4.2 COVID -19, banks' distance to default and heterogeneity by bank characteristics

To evaluate how bank characteristics shape banks' distance to default during the COVID-19 crisis, I use the following regression Model (2) given by Eq. (8):

$$DD_{i,t} = \alpha + \beta LN(Cases)_t * X_i + \delta_i + \omega_t + \varepsilon_{i,t} \quad (8)$$

where $DD_{i,t}$ represents the distance to default of bank i in week t. The main measure of default risk is Merton's distance to default but I also include the Bystrom's distance to default as a robustness check. In this approach, I only use the natural logarithm of one plus the cumulative number of confirmed cases each week represented by $Ln(cases)$. Eq. (8) contains an array of interactions between bank characteristics (X_i), pre-pandemic characteristics, and $Ln(cases)$. Vector X_i includes several bank-level features such as financial conditions, COVID-19 exposure, and the five bank cultural values. The coefficient estimates on $LN(Cases)_t * X_i$ will allow us to examine how certain bank traits help to mitigate the impact of the health crisis on banks' default risk. I also include a set of fixed effects at different aggregation levels to control for unobservable firm-invariant and time-invariant fixed effects. Specifically, fixed effects are included at the bank-level (δ_i) and week-level (ω_t). Finally, $\varepsilon_{i,t}$ is the error term. I estimate Eq.(8) using ordinary least squares with robust standard errors.

4.4.3 Bank culture and distance to default during the COVID-19 pandemic: Difference-in-Differences approach

To further analyse how bank culture helps to mitigate the impact of the pandemic crisis on banks' default risk, I estimate a difference-in differences model. A conventional DiD setting requires two groups and two periods: the control group and treatment group; pre-treatment period or post-treatment period. In general, two dummy variables are created to indicate

whether an observation gets the treatment or not and whether this observation is in the pre-treatment period or post-treatment period. Then, the difference is tested in the difference between the treated group and control group in the periods. Thus, a significant difference in difference would suggest a significant treatment effect (Cao et al., 2018).

In the DiD approach, I directly compare treatment banks (banks that exhibit a strong culture) with the control banks (banks that do not present a strong culture) before and during the pandemic. This study relies on this comparison for several reasons. For instance, it helps to control for omitted variable bias. Further, the DiD approach avoids potential bias by differencing away trends that affect all banks, regardless of the health crisis, such as regulatory changes (Colak and Oztekin, 2021). To carry out the DiD model, I create a time dummy (COVID19) and a treatment dummy variable (StrongCulture). The DiD method is implemented by the interaction term between the dummy variable for the COVID-19 period and those banks with a strong culture (treatment). The estimated coefficient on the interaction term, φ, will examine whether banks with strong cultural values would increase their default risk less than those with a weak culture. In effect, the DiD model is shown in Eq (9):

$$DD_{i,t} = \alpha + \beta COVID19_t + \lambda StrongCulture_{i,j} + \varphi COVID19_t * StrongCulture_{i,j} + \gamma X_i + \delta_i + \omega_t + \varepsilon_{i,t} \quad (9)$$

The main explanatory variable of interest is $COVID19_t * StrongCulture_{i,j}$, where $COVID19_t$ is a binary indicator that equals one during the pandemic, since the first COVID-19 case was confirmed in the U.S., or zero otherwise. $StrongCulture_{i,j}$ is an indicator variable for each bank i that takes the value of one if the cultural value $j = 1, \ldots, 5$ if it is in the top quartile across all banks in the same year, and zero otherwise. The subindex j indicates the five bank cultural values of innovation, integrity, quality, respect, and teamwork, as defined previously and computed in each year of the pre-pandemic period (2019, 2018, 2017, and 2016). For instance, the indicator variable *Strong_Innovation* takes the value of one if the cultural value of innovation for the bank i is in the top quartile across all banks in the same year, and zero otherwise. I also compute a binary indicator of a strong bank culture, which takes the value of one if the sum of a bank's five cultural values is in the top quartile across all banks in a year, and zero otherwise (*Strong_Culture*).

Vector X_i is a set of control variables for bank i computed for December in each previous year respectively. This vector contains the *Bank Size, ROA, Leverage, Liquidity, Non-Interest Income and Non-Performing Assets*. I also include a set of fixed effects at different aggregation levels to account for unobservable firm-invariant and time-invariant fixed effects. In particular, fixed effects are included at the bank-level (δ_i) and week-level (ω_t). I am aware of potential issues related to this estimation which are addressed in detail in the robustness check section below.

4.5 Empirical results

4.5.1 COVID -19 and banks' distance to default: Panel regressions

My first research assumption is that the COVID-19 shock negatively impacts banking stability, particularly regarding how it increases banks' default risk (diminishes the banks' distance to default). Table 4.3 and 4.4 report the results for the different estimations of Eq. (7) using the dummy variable $COVID19_t$ and the natural logarithm of one plus the cumulative number of confirmed cases each week represented by $Ln(cases)$, respectively. In each table, Panel A exhibits the regression results for the main dependent variable, i.e., Merton's (1974) distance to default ($Merton\ DD$) and Panel B shows the results for the alternative measure of default risk proposed by Byström's (2006) distance to default ($Byström\ DD$). In the first specification, I do not include any control variable related to the bank financial's characteristics (Column 1). These control variables are included in a stepwise manner across Columns (2) to (7).

Table 4.3: Bank's Distance to Default and COVID-19

This table shows panel regressions to estimate the impact of COVID-19 on banks' default risk as given by Model (1) in Eq (7). In Panel A, the dependent variable is Merton's distance to default. In Panel B, the dependent variable is Byström's distance to default. COVID-19 is a dummy variable that equals one during the pandemic, since the first COVID-19 case was confirmed in the U.S., and zero otherwise. All the explanatory variables are defined in detail in Appendix F. All the estimations include bank and week fixed effects. Robust standard errors are reported below coefficient estimates in parentheses and clustered at bank level. Asterisks denote the statistical significance level, wherein (***) indicates a significance level below 1%, (**) less than 5%, and (*) and less than 10%.

Panel A: Merton distance to default and COVID-19							
Variables	Merton distance to default						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
COVID19	-3.197***	-3.197***	-3.195***	-3.193***	-3.165***	-3.165***	-3.165***
	(0.166)	(0.166)	(0.166)	(0.166)	(0.166)	(0.166)	(0.166)
Bank Size		-0.002	-0.004	-0.001	0.008	0.010	0.011
		(0.017)	(0.017)	(0.018)	(0.018)	(0.018)	(0.018)
ROA			1.747	1.247	1.133	3.035	3.084
			(2.700)	(2.785)	(2.831)	(2.964)	(2.986)
Leverage				1.013	0.754	1.222	1.174
				(1.246)	(1.256)	(1.275)	(1.295)
Liquid Assets					-0.421**	-0.334*	-0.333
					(0.205)	(0.208)	(0.208)
Non-Interest Income						-1.873***	-1.871***
						(0.716)	(0.715)
Non-Performing Assets							0.450
							(2.835)
Observations	26,974	26,962	26,699	26,699	26,355	26,355	26,355
R-squared	0.452	0.452	0.453	0.453	0.453	0.453	0.453
Bank FE and Week FE?	YES	YES	YES	YES	YES	YES	YES
Panel B: Byström distance to default and COVID-19							
Variables	Byström distance to default						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
COVID19	-3.226***	-3.227***	-3.223***	-3.224***	-3.189***	-3.190***	-3.189***
	(0.139)	(0.139)	(0.139)	(0.139)	(0.139)	(0.139)	(0.139)
Bank Size		0.015	0.013	0.010	0.017*	0.020*	0.018*
		(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
ROA			4.351***	4.790***	5.328***	8.027***	7.758***
			(1.609)	(1.635)	(1.643)	(1.678)	(1.692)
Leverage				-0.889	-0.787	-0.122	0.142
				(0.732)	(0.740)	(0.753)	(0.714)
Liquid Assets					-0.155	-0.031	-0.037
					(0.107)	(0.109)	(0.109)
Non-Interest Income						-2.657***	-2.667***
						(0.428)	(0.427)
Non-Performing Assets							-2.441
							(2.092)
Observations	26,974	26,962	26,699	26,699	26,355	26,355	26,355
R-squared	0.849	0.849	0.848	0.848	0.848	0.848	0.848
Bank FE and Week FE?	YES	YES	YES	YES	YES	YES	YES

Table 4.4: Bank's Distance to Default and COVID-19

This table shows panel regressions to estimate the impact of COVID-19 on banks' default risk as given by Model (1) in Eq (7). In Panel A, the dependent variable is Merton's distance to default. In Panel B, the dependent variable is Byström's distance to default. $Ln(cases)$ is computed as the natural logarithm of one plus the cumulative number of confirmed cases each week. All the explanatory variables are defined in detail in Appendix F. All the estimations include bank and week fixed effects. Robust standard errors are reported below coefficient estimates in parentheses and clustered at bank level. Asterisks denote the statistical significance level, wherein (***) indicates a significance level below 1%, (**) less than 5%, and (*) and less than 10%.

Panel A: Merton distance to default and LN(Cases)							
Variables	Merton distance to default						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LN(Cases)	-0.185***	-0.185***	-0.185***	-0.185***	-0.184***	-0.184***	-0.184***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Bank Size		-0.002	-0.004	-0.001	0.008	0.010	0.011
		(0.017)	(0.017)	(0.018)	(0.018)	(0.018)	(0.018)
ROA			1.747	1.247	1.133	3.035	3.084
			(2.700)	(2.785)	(2.831)	(2.964)	(2.986)
Leverage				1.013	0.754	1.222	1.174
				(1.246)	(1.256)	(1.275)	(1.295)
Liquid Assets					-0.421**	-0.334*	-0.333
					(0.205)	(0.208)	(0.208)
Non-Interest Income						-1.873***	-1.871***
						(0.716)	(0.715)
Non-Performing Assets							0.450
							(2.835)
Observations	26,974	26,962	26,699	26,699	26,355	26,355	26,355
R-squared	0.452	0.452	0.453	0.453	0.453	0.453	0.453
Bank FE and Week FE?	YES	YES	YES	YES	YES	YES	YES
Panel B: Byström distance to default and LN(Cases)							
Variables	Byström distance to default						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LN(Cases)	-0.187***	-0.187***	-0.187***	-0.187***	-0.185***	-0.185***	-0.185***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Bank Size		0.015	0.013	0.010	0.017*	0.020*	0.018*
		(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
ROA			4.351***	4.790***	5.328***	8.027***	7.758***
			(1.609)	(1.635)	(1.643)	(1.678)	(1.692)
Leverage				-0.889	-0.787	-0.122	0.142
				(0.732)	(0.740)	(0.753)	(0.714)
Liquid Assets					-0.155	-0.031	-0.037
					(0.107)	(0.109)	(0.109)
Non-Interest Income						-2.657***	-2.667***
						(0.428)	(0.427)
Non-Performing Assets							-2.441
							(2.092)
Observations	26,974	26,962	26,699	26,699	26,355	26,355	26,355
R-squared	0.849	0.849	0.848	0.848	0.848	0.848	0.848
Bank FE and Week FE?	YES	YES	YES	YES	YES	YES	YES

Regarding the main variable of interest, all the estimation results reported in Table 4.3 in Panel A and B display a negative and statistically significant effect of $COVID19_t$ on banks' distance to default. Panel A shows that the coefficient estimates on $COVID19_t$ range from -3.197 to -3.165, with an average value equal to -3.182 and statistically significant at the 1% confidence level. This suggests that during the pandemic crisis, the Merton's distance-to-default decreases by 3.182. Similarly, Panel B reports that the coefficient estimates on $COVID19_t$ range from -3.227 to -3.189, with an average value equal to -3.210 and statistically significant at the 1% confidence level. This means that during the pandemic crisis the Byström's distance-to-default diminishes by 3.210. These findings are consistent with descriptive statistics presented in Section 3 and provide support to the first research assumption that the COVID-19 shock negatively impacts banking stability. Particularly, the health crisis increases banks' default risk by reducing the distance-to-default of banks.

Concerning the alternative proxy variable for COVID-19 shock, $Ln(cases)$, Panels A and B of Table 4.4 report a negative and statistically significant effect of the pandemic turmoil on banks' default risk. The coefficients on $Ln(cases)$ are negative and statically significant at 1 % confidence level in all regressions. For instance, in Panel A, the coefficient estimates on $Ln(cases)$ exhibit an average value of -0.185 while in Panel B the average value is equal to -0.186. In terms of the economic magnitude of the estimated relationship, this suggests that a one standard deviation increase in $Ln(cases)$ is associated with, a 1.320 basis point reduction in Merton's distance-to-default, equivalent to 40.8% of the standard deviation of $Merton\ DD$, on average. Likewise, the results indicate that a one standard deviation increase in $Ln(cases)$ is associated with a 1.327 basis point reduction in Byström's distance-to-default, which is equivalent to 48.27% of the standard deviation of $Byström\ DD$, on average.

Turning to the control variables, *Non-Interest Income* exhibits a negative and statistically significant effect on bank's default risk in all regressions reported in columns 6 and 7 of Tables4.3 and 4.4, which is statistically significant at the 1% confidence level. Based on column (7) in Panel A of Table 4.3, an increase of 10 percentage points in non-interest income over total assets would lead to an increase by 18.71 percentage points in Merton's distance-to-default. This finding is consistent with empirical evidence provided by previous studies,

particularly with the notion that non-core banking activities reduce bank stability. For instance, Brunnermeier et al. (2012), and more recently Bostandzic and Weiss (2018), argue that banking activities aside from the traditional deposit taking and lending functions lead to a higher contribution of individual banks to systemic risk. In the same lines, DeYoung and Torna (2013) show that higher non-interest income from non-traditional activities that require banks to make asset investments significantly increases a bank's default probability.

Furthermore, the return on assets variable (ROA) is positive and significant in all the $Byström\ DD$ regressions, suggesting that more profitable banks have lower default risk. In Panel B of Table 4.3, the coefficient estimates exhibit an average value equal to 6.051, which suggests that a one standard deviation increase in ROA is associated with a 3.631 basis point increase in Byström's distance-to-default. This effect is statistically significant at the 1% confidence level. I also find evidence of a statistically significant effect of *Bank Size* and *Liquidity* on bank's distance-to-default at different confidence levels.

4.5.2 COVID -19, banks' distance to default and heterogeneity by bank characteristics

In the next step, I investigate whether the negative impact of COVID-19 on banks' default risk varies across banks with different characteristics. Based on related studies conducted in the context of the global financial crisis (Anginer et al., 2017) and during the ongoing pandemic crisis (Ding et al., 2021; Levine et al., 2021), I hypothesise that certain banks features help them to cope default risk. To assess this prediction, I first examine how certain financial characteristics can help mitigate the impact of COVID-19 on banks' distance-to-default. To this end, I use (i) indicators of bank size (Large Banks, Medium Banks and Small Banks), (ii) indicators of bank exposure to of COVID-19 (High and Low exposure), and (iii) more specific measures related to the financial conditions of banks (*ROA, Leverage, Liquidity, Non-Interest Income and Non-Performing Assets*). Then, I examine the role of bank culture with the extent to which COVID-19 affects the banks' default risk. Specifically, I explore the role of the cultural values of *Innovation, Quality, Integrity, Teamwork* and *Respect* on insulating banks from the pandemic crisis.

To test whether the negative impact of COVID-19 outbreak on banks' default risk varies across banks in these ways, I run Eq. (8) focussing the analyses on the differential relationship between $Ln(cases)$ and banks' distance-to-default by bank characteristics specifically

during the covid crisis. Table 4.5 and 4.6 report the results for the different estimations of Eq. (8) using a dependent variable to Merton's (1974) distance to default ($Merton\ DD$) and Byström's (2006) distance to default ($Byström\ DD$), respectively. In each table, column (1) presents the regression results for measures of bank size, column (2) exhibits the results for indicators of bank exposure to of COVID-19, column (3) displays the outcomes including the indicators in the same model and column (4) shows the estimations results for the full model incorporating measures related to the financial conditions of banks.

Table 4.5: Bank's Distance to Default and COVID19, heterogeneity by bank characteristics

This table shows panel regressions to evaluate how bank characteristics shape banks' distance to default during the COVID-19 as given by Model (2) in Eq (8). The dependent variable is Merton's distance to default. $Ln(cases)$ is computed as the natural logarithm of one plus the cumulative number of confirmed cases each week. All the explanatory variables are defined in detail in Appendix F. All the estimations include bank and week fixed effects. Robust standard errors are reported below coefficient estimates in parentheses and clustered at bank level. Asterisks denote the statistical significance level, wherein (***) indicates a significance level below 1%, (**) less than 5%, and (*) and less than 10%.

Variables	Merton distance to default			
	(1)	(2)	(3)	(4)
Large banks*Ln(Cases)	-0.189***		-0.194***	-0.213***
	(0.010)		(0.010)	(0.017)
Medium banks*Ln(Cases)	-0.178***		-0.181***	-0.199***
	(0.010)		(0.010)	(0.017)
Small banks*Ln(Cases)	-0.191***		-0.194***	-0.213***
	(0.010)		(0.010)	(0.018)
Low Bank Exposure		0.012*	0.012*	0.014**
		(0.007)	(0.007)	(0.007)
High Bank Exposure		0.002	0.001	-0.001
		(0.012)	(0.012)	(0.012)
ROA*Ln(Cases)				0.281
				(0.290)
Leverage Ratio*Ln(Cases)				0.190
				(0.132)
Liquid Assets*Ln(Cases)				-0.016
				(0.017)
Non-Interest Income*Ln(Cases)				0.180***
				(0.070)
Non-Performing Assets*Ln(Cases)				-0.035
				(0.236)
Observations	26,974	26,882	26,882	26,263
R-squared	0.452	0.444	0.445	0.446
Bank FE and Week FE?	YES	YES	YES	YES

Table 4.6: Bank's Distance to Default and COVID19, heterogeneity by bank characteristics

This table shows panel regressions to evaluate how bank characteristics shape banks' distance to default during the COVID-19 as given by Model (2) in Eq (8). The dependent variable is Byström's distance to default. $Ln(cases)$ is computed as the natural logarithm of one plus the cumulative number of confirmed cases each week. All the explanatory variables are defined in detail in Appendix F. All the estimations include bank and week fixed effects. Robust standard errors are reported below coefficient estimates in parentheses and clustered at bank level. Asterisks denote the statistical significance level, wherein (***) indicates a significance level below 1%, (**) less than 5%, and (*) and less than 10%.

Variables	Byström distance to default			
	(1)	(2)	(3)	(4)
Large banks*Ln(Cases)	-0.196***		-0.193***	-0.214***
	(0.009)		(0.009)	(0.011)
Medium banks*Ln(Cases)	-0.184***		-0.179***	-0.198***
	(0.009)		(0.009)	(0.011)
Small banks*Ln(Cases)	-0.193***		-0.188***	-0.209***
	(0.009)		(0.009)	(0.012)
Low Bank Exposure		0.019***	0.020***	0.022***
		(0.003)	(0.003)	(0.003)
High Bank Exposure		-0.021***	-0.023***	-0.025***
		(0.004)	(0.004)	(0.004)
ROA*Ln(Cases)				0.329**
				(0.131)
Leverage Ratio*Ln(Cases)				0.155**
				(0.064)
Liquid Assets*Ln(Cases)				-0.014
				(0.008)
Non-Interest Income*Ln(Cases)				0.319***
				(0.050)
Non-Performing Assets*Ln(Cases)				0.291**
				(0.118)
Observations	26,974	26,882	26,882	26,263
R-squared	0.807	0.807	0.807	0.805
Bank FE and Week FE?	YES	YES	YES	YES

Three key findings emerge from the results reported in Table 4.5 and 4.6. First, the sensitivity of banks' distance-to-default to COVID-19 cases varies across banks by size, whether they are considered as large, medium, or small banks. However, the magnitude of the coefficients is similar and statistically significant at 1% confidence level. Second, a low bank exposure to COVID-19 through its branches helps to mitigate the impact of the health crisis. This finding is more pronounced when I use a dependent variable to $Byström\ DD$ (Table 4.6) compared to $Merton\ DD$ (Table 4.5). Further, Table 4.6 shows a negative and statistically significant effect of a high bank level exposure to COVID-19 on banks' default risk. This would suggest that a higher banks' branch networks, i.e., a higher number of branches

through the states, impact negatively on banks' distance-to-default ($Byström\ DD$). Third, the results reported in column (4) of Table 4.5 and 4.6 shows a positive and statistically significant effect of Non-Interest Income on banks' default risk during the pandemic crisis. Further, column (4) of Table 4.6 indicates that *ROA* and *Leverage* increase bank stability during the COVID-19 crisis.

Regarding the role played by bank culture on insulating banks from the pandemic crisis, Table 4.7 and 4.8 report on the impact of the cultural values of *Innovation, Quality, Integrity, Teamwork,* and *Respect* on $Merton\ DD$ (Table 4.7) and on $Byström\ DD$ (Table 4.8) during the pandemic crisis. As shown in Table 4.7 and 4.8, all interaction terms between $Ln(cases)$ and each one of the bank cultural values enter positively and significantly, which indicate that banks which score high on the cultural dimensions of *Innovation, Quality, Integrity, Teamwork* and *Respect* prior to the health crisis tend to exhibit a lower default risk during the COVID-19 pandemic crisis. For instance, column (1) of Table 4.7 indicates that a one standard deviation increase in the cultural value of innovation is associated with a 0.521 basis point increase in Merton's distance-to-default during the crisis, which is equivalent to 19.6% of the standard deviation of $Merton\ DD$.

Taken together, the results exhibited in Table 4.7 and 4.8 suggest that those banks which strongly promote their cultural values, i.e., banks scoring high on the cultural values of *Innovation, Quality, Integrity, Teamwork, and Respect* prior to the health crisis tend to show a lower default risk during the COVID-19 pandemic crisis. This means that a strong bank culture allows banks to mitigate the negative impact of the health crisis on their risk profile. In the next section, I further analyse the role played by bank culture on banks' default risk during the COVID-19 pandemic crisis.

Table 4.7: Bank's Distance to Default and COVID19, heterogeneity by bank characteristics

This table shows panel regressions to evaluate how bank characteristics shape banks' distance to default during the COVID-19 as given by Model (2) in Eq (8). The dependent variable is Merton's distance to default. $Ln(cases)$ is computed as the natural logarithm of one plus the cumulative number of confirmed cases each week. The cultural values of Innovation, Qulaity, Integrity, Respect, and Teamwork are computed as the weighted-frequency count of each value-related words in the QA section of earnings calls averaged over a 1-year window. All the explanatory variables are defined in detail in Appendix F. All the estimations include bank and week fixed effects. Robust standard errors are reported below coefficient estimates in parentheses and clustered at bank level. Asterisks denote the statistical significance level, wherein (***) indicates a significance level below 1%, (**) less than 5%, and (*) and less than 10%.

Variables	Merton distance to default				
	(1)	(2)	(3)	(4)	(5)
Innovation*Ln(Cases)	0.005**				
	(0.002)				
Quality*Ln(Cases)		0.006**			
		(0.003)			
Integrity*Ln(Cases)			0.007**		
			(0.003)		
Teamwork*Ln(Cases)				0.004*	
				(0.002)	
Respect*Ln(Cases)					0.005**
					(0.003)
Large banks*Ln(Cases)	-0.198***	-0.208***	-0.205***	-0.207***	-0.203***
	(0.017)	(0.018)	(0.017)	(0.017)	(0.017)
Medium banks*Ln(Cases)	-0.186***	-0.197***	-0.194***	-0.193***	-0.192***
	(0.017)	(0.018)	(0.018)	(0.017)	(0.018)
Small banks*Ln(Cases)	-0.200***	-0.211***	-0.208***	-0.210***	-0.204***
	(0.018)	(0.019)	(0.018)	(0.018)	(0.019)
Low Bank Exposure	0.005	0.006	0.006	0.009	0.008
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
High Bank Exposure	0.003	0.004	0.003	0.002	0.003
	(0.011)	(0.012)	(0.012)	(0.012)	(0.011)
ROA*Ln(Cases)	0.143	0.157	0.181	0.234	0.075
	(0.293)	(0.292)	(0.291)	(0.289)	(0.292)
Leverage Ratio*Ln(Cases)	-0.011	0.007	0.025	0.063	0.003
	(0.129)	(0.130)	(0.130)	(0.133)	(0.130)
Liquid Assets*Ln(Cases)	-0.031*	-0.028	-0.023	-0.015	-0.028
	(0.017)	(0.017)	(0.017)	(0.018)	(0.017)
Non-Interest Income*Ln(Cases)	0.162**	0.157**	0.149**	0.158**	0.174**
	(0.068)	(0.068)	(0.068)	(0.069)	(0.069)
Non-Performing Assets*Ln(Cases)	-0.180	-0.198	-0.134	0.094	-0.152
	(0.238)	(0.236)	(0.238)	(0.245)	(0.238)
Observations	24,419	24,657	24,474	23,336	24,538
R-squared	0.451	0.449	0.447	0.451	0.449
Bank FE and Week FE?	YES	YES	YES	YES	YES

Table 4.8: Bank's Distance to Default and COVID19, heterogeneity by bank characteristics

This table shows panel regressions to evaluate how bank characteristics shape banks' distance to default during the COVID-19 as given by Model (2) in Eq (8). The dependent variable is Byström's distance to default. $Ln(cases)$ is computed as the natural logarithm of one plus the cumulative number of confirmed cases each week. The cultural values of Innovation, Quality, Integrity, Respect, and Teamwork are computed as the weighted-frequency count of each value-related words in the QA section of earnings calls averaged over a 1-year window. All the explanatory variables are defined in detail in Appendix F. All the estimations include bank and week fixed effects. Robust standard errors are reported below coefficient estimates in parentheses and clustered at bank level. Asterisks denote the statistical significance level, wherein (***) indicates a significance level below 1%, (**) less than 5%, and (*) and less than 10%.

Variables	Byström distance to default				
	(1)	(2)	(3)	(4)	(5)
Innovation*Ln(Cases)	0.011***				
	(0.001)				
Quality*Ln(Cases)		0.015***			
		(0.001)			
Integrity*Ln(Cases)			0.017***		
			(0.001)		
Teamwork*Ln(Cases)				0.009***	
				(0.001)	
Respect*Ln(Cases)					0.012***
					(0.001)
Large banks*Ln(Cases)	-0.209***	-0.227***	-0.222***	-0.205***	-0.215***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Medium banks*Ln(Cases)	-0.194***	-0.212***	-0.208***	-0.186***	-0.200***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Small banks*Ln(Cases)	-0.204***	-0.224***	-0.219***	-0.199***	-0.209***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Low Bank Exposure	0.017***	0.016***	0.016***	0.020***	0.018***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
High Bank Exposure	-0.017***	-0.015***	-0.016***	-0.019***	-0.016***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
ROA*Ln(Cases)	0.014	0.057	0.114	0.113	0.012
	(0.133)	(0.129)	(0.130)	(0.136)	(0.133)
Leverage Ratio*Ln(Cases)	-0.055	-0.038	0.006	-0.035	-0.038
	(0.057)	(0.057)	(0.056)	(0.059)	(0.057)
Liquid Assets*Ln(Cases)	-0.039***	-0.036***	-0.025***	-0.024***	-0.032***
	(0.009)	(0.008)	(0.008)	(0.009)	(0.008)
Non-Interest Income*Ln(Cases)	0.308***	0.296***	0.274***	0.328***	0.324***
	(0.045)	(0.044)	(0.045)	(0.050)	(0.048)
Non-Performing Assets*Ln(Cases)	0.180	0.113	0.286**	0.476***	0.189
	(0.119)	(0.119)	(0.120)	(0.114)	(0.120)
Observations	24,419	24,657	24,474	23,336	24,538
R-squared	0.822	0.822	0.822	0.824	0.823
Bank FE and Week FE?	YES	YES	YES	YES	YES

4.5.3 Bank culture and distance to default during the COVID-19 pandemic: Difference-in-Differences approach

In this section, I further analyse how bank culture helps to mitigate the impact of the pandemic crisis on banks' default risk. I report the DiD results of estimating Eq. (9) in Table 4.9. *COVID19* indicates the pandemic shock period since the first coronavirus case was confirmed in the US, on January 22, 2020, until the end of the first quarter of 2021. The treatment dummy variables capturing strong cultural values are *Strong_Innovation, Strong_Quality, Strong_Integrity, Strong_Teamwork and Strong_Respect,* which equal one for banks scoring in the top quartile across all banks in the same year, and zero otherwise. Additionally, the treatment variable *Strong_Culture* takes the value of one if the sum of a bank's five cultural values is in the top quartile across all banks in a year, and zero otherwise. These strong cultural values are computed on data prior to the pandemic crisis.

Table 4.9 exhibits separately the estimation results for the main dependent variable, Merton's (1974) distance to default (Panel A), and also for the alternative measure of default risk represented by Byström's (2006) distance to default (Panel B). In both panels, using the six dummy treatment variables separately in each column (*Strong_Innovation, Strong_Quality, Strong_Integrity, Strong_Teamwork, Strong_Respect and Strong_Culture,),* I find consistent results; banks with strong cultural values and strong culture were more resilient in terms of default risk during the pandemic shock than those without strong cultural values and culture. The exception is the cultural dimension of *Teamwork* for which the results presented in column 4, in both panels, do not show a statistically significant effect at the conventional levels. Further, I can mention that the DiD model in Eq. (9) is well-fitted with a R-squared equal to 45.3%, on average, in Panel A, and equal to 84.8% %, on average, as shown in Panel B.

Table 4.9: Bank's Distance to Default and COVID19: the role of bank culture

This table presents difference-in-differences regressions to analyse how bank culture helps to mitigate the impact of the pandemic crisis on banks' default risk given by the DiD baseline Eq (9). In Panel A, the dependent variable is Merton's distance to default. In Panel B, the dependent variable is Byström's distance to default. All the explanatory variables are defined in detail in Appendix F. All the estimations include bank and week fixed effects. Robust standard errors are reported below coefficient estimates in parentheses and clustered at bank level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Merton distance to default and culture.						
Variables	Merton distance to default					
	(1)	(2)	(3)	(4)	(5)	(6)
COVID19*Strong_Innovation	0.242***					
	(0.064)					
COVID19*Strong_Quality		0.137**				
		(0.066)				
COVID19*Strong_Integrity			0.252***			
			(0.065)			
COVID19*Strong_Teamwork				0.002		
				(0.066)		
COVID19*Strong_Respect					0.121*	
					(0.064)	
COVID19*Strong_Culture						0.172***
						(0.067)
COVID19	YES	YES	YES	YES	YES	YES
Strong Cultural Values	YES	YES	YES	YES	YES	YES
Control Variables	YES	YES	YES	YES	YES	YES
Observations	26,355	26,355	26,355	26,355	26,355	26,355
R-squared	0.453	0.453	0.453	0.453	0.453	0.453
Bank FE and Week FE?	YES	YES	YES	YES	YES	YES
Panel B: Byström distance to default and culture.						
Variables	Byström distance to default					
	(1)	(2)	(3)	(4)	(5)	(6)
COVID19*Strong_Innovation	0.268***					
	(0.033)					
COVID19* Strong_Quality		0.250***				
		(0.035)				
COVID19* Strong_Integrity			0.369***			
			(0.033)			
COVID19* Strong_Teamwork				-0.010		
				(0.034)		
COVID19* Strong_Respect					0.160***	
					(0.030)	
COVID19*Strong_Culture						0.199***
						(0.035)
COVID19	YES	YES	YES	YES	YES	YES
Strong Cultural Values	YES	YES	YES	YES	YES	YES
Control Variables	YES	YES	YES	YES	YES	YES
Observations	26,355	26,355	26,355	26,355	26,355	26,355
R-squared	0.848	0.848	0.849	0.848	0.848	0.848
Bank FE and Week FE?	YES	YES	YES	YES	YES	YES

Column (1) of Panel A shows an estimated coefficient on *COVID19*Strong_Innovation* equal to 0.242 and statistically significant at 1% level. This indicates that banks with a strong cultural value of Innovation increased their Merton' distance-to-default in 0.242 compared to those without a strong cultural value of Innovation during the COVID-19 crisis. This suggests that banks which strongly promote an innovation-oriented culture and, thus, score high in the cultural value of innovation, are more resilient in terms of default risk than their counterparts during external shocks. Similarly, in column (3), the estimated coefficient on *COVID19*Strong_Integrity* is equal to 0.252 and statistically significant at 1% level. This allows us to infer that a bank culture strongly oriented toward integrity helps banks to increase their Merton's distance-to-default by 0.252 relative to those banks without this cultural orientation.

Regarding to the treatment variable *Strong_Culture,* column (6) reports an estimated coefficient equal to 0.172 and is statistically significant at 1% level. This means that during COVID-19, a strong bank culture allows a bank to exhibit a lower default risk compared to those without a strong culture. Specifically, banks with a strong bank culture have a relatively lower default risk (higher distance –to-default) during the pandemic crisis. Finally, the coefficient estimates reported in columns (2) and (5) of Panel A show a positive effect of the cultural values of quality and respect, which are statistically significant at the 5% and 10% level, respectively.

In summary, the results from the DiD identification in Eq. (9) are consistent with previous findings obtained from the panel regressions of Eq (8) and reported in Tables 4.7 and 4.8. Particularly, banks scoring high on the cultural values of *Innovation, Quality, Integrity and Respect* before the health crisis tend to show less default risk during the COVID-19 turmoil. Additionally, a strong bank culture allows banks to mitigate the negative impact of the pandemic shock on banks' default risk.

4.5.4 Robustness checks

I extend this analysis by providing corroborating evidence of the results from the DiD identification in Eq. (9). First, I carry out a placebo DiD analysis which allow us to check the pre-existing trends in the data under the assumption that a placebo shock arrived a year earlier than the actual pandemic shock. Second, I check the robustness of the results by applying an

entropy balancing procedure to improve covariate balance between the treatment and control groups. Finally, I use a Propensity Score Matching procedure to account for potential endogeneity issues within the identification approach as well as a sample selection bias.

4.5.4.1 Placebo test

I introduce a placebo test to rule out the possibility that the estimated "*Culture Effect*", the interacted effect given by $COVID19_t * StrongCulture_{i,j}$, may either be explained by non-crisis related trends in the treatment and control groups. According to Poczter (2016), a placebo test provides a reliable identification test by removing the actual treatment period from the regression sample to avoid distorting the test. Consequently, I remove the real pandemic crisis observations (January 2020 to March 2021) and use a falsification crisis period (January, 2019 to December, 2019). I then rerun the DID regression in Eq. (9), using the placebo shock period as the dummy variable $COVID19_t$, its interaction with the cultural variables represented by $StrongCulture_{i,j}$, and the same controls as in Eq (9). The results from this placebo DiD analysis are exhibited in Table 4.10 in which Panel A and B show the results for the dependent variables Merton's distance-to-default and Byström's distance-to-default, respectively. For simplicity I only report the results for the main variable of interest, i.e., the interaction terms between $COVID19_t$ and $StrongCulture_{i,j}$.

The coefficient estimates on the interaction between $COVID19_t$ and the six dummy treatment variables capturing strong bank culture (*Strong_Innovation, Strong_Quality, Strong_Integrity, Strong_Teamwork, Strong_Respect and Strong_Culture,)* are negative and statistically insignificant. The exception is the coefficient estimate for *Covid19*Strong_Respect* in column 6 of both panels, which is negative and statistically significant at the conventional levels. These findings provide support to the previous results reported in Table 4.9.

In summary, the insignificant and negative estimated coefficients indicate that the baseline estimations of the "Culture Effect" in the DiD equation (9) capture the unique effect of the bank culture during the pandemic crisis. Failing to find a positive treatment effect under this falsification test provides further support to the causal interpretation of the results.

Table 4.10: Placebo test

This table reports the estimation results for the DiD baseline Eq. (9) derived from a placebo test to rule out the possibility that the estimated culture effect (or treatment effect) may either be explained by non-crisis related trends in the treatment and control groups. In this first placebo test, I modified the crisis period to the January, 2019 to December, 2019. In Panel A, the dependent variable is Merton's distance to default. In Panel B, the dependent variable is Byström's distance to default. All the explanatory variables are defined in detail in Appendix F. All the estimations include bank and week fixed effects. Robust standard errors are reported below coefficient estimates in parentheses and clustered at bank level. ∗, ∗∗, and ∗∗∗ indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Merton distance to default and culture.						
Variables	Merton distance to default					
	(1)	(2)	(3)	(4)	(5)	(6)
Covid19*Strong_Innovation	-0.063					
	(0.052)					
Covid19*Strong_Quality		0.043				
		(0.053)				
Covid19*Strong_Integrity			-0.083			
			(0.053)			
Covid19*Strong_Teamwork				-0.063		
				(0.055)		
Covid19*Strong_Respect					-0.194***	
					(0.053)	
Covid19*Strong_Culture						-0.024
						(0.054)
Covid19	YES	YES	YES	YES	YES	YES
Strong Cultural Values	YES	YES	YES	YES	YES	YES
Control Variables	YES	YES	YES	YES	YES	YES
Observations	26,355	26,355	26,355	26,355	26,355	26,355
R-squared	0.453	0.453	0.453	0.453	0.453	0.453
Bank FE and Week FE?	YES	YES	YES	YES	YES	YES
Panel B: Byström distance to default and culture.						
Variables	Byström distance to default					
	(1)	(2)	(3)	(4)	(5)	(6)
COVID19*Strong_Innovation	-0.012					
	(0.034)					
COVID19*Strong_Quality		0.018				
		(0.034)				
COVID19*Strong_Integrity			-0.052			
			(0.034)			
COVID19*Strong_Teamwork				-0.006		
				(0.038)		
COVID19*Strong_Respect					-0.172***	
					(0.034)	
COVID19*Strong_Culture						0.048
						(0.037)
COVID19	YES	YES	YES	YES	YES	YES
Strong Cultural Values	YES	YES	YES	YES	YES	YES
Control Variables	YES	YES	YES	YES	YES	YES
Observations	26,355	26,355	26,355	26,355	26,355	26,355
R-squared	0.848	0.848	0.848	0.848	0.848	0.848
Bank FE and Week FE?	YES	YES	YES	YES	YES	YES

4.5.4.2 Difference-in-Differences augmented with entropy balancing

A potential concern about the DiD identification Eq (9) is that the relation between the cultural effect or treatment effect given by $COVID19_t * StrongCulture_{i,j}$ and banks' distance to default could be influenced by factors that are not adequately controlled in the regression models. For instance, omitted variables or functional form misspecifications may create endogeneity bias and, thus, spurious inferences (Shipman et al., 2017). To overcome the issues, I follow to Colak and Oztekin (2021) and use the entropy balanced matching approach of Hainmueller (2012). With this approach, each observation in the control group is weighted such that the post-weighting distributions of each matching control variable for the treatment and control groups are identically distributed. This rebalancing (or reweighing) scheme of the control sample applies new weights to each observation in that sample so that the distribution moments of the first three moments of the covariates are equalised across treatment and weighted control observations.

Table 4.11 Panel A exhibits the covariate balance after applying entropy balancing whereby the first three moments (mean, variance and skewness) are equalised between the treatment and control groups. As it can be observed in the last three columns, covariate balance for all control variables is achieved and, in turn, the two groups (or samples) are identically distributed for each control variable. This outcome assures that any remaining differences in the outcome variable (distance to default) between the groups are driven by the main independent variables given by $COVID19_t * StrongCulture_{i,j}$.

Panel B shows the regression results after reaching a covariate balance via entropy balancing and for the main dependent variable Merton's distance to default. Alternatively, Panel C exhibits the same regression results by using a dependent variable to Byström's distance to default. Taken together, the results presented in Table 4.11 are in line with those reported previously and suggest that banks with strong cultural values and a strong culture are more resilient in terms of default risk during the pandemic shock than those without strong cultural values and culture.

Table 4.11: Bank's Distance to Default and COVID19; the role of bank culture

The table shows results from the entropy balancing procedure to improve covariate balance between the treatment and control groups by weighing observations such that the post-weighing distribution moments (mean, variance, and skewness) for the treatment and control samples are equal for each matching dimension. Panel A exhibits the covariate balance after applying entropy balancing whereby the first three moments (mean, variance and skewness) are equalised between the treatment and control groups. Panel B shows the regression results after reaching entropy balancing and for the main dependent variable Merton's distance to default. Panel C exhibits the same regression results by using a dependent variable to Byström's distance to default. All the explanatory variables are defined in detail in Appendix F. All the estimations include bank and week fixed effects. Robust standard errors are reported below coefficient estimates in parentheses and clustered at bank level. ∗, ∗∗, and ∗∗∗ indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Covariate balance: Differences in covariates' distribution after entropy balancing

	Treatment			Control					
Covariate variables	Mean	Var	Skew	Mean	Var	Skew	Mean (Diff.)	Var (Diff.)	Skew (Diff.)
Size	9.515	2.613	1.065	9.515	2.613	1.065	0.000	0.00	0.000
ROA	1.156	0.330	-0.406	1.156	0.330	-0.406	0.000	0.00	0.000
Leverage Ratio	9.954	2.501	1.426	9.954	2.501	1.427	0.000	0.00	0.000
Liquid Assets	22.32	1.490	1.865	22.32	1.490	1.865	0.000	0.00	0.000
Non-Interest Income	1.466	6.157	6.336	1.466	6.159	6.339	0.000	0.003	0.004
Non-Performing Assets	0.676	0.719	3.401	0.676	0.719	3.401	0.000	0.000	0.000

Panel B: Regressions with post-balancing sample-Merton DD

	(1)	(2)	(3)	(5)	(6)	(7)
COVID19*Strong_Innovation	0.235***					
	(0.065)					
COVID19* Strong_Quality		0.089				
		(0.057)				
COVID19* Strong_Integrity			0.245***			
			(0.066)			
COVID19* Strong_Teamwork				0.018		
				(0.066)		
COVID19* Strong_Respect					0.124*	
					(0.064)	
COVID19*Strong_Culture						0.182***
						(0.067)
Observations	26,355	26,355	26,355	26,355	26,355	26,355
R-squared	0.4154	0.4152	0.4154	0.4152	0.4152	0.4155
Week FE and Bank FE	YES	YES	YES	YES	YES	YES

Panel C: Regressions with post-balancing sample: Byström DD

	(1)	(2)	(3)	(5)	(6)	(7)
COVID19*Strong_Innovation	0.274***					
	(0.033)					
COVID19* Strong_Quality		0.167***				
		(0.028)				
COVID19* Strong_Integrity			0.366***			
			(0.033)			
COVID19* Strong_Teamwork				0.023		
				(0.034)		
COVID19* Strong_Respect					0.165***	
					(0.030)	
COVID19*Strong_Culture						0.219***
						(0.035)
Observations	26,355	26,355	26,355	26,355	26,355	26,355
R-squared	0.866	0.866	0.866	0.866	0.866	0.866
Week FE and Bank FE	YES	YES	YES	YES	YES	YES
COVID19	YES	YES	YES	YES	YES	YES
Bank Cultural Values	YES	YES	YES	YES	YES	YES
Control Variables	YES	YES	YES	YES	YES	YES

4.5.4.3 Propensity score matching estimations

Since the banks share similar observables characteristics, a matching DiD approach can further improve the quality of the previous results on the "Culture Effect". Following Elnahass et al. (2021), I use a three step procedure of Propensity Score Matching (PSM), starting with an estimation of the propensity scores for any banks observed in the COVID-19 period (post-treatment period), and with a strong culture (treatment group), and those observed during the COVID-19 crisis (post-treatment period) without a strong culture (control group). Once I obtain the propensity scores by using a probit model, I proceed to the second step in which I match the samples employing 1:1 nearest neighbor matching without replacement. Next, I test the average effects of strong bank culture during the pandemic crisis on banks' default risk.

In Tables 4.12 and 4.13, Panel A shows univariate findings for the average treatment effects with the 1:1 nearest neighbor matching without replacement for each one of the six dummy treatment variables capturing strong bank culture (*Strong_Innovation, Strong_Quality, Strong_Integrity, Strong_Teamwork, Strong_Respect and Strong_Culture,)*. Overall, the results presented in Panel A of Table 4.12 and 4.13 reveal that banks' default risk are lower for the treatment group (or banks with strong cultural values and strong culture) than the control group (or banks without strong cultural values and strong culture). Additionally, the regression results for the matched sample in Panel B of Tables 4.12 and 4.13 also indicate that strong cultural values and a strong culture reduce the banks' default risk during the pandemic crisis compared to those banks without strong cultural values and bank culture.

Table 4.12: Propensity Score Matching

This table reports PSM results to account for potential endogeneity issues as well as sample selection bias. Panel A shows univariate findings for the average treatment effects with 1:1 nearest neighbour matching without replacement for each one of the six dummy treatment variables capturing strong bank culture. Panel B exhibits the regression results for the matched sample according to the DiD baseline Eq. (9). The dependent variable is Merton's distance to default. All the explanatory variables are defined in detail in Appendix F. All the estimations include bank and week fixed effects. Robust standard errors are reported below coefficient estimates in parentheses and clustered at bank level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Average treatment effects (ATE) with 1:1 nearest neighbor matching without replacement

Variables		Treated	Control	Diff.	S.E.	T-stat
COVID19*Strong_Innovation						
	Unmatched	3.823	6.022	-2.199***	0.050	-43.97
	Matched	3.823	6.17	-2.350***	0.046	-50.60
COVID19* Strong_Quality						
	Unmatched	3.902	6.049	-2.146***	0.047	-45.42
	Matched	3.902	5.633	-1.730***	0.038	-45.38
COVID19* Strong_Integrity						
	Unmatched	3.839	6.090	-2.250***	0.045	-49.96
	Matched	3.839	6.207	-2.367***	0.041	-56.93
COVID19* Strong_Teamwork						
	Unmatched	3.912	6.057	-2.145***	0.046	-46.08
	Matched	3.912	5.856	-1.944***	0.042	-45.76
COVID19*Strong_Respect						
	Unmatched	3.911	6.093	-2.181***	0.044	-49.16
	Matched	3.911	5.961	-2.049***	0.040	-50.32
COVID19* Strong_Culture						
	Unmatched	3.799	5.985	-2.186***	0.053	-40.49
	Matched	3.799	6.163	-2.364***	0.048	-48.86

Panel B: Regressions on matched samples

Variables	Merton distance to default					
	(1)	(2)	(3)	(4)	(5)	(6)
COVID19*Strong_Innovation	2.153***					
	(0.258)					
COVID19*Strong_Quality		1.472***				
		(0.225)				
COVID19*Strong_Integrity			2.095***			
			(0.214)			
COVID19*Strong_Teamwork				1.533***		
				(0.211)		
COVID19*Strong_Respect					1.601***	
					(0.199)	
COVID19*Strong_Culture						1.492***
						(0.310)
COVID19	YES	YES	YES	YES	YES	YES
Strong Cultural Values	YES	YES	YES	YES	YES	YES
Control Variables	YES	YES	YES	YES	YES	YES
Observations	5,862	6,650	7,314	6,870	7,612	4,992
R-squared	0.3010	0.2544	0.2996	0.2723	0.2720	0.2941
Week FE and Bank FE?	YES	YES	YES	YES	YES	YES

Table 4.13: Propensity Score Matching

This table reports PSM results to account for potential endogeneity issues as well as sample selection bias. Panel A shows univariate findings for the average treatment effects with 1:1 nearest neighbour matching without replacement for each one of the six dummy treatment variables capturing strong bank culture. Panel B exhibits the regression results for the matched sample according to the DiD baseline Eq. (9). The dependent variable is Byström's distance to default. All the explanatory variables are defined in detail in Appendix F. All the estimations include bank and week fixed effects. Robust standard errors are reported below coefficient estimates in parentheses and clustered at bank level. ∗, ∗∗, and ∗∗∗ indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Average treatment effects (ATE) with 1:1 nearest neighbor matching without replacement

Variables		Treated	Control	Diff.	S.E.	T-stat
COVID19*Strong_Innovation						
	Unmatched	3.920	6.460	-2.540***	0.051	-49.45
	Matched	3.920	6.728	-2.808***	0.043	-64.84
COVID19* Strong_Quality						
	Unmatched	4.075	6.481	-2.405***	0.048	-49.45
	Matched	4.075	6.096	-2.020***	0.035	-57.53
COVID19* Strong_Integrity						
	Unmatched	3.963	6.535	-2.571***	0.046	-55.65
	Matched	3.963	6.778	-2.815***	0.039	-70.69
COVID19* Strong_Teamwork						
	Unmatched	4.021	6.501	-2.480***	0.047	-51.91
	Matched	4.021	6.341	-2.320***	0.039	-59.02
COVID19*Strong_Respect						
	Unmatched	4.001	6.545	-2.544***	0.045	-56.02
	Matched	4.001	6.478	-2.477***	0.038	-65.10
COVID19* Strong_Culture						
	Unmatched	3.888	6.417	-2.529***	.055	-45.55
	Matched	3.888	6.741	-2.853***	.044	-64.45

Panel B: Regressions on matched samples

Variables	Byström distance to default					
	(1)	(2)	(3)	(4)	(5)	(6)
COVID19*Strong_Innovation	2.536***					
	(0.228)					
COVID19*Strong_Quality		0.673***				
		(0.198)				
COVID19*Strong_Integrity			1.358***			
			(0.196)			
COVID19*Strong_Teamwork				0.952***		
				(0.188)		
COVID19*Strong_Respect					2.144***	
					(0.178)	
COVID19*Strong_Culture						2.173***
						(0.278)
COVID19	YES	YES	YES	YES	YES	YES
Strong Cultural Values	YES	YES	YES	YES	YES	YES
Control Variables	YES	YES	YES	YES	YES	YES
Observations	5,862	6,650	7,312	6,868	7,610	4,990
R-squared	0.4377	0.4270	0.4313	0.4123	0.3976	0.4196
Week FE and Bank FE?	YES	YES	YES	YES	YES	YES

4.6 Conclusion

This study examines whether and how bank culture helps to mitigate the impact of COVID-19 on banks' default risk. To the best of my knowledge, this is an unexplored question that deserves to be answered as banks' default risk is the ultimate risk that matters for banking stability, and is the risk that regulators are most likely to care about the most (Anginer et al., 2017). To this end, I measure and group the five cultural values underlying a strong culture into two subcultures: technology-oriented culture comprised of innovation and quality, and people-oriented culture comprised of integrity, respect and teamwork (Li et al., 2021a,b).

First, I show that COVID-19 negatively impacts banking stability, i.e., the pandemic crisis increases banks' default risk by reducing the distance-to-default of banks. Second, I find that despite COVID-19 shock increased banks' default risk, banks with a strong culture exhibit a lower default risk than their peers without a strong culture. Third, I find that banks with a strong technology-oriented culture show less default risk than their counterparts during the pandemic crisis. Among the three components of people-oriented culture, only integrity helps to mitigate the impact of COVID-19. Finally, I find that low bank exposure to COVID-19 through its branches and a high non-interest income help to mitigate the negative impact of the health crisis on banks' default risk.

These findings have implications for supervisors and bank managers alike. The results suggest supervisors' assessment of culture should focus on encouraging and aligning technology-oriented cultural values with a bank's strategic goals. Regulators should create incentives for banks to invest and develop these bank values. This might reduce the future burden on regulators in case of future shocks derived, for instance, from climate change risks. Additionally, investors would be wise to invest in banks with those cultural characteristics as they prove more resilient during downturns. In the event of default, banks are not able to pay its depositors and, thus, equity holders receive nothing.

CHAPTER 5: CONCLUSION

The Global Financial Crisis (GFC) has revealed several weaknesses in the supervision and regulation of international banking and has highlighted the importance of cooperation among banking supervisors in the transmission of shocks (e.g., De Hass and van Lelyveld, 2014). In the same vein, practitioners, researchers and financial regulators have argued that failures in corporate governance and, particularly, in bank culture were shortcomings of financial system before and during the crisis (e.g., Group of Thirty, 2015; Thakor, 2016; Berger et al., 2016). In this sense, regulators may influence bank culture by focussing on corporate governance and on existing regulations (Thakor, 2020). Consequently, banking supervisors in several jurisdictions have developed approaches to supervision that aim to assess culture, conduct and governance (Dudley, 2015).

This PhD research examines the relationship between banking regulations/supervision and financial stability. Regarding to financial stability, I focus on the financial sector and, specifically, on the banking industry. I first examine the role of foreign banks in the transmission of shocks through the lending channel. Additionally, I study banking stability through several indicators of a bank's stand-alone risk, such as the bank's z-score and the Merton (1974)' distance to default, among others. Concerning banking supervision and regulations, I examine two underexplored topics: the role of supervisory cooperation agreements and bank culture for banking stability. The results of this PhD research contribute to the banking literature by providing several new facts, as follows.

5.1 Summary of Findings

The first empirical chapter (Chapter 2) examines how lending behavior of foreign banks is affected by cross-border banking supervision during the global financial crisis. To this end, I collect data by hand on bilateral and multilateral cooperation agreements at the country-level for countries in Central Eastern Europe (CEE) and Latin America (LA). Then, I classify these agreements as three types: MoU for information sharing, MoU for crisis management and resolution and colleges of supervisors (CS). The results show that these cooperation agreements help to mitigate the reduction in foreign lending growth by between 3.6% and 9.9%, relative to their counterparts during the GFC. Besides, this mitigating effect is positively related to the level of supervisory power and the number of on-site inspections and

negatively associated with the level of supervisory consolidation. Other regulatory and supervisory arrangements are less strongly related to this matter.

The second empirical chapter (Chapter 3) analyses how board attributes influence bank risk-taking behaviour through bank culture. Following to Li et al (2021), I use a machine learning technique-the word embedding model- to score the five cultural values of *innovation, quality, integrity, respect* and *teamwork.* This study reveals that board attributes influence bank risk-taking through the cultural values of *innovation, quality, and integrity.* No significant evidence is found for the cultural values of respect and teamwork. First, board gender diversity affects positively the bank cultural values of *Innovation, Quality and Integrity*, which in turn reduce bank-risk taking. Second, CEOs Age impact negatively the cultural values of *Innovation* and *Quality,* leading to an increase in bank risk. Third, CEO's power impacts positively the bank cultural values of *Integrity* and *Innovation,* which translate in less bank-risk taking.

Bank's distance to default contributes to financial stability due to the high default risk co-dependence among banking institutions (e.g., Anginer and Demirguc-Kunt, 2014). In the third empirical chapter (Chapter 4), I investigate whether and to what extend bank culture helps to insulate banks' default risk amid Covid-19 pandemic shock. First, the findings show that Covid-19 shock impacts negatively on bank stability, i.e., the pandemic crisis increases banks' default risk by reducing the distance-to-default of banks. Specifically, during the pandemic crisis the Merton's distance-to-default decreases by 3.182 and, alternatively, the Bystrom's distance-to-default diminishes by 3.210. Considering that the sample average of Merton's and Bystrom's distance-to-default are 5.786 and 6.184, respectively, the results indicate a significant meaningful impact of Covid-19 on banks' default risk. Then, the estimates show that despite Covid-19 shock increased banks' default risk, banks with a strong culture exhibit lower default risk than their peers without strong culture. Furthermore, the results show that banks with strong culture on the cultural values of *Innovation, Quality and Integrity* before the health crisis tend to show less default risk during the Covid-19 turmoil. Finally, I find low bank exposure to Covid-19 through its branches as well as high non-interest income help to mitigate the negative impact of the health crisis on banks' default risk.

5.2 Contributions of the Study

This PhD research contributes to the banking literature by expanding the empirical evidence on the relationship between bank regulation/supervision and financial stability in three cohesive chapters. Chapter 2 contributes to the recent literature on bank lending (e.g., Allen et al., 2017; Adams-Kane et al., 2017) by investigating the role of cooperation agreements in the lending behaviour of foreign banks in CEE and LA countries. The role of supervisory cooperation is not incorporated into their analysis. The closest paper on this topic by De Haas et. al. (2015) limits the discussion to the Vienna Initiative of 2008, in which country specific commitment letters were signed by western European banks through which they pledged to maintain exposure to support their subsidiaries in emerging Europe. Recently, Beck et al. (2021) examine the role of cooperation agreements but focusing on bank risk-taking.

Chapter 3 relates and contributes to three strand of literatures. First, it expands the emerging line of literature about bank culture (e.g., Song and Thakor, 2019; Bianchi et al., 2021). Other studies investigate the impact of national culture on bank risk-taking using international samples (e.g., Mourouzidou-Damtsa et al., 2019; Berger et al., 2021c). The second strand of literature relates to the growing body of literature about how to measure corporate culture and its impact on different aspects of business operations (e.g., Guiso et al., 2015; Graham et al., 2019). Third, this essay also adds to the literature on corporate governance and bank risk-taking (e.g., Anginer et al., 2018) and, more specifically, to the existing research on the effects of manager/director attributes on bank risk (e.g., Hagendorff et al., 2021). I extend this literature by documenting the unexplored link between bank culture, board attributes and bank risk-taking.

Chapter 4 contributes to the rapidly emerging literature on the impact of the Covid-19 shock on the banking sector in aspects such as bank lending (Colak and Oztekin, 2021), deposit growth (Levine et al., 2021), performance (Elnahass et al., 2021), bank systemic risk (Dual et al., 2021) among others. This essay expands this line of research by investigating the link between bank culture and banks' distance to default during Covid-19 turmoil. Specifically, this study contributes by providing evidence on how bank culture helps to mitigate the impact of pandemic shock on banks' default risk. To the best of my knowledge, this is an unexplored question that deserve to be answered as banks' default risk is the ultimate risk that matter for banking stability and the risk that regulators are likely to care the most (Anginer et al., 2017).

5.3 Implications of the Study

These findings have several implications for policymakers and market participants alike. First, the GFC led to an increase in regional and global cooperation, mainly related to information sharing; however, there remains a lack of cooperation among national and international supervisors (Berger et al., 2021; Beck et al., 2021). Additionally, existent cross-border regulation and supervision has been carried out primarily among banking authorities in advanced economies. Nevertheless, they mostly focus on enhancing the effectiveness of the Basel accords and advising a set of principles for effective banking supervision (Beck, 2016). Therefore, my results suggest enhancing supervisory coordination and cooperation among national and international regulators worldwide to mitigate the international transmission of shocks. This cooperation should also be expanded and include elements related to crisis management and resolution. Based on recent events about cyber-attacks and developments in the financial industry (e.g., FinTech), cooperation among national and international regulators should address these facts that threaten financial stability.

Second, the results of this research reveal that gender diversity and CEO power encourage a bank culture oriented toward innovation, quality and integrity, which reduces bank risk-taking. These factors should be considered in approaches to assess the management factor in the third component in the CAMELS rating. The management factor (M) in the "CAMEL" rating, which is used, for instance, for regulatory purposes, such as in setting deposit insurance premia, currently has the same weighting as capital adequacy in calculating this rating, i.e., 25 percent (Hagendorff et al., 2021). Thus, my results suggest improving qualitative approaches to assess the management factor in terms of gender diversity and CEO power and, perhaps, increase its weighting in the CAMELS rating.

Third, regulators should promote and develop opportunities for banks to develop a culture oriented toward innovation, quality and integrity, which can reduce the future burden on regulators in case of adverse events. Also, an innovation-oriented culture can lead banks become more growth-oriented and banks pursuing a quality and integrity-oriented culture can become more safety-oriented. The growth and safety trade-off is similar to the trade-off between risk and return, which affects the asset allocation by investors. Currently, the main focus of supervisory authorities has been on "Risk Culture", for instance, the Financial Stability Board (2014) released a framework for assessing bank culture in which the main

attributes that make a bank's risk culture "sound" are: Tone from the top, Accountability, Effective Communication, and Incentives.

5.4 Limitations of the Study

The limitations of this study arise mainly from the unavailability of data. As I explain in Chapter 2, the main data used in this study is based on an extensive data collection effort on supervisory cooperation agreements and the evolution of bank ownership in Central and Eastern Europe and Latin America for the period of 2003-2018. Particularly, as the BankScope database is no longer available since 2016, I track the year-by-year ownership status of each bank in the sample using several databases. Consequently, would be interesting to expand the analyses to other emerging countries with presence of foreign banks such as Indonesia, Malaysia, Thailand, and the rest of Asia. This limitation do not undermine the reliability of the results obtained in this study. Similarly, in Chapters 3 and 4, I measure bank culture using the earnings call transcripts from the S&P Global Market Intelligence database. This database provides information mainly for the US banking sector and, particularly, the earnings call transcripts were available for the main US BHCs. I consider fruitful to incorporate the rest of the US BHCs.

5.5 Future research directions

The results of this study also suggest paths for future research. One area of future research is how cooperation agreements on cross-border banking supervision and the different policy measures implemented across the world impacted foreign bank lending during the Covid-19 crisis. Another area of potential research could be to examine how compensation schemes may influence the bank cultural values and, in turn, the risk-taking behaviour. Finally, it could be fruitful to examine how bank managers have reoriented the cultural values to make banks resilient to future shocks, for instance, encouraging environmental cultural values. This latter point, has been stressed by regulators and researchers (e.g., Berger et al., 2021b).

REFERENCES

Abadie, A., Drukker, D.M., Herr, J. L., Imbens, G.W., 2004. Implementing Matching Estimators for Average Treatment Effects in Stata." Stata Journal, 4, 290–311.

Abadie, A., Imbens, G.W., 2006. Large Sample Properties of Matching Estimators for Average Treatment Effects. Econometrica, 74, 235–67.

Abadie, A., Imbens, G.W., 2011. Bias-Corrected Matching Estimators for Average Treatment Effects. Journal of Business & Economic Statistics, 29, 1–11.

Acharya, V., and Steffen, S., 2020a. The risk of being a fallen angel and the corporate dash for cash in the midst of COVID. Review of Corporate Finance Studies 9, 430-471.

Acharya, V., Engle, R., Steffen, S., 2021.Why Did Bank Stocks Crash During COVID-19? NBER Working Papers 28559.

Acharya, V., Naqvi, H., 2012. The Seeds of a Crisis: A Theory of Bank Liquidity and Risk Taking over the Business Cycle. Journal of Financial Economics 106, 349-366.

Acharya, V., Steffen, S., 2020b, 'Stress tests' for banks as liquidity insurers in a time of COVID. CEPR VoxEU.org.

Adams, R.B., Light, A.N., Sagiv, L., 2011. Shareholders and stakeholders: how do directors decide? Strategic Management Journal 32, 1331-1355.

Adams-Kane, J., Caballero, J., Lim, J.J., 2017. Foreign Bank Behavior during Financial Crises. Journal of Money, Credit and Banking 49 (2-3), 351-392.

Ali, A., Zhang, W., 2015. CEO tenure and earnings management. Journal of Accounting and Economics 59, 60–79.

Allen, F., Jackowicz, K., Kowalewski, O., Kozłowski, L., 2017. Bank lending, crises, and changing ownership structure in Central and Eastern European countries. Journal of Corporate Finance 42, 494-515.

Altunbas, Y., Thornton, J., Uymaz, Y., 2018. CEO tenure and corporate misconduct: Evidence from US banks. Finance Research Letters 26, 1-8.

Alves, P.F.P., Ferreira, M.A., 2011. Capital structure and law around the world. Journal of Multinational Financial Management, 21 (3), 119–150.

Anderson, R.C., Reeb, D.M., Upadhyay, A., Zhao, W., 2011. The economics of director heterogeneity. Financial Management 40, 5-38.

Anginer, D. , Demirguc-Kunt, A. , Zhu, M. , 2014. How does competition affect bank systemic risk? Journal of Financial Intermediation 23, 1–26.

Anginer, D., Cerutti, E., Martinez-Peria, M.S., 2017. Foreign bank subsidiaries' default risk during the global crisis: What factors help insulate affiliates from their parents? Journal of Financial Intermediation 29, 19-31.

Anginer, D., Demirguc-Kunt, A., Huizinga, H., Ma, K., 2018. Corporate governance of banks and financial stability. Journal of Financial Economics 130, 327-346.

Arnaboldi, F., Casu, B., Gallo, A., Kalotychou, E., Sarkisyan, A., 2021. Gender diversity and bank misconduct, Journal of Corporate Finance, 101834.

Atkinson, T., Luttrell, D., Rosenblum, H., 2013. How bad was it? The costs and consequences of the 2007–09 financial crisis. Working Paper.

Bae, K-H., El Ghoul, S., Gong, Z., Guedhami, O., 2021. Does CSR matter in times of crisis? Evidence from the COVID-19 pandemic, Journal of Corporate Finance, Volume 67, 2021,101876. https://doi.org/10.1016/j.jcorpfin.2020.101876.

Barber, B.M., Odean, T., 2001. Boys will be boys: gender, overconfidence, and common stock investment. Quarterly Journal of Economics 116, 261-292.

Barth, J.R., Caprio Jr., G., Levine, R., 2001. Banking systems around the globe: Do regulations and ownership affect performance and stability? In: Mishkin, F.S. (Ed.), Prudential Supervision: What Works and What Doesn't. Univ. of Chicago Press, pp. 31–88.

Bartram, S., Gregory, B., Hund, J., 2007. Estimating systemic risk in the international financial system. Journal of Financial Economics 86, 835–869.

Bartram, S.M., Brown, G.W., Hund, J.E., 2007. Estimating systemic risk in the international financial system. Journal of Financial Economics 86, 835-869.

Basel Committee on Banking Supervision, 1975. Concordat. Bank for International Settlements.

Basel Committee on Banking Supervision, 1983. Principles for the supervision of banks' foreign establishments. Bank for International Settlements.

Basel Committee on Banking Supervision, 1992. Minimum standards for the supervision of international banking groups and their cross-border establishments. Bank for International Settlements.

Basel Committee on Banking Supervision, 1996. Supervision of cross border banking. Bank for International Settlements.

Basel Committee on Banking Supervision, 1999. International Convergence of Capital Measurement and Capital Standards. Bank for International Settlements.

Basel Committee on Banking Supervision, 2001.Essential elements of a statement of cooperation between banking supervisors. Bank for International Settlements.

Basel Committee on Banking Supervision, 2003.High-level principles for the cross border implementation of the new accord. Bank for International Settlements.

Basel Committee on Banking Supervision, 2006. Home-Host information sharing for effective Basel II implementation. Bank for International Settlements.

Basel Committee on Banking Supervision, 2010. Good practice principles on supervisory colleges. Bank for International Settlements.

Baycan T and Nijkamp P (2011) A Socio-Economic Impact Analysis of Cultural Diversity. Amsterdam: Faculty of Economics and Business Administration Research Memorandum, Vrije Universiteit Amsterdam.

Beck, T., 2016. Regulatory Cooperation on Cross-Border Banking – Progress and Challenges After the Crisis. National Institute Economic Review, 235, 40-49.

Beck, T., Behr, P., Güttler, A., 2013. Gender and banking: are women better loan officers? Review of Finance 17, 1279–1321.

Beck, T., Keil, J., 2020. Are banks catching corona? Effects of COVID on lending in the U.S. Available at SSRN: https://ssrn.com/abstract=3766831.

Beck, T., Silva-Buston, C., Wagner, W., 2018. The economics of supranational bank supervision. CEPR Discussion Paper N°DP12764, Available at SSRN: https://ssrn.com/abstract=3134415.

Beck, T., Silva-Buston, C., Wagner, W., 2019. The economics of supranational bank supervision. Available at SSRN: https://ssrn.com/abstract=3130124.

Beck, T., Todorov, R., Wagner, W., 2013. Bank supervision going global? A cost-benefit analysis. Economic Policy 28, 285-344.

Beltratti, A., Stulz, R.M., 2012. The credit crisis around the globe: why did some banks perform better? Journal of Financial Economics 105, 1-17.

Berger, A., Imbierowicz, B. , Rauch, C. , 2016. The roles of corporate governance in bank failures during the recent financial crisis. Journal of Money, Credit and Banking 48, 729–770.

Berger, A., Kick, T., Schaeck, K., 2014. Executive board composition and bank risk taking. Journal of Corporate Finance 28, 48–65.

Berger, A.N., Bouwman, C. H. S., Norden, L., Roman, R. A., Udell, G.F.,Wang, T., 2021a. Is a Friend in Need a Friend Indeed? How Relationship Borrowers Fare during the COVID-19 Crisis (May 25, 2021). Kelley School of Business Research Paper No. 2021-01, Available at SSRN: https://ssrn.com/abstract=3755243

Berger, A.N., Demirgüç-Kunt, A., Moshirian, F., Saunders, A., 2021b.The way forward for banks during the COVID-19 crisis and beyond: Government and central bank responses, threats to the global banking industry. Journal of Banking and Finance, 133,106303.

Berger, A.N., Li., X., Morris, Ch., Roman, R., 2021c. The Effects of Cultural Values on Bank Failures around the World. Journal of Financial and Quantitative Analysis 56, 945-993.

Berger, A.N., Bouwman, C.H.S., 2017. Bank Liquidity Creation, Monetary Policy, and Financial Crises. Journal of Financial Stability 30, 139-155

Bertrand, M., Schoar, A., 2003. Managing with style: the effect of managers on firm policies. Quarterly Journal of Economics 118, 1169-1208

Bhagat, S., Bolton, B. , 2008. Corporate governance and firm performance. Journal of Corporate Finance 14, 257-273.

Bhagat, S., Bolton, B., 2013. Director ownership, governance, and performance. Journal of Financial and Quantitative Analysis 48, 105–135.

Bharath, S., Shumway, T. , 2008. Forecasting default with the Merton distance to de- fault model. The Review of Financial Studies 21, 1339–1369.

Bianchi, N., Carretta, A., Farina, V., Fiordelisi, F., 2021. Does espoused risk culture pay? Evidence from European banks. Journal of Banking and Finance 122, 105767.

Bickenbach, Frank and Bode, Eckhardt (2008), Disproportionality Measures of Concentration, Specialization, and Localization. International Regional Science Review 31, 359-388.

Bilimoria, D., Wheeler, J.V., 2000. Women corporate directors: current research and future directions. In: Burke, R.J., Mattis, R.C. (Eds.), Women in Management: Current Research Issues, vol. 2. Springer, Berlin, pp. 138–163 (Chapter 10).

Bolton, P., Mehran, H., Shapiro, J. 2015. Executive compensation and risk taking, Review of Finance, 19, 2139–2181

Bono, J.E., Judge, T.A., 2004. Personality and transformational and transactional leadership: a meta-analysis. Journal of Applied Psychology 89, 901-910.

Bostandzic, D., Weiss, G., 2018. Why do some banks contribute more to global systemic risk? Journal of Financial Intermediation 35, 17-40.

Boyd, J.H., Graham, S.L., Hewitt, R.S., 1993. Bank holding company mergers with nonbank financial firms: effects on the risk of failure. Journal of Banking and Finance 17, 43-63.

Boyd, J.H., Levine, R., Smith, B.D., 2001. The impact of inflation on financial sector performance. Journal of Monetary Economics 47, 221–248.

Boyd, J.H., Runkle, D.E., 1993. Size and performance: testing the predictions of banking firms of theory. Journal of Monetary Economics 311, 47-67.

Bremus, F., Buch, C. M., 2015. Banking market structure and macroeconomic stability: Are low-income countries special? Pacific Economic Review 20, 73–100.

Brunnermeier, M.K., Dong, G., Palia, D., 2012. Banks' Non-Interest Income and Sys- temic Risk Working paper. Princeton University.

Bucciol, A., Miniaci, R., 2011. Household portfolios and implicit risk preference. Review of Economics and Statistics 93, 1235-1250.

Byron, K., Post, C., 2016. Women on boards of directors and corporate social performance: a meta-analysis. Corporate Governance: An International Review 24, 428-442.

Byström, H., 2006. Merton unraveled: a flexible way of modelling default risk. The Journal of Alternative Investments 8 (4), 39–47.

Calzolari, G. and Loranth, G., 2011. Regulation of multinational banks: A theoretical inquiry. Journal of Financial Intermediation 20, 178-198.

Calzolari, G., Colliard, J-E, Loranth, G., 2019. Multinational banks and supranational supervision. Review of Financial Studies 32(8), 2997-3035.

Campbell, J.Y. , Hilscher, J. , Szilagyi, J. , 2008. In search of distress risk. The Journal of Finance 63, 2899–2939.

Campbell, J.Y., 2001. Household finance. The Journal of Finance 61, 1553-1604.

Campbell, K., Minguez-Vera, A., 2008. Gender diversity in the boardroom and firm financial performance. Journal of Business Ethics 83 (3), 435–451.

Cao, Y., Gregory-Smith, I., Montagnoli, A., 2018. Transmission of liquidity shocks: Evidence on cross-border bank ownership linkages. Journal of International Financial Markes, Institutions & Money 53, 158-178.

Cardillo, G., Onali, E., Torlussio, G., 2020. Does gender diversity on banks' boards matter? Evidence from public bailouts. Journal of Corporate Finance, 101560

Carletti, E., Claessens, S., Fatás, A., Vives, X., 2020. The bank business model in the post-Covid-19 world. https://voxeu.org/article/bank-business-model-post-covid-19-world

Carter, D.A., Simkins, B.J., Simpson, W.G., 2003. Corporate governance, board diversity, and firm value. Financial Review 38, 33-53.

Castro, P., Keasey, k., Amor-Tapia, B., Tascon, M., Vallascas, F., 2020. Does debt concentration depend on the risk-taking incentives in CEO compensation? Journal of Corporate Finance 64, 101684.

Cetorelli, N., Goldberg, L.S., 2011. Global banks and international shock transmission: Evidence from the crisis. IMF Economic Review 59, 41–76.

Claessens, S., Van Horen, N., 2014. Foreign Banks: Trends and Impact. Journal of Money, Credit and Banking 46 (1), 295-326.

Claessens, S., Van Horen, N., 2015. The impact of the global financial crisis on banking globalization. IMF Economic Review 63 (4), 868–918.

Çolak, G., Öztekin, Ö., 2021. The impact of COVID-19 pandemic on bank lending around the world, Journal of Banking and Finance, 106207.

Combs, J.G., Ketchen Jr, D.J., Perryman, A.A., Donahue, M.S., 2007. The moderating effect of CEO power on the board composition–firm performance relationship. Journal Management Studies 44, 1299-1323.

Cull, R., Martinez Peria, M.S., 2013a. Foreign Bank Participation in Developing Countries: What Do We Know about the Drivers and Consequences of this Phenomenon? in Gerard Caprio, ed., Encyclopedia of Financial Globalization. Elsevier: Oxford, UK.

Cull, R., Martinez Peria, M.S., 2013b. Bank ownership and lending patterns during the 2008-2009 financial crisis: evidence from Latin America and Eastern Europe. Journal of Banking & Finance 37, 4861-4878.

Cumming, D. J., Leung, T.Y., 2018. Diversity and innovation: the differential role of scope versus levels. Available at SSRN: https://ssrn.com/abstract=3181323.

Cumming, D., Leung, T.Y., Rui, O., 2015. Gender diversity and securities fraud. Academy of Management Journal 58, 1572-1593.

D'Hulster, K., 2012. Cross-border banking supervision: Incentive conflicts in supervisory information sharing between home and host supervisors. Journal of Banking Regulation 13, 300–319.

Daily, C., Johnson, J., 1997. Sources of CEO power and firm financial performance: a longitudinal assessment. Journal of Management 23, 97-117.

Dbouk, W., Fang, Y., Liu, L., Wang, H., 2020.Do social networks encourage risk-taking? Evidence from bank CEOs. Journal of Financial Stability 46, 100708.

De Haas, R., Korniyenko, Y., Pivovarsky, A., Tsankova, T., 2015. Taming the herd? Foreign banks, the Vienna Initiative and crisis transmission. Journal of Financial Intermediation 24 (3), 74–94.

De Haas, R., Van Horen, N., 2012. International shock transmission after the Lehman Brothers collapse: Evidence from syndicated lending. American Economic Review: Papers & Proceedings 102, 231–237.

De Haas, R., Van Horen, N., 2013. Running for the exit? International bank lending during a crisis. Review of Financial Studies 26(1), 244-285.

De Haas, R., Van Lelyveld, I., 2010. Internal capital markets and lending by multinational bank subsidiaries Journal of Financial Intermediation 19, 1-25.

De Haas, R., Van Lelyveld, I., 2014. Multinational banks and the global financial crisis: weathering the perfect storm? Journal of Money, Credit and Banking 46, 333–364.

Demirgüc¸-Kunt, A., Huizinga, H., 2010. Bank activity and funding strategies: the impact on risk and returns. Journal of Financial Economics 98, 626-650.

Demirgüç-Kunt, A., Detragiache, E., 2002. Does deposit insurance increase banking system stability? An empirical investigation. Journal of Monetary Economics 49, 1373-1406.

Demirguc-Kunt, A., Maksimovic, V., 2002. Funding Growth in Bank-Based and Market-Based Financial Systems: Evidence from Firm-Level Data. Journal of Financial Economics 65 (3), 337-363.

DeYoung, R., Torna, G., 2013. Nontraditional banking activities and bank failures during the financial crisis. Journal of Financial Intermediation 22, 397–421.

Dezsö, C.L., Ross, D.G., 2012. Does female representation in top management improve firm performance? A panel data investigation. Strategic Management Journal 33, 1072-1089.

Ding, W., Levine, R., Lin, C., Xie, W., 2021. Corporate immunity to the COVID-19 pandemic. Journal of Financial Economics 141, 802–830.

Ditlmann, R.K. , Purdie-Vaughns, V. , Eibach, R.P. , 2011. Heritage- and ideology-based national identities and their implications for immigrant citizen relations in the United States and in Germany. International Journal of Intercultural Relations 35, 395-405.

Dohse, D., Gold, R., 2013. Measuring Cultural Diversity at a Regional Level. WWWforEurope Working Paper, No. 10, WWWforEurope, Vienna.

Duan, Y., El Ghoul, S., Guedhami, O., Li, H., Li, X., 2021. Bank systemic risk around COVID-19: A cross-country analysis, Journal of Banking and Finance, 106299.

Dursun-de Neef, H.¨O., Schandlbauer, A., 2021. COVID-19 and lending responses of European banks, Journal of Banking and Finance, 106236.

Eagly, A.H., Carli, L.L., 2003. The female leadership advantage: an evaluation of the evidence. The Leadership Quarterly 14, 807–834.

Eagly, A.H., Johannesen-Schmidt, M.C., 2001. The leadership styles of women and men. Journal of Social Issues 57, 781-797.

Eagly, A.H., Johannesen-Schmidt, M.C., Van Engen, M.L., 2003. Transformational, transactional, and laissez-faire leadership styles: a meta-analysis comparing women and men. Psychological Bulletin 129, 569-591

Eagly, A.H., Johnson, B.T, 1990. Gender and leadership style: a meta-analysis. Psychological Bulletin 108, 233-256.

Egan, M.L., Matvos, G., Seru, A., 2018. When Harry fired Sally: the double standard in punishing misconduct. In: NBER Working Paper Series, WP 23242.

Ellul, A., Yerramilli, V. , 2013. Stronger risk controls, lower risk: evidence from U.S. bank holding companies. The Journal of Finance 68, 1757-1803

Elnahass, M., Trinh V.Q., Li, T., 2021. Global banking stability in the shadow of Covid-19 outbreak, Journal of International Financial Markets, Institutions and Money, https://doi.org/10.1016/j.intfin.2021.101322

European Systemic Risk Board, 2022. Will video kill the radio star? Digitalisation and the future of banking, January.

Fahlenbrach, R., Rageth, K.,Stulz, R., 2020. How Valuable Is Financial Flexibility when Revenue Stops? Evidence from the COVID-19 Crisis, The Review of Financial Studies, hhaa134. https://doi.org/10.1093/rfs/hhaa134

Farag, H., Mallin, C., 2017. Board diversity and financial fragility: evidence from European banks. International Review of Financial. Analyses 49, 98-112.

European Central Bank (2007): "Progress towards a framework for financial stability assessment", speech by José-Manuel González-Páramo, Member of the Executive Board of the ECB, OECD World Forum on "Statistics, Knowledge and Policy", Istanbul, 28 June.

European Systemic Risk Board (2022). Will video kill the radio? Digitalisation and the future of banking. January.

Financial Stability Board. 2014. "Guidance on Supervisory Interaction with Financial Institutions on Risk Culture: A Framework for Assessing Risk Culture." Available at http://www.financialstabilityboard.org/2014/04/ guidance on supervisory interaction with financial institutions on risk culture a framework for assessing risk culture 2/.

Finkelstein, S., 1992. Power in top management teams: dimensions, measurement, and validation. Academy of Management Journal 35, 505-538.

Fiordelisi, F., Ricci, O., 2014. Corporate culture and CEO turnover. Journal of Corporate Finance 28, 66–82.

Fiordelisi, F., Ricci, O., Stentella Lopes, F.S., 2017. The unintended consequences of the launch of the single supervisory mechanism in Europe. Journal of Quantitative and Financial Analysis 52(6), 2809-2836.

Florackis, C., Sainani, S., 2018. How do chief financial officers influence corporate cash policies? Journal of Corporate Finance 52, 168-191.

Foos, D., Norden, L., Weber, M., 2010. Loan growth and riskiness of banks. Journal of Banking and Finance 34, 2929-2940.

Francis, B., Hasan, I., Park, J.C., Wu, Q., 2015. Gender differences in financial reporting decision-making: evidence from accounting conservatism. Contemporary Accounting Research 32, 1285–1318

Francis, B., Hasan, I., Park, J.C., Wu, Q., 2015. Gender differences in financial reporting decision-making: evidence from accounting conservatism. Contemporary Accounting Research 32, 1285-1318.

Francis, B.B., Hasan, I., Wu, Q., Yan, M, 2014. Are female CFOs less tax aggressive? Evidence from tax aggressiveness Journal of the American Taxation Association 36, 171-202.

Francoeur, C., Labelle, R., Sinclair-Desgagne, B., 2008. Gender diversity in corporate governance and top management. Journal of Business Ethics 81, 83-95.

García Lara, J.M., García Osma, B., Mora, A., Scapin, M., 2017. The monitoring role of female directors over accounting quality. Journal of Corporate Finance 45, 651-668.

García-Kuhnert, Y., Marchica, M.-T., Mura, R., 2015. Shareholder diversification andbank risk-taking. Journal of Financial Intermediation 24, 602-635.

García-Meca, E.,García-Sanchez, I.M., Martínez-Ferrero, J., 2015. Board diversity and its effects on bank performance: An international analysis. Journal of Banking and Finance 53, 202-214.

Giannetti, M., Laeven, L., 2012a. Flight home, flight abroad, and international credit cycles. American Economic Review: Papers & Proceedings 102, 219-224.

Giannetti, M., Laeven, L., 2012b. The flight home effect: Evidence from the syndicated loan market during financial crises. Journal of Financial Economics 104, 23-43.

Grable, J.E., McGill, S., Britt, S., 2009. Risk tolerance estimation bias: the age effect. Journal of Business and Economic Research 7, 1–12.

Graham, J. R., J. Grennan, C. R. Harvey, and S. Rajgopal. 2018. Corporate culture: The interview evidence. Working Paper, Duke University.

Graham, J. R., J. Grennan, C. R. Harvey, and S. Rajgopal. 2019. Corporate culture: Evidence from the field. Working Paper, Duke University.

Graham, J. R., J. Grennan, C. R. Harvey, and S. Rajgopal. 2019. Corporate culture: Evidence from the field. Working Paper, Duke University.

Grennan, J., 2019. A Corporate Culture Channel: How Increased Shareholder Governance Reduces Firm Value. Available at SSRN: https://ssrn.com/abstract=2345384

Grennan, J., 2020. Communicating Culture Consistently: Evidence from Banks. Available at SSRN: https://ssrn.com/abstract=3350645

Group of Thirty, 2015. Banking Conduct and Culture: A Call for Sustained and Comprehensive Reform. Monograph, Washington, D.C. (July).

Guiso, L., P. Sapienza, and L. Zingales. 2015. The value of corporate culture. Journal of Financial Economics 117:60–76.

Guiso, L., Sapienza, P., Zingales, L., 2015. The value of corporate culture. Journal of Financial Economics 117, 60–76.

Gul, F.A., Srinidhi, B., Ng, A.C., 2011. Does board gender diversity improve the informativeness of stock prices? Journal of Accounting and Economics 51, 314–338.

Gungoraydinoglu, A., Çolak, G., Öztekin, Ö., 2017. Political environment, financial intermediation costs, and financing patterns. Journal of Corporate Finance 44, 167-192.

Hagendorff, J., Saunders, A., Steffen, S., Vallascas, F., 2021.The wolves of Wall Street? Managerial attributes and bank risk. Journal of Financial Intermediation, 47,100921.

Hainmueller, J., 2012. Entropy balancing for causal effects: A multivariate reweighting method to produce balanced samples in observational studies. Political Analysis 20, 25–46.

Hambrick, D.C., Mason, P.A., 1984. Upper echelons: the organization as a reflection of its top managers. Academy of Management Review 9, 193-206

Hasan, I., Marra, M., To, T., Wu, E., Zhang, G., 2021, COVID-19 pandemic and global corporate CDS spreads. Available at SSRN: https://ssrn.com/abstract=3858059

Hillegeist, S.A. , Keating, E.K. , Cram, D.P. , Lundstedt, K.G. , 2004. Assessing the probability of bankruptcy. Review of Accounting Studies 9, 5–34

Hillman, A.J., Cannella, A.A., Harris, I.C., 2002. Women and racial minorities in the boardroom: how do directors differ? Journal of Management 28, 747-763.

Hirtle, B., Kovner, A., Plosser, M., 2020. The Impact of Supervision on Bank Performance**.** Journal of Finance 75, 2719-2763.

Hitchens, T, Goren, N., 2017. International Cybersecurity Information Sharing Agreements. Center for International & Security Studies, U. Maryland.

Ho, P-H, Huang C-W, Lin,C-Y. Yen, J-F, 2016. CEO overconfidence and financial crisis: Evidence from bank lending and leverage. Journal of Financial Economics, 120, 194-209.

Houston, J., James, C., Marcus, D., 1997. Capital market frictions and the role of internal capital markets in banking, Journal of Financial Economics, 46(2), 135-164.

Houston, J.F., Lin, C., Lin, P., Ma, Y., 2010. Creditor rights, information sharing, and bank risk taking. Journal of Financial Economics 96, 485-bru512.

Imbens, G. W., Wooldridge, J.M., 2009. Recent Developments in the Econometrics of Program Evaluation. Journal of Economic Literature, 47, 5–86.

James, Ch., Lu, J., Sun, Y., 2021.Time is money: Real effects of relationship lending in a crisis. Journal of Banking and Finance, 106283.

Jeon, B.N., Olivero, M.P., Wu, J., 2013. Multinational banking and the international transmission of financial shocks: Evidence from foreign bank subsidiaries. Journal of Banking & Finance 37, 952–972.

Jianakoplos, N.A., Bernasek, A., 1998. Are women more risk averse? Economic Inquiry 36, 620–630.

Jiang, F., Ma, Y., Shi, B., 2017. Stock liquidity and dividends payouts. Journal of Corporate Finance 42, 295-314.

John, K., De Masi, S., Paci, A., 2016. Corporate governance in banks. Corporate Governance: An international Review 24, 308-321.

Jorion, P., Zhang, G., 2007. Good and bad credit contagion: evidence from credit default swaps. Journal of Financial Economics 84, 860-883.

Jung, D., 2001. Transformational and transactional leadership and their effects on creativity in groups. Creativity Research Journal 13, 185-195.

Khanna, V., Kim, E.H., Lu, Y., 2015. CEO connectedness and corporate fraud. The Journal of Finance 70, 1203-1252

Kuhnert, K.W., Lewis, P., 1987. Transactional and transformational leadership: a constructive developmental analysis. Academy of Management Review 12, 648–657

Kuzman, T., Talavera, O., Bellos, S., 2018. Politically induced board turnover, ownership arrangements, and performance of SOEs. Corporate Governance: An International Review 26, 160– 179

La Porta, R., López de Silanes, F., Shleifer, A., 2002. Government ownership of banks. Journal of Finance 57, 265–301.

Laeven, L., and Valencia F., 2013, Systemic Banking Crises Database. IMF Economic Review 61, 225–270.

Laeven, L., Levine, R., 2009. Bank governance, regulation, and risk taking. Journal of Financial Economics 93, 259-275.

Lechner, M., 2010. The Estimation of Causal Effects by Difference-in-Difference Methods. Foundations and Trends in Econometrics 4, 165–224.

Lee, J. 2016. Can investors detect managers' lack of spontaneity? Adherence to predetermined scripts during earnings conference calls. Accounting Review 91, 229-50.

Letendre, L., 2004. The dynamics of the boardroom. Academy of Management Executive 18, 101–104.

Levine, R., Lin, C., Tai, M., Xie, W., 2021. How did depositors respond to COVID-19? The Review of Financial Studies, hhab062. https://doi.org/10.1093/rfs/hhab062.

Lewbel, A., 2012. Using heteroscedasticity to identify and estimate mismeasured and endogenous regressor models. Journal of Business and Economic Statistics 30, 67–80.

Li, K., Liu, X., Mai, F., Zhang, T., 2021b. The Role of Corporate Culture in Bad Times: Evidence from the COVID-19 Pandemic. Journal of Financial and Quantitative Analysis, 1-68. doi:10.1017/S0022109021000326

Li, K., Mai, F., Shen, R., Yan, X., 2021a. Measuring Corporate Culture Using Machine Learning. The Review of Financial Studies 34, 3265–3315.

Li, L., Strahan, P., Zhang, S., 2020. Banks as Lenders of First Resort: Evidence from the COVID-19 Crisis. Review of Corporate Finance Studies 9, 472-500.

Liu, C., 2018. Are women greener? Corporate gender diversity and environmental violations. Journal of Corporate Finance 52, 118-142.

Liu, Y., Jiraporn, P., 2010. The effect of CEO power on bond ratings and yield. Journal of Empirical Finance 17, 744-762.

Liu, Y., Qiu, B., Wang, T., 2021. Debt rollover risk, credit default swap spread and stock returns: evidence from the COVID-19 crisis. Journal of Financial Stability 53, 100855.

Liu, Y., Wei, Z., Xie, F., 2014. Do women directors improve firm performance in China. Journal of Corporate Finance 28, 169–184.

Loughran, T., McDonald, B., 2011. When Is a Liability Not a Liability? Textual Analysis, Dictionaries, and 10-Ks. The Journal of Finance 66, 35-65.

Loy, J.P., Weiss, C., Glauben, T., 2016. Asymmetric cost pass-through? Empirical evidence on the role of market power, search and menu costs. Journal of Economic Behaviour and Organization 123, 184-192.

MacCrimmon, K.R., Wehrung, D.A., 1990. Characteristics of risk taking executives. Management Science 36, 422-435.

Masulis, R., Wang, C., Xie, F., 2012. Globalizing the boardroom-the effects of foreign directors on corporate governance and firm performance. Journal of Accounting and Economics 53, 527-554.

Matsa, D.A., Miller, A.R., 2013. A female style in corporate leadership? Evidence from quotas. American Economic Journal: Applied Economics 5, 136-169.

Mc Namara, A., Murro, P., O'Donohoe, S., 2017. Countries lending infrastructure and capital structure determination: The case of European SMEs. Journal of Corporate Finance 43, 122-138.

McGuinness, P.B., Vieito, J.P., Wang, M., 2017. The role of board gender and foreign ownership in the CSR performance of Chinese listed firms. Journal of Corporate Finance 42, 75-99.

Merton, R.C., 1974. On the pricing of corporate debt: the risk structure of interest rates. The Journal of Finance 29, 449–470.

Mikolov, T., Sutskever, I., Chen, K., Corrado, G., Dean, J., 2013. Distributed representations of words and phrases and their compositionality. In Advances in Neural Information Processing Systems, eds. M. I. Jordan, Y. LeCun, and S. A. Solla, 3111–9. Cambridge: MIT Press.

Miller, T., Triana, M., del, C., 2009. Demographic diversity in the boardroom: mediators of the board diversity–firm performance relationship. Journal of Management Studies 46, 755-786.

Minton, B. A., Taillard, J. P., Williamson, R., 2014. Financial expertise of the board, risk taking, and performance: Evidence from bank holding companies, Journal of Financial and Quantitative Analysis 49, 351–380.

Morgan, D., Rime, B., Strahan, P.E., 2004. Bank integration and state business cycles. Quarterly Journal of Economics 119, 1555–1584.

Mourouzidou-Damtsa S., Milidonis, A., Stathopoulos, K., 2019. National culture and bank risk-taking. Journal of Financial Stability 40, 132-143.

Mumford, M.D., Gustafson, S.B., 1988. Creativity syndrome: integration, application, and innovation. Psychological Bulletin 103, 27-43.

Nguyen, D.D., Hagendorff, J., Eshraghi, A., 2018. Does CEO cultural heritage affect performance under competitive pressure? The Review of Financial Studies 31, 97–141.

Nguyen, D.D., Nguyen, L., Sila, V., 2019. Does Corporate Culture Affect Bank Risk-Taking? Evidence from Loan-Level Data. British Journal of Management 30, 106-133.

Niederle, M., Vesterlund, L., 2007. Do women shy away from competition? Do men compete too much? Quarterly Journal of Economics 122, 1067-1101.

Niepmann, F., Schmidt-Eisenlohr, T., 2013. Bank bailouts, international linkages, and cooperation, American Economic Journal: Economic Policy 5, 270-305.

Norden, L., Mesquita, D., Wang, W., 2021. COVID-19, Policy interventions and credit: the Brazilian experience. Journal of Financial Intermediation, 100933.

O'Reilly, C., and J. A. Chatman. 1996. Culture as social control: Corporations, cults, and commitment. In Research in organizational behavior, vol. 18, eds. B. M. Staw and L. L. Cummings, 157–200. Greenwich, CT: JAI Press.

Ocasio, W., 1994. Political dynamics and the circulation of power: CEO succession in U.S. industrial corporations, 1960–1990. Administrative Science Quarterly 39, 285-312.

Onali, E., Galiakhmetova, R., Molyneux, P., Torluccio, G., 2016. CEO power, government monitoring, and bank dividends. Journal of Financial Intermediation 27, 89-117.

Oxelheim, L., Randoy, T., 2003. The impact of foreign board membership on firm value. Journal of Banking and Finance 27, 2369-2392.

Ozili, P.K., Arun, T., 2020. Spillover of COVID-19: Impact on the global economy. Available at SSRN: https://ssrn.com/abstract=3562570

Palvia, A., Vahamaa, E., Vahamaa, S., 2015. Are female CEOs and chairwomen more conservative and risk averse? Evidence from the banking industry during the financial crisis. Journal of Busisness Ethics 131, 577–594

Pandey, M., Chaudhuri, A.R., 2017. Immigration-induced effects of changes in size and skill distribution of the labor force on wages in the U.S.. Journal of Macroeconomics 52, 118-134.

Pathan, S., 2009. Strong boards, CEO power and bank risk-taking. Journal of Banking and Finance 33, 1340–1350.

Pathan, S., Faff, R., 2013. Does board structure in banks really affect their performance?. Journal of Banking and Finance 37, 1573–1589.

Pathan, S., Haq, M., Faff, R., Seymour, T., 2021. Institutional investor horizon and bank risk-taking. Journal of Corporate Finance, 101794.

Post, C., Rahman, N., Rubow, E., 2011. Green Governance: Boards of Directors' Composition and Environmental Corporate Social Responsibility. Business and Society 50, 189-223.

Quinn, J.B., Rohrbaugh, J., 1983. A spatial model of effectiveness criteria: towards a competing values approach to organizational analysis. Management Science 29, 363–377.

Rajan, R.G., Zingales, L., 1995. What do we know about capital structure? Some evidence from international data. Journal of Finance 50(5), 1421-1460.

Richardson, G., Taylor, G., Lanis, R., 2016. Women on the board of directors and corporate tax aggressiveness in Australia: an empirical analysis. Accounting Research Journal 29, 313-331.

Robinson, G., Dechant, K., 1997. Building a business case for diversity. Academy of Management Executive 11, 21-31.

Sahm, C.R., 2007. How much does risk tolerance change? The Quarterly Journal of Finance 2, 1-38.

Sapienza, P., Zingales, L., Maestripieri, D., 2009. Gender differences in financial risk aversion and career choices are affected by testosterone. Proceedings of the National Academy of Sciences 106, 15268–15273.

Schein, E.H., 1992. Organizational Culture and Leadership. Jossey-Bass, San Francisco, CA.

Schubert, R., Brown, M., Gysler, M., Brachinger, H.W., 1999. Financial decision-making: are women really more risk-averse? American Economic Review 89, 381–385.

Sedunov, J., 2021. Federal reserve intervention and systemic risk during financial crises. Journal of Banking and Finance, 106210,

Shipman, J., Swanquist, Q., Whited, R., 2017. Propensity score matching in accounting research. The Accounting Review. 92, 213–244

Sila, V., Gonzalez, A., Hagendorff, J., 2016. Women on board: does boardroom gender diversity affect firm risk? Journal of Corporate Finance 36, 26–53.

Song, F., Thakor, A., 2019. Bank Culture. Journal of Financial Intermediation 39, 59–79.

Srivastav, A., Hagendorff, J., 2016. Corporate Governance and Bank Risk-Taking. Corporate Governance: An international Review 24, 334-345.

Tang, N., Hasan, I., Lin, C.-Y, Lu, C.-L., 2021. Bank Safety-oriented Culture and Lending Decisions. Available at SSRN: https://ssrn.com/abstract=3860627.

Tanghi, N., Carretta, A., Farina, V., Fiordelisi, F., 2021. Does espoused risk culture pay? Evidence from European banks, Journal of Banking and Finance, 105767.

Terjesen, S., Sealy, R., Singh, V., 2009. Women directors on corporate boards: a review and research agenda. Corporate Governance: An international Review 17, 320–337.

Thakor, A., 2016. Corporate culture in banking. Economic Policy Review 22, 5–16.

Thakor, A., 2020. Post-Crisis Corporate Culture and Governance in Banking. European Corporate Governance Institute. Finance Working Paper N° 658/2020

Wahid, A.S., 2019. The effects and the mechanisms of board gender diversity: evidence from financial manipulation. Journal of Business Ethics 159, 705-725.

Wang, T., Hsu, C., 2013. Board composition and operational risk events of financial institutions, Journal of Banking & Finance, 37, 2042-2051.

Weiss, J., Anisimova, T., Shirokova, G., 2019. The translation of entrepreneurial intention into start-up behaviour: the moderating role of regional social capital. International Small Business Journal: Researching Entrepreneurship 37, 473-501.

Williams, J.C., 2018. Now Is the Time for Banking Culture Reform. Remarks at Governance and Culture Reform Conference, Federal Reserve Bank of New York, New York City.

Wooldridge, J.M., 2010. Econometric Analysis of Cross Section and Panel Data. MIT press.

Wu, Q., Dbouk, W., Hasan, I., Kobeissi, N., Zheng, L., 2021.Does gender affect innovation? Evidence from female chief technology officers. Research Policy 50,104327.

Ye, D., Deng, J., Liu, Y., Szewczyk, S.H., Chen, X., 2019. Does board gender diversity increase dividend payouts? Analysis of global evidence. Journal of Corporate Finance 58, 1–26.

Yukl, G., 2002. Leadership in Organizations, fifth ed. Prentice Hall, Upper Saddle River, NJ.

Zelechowski, D.D., Bilimoria, D., 2004. Characteristics of women and men corporate inside directors in the US. Corporate Governance: An International Review 12, 337–342.

Zingales, L. 2015. The “cultural revolution” in finance. Journal of Financial Economics 117, 1-4.

APPENDIX

Appendix A: Main BCBS reports and cross-border banking supervision and regulation

***"Concordat"* or the "*Report on the Supervision of Bank's foreign Establishments*" (BCBS, 1975)**	This report defines certain guidelines for cross-border cooperation in the supervision of banks' foreign establishments (e.g. Branches, Subsidiaries and Joint Ventures) and to suggest ways of improving its efficacy in terms of liquidity, solvency and foreign exchange operations.
***"Principles for the supervision of Bank's Foreign Establishments"* (BCBS, 1983)..**	This report replaced the "Concordat" and reformulated some of its provisions to take into account the principle that supervisory authorities must examine the totality of bank's business in a consolidated basis worldwide.
***"Minimum Standards for the Supervision of International Banking Groups and their Cross-Border Establishments"* (BCBS, 1992).**	This report aimed to clarify how the 1983 updated version of the "Concordat" was to be implemented by banking supervisors. In summary, the report states out that no foreign banking institution should avoid supervision and both home and host supervisors should explicitly approve its establishment.
***"Supervision of Cross Border Banking"* (BCBS, 1996)**	This report indicates several recommendations aiming to remove obstacles in the implementation of effective consolidated supervision. In this report, the BCBS mentions for the first time the possibility to develop a Memorandum of Understanding (MOU) to formalize some specific aspects of cross-border cooperation in banking supervision.
***"Essential Elements of a Statement of Cooperation between Banking Supervisors"* (BCBS 2001).**	The report states out the essential elements in the areas of information sharing, onsite inspections, protection of information and ongoing coordination that should contain the MoUs.
The aforementioned reports were developed to enhance financial stability in the context of the Basel Capital Accord (Basel I)	
***A New Capital Adequacy Framework* (BCSC, 1999).**	In 1999, the Committee issued a proposal for a new capital adequacy framework to improve and replace the Basel Accord of 1988. The revised and final framework was released in June 2004 and is known as Basel II accord.
***"High-Level Principles for the Cross Border Implementation of the New Accord"* (BCBS 2003).**	The report presents six principles related to effective implementation of Basel II Accord.
***"Home Host Information Sharing for Effective Basel II Implementation"* (BCBS 2006).**	This report focussed on information sharing processes specifically associated with the Basel II Accord and provided guidance as well as specific examples of information that supervisors might need for an effective Basel II implementation
***"Good practice principles on supervisory colleges"* (BCBS, 2010).**	The report aims to promote and strengthen the operation of supervisory colleges. The report provides eight principles related to information sharing and to crisis management states, among other issues to enhance the effectiveness of Colleges of Supervisors.

Appendix B: Variable definitions

Abbreviation	Variable	Definition	Source
Dependent variables:			
$\Delta Loans_{bijt}$	Growth rate of gross loans	% Annual change in total gross loans (%)	Authors' calculation using data from S&P Capital IQ/SNL Financials
Independent variables:			
Bank-level explanatory variables:			
Size	Bank Size	Logarithm of total assets	Authors' calculation using data from S&P Capital IQ/SNL Financials
Capital	Capital Ratio	Ratio of equity capital to total assets	Authors' calculation using data from S&P Capital IQ/SNL Financials
ROA	Profitability	Return of net results to total assets	Authors' calculation using data from S&P Capital IQ/SNL Financials
Liquidity	Liquidity Ratio	Ratio of liquid assets to total assets	Authors' calculation using data from S&P Capital IQ/SNL Financials
Funding	Deposit Funding Ratio	Ratio of total deposits to total liabilities	Authors' calculation using data from S&P Capital IQ/SNL Financials
Host Country-Level explanatory variables:			
Cooperation on cross-border banking supervision.			
$\Delta Cooperation_{jht}$	Supervisory Cooperation	Dummy variable equal to one if host country "j" and home country *h* have signed a Memorandum of Understanding or College of supervisor agreement for cooperation in cross-border banking supervision or if they have a supranational supervisor	Central Banks' and supervisory authorities' websites and other sources
Bank Supervision and Regulation:			
Supervision	Supervisory Powers	An index variable that ranges from zero to fourteen, with fourteen indicating the highest power of supervisory authorities	Data come from World Bank Regulation and Supervision Survey (V, IV and III). Index is constructed following Barth et al. (2001, 2013)
Consolidation	Consolidation of supervisory powers	Level of consolidation of the supervisory powers. An index variable that ranges from one to five, with five indicating the greater level of consolidation of the supervisory powers (number of financial markets in which the banking is authority exert supervisory role)	Data come from World Bank Regulation and Supervision Survey (V, IV and III).
Activity Restrictions	Activity Restrictions	An index variable that ranges from 3 to 12, with 12 indicating the highest restrictions on bank activities such as securities, insurance and real estate. (For each type of activity: Unrestricted=1, Permitted=2, Restricted=3 and Prohibited=4).	Data come from World Bank Regulation and Supervision Survey (V, IV and III). Index is constructed following Barth et al. (2001, 2013)
Inspections	On-site inspections	Number of onsite examinations per bank performed in the last 5 or 6 years	Data come from World Bank Regulation and Supervision Survey (V, IV and III).
Foreign Banks	Foreign banks participation	Ratio between foreign banks among total banks.	Data come from World Bank Global Financial Development Database (2019).
Macroeconomic Variables:			
Crisis	Global Crisis	A dummy variable equal to one for the years 2008-2011 and zero otherwise.	
GGDP	GDP Growth	Annual GDP growth rate	Source: World Development Indicators
Inflation	Inflation Rate	Annual CPI growth rate	Source: World Development Indicators

Appendix C: Variable definitions and data sources

Variable names	Variable definition
Dependent variables: Risk Proxies	
Z-score	Z-score measures the distance from insolvency in standard deviations. It is defined as the average return on assets (ROA) ratio plus the average capital asset ratio (CAR) divided by the standard deviation of ROA, on a five-year rolling window basis. To deal with extreme values, we have log transformed z-score. Higher z-score values imply lower probability of insolvency, so to facilitate exposition we have multiplied the log transformed z-score values by minus 1. *Source:* Authors' calculation using data from S&P Capital IQ/SNL Financials.
ROA Volatility	ROA volatility is defined as the standard deviation of the ratio of net profit to total assets (average) over five years, that is, ROA Volatility at time t is estimated using the ROA values during t-4 to t. To deal with extreme values, we have logarithmically transformed ROA volatility. *Source:* Authors' calculation using data from S&P Capital IQ/SNL Financials.
Independent variables:	
Cultural variables:	
Innovation	Weighted-frequency count of innovation-related words in the QA section of earnings calls averaged over a 1-year window. *Source:* Authors' calculation using data from S&P Capital IQ/SNL Financials.
Quality	Weighted-frequency count of quality-related words in the QA section of earnings calls averaged over a 1-year window. *Source:* Authors' calculation using data from S&P Capital IQ/SNL Financials.
Integrity	Weighted-frequency count of integrity-related words in the QA section of earnings calls averaged over a 1-year window. *Source:* Authors' calculation using data from S&P Capital IQ/SNL Financials.
Respect	Weighted-frequency count of respect-related words in the QA section of earnings calls averaged over a 1-year window. *Source:* Authors' calculation using data from S&P Capital IQ/SNL Financials.
Teamwork	Weighted-frequency count of teamwork-related words in the QA section of earnings calls averaged over a 1-year window. *Source:* Authors' calculation using data from S&P Capital IQ/SNL Financials.
Bank governance variables:	
Gender Diversity	The percentage of female directors on the board. *Source:* Authors' calculation using data from Boardex.
CEO Age	Logarithm of CEO age. *Source*: Authors' calculation using data from Boardex.
CEO Power	Dummy variable that equals 1 if the CEO is also the chairman of the board. *Source*: Authors' calculation using data from Boardex.
Board Size	Logarithm of number of board members. *Source*: Authors' calculation using data from Boardex.
CEO Tenure	Logarithm of the number of years that CEO has worked for the bank. *Source*: Authors' calculation using data from Boardex.
Bank finacial variables:	
Size	Logarithm of total assets. *Source:* Authors' calculation using data from S&P Capital IQ/SNL Financials.
ROA	Ratio of net profit to average total assets. *Source*: Data come from S&P Capital IQ/SNL Financials.
Bank Age	Logarithm of bank age. *Source:* Authors' calculation using data from S&P Capital IQ/SNL Financials.
CAR	Ratio of equity to total assets. *Source:* Authors' calculation using data from S&P Capital IQ/SNL Financials.
Deposits	Ratio of total deposits to total assets. *Source:* Authors' calculation using data from S&P Capital IQ/SNL Financials.
Provisions	Ratio of loan loss provisions to average total assets. *Source*: Authors' calculation using data from S&P Capital IQ/SNL Financials.
Loan Growth Rate	Annual growth rate of total loans. *Source*: Data come from S&P Capital IQ/SNL Financials.

Appendix D: Bank culture and board of directors

VARIABLES	(1) Teamwork	(2) Teamwork	(3) Teamwork	(4) Teamwork
Gender Diversity(t-1)	-0.105			-0.073
	(0.243)			(0.247)
CEO Age (t-1)		-0.231		-0.262
		(0.175)		(0.182)
CEO Power (t-1)			0.025	0.036
			(0.041)	(0.044)
Board Size (t-1)	-0.240***	-0.233**	-0.237***	-0.227**
	(0.091)	(0.091)	(0.091)	(0.091)
CEO Tenure(t-1)	-0.042**	-0.036*	-0.042**	-0.036*
	(0.018)	(0.019)	(0.018)	(0.019)
Size (t-1)	0.141***	0.141***	0.138***	0.140***
	(0.014)	(0.013)	(0.013)	(0.014)
ROA (t-1)	0.034	0.035	0.033	0.032
	(0.028)	(0.028)	(0.028)	(0.027)
Bank Age (t-1)	0.001	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Observations	1,076	1,076	1,076	1,076
R-squared	0.149	0.151	0.149	0.151
Year FE	YES	YES	YES	YES
Clusters	Firm-Year	Firm-Year	Firm-Year	Firm-Year

Appendix E: Bank culture and board of directors

VARIABLES	(1) Respect	(2) Respect	(3) Respect	(4) Respect
Gender Diversity(t-1)	0.314			0.322
	(0.257)			(0.261)
CEO Age (t-1)		-0.010		-0.028
		(0.213)		(0.226)
CEO Power (t-1)			0.006	0.013
			(0.047)	(0.051)
Board Size (t-1)	0.185*	0.186*	0.186*	0.187*
	(0.105)	(0.105)	(0.104)	(0.105)
CEO Tenure(t-1)	-0.062***	-0.062***	-0.062***	-0.061***
	(0.021)	(0.022)	(0.021)	(0.022)
Size (t-1)	0.022	0.028**	0.027*	0.021
	(0.015)	(0.014)	(0.014)	(0.015)
ROA (t-1)	0.050	0.050	0.049	0.049
	(0.032)	(0.032)	(0.033)	(0.033)
Bank Age (t-1)	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Observations	1,119	1,119	1,119	1,119
R-squared	0.082	0.080	0.080	0.082
Year FE	YES	YES	YES	YES
Clusters	Firm-Year	Firm-Year	Firm-Year	Firm-Year

Appendix F: Variable definitions

Variable names	Variable definition and data sources
Dependent variables: Risk Proxies	
Merton DD	Merton's (1974) distance-to-default measure computed as the difference between the market asset value of the bank and the face value of its debt scaled by the standard deviation of the bank's asset value. Authors' calculation using data from S&P Capital IQ/SNL Financials and Datastream.
Bystrom DD	Bystrom's (2006) distance-to-default measure computed as the simplified version of Merton's (1974), which does not rely on distributional assumptions. *Source:* Authors' calculation using data from S&P Capital IQ/SNL Financials and Datastream.
Independent variables:	
Cultural variables:	
Innovation	Weighted-frequency count of innovation-related words in the QA section of earnings calls averaged over a 1-year window. *Source:* Authors' calculation using data from S&P Capital IQ/SNL Financials.
Quality	Weighted-frequency count of quality-related words in the QA section of earnings calls averaged over a 1-year window. *Source:* Authors' calculation using data from S&P Capital IQ/SNL Financials.
Integrity	Weighted-frequency count of integrity-related words in the QA section of earnings calls averaged over a 1-year window. *Source:* Authors' calculation using data from S&P Capital IQ/SNL Financials.
Respect	Weighted-frequency count of respect-related words in the QA section of earnings calls averaged over a 1-year window. *Source:* Authors' calculation using data from S&P Capital IQ/SNL Financials.
Teamwork	Weighted-frequency count of teamwork-related words in the QA section of earnings calls averaged over a 1-year window. *Source:* Authors' calculation using data from S&P Capital IQ/SNL Financials.
Control variables:	
Bank Size	Logarithm of total assets. *Source:* Data come from S&P Capital IQ/SNL Financials.
ROA	Ratio of net profit to average total assets. *Source*: Data come from S&P Capital IQ/SNL Financials.
Leverage	The Tier 1 leverage ratio according to regulatory capital guidelines. Usually defined as Tier 1 capital as a percent of tangible assets. Data come from S&P Capital IQ/SNL Financials.
Liquidity	Ratio of total liquid assets to total assets. *Source:* Authors' calculation using data from S&P Capital IQ/SNL Financials.
Non-Interest Income	Ratio of Noninterest income (excluding only gains from securities transactions and nonrecurring items) as a percent of average assets. Source: Authors' calculation using data from S&P Capital IQ/SNL Financials.
Non-Performing Assets	Ratio of nonperforming assets (nonaccrual loans and leases, renegotiated loans and leases, and real estate owned) as a percent of assets. Source: Authors' calculation using data from S&P Capital IQ/SNL Financials.