Three Essays on Bank Capital Structure, Performance, and Financial Inclusion

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To my brother…

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ABBREVIATIONS

AFI - Alliance for Financial Inclusion

ATM - Automated teller machine

BCP - Basel Core Principles

BRIC - Brazil Russia India China

CAMEL - Capital, Asset quality, Management, Earnings, and Liquidity

CGAP - Consultative Group to Assist the Poor

CI - Cost to Income

CSR - Corporate Social Responsibility

EEA - European Economic Area

ESG - Environmental, Social, and Governance

EU - European Union

FAS - Financial Access Survey

FSB - Financial Stability Board

GDP - Gross Domestic Product

GFDD - Global Financial Development Database

GMM - Generalised Method of Moments

GNI - Gross National Income

GPFI - Global Partnership for Financial Inclusion

IMF - International Monetary Fund

MENA - Middle East and North Africa

M-M - Modigliani and Miller

NPLs - Non-Performing Loans

OECD - The Organisation for Economic Co-operation and Development

OLS - Ordinary Least Squares

PCA - Principal Component Analysis

ROA - Return On Assets

RRI - RepRisk Index

RWA - Risk Weighted Assets

SMEs - Small and Medium Enterprises

SSA - Sub-Saharan Africa

TBTF - Too Big To Fail

UFA - Universal Financial Access

UN - United Nations

US - United States

WDI - World Bank Development Indicators

WGI - Worldwide Governance Indicators

ABSTRACT

This thesis consists of three empirical essays on contemporary issues related to the banking and financial sector, particularly banks' capital, performance, and financial inclusion.

The first essay investigates the determinants of bank capital structure taking into account the impact of the crisis, banks' systemic size and risks. Using a sample of the European Economic Area's listed banks over 2005-2014, we find that equity capital is negatively associated with size and positively with profits, market-to-book ratio, dividends, and market return volatility risk; while credit risk does not seem to significantly affect banks' capital structure decisions. Moreover, we find a positive relationship between equity capital and banks' reputational risk related to Environmental Social Governance issues.

The second essay explores the relationship between financial inclusion and bank performance proxied by a CAMEL-based performance index constructed using principal component analysis. We use alternative measures of financial inclusion, and distinguish between high and low income countries for 131 countries over 2005-2014. Our evidence shows that bank performance is negatively associated with credit deepening and positively with the number of ATMs. However, we find a positive association between different indicators of financial inclusion and bank performance in low income countries.

The third essay develops a multidimensional financial inclusion index using principal component analysis for a sample of 95 countries over the period 2004-2015. The financial inclusion index shows an overall progress over the sample period, most markedly in the accessibility and usage dimensions. Examining country-specific factors that explain differences in the level of financial inclusion, we find that higher banking system competition, financial freedom, and capital stringency are associated with higher financial inclusion. Additionally, the

level of human development, gender inequality, and education matters greatly in explaining the variation in financial inclusion across countries.

1 INTRODUCTION

This thesis covers two main topics related to the banking and financial sector: bank capital structure and financial inclusion. The first essay investigates the determinants of bank capital structure motivated by the renewed interest in banks' capital and stability particularly after the recent crises. In the second and third essays the focus is shifted to financial inclusion; however, capital is always included in the analysis albeit with different aims. Specifically, the second essay explores the relationship between financial inclusion and bank performance measured by CAMEL ratios; capital adequacy is included as one of the indicators of bank performance (the 'C'). The third essay investigates the factors that explain the cross-country variation in financial inclusion; capital regulation aspect is included as part of the banking conditions. The essay also includes constructing a financial inclusion index and an examination of progress and trends.

Capital structure

Background

Capital structure refers to the firm's decision on how to finance its operations and growth, reflecting the mix of debt and equity financing. Banks tend to have highly leveraged capital structures and operate with considerably lower equity ratios than non-financial firms. This is linked to the fact that the primary role of banks is to receive deposits and provide loans. In particular, banks' unique ability to issue insured deposits influence their capital structure decisions. Another distinctive characteristic of banks is that they operate under regulatory capital requirements to ensure their ability to absorb losses, survive unexpected shocks, and have an incentive to manage different types of risks. However, studies have shown that banks do not operate with the minimum capital required by regulators but usually choose to hold a capital surplus. Hence, it is important to analyse factors that govern bank capital choices.

There are two views regarding banks' capital structure decision: (i) the regulatory (buffer) view that states that banks' capital choice is fully determined by regulatory requirements, and that banks hold excess (buffer) capital to avoid falling below the minimum requirements as raising capital at short notice can be costly; and (ii) the corporate finance view states that banks are similar to non-financial firms in terms of the bank-specific factors that determine the capital structure decision.

In the last decade, the banking sector stability and particularly bank capital have been the main focus of regulators around the world triggered by the global financial crisis that illustrated that inadequate capital structures are a significant source of instability for the financial system and the economy as a whole. This has created a renewed interest in the determinants of bank capital structure.

Aims and Contributions

In the **first empirical essay**, we extend Gropp and Heider (2010)'s work to investigate bank-specific determinants of capital structure distinguishing between the regulatory view and corporate finance view predictions. The aim is to examine whether banks are similar to non-financial firms in terms of the factors that determine their capital structure choice, or whether regulation is of first order importance in this decision. We employ firm-specific variables that are reliably related to the capital structure of non-financial firms including: market-to-book ratio (as a proxy for growth opportunities), profitability, dividend, size, collateral, and market return volatility risk (Frank and Goyal, 2009). Moreover, we analyse the impact of the financial crisis and the Euro sovereign debt crisis on banks' equity capital and test whether the determinants have a different effect during the crisis period. Further, we explore the relationship between bank equity capital and alternative types of risk. In particular, we examine equity capital association with the traditional credit risk, liquidity risk, and reputation risk related to environmental, social, and governance (ESG) issues. Finally, we examine the "too-big-to-fail" effect on banks' capital structure by considering their systemic size.

For the empirical analysis we use bank-level data for the European Economic Area's listed commercial banks for the period 2005-2014. Applying a panel data fixed effects regression to investigate bank capital structure, we find support for the corporate finance view, as banks' equity capital seem to be positively related to the market-to-book ratio, profitability, dividends, and market return volatility risk, and negatively related to size. In terms of risk, our evidence suggests that: (i) on average, credit risk does not seem to affect banks' capital choice; (ii) banks with higher liquidity risk seem to hold lower equity capital and thus are not hedging for this type of risk through increased capital; and (iii) interestingly, banks that have higher reputation risk related to ESG issues appear to hold higher equity capital. Results also show that banks' equity capital is negatively related to its systemic size. The results offer potentially important implications as the debate on optimal capital structures of banks is still ongoing.

We perform a number of robustness tests for our results. The first two robustness checks provide a test of the regulatory explicit effect on the capital structure decision, by examining the effect of deposit coverage scheme and a number of country-level regulatory variables on banks' equity capital. The estimation results from both models show that there is no significant regulatory impact on banks' capital structure decision suggesting that the regulatory view does not fully explain the determinants of banks' capital structure. In the third robustness check we attempt to address the endogeneity problem by using a dynamic panel data approach (GMM) and find consistent results.

The paper contributes to the literature in several ways. First, we examine bank capital structure determinants over an extended sample period that covers the financial crisis and the Euro sovereign debt crisis which allows us to assess the impact of the bank-specific factors in this period. Second, we examine the impact of different measures of risk including the reputational risk on banks' equity capital.

Financial inclusion

Background

Financial inclusion refers to enabling all individuals and businesses in the economy to have access to useful and affordable financial services that meet their needs. The benefits of financial inclusion are well documented from the perspective of both individuals and the economy as a whole. At the individual level, financial inclusion allows people to have the opportunity to secure their savings, make payments and transactions, obtain financing for small projects and businesses, and manage expenses related to unexpected shocks such as health issues (Karlan and Zinman, 2009). Recent research has also shown the positive impact of financial inclusion on the economy as a whole, economically and socially, including enhancing inclusive growth, employment, and lowering poverty and inequality (Kpodar and Andrianaivo, 2011, Burgess and Pande, 2005, Mookerjee and Kalipioni, 2010). Hence, efforts have been made recently to reach global financial inclusion in which all individuals, regardless of their income, gender, and geographic location, have access to appropriate financial services (World Bank, 2017).

Formal banking institutions have a crucial role in achieving the financial inclusion target.[1] Two important issues arise in this respect: (i) what is the impact of financial inclusion on banks' performance, and (ii) what factors influence the level of financial inclusion in a country, particularly banking conditions. These questions are addressed in the second and third essays of this thesis.

Aims and Contributions

In the **second empirical essay**, we investigate the link between financial inclusion and bank performance. In particular, we aim to assess the impact of different tools of financial inclusion on an index of CAMEL-based performance for banks. Further, we investigate the relationship between financial inclusion and bank performance distinguishing between high and

[1] Studies have shown that about 1.7 billion adults around the world are unbanked (Demirguc-Kunt et al., 2018).

low income countries. This allows us to explore potential differences in the relationship based on countries' income classification. Moreover, we test different country-specific conditions that underlie the relationship between financial inclusion and bank performance including a country's existing level of financial inclusion, equality of income, and quality of capital regulation, in addition to economic conditions including banking crisis and business cycle.

To explore the relationship between financial inclusion and bank performance, we use country-level data for 131 countries for the period 2005-2014. We obtain data on financial inclusion from the IMF's Financial Access Survey, measured by deposits to GDP, loans to GDP, number of borrowers from commercial banks per 1000 adults, number of deposit accounts with commercial banks per 1000 adults, in addition to measures of geographical outreach including the number of branches and ATMs. We then construct an aggregate index of bank performance using a principal component analysis (PCA). The index relates to five important dimensions of bank performance: (i) capital, (ii) asset quality, (iii) management, (iv) earnings, and (v) liquidity. Applying a fixed effects regression analysis, we find that the relationship between financial inclusion and bank performance depends on a number of factors: (i) the type of financial service: there seems to be a trade-off between increased credit deepening and bank performance and a positive association between the number of ATMs and bank performance; (ii) the country's level of income: benefits from financial inclusion for bank performance arise in low and lower middle income countries; and (iii) other country-specific conditions: banks operating in countries with lower level of inclusion, higher level of income equality, and higher capital stringency can achieve greater gains from financial inclusion. Moreover, results suggest that financial inclusion does not seem to adversely affect bank performance during crisis period and that there is no effect of the business cycle on the relationship between financial inclusion and bank performance. The results suggest that policy makers should focus on promoting the use of bank deposits and borrowing in low and lower middle income countries; additionally, improvements in financial

inclusion should be accompanied with proper regulation, supervision, and equality considerations.

The paper makes several contributions to the literature. First, while the literature mainly focuses on the stability aspect of performance when analysing the relationship between financial inclusion and bank performance (Han and Melecky, 2013, Sahay et al., 2015b, Morgan and Pontines, 2014), our performance index is broadly defined to include stability, profitability, and efficiency measures. Second, we examine the relationship for different countries based on their income classifications, in addition to a number of country characteristics that may affect the relationship between financial inclusion and bank performance.

In the **third empirical essay** we focus on constructing a multidimensional index of financial inclusion that is comparable across economies and time to rank countries and analyse progress trends. The index incorporates three dimensions of financial inclusion: availability, accessibility, and usage of financial services. Moreover, we investigate country-specific characteristics that explain high variation in financial inclusion across countries. The characteristics we consider are related to the following factors: (i) macro-economic, (ii) banking system conditions, (iii) institutional quality, (iv) technological, and (v) social.

Recent studies proposed different approaches to constructing a multidimensional index. One group of papers uses exogenous weight assignment (Sarma, 2008, Sarma, 2012, Park and Mercado JR, 2018a) that is often criticised for imposing equal or subjective weights; another group uses weights assigned endogenously by employing principal component or factor analysis (Cámara and Tuesta, 2014, Mialou et al., 2017). In this paper, we use a principal component analysis and six indicators drawn from the IMF's Financial Access Survey to construct our financial inclusion index for a sample of 95 countries over the period 2004-2015. Further, we use country-level data and a fixed effects panel regression analysis to investigate the relationship between financial inclusion and different country characteristics.

Our financial inclusion index shows an overall progress over the 12 years sample period, most markedly in the accessibility and usage dimensions. It also shows high variation between groups of countries with high and upper-middle income countries over-ranking low and lower-middle income countries and European countries over-ranking other regions. The Sub-Saharan Africa region ranks the lowest, while the BRIC countries collectively show a rapid growth in financial inclusion. Examining the relationship between financial inclusion and different country characteristics, we find that banking systems that are highly competitive, concentrated, have proper enforcement of capital regulation, and have high financial freedom seem to be more financially inclusive. Additionally, the level of human development, education, gender inequality, institutional quality, and technology matters greatly in explaining the variation in financial inclusion across countries. This is a useful set of results for policy makers particularly in relation to banking market features, social, and technological factors that should be prioritised to achieve greater financial inclusion.

This study makes the following main contributions. Previous studies that attempt to construct a multidimensional financial inclusion index either consider one or two points in time, or a limited number of countries, or use exogenous weight assignment. Our first contribution relates to constructing a financial inclusion index using a principal component analysis for a global sample over a relatively long time period that enables us to analyse progress trends in financial inclusion and to perform a regression analysis. Moreover, we contribute to the growing literature that examines the determinants of financial inclusion. We extend prior research that demonstrates the importance of country-level characteristics on advancing financial inclusion by analysing a wider range of factors that may impact the level of financial inclusion, including banking conditions.

Structure of the thesis

The remainder of the thesis is structured as follows. Chapter 2 presents the first empirical essay on the determinants of bank capital structure. The study investigates the main bank-specific

determinants of capital structure of European listed commercial banks. We examine the relationship between banks' equity capital and different types of risk including credit risk, liquidity risk, and reputational risk. Moreover, we assess the impact of the global financial crisis and the Euro sovereign debt crisis on banks' capital structure.

Chapter 3 contains the second empirical essay of the thesis on financial inclusion and bank performance. The study aims to construct a CAMEL-based bank performance index and examine the impact of financial inclusion on the index. Furthermore, we investigate whether the relationship is different for banks operating in high income countries compared to that in low income countries.

Chapter 4 presents the third empirical essay on financial inclusion. The study develops a composite index of financial inclusion and presents ranking and progress trends. Moreover, the study aims to examine country-specific factors that explain differences in the level of financial inclusion, including banking conditions, social and technological factors, among others.

Finally, Chapter 5 concludes the thesis. It provides an overall summary of the empirical essays, discusses some limitations, and suggests avenues for future research.

2 ESSAY I: The Determinants of Bank Capital Structure: A European Study

ABSTRACT

The paper investigates the capital structure determinants of the European Economic Area's listed banks over 2005-2014. We account for the impact of the financial crisis and the Euro sovereign debt crisis and examine moral hazard effects derived from too-big-to-fail status and alternative types of risk. In line with the corporate finance literature, we find that equity capital is negatively associated with size and positively with profits, market-to-book ratio, and dividends. Our evidence also shows that market return volatility risk significantly increases banks' equity capital; while credit risk measured by non-performing loans does not seem to significantly affect banks' capital structure decisions. Moreover, we find a positive relationship between equity capital and banks' reputational risk related to Environmental Social Governance (ESG) issues. Finally, it appears that large systemically important banks hold significantly lower equity capital. The study offers potentially important implications as the debate on optimal capital structures of banks is still ongoing.

Keywords: Bank Capital; Capital Structure; Financial Crisis; TBTF; Reputational Risk.

2.1 Introduction

Banks are the most regulated financial institutions, and the financial sector is among the most regulated in the economy. This is motivated, among other factors, by the need to ensure stability and protect consumers and results in the provision of government safety nets. Post-crisis international regulators have focused on banks' leverage ratios, liquidity, and, in particular, quantity and quality of their capital due to its important function as a buffer to absorb losses in case of crisis. Bank managers typically argue that high capital requirements increase banks' costs and reduce their profitability and ability to compete, therefore it would be rational to expect that banks would not hold more capital than required by regulators.

Yet, studies have shown that many banks, including those located in the US and EU, maintain capital ratios well above the regulatory minimum which motivates the need to further investigate banks' capital structure determinants (Berger et al., 2008, Brewer et al., 2008, Flannery and Rangan, 2008). In a study of 200 US and EU banks during the period 1991-2004, Gropp and Heider (2010) show that regulatory capital requirements are not of first-order importance in determining banks' capital structure, and find similarities between banks and non-financial firms in their capital structure decisions. However, the "specialness" of banking firms and their remarkable growth in asset size in recent years has highlighted the importance of understanding their capital structure and risk-taking, especially after the recent period of financial instability and bank failures.

In this paper we extend Gropp and Heider (2010)'s study and address the following research questions: What are the main bank-specific determinants of capital structure of European listed commercial banks?[2] What is the impact of market return volatility risk on banks' capital structure? What other risks - between traditional credit risk, liquidity risk, and reputational risk related to environmental social governance (ESG) issues - are most likely to be related to capital?

[2] Capital structure in our study refers to book and market equity ratios while Gropp and Heider (2010) consider book and market leverage.

We extend the sample period to cover the international financial crisis and the Euro sovereign debt crisis and assess their effect on banks' capital structure. Finally, we investigate the capital structure for systemically important banks and test for the too-big-to fail moral hazard effect.

Our main findings are that capital regulation is not of first-order importance in determining banks' capital structure, thereby confirming Gropp and Heider (2010)'s results and providing support for the corporate finance view on the bank-specific factors that affect the capital structure decision, namely: market-to-book ratio, profitability, size, dividends and market return volatility risk. We also find that crisis time erodes the positive effect of profitability and growth on the market capital ratio. Our evidence indicates that size and market return volatility risk variables are the most important factors affecting capital. Concerning alternative types of risk, we find that credit risk does not seem to affect banks' capital choices. Further, we find a positive relationship between equity capital and banks' reputational risk related to Environmental Social Governance (ESG) issues. However, we find that liquidity risk is negatively associated with banks' equity capital. Finally, our results suggest that a bank's equity ratio is negatively related to its systemic size, or size relative to the country's economy. Overall, the findings suggest that regulatory concerns are not the main driver for capital structure and that size and market-related factors (i.e., market return volatility risk and reputational risk) play a crucial role in the decision.

This paper is structured as follows. Section 2.2 reviews the relevant theoretical and empirical literature. Section 2.3 discusses the hypotheses and variables selection. Section 2.4 explains the data and main methodology used in this paper. Section 2.5 presents and discusses the results. Finally, Section 2.6 concludes.

2.2 Literature review

In this section we review theoretical and empirical studies related to capital structure and the importance of bank capital.

2.2.1 Theoretical strand

The literature on the capital structure of banks is normally separated from that of non-financial firms. This is due to the 'specialness' of banks, their business models and the regulatory and supervisory pressure they operate under due to imposed minimum capital requirements. Moreover, compared to other industries, banks operate with considerably lower equity levels.

Modigliani and Miller's (M-M) theorem (1958) is considered the starting point of the academic literature on firms' capital structure. The M-M theorem states that in perfect and frictionless markets, capital structure is irrelevant to the firm value. Based on a set of assumptions, they suggest that capital does not affect the firm's funding costs, hence it should not matter if a firm uses debt or equity financing. When asked whether the M-M propositions apply to banks, Miller (1995) replied "Yes and No". Specifically, he suggests that, on one hand, the capital indifference theorem can be extended to banks, as it is difficult to consider bank deposits so special to eliminate the applications of M-M propositions to banks (compared to other corporate securities). On the other hand, what makes banks special are the government repayment guarantees that will affect the banks' cost of capital as banks have the opportunity to obtain funds at less than risk-adjusted cost. Miller argues that the view of banks' equity capital being scarce and expensive is incoherent, and if capital market is left to its devices (i.e., free from the government repayment guarantees for deposits) the M-M propositions cannot be ruled out.

Berger et al. (1995) confirm that capital structure of financial institutions, similar to other firms, is determined partly by the departure from the perfect world of Modigliani and Miller (1958). The major market imperfections they consider in determining financial institutions'

optimal capital ratios are taxes, costs of financial distress, asymmetric information and transactions costs as well as government safety net. According to Berger et al. (1995) banks differ from other firms in two aspects that affect their capital structure: (i) government safety nets that protect the soundness of the financial system and are likely to reduce bank capital as it protects bank creditors from the penalties of bank risk-taking and therefore tends to decrease market capital requirement, and (ii) the regulatory capital requirements that aim to increase the capital of banks. As banks have the highest leverage among firms, Berger et al. (1995) argue that this is in contrast with the implications of M-M propositions, which expect capital structure to vary randomly across firms.

The bank-specific capital structure theories developed significantly over the last decades. In particular, Diamond and Rajan (2000) build a model for capital structure where in case of certainty banks use deposits only to fund their projects but under uncertainty the costs of runs motivate the use of other sources of outside capital. The authors argue that increased bank capital reduces banks' liquidity creation but enables them to survive and avoid financial distress. Allen et al. (2011) discuss the excess capital that banks hold, and how it is expected to support market discipline and system stability. Their model focuses on the assets/lending side and shows that when markets are perfectly competitive, banks choose to use costly capital rather than increasing loan rate to incentivise monitoring and at the same time to attract more borrowers.

Admati et al. (2013) examine the arguments that equity is expensive and high capital requirements are costly for large banks. They find this view to be supported by weak arguments from managers and shareholders who have strong incentives to maintain high leverage. Instead, they argue that when banks hold more equity, the risk premium decreases thereby reducing the

required return on equity which in turn reduces banks' costs. In their view banks with higher capital face fewer distortions in lending decisions and improve their performance.[3]

Thakor (2014) provides a simple model of a bank that provides quality asset transformation and chooses its capital structure. This model is used to explain the relationship between bank capital and stability; it also addresses various theories of bank capital structure. Moreover, the paper reviews the theoretical and empirical debate in the literature on bank capital. The author states that higher capital is linked to increased lending, creation of liquidity, increased shareholder value in banking, and increased probabilities of survival in crises; while lower capital might lead to systemic instability and increased government debt resulting in bailouts and sovereign crisis. The paper provides extensive discussion of how regulation can enhance banking stability and argues that financial institutions should be required to hold more capital in order to mitigate risks.

Other theories discuss how capital affects banks' liquidity creation, lending, and shareholder value. Some argue that higher capital increases banks' efficiency in assets allocation, thereby increasing lending and liquidity creation and incentivising more monitoring and consequently higher bank value (Mehran and Thakor, 2011). Others maintain that higher capital decreases liquidity, increases costs and consequently lowers lending and liquidity creation (Diamond and Rajan, 2001). However, there seems to be an agreement on the positive effect of bank capital in sustaining systemic stability.

2.2.2 Empirical strand

Early empirical studies tend to find similarities in the factors affecting the capital structure of banks and those of non-financial firms. More recent studies include capital as an independent

[3] Miles et al. (2013) support Admati et al. (2013) empirically and attempt to estimate the optimal equity capital for banks. They find that large increases in equity capital result in small long-term increases in borrowing costs faced by customers. On the other hand, substantially higher capital requirements could result in great benefits by reducing the risk of systemic banking crisis.

variable to examine other issues such as performance during the crisis (Beltratti and Stulz, 2012), or understanding the performance of systemically important banks (Bertay et al., 2013).

Lindquist (2004) focuses on the relationship between banks' capital buffer and credit risk and investigates whether this buffer acts as insurance against falling below the capital regulatory requirements, whether it is used as a competition signal or a supervisory discipline, and whether it depends on economic growth. A generalised least squares random effects model is used to analyse the determinants of capital buffers in 127 savings and 10 commercial banks in Norway covering the period 1995:Q4-2001:Q1. Explanatory variables include banks' credit risk, price of excess capital, profitability, size, amount of unspecified loan loss provisions, competitors' average capital buffer, supervisory scrutiny, and growth rate of gross domestic product. For commercial banks the author finds a negative relationship between capital buffer and unspecified loan loss provisions which suggests that the latter is used as an alternative to increasing capital buffer and supports the insurance explanation. Additionally, the author finds that the buffer capital of commercial banks does not increase with the measure of credit risk and is negatively related to size. The results suggest a positive relationship between banks' capital buffer and supervisory monitoring which supports the supervisory discipline explanation. The author also concludes that commercial banks make a notable effort to rebuild capital buffer after a period of distress.

In a US study, Berger et al. (2008) investigate alternative hypotheses that may help explain the "excess" capital that banks hold from the mid-1990s. They first test the "pecking order" theory of capital structure which implies that the capital ratio at any point simply reflects the history of retained earnings. Second, they test the economic capital hypothesis which states that banks match their capital ratio to risk exposure, valuable charters that they would like to maintain, and asset size. Finally, they test if banks maintain excess capital to be able to take advantage of future investment opportunities. The results of their initial analysis strongly suggest that excess capital reflects more than simple historical accumulation of retained earnings; in fact,

they suggest that banks actively manage their capital ratios. The authors also apply a partial adjustment model to a sample of publicly traded US bank holding companies between 1992 and 2006 to test the determinants of target capital ratios.[4] The variables include two measures of risk: returns volatility and counterparty risk as well as market to book ratio, external growth/business strategies, size, and bank fixed effects. Size, market to book ratio, and business strategies are found to be statistically significant in explaining the target capital ratios that are set well above the minimum regulatory requirements. The study also includes an estimation of the determinants of banks' capital adjustment speed. It provides evidence that merely adequately capitalised banks adjust toward their capital targets faster than well-capitalised banks. Nevertheless, troubled banks under supervisory pressure adjust toward their targets more slowly.

In another cross-country study that includes 12 industrial countries' banking sectors, Brewer et al. (2008) attempt to explain the variation in banks' capital structure. They test public and regulatory policies in home countries, bank-specific characteristics, and macroeconomic and financial conditions of the country in explaining these differences. The main hypothesis examined in this study is that public and regulatory policies in home countries are essential in explaining the variations in banks' capital structure. This is examined empirically by testing the relation between changes in banks' capital ratios and a country's safety net, quality of external governance, the degree of authorities' intervention to maintain safe and sound banking system, and other regulatory variables. Other determinants included in the model are bank-specific factors (size, risk exposure, and profitability), country-specific macroeconomic factors (growth rate of real gross domestic product and the extent to which the financial system of the country is bank-based). Similar to Berger et al. (2008), the authors employ a partial adjustment model estimated using 78 banking organisations headquartered in 12 industrial economies. The authors find that changes in leverage ratios (measured as book value of equity to total assets) are negatively

[4] Partial adjustment models mainly focus on the adjustment speed towards target capital ratios and how this adjustment speed may varies for banks with different characteristics (see Brewer et al. (2008) and Gropp and Heider (2010)).

correlated with size and positively related to risk and profitability. They also find the extent to which the financial system of a country is bank-based to be statistically significant in explaining the capital ratios. Remarkably, they find that changes in capital ratios are higher in countries with better provisions for prompt corrective action, better external governance, and more explicit capital regulatory requirements; whereas government safety net (this variable captures features of deposit insurance systems that are associated with moral hazard behaviour by banks) is found to be insignificant in explaining the differences among these countries. In general, banks are found to maintain higher capital ratios in smaller countries that have better corporate governance structures.

Jokipii and Milne (2008) analyse the extent of co-movement between European banks' capital buffers and the business cycle. Employing the two-step generalised method of moments (GMM), they examine the impact of the business cycle in addition to other bank-specific factors including return on equity (can be interpreted as a measure of equity cost or revenue), credit risk measured by non-performing loans ratio, bank size, profitability, and credit demand (measured by annual loan growth) on banks' equity capital buffers for a sample of European banks over the period 1997-2004. The authors find a negative co-movement between commercial and large banks' buffers and the business cycle (i.e., these banks increase capital buffers in recessions). As for other bank-specific variables, they find a significant negative effect of size and return on equity and a significant positive effect of non-performing loans ratio.

Literature on the determinants of banks' capital structure considers two alternative views: on one hand, the corporate finance view, which extends the conventional determinants of capital structure found important for non-financial firms to banks. An alternative view is the buffer / regulatory view, according to which banks hold capital buffers above the regulatory minimum requirements in order to avoid the high costs associated with issuing equity capital at short notice in case of any violation of capital requirements. In the present study we borrow a set of firm-specific variables that are related to the capital structure from the empirical corporate finance

literature that has examined the capital structure of non-financial firms to examine the similarities between banks and those firms. We refer mainly to three studies from the corporate finance literature on non-financial firms. First, Titman and Wessels (1988) empirically analyse a number of theories of capital structure. The authors examine the relationship between different measures of financial leverage and firm-specific factors for US non-financial firms over the period 1974-1982. They find a negative relationship between firms' leverage (related to debt ratios) and the uniqueness of a line of business, between short-term debt and firms' size, and between past profitability and current debt levels to the market value of equity. However, they find the effect of collateral, volatility, and future growth to be insignificant. Second, Rajan and Zingales (1995) find similarities between G-7 countries and US firms in terms of the factors related to leverage when analysing the determinants of capital structure for the period 1987-1991. The authors focus on size, tangibility (measured as the ratio of fixed to total assets as a proxy for collateral), market-to-book ratio, and profitability as determinants of non-financial firms' capital structure choice. They find that leverage (defined as debt to capitalisation in both book and market values) is positively correlated with tangibility and size, and negatively correlated with profitability and market-to-book ratio. The third important study is Frank and Goyal (2009) who focus on investigating the main factors that explain capital structure decisions of listed US non-financial firms from 1950-2003. This study identifies a set of firm-specific variables that are related to the capital structure of non-financial firms. Using an OLS regression, they find that the variation in leverage depends mainly on a set of six variables called "core factors". Specifically, leverage (measured as debt to assets) is found to be positively related to median industry leverage, tangibility, assets size, and inflation, while negatively related to profits, market to book assets ratio, and dividends. They also find that the importance of these factors in the core model changes over time; for example, profits played an important role in determining the leverage ratio before the 1980s but a less powerful role in later periods.

Returning to financial firms, Gropp and Heider (2010) investigate the determinants of banks' capital structure and contrast the corporate finance view with the regulatory (buffer) view. They examine whether banks' capital determinants are similar to non-financial firms' determinants (market/corporate finance view) as opposed to capital requirements being the most important determinant of capital structure (buffer view). The authors focus on 200 largest publicly traded commercial banks and bank holding companies in the US and EU for the period 1991-2004. Using a standard capital structure OLS regression, they regress the book/market leverage ratios on the standard corporate finance determinants used for non-financial firms (i.e., market-to-book ratio, profits, size, collateral, dividends, and risk). All variables are found to be statistically significant in explaining the market leverage ratio and have the same sign as the standard regression for non-financial firms. In order to further identify a potential effect of regulation on capital structure, deposit insurance coverage (moral hazard effect) is added as an additional explanatory variable, but no evidence of its impact on banks' capital structure is found. They also examine banks that hold capital close to the regulatory minimum, and provide evidence that regulation becomes important in determining capital structure for these banks. In general, the authors find support for the market/corporate finance view rather than the buffer view of capital structure.

A number of studies focus on the relationship between capital and different types of risks. Vallascas and Hagendorff (2013) investigate the sensitivity of regulatory capital requirements to risk; in other words, they examine whether minimum capital requirements reflect the risk of banks' portfolio accurately. The authors estimate the link between the change in a bank's risk-weighted assets (which is the regulatory measure of the risk of a bank's portfolio) and the volatility of the bank's assets return (which is the market measure of a bank's portfolio risk), while controlling for lagged risk-weighted assets and a vector of other bank-specific and country-specific variables. They estimate the regression using a dynamic GMM estimator on a cross-

country sample of 246 large listed banking organisations from 41 countries for the period 2000-2010. The results of their study show that there is a positive relation between risk-weighted assets and asset volatility, but significant increases in the market measure of banks' portfolio risk generate a small increase in the regulatory capital requirements.

As for liquidity risk, Distinguin et al. (2013) study the determinants of bank capital buffer focusing on the role of liquidity. They mainly investigate whether banks maintain higher regulatory capital ratios when they face higher illiquidity. Their sample includes US and European listed commercial banks over the period 2000–2006. Using the GMM, the authors regress the regulatory capital ratio on illiquidity variables (proxied by the liquidity creation ratio and net stable funding ratio) and a set of factors including profitability, dividends, credit risk, debt funding structure, market-to-book ratio, size, regulatory oversight, and, finally, business cycle. Interestingly, results show that higher illiquidity has a negative impact on banks' regulatory capital. In other words, banks do not strengthen their solvency situation when faced with higher illiquidity. Additionally, they find that banks with higher profitability, lower dividends, and higher credit risk tend to have higher capital ratios.

We also consider the link between banks' equity capital and reputational risk. To the best of our knowledge, there are no previous studies investigating the impact of reputational risk related to ESG issues on banks' capital structure. However, it is well documented in the literature that firms with better corporate social responsibility (CSR) have lower cost of equity financing and lower risk (El Ghoul et al., 2011, Dhaliwal et al., 2014, Valter and Alain, 2017). Fiordelisi et al. (2013) investigate the determinants of reputational risk in the banking sector for the period 2003-2008. Their results show that in case of operational loss, the reputational damage is lower for well capitalised banks. Moreover, they find that reputational damage is positively associated with the bank's size and profitability.

The financial crisis prompted a widespread interest in developing a better understanding of banks' book capital, market capital, and regulatory capital. A number of studies use capital as an explanatory variable to examine banks' performance in crisis time. These studies provide evidence that equity capital ratio has a positive effect on the bank's stock returns, probability of survival, and market share during crisis period (Beltratti and Stulz, 2012, Berger and Bouwman, 2013, Demirguc-Kunt et al., 2013).

Turning to systemic size, Bertay et al. (2013) empirically analyse whether systemically important banks are different in terms of performance (risk and return), business models (activity mixes and funding strategies including leverage), and finally whether these banks face a different degree of market discipline compared to small banks. The authors examine an international sample of banks from 90 countries for the period 1991-2011. To analyse the relationship between absolute and systemic size and banks' capital, the authors regress the equity ratio on two measures of size - assets as an absolute measure and liabilities over GDP as a proxy for systemic size - and a set of bank-level and country-level control variables including country and year fixed effects. Results show a significant negative effect of both absolute and systemic size measures on banks' capital, providing evidence that large and systemically important banks hold significantly lower equity capital than small banks.

In this section we have surveyed the most relevant empirical literature on the determinants of capital structure and the risk sensitivity of capital. Two key observations can be drawn from this review. First, regulatory requirements do not seem to be the primary determinants of banks' capital structure decisions; and second, there are a number of bank-specific factors and macroeconomic variables that are reliably related to the bank capital structure decisions. In this study, we investigate whether these findings can be extended to the period of recession that followed the global financial crisis and the euro sovereign debt crisis. We also specifically test the sensitivity of equity capital decision to alternative measures of bank risk.

2.3 Hypotheses

Titman and Wessels (1988), Rajan and Zingales (1995), and Frank and Goyal (2009) have identified a set of firm-specific variables that are reliably related to the capital structure of non-financial firms. As for banks, Gropp and Heider (2010) confirm the relevance of these variables. Specifically, they find that banks' leverage (defined as one minus equity to assets) is positively related to bank size and collateral, and negatively related to market-to-book ratio, profits and dividends. We use the same set of factors as Gropp and Heider (2010) in our baseline model, but extend the sample period to cover the financial and the Euro sovereign crises. If our results show that these bank-specific variables are the main determinants of banks' capital structure and have the signs predicted by the corporate finance view, we then can conclude that regulatory requirements are not of first-order importance and provide further evidence for the similarities between banks' and non-financial firms' capital structure.

H1. Similar to non-financial firms, banks' desired equity capital level is negatively associated with size and collateral, and positively with the market-to-book ratio, profits, and dividends.

The global financial crisis showed fundamental weaknesses in the capital regulation and its role in preventing bankruptcy. In this paper we study whether the financial crisis and the Euro sovereign debt crisis show any significant effect on banks' capital structure. On the one hand, a few studies have found a negative relationship between the economic cycle and capital buffers indicating that banks reduce their capital buffers in good times and increase capital in recessions (Ayuso et al., 2004, Jokipii and Milne, 2008). On the other hand, the substantial losses banks experienced during the crisis period and the fact that it was harder to raise equity financing than debt financing motivates us to expect a negative relationship between capital held by banks and the crisis period. Additionally, we test whether the factors determining bank equity capital have the same effect during the crisis period (Beltratti and Stulz, 2012).

H2. The relationship between equity capital and crisis period is negative, and the relationship between bank-specific variables and equity capital may differ during the crisis.

The regulatory (or buffer) view of capital predicts that equity capital held by banks depends on the probability of their capital falling below the regulatory minimum requirements; hence riskier banks hold higher equity capital. Similarly, the trade-off theory of corporate finance assumes that firms with higher risk face higher costs of financial distress therefore tend to have more capital. Accordingly, both the buffer view and the corporate finance view predict a positive impact of risk on banks' equity capital. It has been argued that banks held insufficient capital during the crisis as regulatory requirements were not in line with the riskiness of banks activities (Hellwig, 2010). Therefore, it is important to test the impact of different measures of risk on banks' capital structure.

H3. The relationship between equity capital and alternative measures of risk is positive and significant.

Our main measure of risk is the market return volatility risk used in Gropp and Heider (2010)'s model and measured as the annualised standard deviation of daily stock returns multiplied by the market value of equity over the market value of bank. Market return volatility risk is expected to have a positive impact on banks' use of equity capital. Riskier banks with higher market return volatility are expected to hold higher capital ratios to decrease the probability of insolvency and the costs of bankruptcy. Vallascas and Hagendorff (2013) show that there is a positive relation between risk-weighted assets as a measure of capital requirements and asset volatility.

In addition to market return volatility risk, we consider other types of risk. First, we add credit risk proxied by the non-performing loans ratio. Jokipii and Milne (2008) find that banks with relatively risky portfolios generally hold more capital to hedge against borrowers' default risk and meet potential adverse shocks. This is an ex-post measure of the risks associated with the

banks' traditional activities and, therefore, its expected sign is positive. As for the second additional measure of risk, we consider liquidity risk. Banks have an incentive to avoid failure through holding enough capital to hedge against different types of risk, and since traditionally banks' main assets are relatively illiquid loans, we expect banks to hold higher capital in order to offset liquidity risk.

Finally, we include the reputational risk related to environmental, social, and governance (ESG) issues. El Ghoul et al. (2011) find that firms with better corporate social responsibility (CSR) scores obtain cheaper equity financing. Therefore, we expect banks that are less involved in ESG issues to have lower cost of capital and consequently to hold lower capital as they can obtain better price when issuing equity at short notice. While banks that are more involved in ESG issues are expected to have higher equity-issuing costs and, consequently, to hold higher equity capital. To the best of our knowledge, this is the first work that investigates the impact of reputational risk related to ESG issues on banks' capital.

Up to the global financial crisis, banking institutions around the world grew in size significantly and expanded their balance sheets. Reasons behind this growth include taking advantage of scale economies, risk reduction through diversification, managerial benefits in addition to the desire to reach Too-Big-To-Fail (TBTF) positions to be able to benefit from greater government protection (Demirgüç-Kunt and Huizinga, 2013). Brewer and Jagtiani (2013) find that banks were willing to pay an added premium for mergers to reach the TBTF status, and capture extended government safety net access which allows these banks to operate at lower capital levels. We expect systemic size to be negatively related to banks' equity capital proving a moral hazard effect.

H4. Systemically important banks hold lower equity capital.

2.4 Methodology and data

2.4.1 Empirical model

Following Gropp and Heider (2010), we use the baseline model borrowed from the corporate finance literature for non-financial firms to explain the determinants of banks' capital structure. The model includes asset size, profitability, market-to-book ratio, collateral, dividends, and market return volatility risk. At this stage we compare the buffer view and the corporate finance view of capital structure. The buffer view states that the main reason for banks holding capital buffer is to avoid their capital falling below the regulatory requirements, whereas the corporate finance view relates banks' capital buffer to the standard capital structure variables similar to non-financial firms.

Our standard capital structure regression can be presented as follows:

$$\begin{aligned} \boldsymbol{Capital}_{ict} = {} & \boldsymbol{\beta_0} + \boldsymbol{\beta_1 Market\ to\ Book}_{ict-1} + \boldsymbol{\beta_2 Profitability}_{ict-1} + \boldsymbol{\beta_3 Size}_{ict-1} \\ & + \boldsymbol{\beta_4 Collateral}_{ict-1} + \boldsymbol{\beta_5 Dividend}_{ict} + \boldsymbol{\beta_6 Asset\ Risk}_{ict-1} + \boldsymbol{c_c} + \boldsymbol{c_t} + \boldsymbol{u_{ict}} \end{aligned} \quad (2.1)$$

The dependent variable is *Capital* (measured alternatively by the book equity capital ratio and market equity capital ratio) of bank *i* in country *c* at time *t*; the explanatory variables include the market-to-book ratio (*Market to Book*), profitability (*Profitability*), natural logarithm of total assets (*Size*), tangibility (*Collateral*), dividend dummy (*Dividend*), and market return volatility risk (*Market return volatility risk*). All bank-level explanatory variables are lagged by one year to control for potential endogeneity issues. The model also includes country and time fixed effects (c_c and c_t, respectively) to account for heterogeneity across time and countries which may be correlated with the independent variables. Standard errors are clustered at the bank level to control for serial correlation of errors and heteroscedasticity (Petersen, 2009). The model is estimated using ordinary least squares (OLS).

We then replace country fixed effects in our baseline model in Equation (2.1) with a set of macroeconomic variables controlling for heterogeneity across countries by including GDP growth and inflation. This can be presented as follows:

$$C_{ict} = \beta_0 + \beta_1 Market\ to\ Book_{ict-1} + \beta_2 Profitability_{ict-1} + \beta_3 Size_{ict-1} + \beta_4 Collateral_{ict-1} + \beta_5 Dividend_{ict} + \beta_6 Market\ return\ volatility\ risk_{ict-1} + \beta_7 GDP growth_{ct} + \beta_7 Inflation_{ct} + c_t + u_{ict} \quad (2.2)$$

We next analyse the effect of the global financial crisis and the Euro sovereign debt crisis on banks' capital structure. Further, we test additional risk measures in the baseline model including credit risk measured by non-performing loans ratio, liquidity risk measured by liquid assets to deposits and short-term funding, and reputation risk measured by the reputation risk index (RepRisk Index) which captures and quantifies reputational risk exposure related to ESG issues. Finally, we examine the equity capital for systemically important banks to test for the too-big-to fail moral hazard effect.

We now provide a description of our variables and the expected relations between the independent variables and the equity capital, in line with the predictions of the corporate finance view and the regulatory view of capital. Table 2.1 displays the definition of bank-specific and macroeconomic variables as well as the data sources used in the study.

Table 2.1: Definition of variables

Variables	Definition	Source
Dependent variables		
Book Capital Ratio	Book value of equity / Book value of assets	BankScope
Market Capital Ratio	Market value of equity (=Number of shares * End of year stock price) / Market value of bank (=Market value of equity + Book value of liabilities)	DataStream
Bank-specific independent variables		
Market-to-Book Ratio	Market value of assets / Book value of assets	BankScope/DataStream
Profitability	Return on average assets (ROA)	BankScope
Size	Log(Total book value of assets)	BankScope
Collateral	(Total securities + Cash and due from banks + Fixed assets)/ Book value of assets	BankScope
Dividend Dummy	1 if the bank pays dividends in a given year, 0 otherwise	DataStream
Risk		
Market return volatility risk	Log of annualised standard deviation of daily stock returns * (Market value of equity / Market value of bank)	DataStream
NPLs	Non-performing loans / Gross loans	BankScope
RepRisk Index	End-of-year reputation risk index	RepRisk
Liquidity Ratio	Liquid assets / Deposits and short-term funding	BankScope
Macroeconomic independent variables		
GDP Growth	Annual percentage change of gross domestic product	World Bank Development Indicators and Eurostat database
Inflation	Annual percentage change in average consumer price index	World Bank Development Indicators
Crisis Dummy	Dummy equal to 1 for years of the financial and the Euro sovereign crises (2008-2011), and 0 otherwise	
Systemically Important Banks – Assets	Dummy equal to 1 for banks with total assets equal or above 50% of GDP, and 0 otherwise	BankScope/Eurostat database
Systemically Important Banks – Liabilities	Dummy equal to 1for banks with total liabilities equal or above 50% of GDP, and 0 otherwise	BankScope/Eurostat database

Note: The table consists of variable definitions and sources.

Our dependent variables are the banks' market equity capital ratio measured as a ratio of the market value of equity to the market value of assets and the book equity capital ratio measured as a ratio of the book value of equity to the book value of assets.

Turning to the independent variables, we use a market-to-book ratio as a measure of growth opportunities. It has been found to have a positive relation with the equity capital of financial and non-financial firms (Rajan and Zingales, 1995, Frank and Goyal, 2009, Gropp and Heider, 2010), which is in line with the sign predicted by the trade-off theory where higher

growth opportunities increase the costs of financial distress and consequently less debt is used (growth is an intangible asset that cannot be used as collateral). On the other hand, the buffer view predicts that banks with higher growth opportunities tend to hold less equity capital, as these banks are better known to investors and can obtain better price when issuing equity at short notice (Gropp and Heider, 2010).

Next, we measure profitability as return on the book value of average assets. The pecking order theory of Myers and Majluf (1984) predicts a positive relationship between profitability and equity capital as profitable firms prefer to use internal financing rather than debt; whereas the agency theory expects firms with higher profitability to rely more on debt financing to discipline managers and decrease free cash-flow (Jensen, 1986). Frank and Goyal (2009) report that most empirical corporate finance studies find a positive relation between profitability and equity capital, which validates the pecking order theory. On the other hand, the buffer view of capital predicts a negative relationship between profitability and equity capital. Based on the same argument given for growth opportunities, profitable banks are better known to investors and can obtain a better price when issuing equity at short notice so they do not need to hold higher equity capital.

Size calculated as the logarithm of total assets is expected to have a negative impact on equity capital according to the trade-off theory that predicts that larger firms tend to have more leverage capacity. However, according to the buffer view the relation between size and equity capital is ex-ante ambiguous (Gropp and Heider, 2010). Larger banks may hold larger buffers to compensate for higher complexity and asymmetric information; alternatively, it is possible that larger banks hold smaller buffers because they are better known to investors and able to issue equity with less cost at a short notice.

Further, we include collateral as a measure of tangibility, which is expected to have a negative relation with equity capital as according to the trade-off theory tangibility enhances the lenders' willingness to provide debt financing to borrowers. Titman and Wessels (1988), Rajan and Zingales (1995), and Frank and Goyal (2009) argue that tangibility reduces the costs of financial distress and hence motivates higher debt financing.

As for the dividend variable, we use a dummy that takes the value of one if the bank pays dividends in a given year and zero otherwise. Corporate finance studies support the pecking order theory that dividend-paying firms with higher profits prefer internal financing rather than debt financing; hence a positive relation is expected. Alternatively, the buffer view expects dividend-paying banks to have lower equity-issuing costs and, consequently, to hold lower equity capital.

We also investigate the effect of the financial crisis and the Euro sovereign debt crisis on banks' equity capital and whether the determinants of capital structure have the same effect during this period. To this end, we use a crisis dummy variable that takes the value of one for the years of the financial crisis and the Euro sovereign debt crisis (2008–2011) and zero otherwise. Additionally, we incorporate into the model a set of interactions between the crisis dummy variable and selected bank-specific explanatory variables (i.e., Crisis dummy * Market-to-Book Ratio, Crisis dummy * Profitability, Crisis dummy * Size, Crisis dummy * Market return volatility risk). We generally expect a negative effect of the crisis period on equity capital due to the recession and distress banks experienced during the period. Additionally, we expect different effects of our key capital determinants during the crisis period especially with the regulatory pressure on banks to adjust their strategies and improve their stability.

Concerning banks' risk, we employ four different measures. In the baseline model, following Gropp and Heider (2010), we use market return volatility risk measured by stock return volatility (Market return volatility risk) as the annualised standard deviation of daily stock returns

by the market value of equity over the market value of the bank. Additionally, we use credit risk proxied by non-performing loans over gross loans (NPLs), liquidity risk measured by liquid assets to deposits and short-term funding (Liquidity Ratio), and reputation risk measured by reputation risk index (RepRisk Index).

The RepRisk Index is an algorithm that captures and quantifies reputational risk exposure related to environmental social and governance issues. RepRisk identifies ESG incidents through screening media and stakeholder information sources executed in 15 languages including print and online media every day. The incidents considered in the Index are: (i) environmental including: climate change, global pollution, ecosystems, waste issues, and animal mistreatment; (ii) social including: community relations (human rights abuses, social discrimination) and employee relations (child labour, discrimination in employment, and poor employment conditions); and (iii) corporate governance including: corruption, bribery, money laundering, executive compensation issues, misleading communication, fraud, tax evasion, and anti-competitive practices. These incidents are used to calculate an ESG risk exposure score, the RepRisk Index, for each firm in the sample. Major incidents are distinguished from minor incidents, based on the severity, reach, and novelty of an incident. RepRisk Index decays to zero over a maximum period of two years if no risk incident has appeared for a company. The current RepRisk Index used in our study denotes the level of media and stakeholder exposure of a company related to these issues; we use its end-of-year value. It ranges from zero (lowest) to 100 (highest), with the higher indicating higher risk exposure to ESG issues. It is worth mentioning that the RepRisk Index data are available from beginning of year 2007 and for 74 banks in our sample.

Our measures of risk are expected to have a positive effect on equity capital according to both the buffer view and corporate finance view. Under the trade-off theory assumption that firms with higher risk and higher volatility in cash flows face higher costs of financial distress and

therefore tend to have more capital. As for the buffer view, riskier banks are required to have more equity capital as they have higher probability of their capital falling below the minimum regulatory capital.

Table 2.2 is adapted from Gropp and Heider (2010) and reviews the predicted signs of the capital structure determinants for corporate finance view and buffer view.

Table 2.2: Predicted effects of explanatory variables on equity capital: Corporate finance view versus buffer view

Variable	Predicted signs on equity capital	
	Market / corporate finance view	Buffer view
Market-to-book ratio	(+)	(-)
Profitability	(+)	(-)
Size	(-)	(+)/(-)
Collateral	(-)	0
Dividend	(+)	(-)
Market return volatility risk	(+)	(+)
Credit risk	(+)	(+)
Liquidity risk	(+)	(+)
Reputational risk	(+)	(+)

Note: The table compares the traditional corporate finance view and regulatory buffer view in terms of the predicted signs of determinants of capital structure. Source: Adapted from Gropp and Heider (2010).

The analysis of the systemically important banks or the TBTF moral hazard effect is conducted using a framework that is similar to Demirgüç-Kunt and Huizinga (2013), we include a dummy variable that is equal to one if a bank's average liabilities to national GDP ratio is equal to or above 0.5 over the bank's lifetime in the sample period. Alternatively, we include a dummy variable that is equal to one if a bank's average assets to national GDP ratio is equal to or above 0.5 over the sample period. We expect a negative relationship between systemic size and equity capital held by banks, as the TBTF status enables these banks to capture extended government protection and allows them to operate with a lower level of equity capital (Brewer and Jagtiani, 2013).

Finally, we include macroeconomic variables to control for the anticipated exposure of banks' activities to the economy of each country. These variables are the GDP growth which is a measure of the annual percentage change of gross domestic product and inflation which is a measure of the annual percentage change in the average consumer price index. Higher GDP growth may be associated with higher growth opportunities that in turn may lead banks to increase their capital ratio to take advantage of these opportunities, while recessions are associated with higher default rates and losses which are absorbed by bank capital. Hence we expect a positive relationship between GDP growth and bank's equity capital (Brewer et al., 2008). Inflation is expected to be negatively associated with equity capital, as a higher rate of inflation increases the rate of return or cost of capital and increases the use of debt (Mokhova and Zinecker, 2014).

2.4.2 Data sources

The data for the analysis are drawn from the following sources: banks' financial statements data from the BankScope database of the Bureau Van Dijk; market data (stock prices, dividends, and number of shares) from Thompson Financial's DataStream database; reputation risk index from RepRisk database; country-level economic data from the World Bank Development Indicators and Eurostat database.

The sample period spans from 2005 to 2014, thereby covering the financial crisis and the Euro sovereign debt crisis. To select the sample, we start with listed commercial banks and bank holding companies in the European Economic Area excluding Iceland (to avoid the Icelandic financial crisis) and Liechtenstein (as there are no listed banking institutions). The focus is on the 28 EU countries, Norway, and Switzerland. Estonia and Latvia are dropped from the sample as there are no banks that meet the sample criteria. At this stage the sample consists of 182 banks.

Following Beltratti and Stulz (2012), for a bank to be included in the sample we require it to be a deposit-taking and loan-making institution, therefore two criteria are implemented: first, deposit and short-term funding to total assets ratio should be at least 20%, and second, the gross loans to assets ratio should be at least 10%. As a result, Luxembourg is also excluded from the sample. The final sample consists of 149 listed commercial banks and bank holding companies operating in the European Economic Area region (EEA). Further, to avoid the possibility of outliers driving the results, we follow Beltratti and Stulz (2012) and winsorise all bank-level variables at the 1% level.

Table 2.3 reports the number of banks in each country of the sample, their average size (total assets in billion euros) and book equity capital ratio. The data show that Denmark has the highest number of banks in the sample (24 banks), followed by Poland (13 banks) and Switzerland (10 banks). France has the highest average bank size (910 billion euro), followed by the United Kingdom (854 billion euro). As for equity capital (measured as average bank book equity to assets ratio over the period), Belgium and France have the lowest average capital ratios of 3.78% and 3.97%, respectively; whereas Bulgaria and Hungary have the highest average capital ratios of 16.53% and 12.39%, respectively.

Table 2.3: Number of banks, average size and book capital ratios (2005-2014)

Country	Number of banks	Average bank size (Euro billions)	Average bank book capital ratio%
Austria	6	54.49	7.76
Belgium	2	387.40	3.78
Bulgaria	3	1.31	16.53
Switzerland	10	129.70	11.35
Cyprus	3	22.89	6.97
Czech Republic	1	27.09	10.21
Germany	8	353.20	6.15
Denmark	24	23.36	10.75
Spain	8	347.00	5.90
Finland	2	6.04	4.80
France	4	910.20	3.97
United Kingdom	10	854.60	7.25
Greece	5	58.85	6.75
Croatia	13	2.12	12.23
Hungary	1	32.63	12.39
Ireland	3	144.80	6.05
Italy	11	176.80	8.91
Lithuania	1	0.80	10.99
Malta	2	4.01	9.65
Netherlands	2	607.60	5.77
Norway	2	152.90	8.19
Poland	13	12.00	11.28
Portugal	4	60.88	5.92
Romania	3	5.37	9.91
Sweden	3	337.50	4.12
Slovenia	1	0.97	6.73
Slovakia	4	5.60	7.55
Total	149	171.40	8.90

Note: The table reports the number of banks included in the sample from each country, the average size and capital ratio of these banks by country over the period 2005-2014.

Table 2.4 provides descriptive statistics for the main variables used in the study.[5] The data in the table show that the mean of book capital ratio for our sample is approximately 9%, suggesting a relatively high leverage of the sample banks. The results also show high variation in the banks' book and market capital ratios, which contradicts the traditional view that the amount of capital held by banks is determined by regulatory requirements and suggests low capital dispersion among banks falling under the same regulatory regimes. The mean of total book assets is 171 billion euro; the smallest bank in the sample has a total asset value of 45 million euro

[5] Greek banks were the most affected by the recent European sovereign crisis; therefore, to avoid possible bias, descriptive statistics and correlations were calculated with and without Greece. However, we find that the effect of these banks is insignificant due to their relatively low number in the sample (5 banks).

which exhibits significant heterogeneity in the sample. The sample banks, on average, appear to earn low returns during the sample period as suggested by the mean return on assets of about 0.5%.

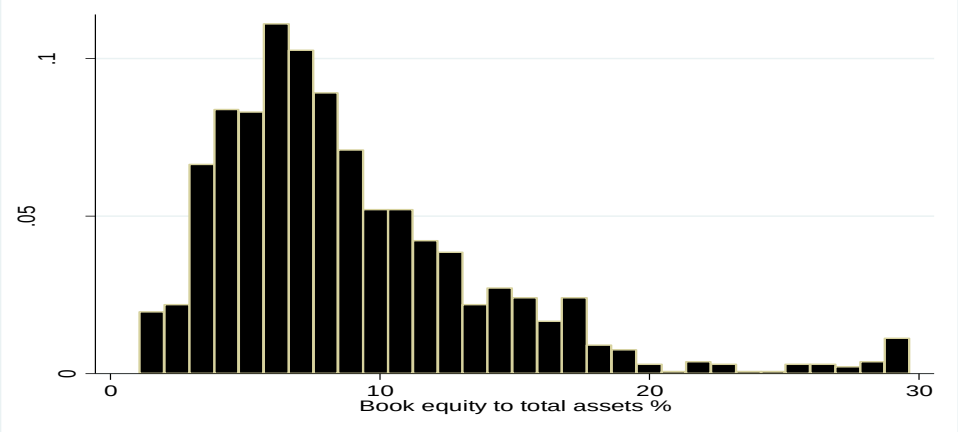
Table 2.4: Descriptive statistics of main variables

Variable	Mean	Std. Dev.	Min	Median	Max	Observations
Book Capital Ratio	8.898	5.167	1.080	7.620	29.670	1324
Market Capital Ratio	10.151	10.009	0.020	6.955	52.440	1324
Market-to-Book Ratio	102.096	11.230	85.060	99.340	161.750	1324
Profitability (ROA)	0.461	1.461	-6.560	0.550	4.150	1324
Size (Euro billions)	171	390	0.045	9.804	1970	1324
Collateral	28.741	14.022	3.280	27.010	68.640	1313
Dividend	0.559	0.497	0.000	1.000	1.000	1485
Market return volatility risk	3.793	4.526	0.100	2.140	25.630	1251
NPLs	8.006	8.737	0.150	5.350	44.900	1038
RepRisk Index	15.171	17.821	0.000	12.000	71.000	592
Liquidity Ratio	29.230	21.639	3.310	24.395	113.280	1284
GDP Growth	1.147	3.065	-14.810	1.600	11.090	1477
Inflation	2.139	1.606	-4.480	2.120	12.350	1490

Note: The table presents basic summary statistics for the full sample of 149 publically traded commercial banks and bank holding companies in EEA (excluding Iceland), covering the period from 2005-2014. Bank-level variables are winsorised at 1% level.

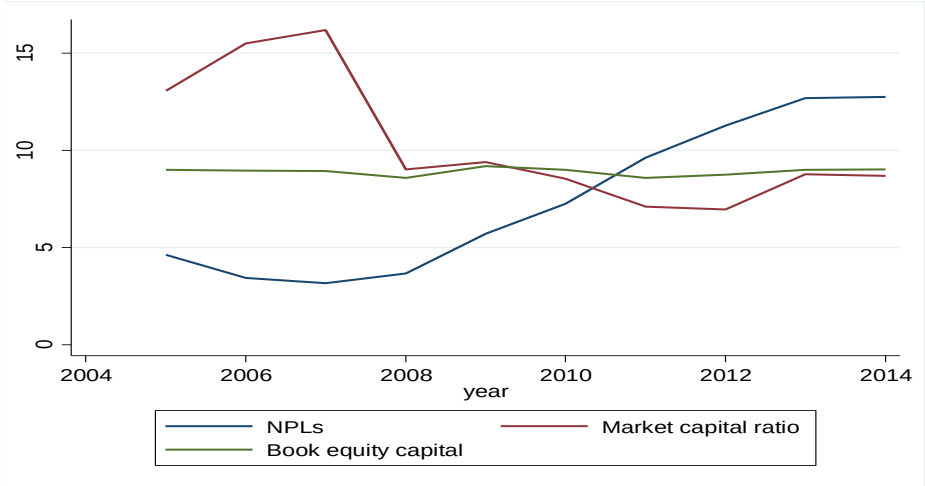
Figure 2.1 illustrates the distribution of the book equity to assets ratio for our sample; the ratio varies from the minimum of 1% to the maximum of 30%. Figure 2.2 shows a significant decrease in the average market equity capital ratio for the banks in the sample over the period 2005–2014. Since the financial crisis hit the global economy in 2007-2008 the average credit quality of the banks' loan portfolios decreased severely as a result of the global economic recession (Beck et al., 2013). Figure 2.2 also shows a significant increase in average non-performing loans ratio for the sample banks over the period 2005–2014.

Figure 2.1: Distribution of banks' book capital ratios



Note: The figure shows the distribution of book capital ratio for the sample.

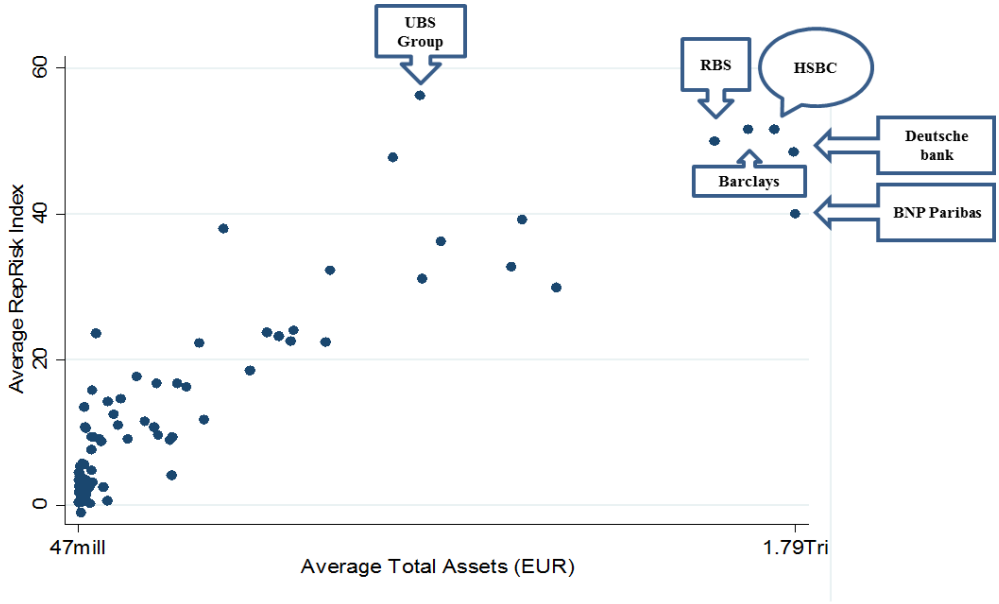
Figure 2.2: Change in average equity capital and NPLs ratios over the sample period



Note: The figure shows the change in the average book equity ratio (Book equity capital), market equity ratio (market capital ratio), and non-performing loans ratio (NPLs) of the sample banks from 2005 to 2014.

Figure 2.3 illustrates the relationship between the sample banks' average assets and average RepRisk Index for the period 2007-2014. Banks that have the highest average end-of-year reputational risk exposure over the period seem to be the largest banks in terms of average assets (e.g., Barclays Plc, Royal Bank of Scotland Group Plc, BNP Paribas SA, Credit Suisse Group AG, HSBC Holdings Plc, UBS Group AG, Deutsche Bank AG, and Societe Generale SA).

Figure 2.3: The relationship between banks' average assets and RepRisk Index



Note: The figure shows the relationship between sample banks' average assets (average assets (EUR)) and average RepRisk Index (Average RRI) for the period 2007-2014.

Before proceeding to the regression results, we examine the correlation between the main bank-specific variables reported in Table 2.5. The correlations are largely in line with those found in the empirical literature. The data show that banks with higher market return volatility risk, higher profitability, and higher growth opportunities tend to have higher book and market equity capital ratios, while larger banks and banks with high collateral tend to have greater leverage.

Table 2.5: Correlation matrix for selected bank-specific variables

	Book Capital Ratio	Market Capital Ratio	Market-to-Book Ratio	Profitability	Size	Dividend	Market return volatility risk	Collateral
Book Capital Ratio	1.0000							
Market Capital Ratio	0.6421***	1.0000						
Market-to-Book Ratio	0.2504***	0.8821***	1.0000					
Profitability	0.2933***	0.4122***	0.3474***	1.0000				
Size	-0.3427***	-0.2455***	-0.1066***	-0.0519**	1.0000			
Dividend	-0.0544**	0.1332***	0.1676***	0.3192***	0.1668***	1.0000		
Market return volatility risk	0.5950***	0.8392***	0.7365***	0.2145***	-0.2218***	-0.0643**	1.0000	
Collateral	-0.1805***	-0.0988***	-0.0103	-0.0266	0.5007***	0.0615**	-0.1009***	1.0000

Note: The table reports correlation coefficients for selected bank variables. *, **, *** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

2.5 Empirical results

2.5.1 The determinants of banks' equity capital: The corporate finance view versus the buffer view

In this section we analyse the results derived from estimating Equations (2.1) and (2.2) testing for our first hypothesis based on the full sample. The results for the determinants of equity capital are reported in Table 2.6. We consider two measures of equity capital, namely, the market equity capital ratio (Models (1)-(2)) and the book equity capital ratio (Models (3)-(4)). In order to determine whether to apply a random or a fixed effects estimator, we use the Hausman (1978) test. The test suggests that the random effect assumption cannot be accepted; hence we use the fixed effects estimator. The model is estimated with macroeconomic variables and time fixed effects (Models (1) and (3)), and with country and time fixed effects (Models (2) and (4)).

The results of Models (1)-(2) where the dependent variable is the market capital ratio and Models (3)-(4) where the dependent variable is the book capital ratio show that the coefficients on the bank-specific variables are mostly consistent with the predictions of the corporate finance literature (Frank and Goyal, 2009, Rajan and Zingales, 1995), which provides evidence that the equity capital held by banks is determined by the same set of factors that determines the capital structure of non-financial firms. This suggests that the regulatory (buffer) view does not fully explain the determinants of banks' capital structure. In particular, the buffer view predicts negative relationships between market-to-book ratio, profits, dividends, and equity capital (as shown in Table 2.2). In other words, the buffer view suggests that banks with higher growth opportunities, higher profits, and pay dividends would hold less equity capital since they can issue equity at a lower cost and at a short notice. However, our results suggest that these banks hold more equity capital providing evidence to our first hypothesis H1 and support the corporate finance view where banks with higher growth opportunities use less debt (trade-off theory) and those with higher profits and dividends prefer to use internal financing (pecking order theory).

Table 2.6: Market and book equity capital ratio models

	Model (1)	Model (2)	Model (3)	Model (4)
Dependent variable	**Market Capital Ratio**		**Book Capital Ratio**	
Market-to-Book Ratio	0.474***	0.457***	0.007	0.003
	(0.040)	(0.046)	(0.028)	(0.027)
Profitability	0.373	0.336	0.683***	0.693***
	(0.254)	(0.249)	(0.210)	(0.199)
Size	-0.739***	-0.755***	-0.831***	-0.815***
	(0.097)	(0.167)	(0.100)	(0.194)
Dividend	1.189**	1.384***	0.720*	0.622
	(0.480)	(0.519)	(0.425)	(0.391)
Market return volatility risk	2.382***	2.198***	1.660***	1.689***
	(0.413)	(0.487)	(0.373)	(0.479)
Collateral	0.008	0.011	-0.002	0.003
	(0.016)	(0.018)	(0.018)	(0.021)
Inflation	-0.457**		-0.120	
	(0.191)		(0.207)	
GDP Growth	0.249**		-0.009	
	(0.104)		(0.096)	
Constant	-26.29***	-24.18***	19.10***	19.63***
	(4.716)	(6.389)	(3.016)	(4.427)
Time fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	No	Yes	No	Yes
Clustering (bank)	Yes	Yes	Yes	Yes
Adjusted R-squared	0.740	0.747	0.502	0.539
Number of observations	1090	1101	1090	1101

Note: The table reports the regression results of estimating the relation between capital ratios and a set of bank-specific and country-level factors. The dependent variables are: (i) market capital ratio (Columns (1)-(2)) and (ii) book capital ratio (Columns (3)-(4)). The independent bank-specific variables include: (i) market-to-book ratio; (ii) profitability; (iii) size; (iv) collateral; (v) market return volatility risk; and (vi) dividend dummy; all lagged by one year. The independent country-level variables include: (i) inflation; and (ii) GDP growth. The regressions are run on the full sample of 149 publicly traded commercial banks and bank holding companies in EEA (excluding Iceland) covering the period of 2005-2014. Standard errors clustered at bank level are reported in parentheses. *, **,*** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

The coefficients of risk and size variables support both the buffer view and the corporate finance view of capital. The buffer view suggests that riskier banks hold higher equity to avoid their capital falling below the regulatory minimum, while larger banks take advantage of being known to the public so they can issue equity at a lower cost and at a short notice. The corporate finance view suggests that riskier banks tend to have more equity capital to lower the costs of financial distress and larger banks tend to rely more on debt as they are less likely to face default risk.

The estimated coefficient of the collateral variable appears to be insignificant in all models. While risk and size variables are highly significant in all models estimated; hence we can conclude that the most important factors affecting capital appear to be size and risk.

As for the macroeconomic variables, we find that the market equity capital tends to be associated with higher GDP growth and lower inflation. Banks increase their capital ratios in

good times to take advantage of high growth opportunities, and use capital to absorb losses in recessions (Brewer et al., 2008). Inflation increases the cost of capital and hence increases the use of debt (Mokhova and Zinecker, 2014).

Overall, our results are consistent with Gropp and Heider (2010) in that regulation does not appear to be of first order importance in determining banks' capital structure. This confirms our first hypothesis H1 and provides evidence that there are similarities between banks and non-financial firms regarding the determinants of their capital structure decisions in the period under analysis.

2.5.2 Impact of global financial crisis and Euro sovereign debt crisis

In this section we investigate the impact of the global financial crisis and the Euro sovereign debt crisis on banks' equity capital and whether the determinants of capital structure differ during this period (testing the second hypothesis). We expect a negative effect of the crisis period on the equity capital as banks experienced substantial losses and it was harder to raise equity financing than debt financing. Table 2.7 presents the estimation results of the equity capital model incorporating a dummy variable for the international financial crisis and the Euro sovereign debt crisis years (2008-2011) and interaction terms between selected bank-specific variables and the crisis dummy.

The results in Table 2.7 show that the relationship between banks' equity capital and the crisis period is not straightforward. The global financial crisis and Euro sovereign crisis period witnessed a great recession and many banks experienced distress, defaults and losses were charged against capital; additionally banks faced difficulty in obtaining equity financing(Brewer et al., 2008).Moreover, the unusual activities of banks during the crisis such as recapitalisations and deleveraging provide inconsistent results.

Incorporating the interaction terms in Model (2), results show that crisis time diminishes the positive effect of profitability and growth on the market capital ratio, indicating that in this period the market reassessed the value of profitability and growth of banks. The results of Model (4) show no significant impact of the crisis period on the determinants of banks' book equity capital.

As shown in our estimations reported in Table 2.7, we find that the relationship between capital and the crisis period is not straightforward. However, we find support for the second part of our hypothesis H2, as some bank-specific variables such as market-to-book ratio and profitability appear to affect equity capital differently during the crisis.

Table 2.7: Equity capital ratios and crisis effect

	Model (1)	Model (2)	Model (3)	Model (4)
Dependent variable	**Market Capital Ratio**		**Book Capital Ratio**	
Market-to-Book Ratio	0.454***	0.552***	-0.020	-0.032
	-0.040	-0.031	-0.027	-0.035
Profitability	0.489*	0.734***	0.603***	0.716***
	-0.255	-0.185	-0.213	-0.192
Size	-0.725***	-0.719***	-0.835***	-0.789***
	-0.097	-0.111	-0.100	-0.105
Dividend	0.759	0.810*	0.447	0.399
	-0.464	-0.436	-0.422	-0.403
Market return volatility risk	2.496***	2.364***	1.732***	1.530***
	-0.408	-0.388	-0.357	-0.373
Collateral	0.003	0.003	0.005	0.004
	-0.017	-0.018	-0.018	-0.018
Inflation	-0.708***	-0.489***	-0.183	-0.214
	-0.128	-0.145	-0.140	-0.137
GDP Growth	0.203***	0.150**	-0.0665	-0.0608
	-0.0755	-0.0645	-0.0596	-0.0595
Crisis Dummy	-2.670***	23.17***	-0.664***	-2.628
	-0.342	-8.151	-0.214	-4.577
Crisis dummy * Market-to-Book Ratio		-0.245***		0.032
		-0.081		-0.045
Crisis Dummy * Profitability		-0.977**		-0.270
		-0.449		-0.350
Crisis Dummy * Size		-0.041		-0.091
		-0.120		-0.067
Crisis Dummy * Market return volatility risk		0.232		0.436
		-0.516		-0.345
Constant	-25.29***	-35.82***	22.95***	23.53***
	-4.323	-3.868	-2.745	-3.580
Time fixed effects	No	No	No	No
Country fixed effects	No	No	No	No
Clustering (bank)	Yes	Yes	Yes	Yes
Adjusted R-squared	0.708	0.733	0.485	0.489
Number of observations	1085	1085	1085	1085

Note: The table reports the regression results of estimating the relation between capital ratios and a set of bank-specific and country-level factors, taking into account the crisis effect. The dependent variables are: (i) market capital ratio (Columns (1)-(2)) and (ii) book capital ratio (Columns (3)-(4)). The independent bank-specific variables include: (i) market-to-book ratio; (ii) profitability; (iii) size; (iv) collateral; (v) market return volatility risk; and (vi) dividend dummy; all lagged by one year. The independent country-level variables include: (i) inflation; and (ii) GDP growth. Additionally, we incorporate the crisis dummy (columns (1) and (3)) and interaction terms between the crisis dummy and selected bank-specific variables (columns (2) and (4)).The regressions are run on the full sample of 149 publicly traded commercial banks and bank holding companies in EEA (excluding Iceland) covering the period of 2005-2014. Standard errors clustered at bank level are reported in parentheses. *, **, *** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

2.5.3 Alternative measures of risk

In addition to our main measure of risk that is market return volatility risk, we investigate other types of risk that may have an effect on banks' capital structure decisions (testing the third hypothesis). In particular, we first examine the credit risk measured by banks' non-performing loans to gross loans ratio. As in Jokipii and Milne (2008), banks are expected to hold higher equity capital to hedge against borrowers' default risk. Table 2.8 presents the estimation results of the equity capital model with the addition of lagged non-performing loans to gross loans ratio.

The estimated coefficient of the NPLs variable, although positive as expected, is insignificant in both the market capital and book capital regressions (Models (1) and (2), respectively). This result suggests that credit risk does not seem to affect banks' capital choice significantly. This could explain the fact that the core capital held by banks proved to be insufficient to cover loan losses during the recent financial crisis. Despite the fact that there is a significant increase in average non-performing loans for the sample banks over the period 2005-2014 (as shown in Figure 2.2, Section 4), the relationship between capital choice and credit risk is weak and we do not find support for our hypothesis that banks with higher credit risk hold higher equity capital.

Table 2.8: Equity capital ratios and credit risk

	Model (1)	Model (2)
Dependent variable	**Market Capital Ratio**	**Book Capital Ratio**
Market-to-Book Ratio	0.473***	-0.0426*
	(0.052)	(0.024)
Profitability	0.336	0.497*
	(0.341)	(0.271)
Size	-0.685***	-0.771***
	(0.116)	(0.125)
Dividend	1.299***	1.067**
	(0.450)	(0.447)
Market return volatility risk	2.256***	1.692***
	(0.440)	(0.407)
NPLs	0.024	0.031
	(0.050)	(0.064)
Collateral	0.002	-0.02
	(0.015)	(0.017)
Inflation	-0.290*	0.102
	(0.151)	(0.158)
GDP growth	0.227**	0.082
	(0.100)	(0.077)
Constant	-27.63***	22.55***
	(6.115)	(3.642)
Time fixed effects	Yes	Yes
Country fixed effects	No	No
Clustering (bank)	Yes	Yes
Adjusted R-squared	0.724	0.517
Number of observations	832	832

Note: The table reports the regression results of estimating the relation between capital ratios and a set of bank-specific and country-level factors, taking into account credit risk. The dependent variables are: (i) market capital ratio (Column (1)) and (ii) book capital ratio (Column (2)). The independent bank-specific variables include: (i) market-to-book ratio; (ii) profitability; (iii) size; (iv) collateral; (v) market return volatility risk; (vi) NPLs; and (vi) dividend dummy; all lagged by one year. The independent country-level variables include: (i) inflation; and (ii) GDP growth. The regressions are run on the full sample of 149 publicly traded commercial banks and bank holding companies in EEA (excluding Iceland) covering the period of 2005-2014. Standard errors clustered at bank level are reported in parentheses. *, **,*** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

Further, we examine the effect of liquidity risk on banks' capital. Table 2.9 presents the estimation results of the equity capital model with the addition of the liquid assets to deposits and short-term funding ratio (lagged by one year).

Consistent with Distinguin et al. (2013), we find that banks with higher liquidity risk (lower liquidity) seem to hold lower equity capital and thus are not hedging for this type of risk through increased capital. Distinguin et al. (2013) find that banks reduce their equity capital when faced with higher illiquidity, in other words banks that face high illiquidity do not strengthen their

solvency standards. Their explanation for this finding is that certain liquid liabilities are considered stable by managers and thus might be substituting the capital. In both Model (1) and (2) we reject our hypothesis that banks hold higher capital to offset liquidity risk.

Table 2.9: Equity capital ratios and liquidity risk

	Model (1)	**Model (2)**
Dependent variable	**Market Capital Ratio**	**Book Capital Ratio**
Market-to-Book Ratio	0.460***	-0.01
	(0.043)	(0.030)
Profitability	0.398	0.753***
	(0.261)	(0.180)
Size	-0.712***	-0.827***
	(0.103)	(0.100)
Dividend	1.170**	0.627
	(0.469)	(0.385)
Market return volatility risk	2.563***	1.835***
	(0.427)	(0.348)
Liquidity Ratio	0.0374*	0.0555**
	(0.020)	(0.021)
Collateral	-0.03	-0.0514**
	(0.024)	(0.026)
Inflation	-0.355**	-0.01
	(0.162)	(0.146)
GDP growth	0.251**	-0.01
	(0.101)	(0.087)
Constant	-25.83***	19.53***
	(4.865)	(3.149)
Time fixed effects	Yes	Yes
Country fixed effects	No	No
Clustering (bank)	Yes	Yes
Adjusted R-squared	0.739	0.554
Number of observations	1061	1061

Note: The table reports the regression results of estimating the relation between capital ratios and a set of bank-specific and country-level factors, taking into account liquidity risk. The dependent variables are: (i) market capital ratio (Column (1)) and (ii) book capital ratio (Columns (2)). The independent bank-specific variables include: (i) market-to-book ratio; (ii) profitability; (iii) size; (iv) collateral; (v) market return volatility risk; (vi) Liquidity Ratio; and (vi) dividend dummy; all lagged by one year. The independent country-level variables include: (i) inflation; and (ii) GDP growth. The regressions are run on the full sample of 149 publicly traded commercial banks and bank holding companies in EEA (excluding Iceland) covering the period of 2005-2014. Standard errors clustered at bank level are reported in parentheses. *, **,*** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

We next investigate the potential effect of reputation risk on the book and market equity capital. We use a reputation risk index (RepRisk Index) that measures the current reputational

risk exposure of the bank related to environmental, social, and governance issues. Since the RepRisk Index data are available from beginning of year 2007 and for 74 banks in our sample, we run the regression on a sub-sample of these banks. Table 2.10 presents the estimation results of the equity capital model with the addition of a lagged end-of-year RepRisk Index.

Table 2.10: Equity capital ratios and reputational risk

	Model (1)	**Model (2)**
Dependent variable	**Market Capital Ratio**	**Book Capital Ratio**
Market-to-Book Ratio	0.492***	-0.0569**
	(0.077)	(0.024)
Profitability	-0.010	0.354*
	(0.451)	(0.204)
Size	-0.698***	-0.666***
	(0.141)	(0.100)
Dividend	0.868***	0.280
	(0.303)	(0.255)
Market return volatility risk	1.938***	1.595***
	(0.302)	(0.220)
RepRisk Index	0.0278**	0.0213**
	(0.014)	(0.009)
Collateral	-0.004	-0.011
	(0.015)	(0.013)
Inflation	-0.075	0.159*
	(0.162)	(0.084)
GDP growth	0.084	0.034
	(0.156)	(0.079)
Constant	-36.66***	21.47***
	(7.921)	(3.392)
Time fixed effects	Yes	Yes
Country fixed effects	No	No
Clustering (bank)	Yes	Yes
Adjusted R-squared	0.733	0.568
Number of observations	470	470

Note: The table reports the regression results of estimating the relation between capital ratios and a set of bank-specific and country-level factors, taking into account reputational risk. The dependent variables are: (i) market capital ratio (Column (1)) and (ii) book capital ratio (Columns (2)). The independent bank-specific variables include: (i) market-to-book ratio; (ii) profitability; (iii) size; (iv) collateral; (v) market return volatility risk; (vi) RepRisk Index; and (vi) dividend dummy; all lagged by one year. The independent country-level variables include: (i) inflation; and (ii) GDP growth. The regressions are run on a subsample of 74 publicly traded commercial banks and bank holding companies in EEA (excluding Iceland) covering the period of 2007-2014. Standard errors clustered at bank level are reported in parentheses. *, **,*** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

The results show that the estimated coefficients of reputation risk index are positive and statistically significant at 5% level in both the market equity and book equity models. This

suggests that banks that have higher risk related to ESG issues hold more capital, these banks have higher cost of capital (El Ghoul et al., 2011, Dhaliwal et al., 2014) and consequently hold higher capital as it can be costly for them to issue equity at short notice (according to the buffer view). The regressions in Table 2.10 enable us to accept the hypothesis that the relationship between capital and reputational risk is positive and significant.

The results show mixed evidence in terms of the effect of alternative types of risk on bank equity capital. Asset and reputational risks sign and significance provide evidence of our third hypothesis H3, while credit risk doesn't seem to affect equity capital and liquidity risk show an opposite effect.

2.5.4 Systemically important banks

In this section we examine the "too-big-to-fail" effect on banks' capital structure. Access to safety net allows large institutions to operate with lower capital and thus lower their costs compared to smaller institutions (Brewer and Jagtiani, 2013). To capture banks' systemic importance, we follow Demirgüç-Kunt and Huizinga (2013) and include a dummy variable that is equal to one if a bank's average liabilities to national GDP ratio is equal to or above 0.5 over the sample period. Alternatively, we include a dummy variable that is equal to one if a bank's average assets to national GDP ratio is equal to or above 0.5 over the sample period. There are 24 banks in our sample that meet the liabilities criterion and 26 banks that meet the assets criterion.

Table 2.11 presents the estimation results of the equity capital model incorporating the dummy variables for the systemically important banks. The estimated coefficients for the dummy variables are negative and significant which confirms that these systemically important banks hold significantly less equity capital, confirming our hypothesis H4. This result shows that banks' growth may be driven by their desire to exploit the too-big-to-fail status and benefit from lower financing cost and higher government protection. Our results are in line with Bertay et al. (2013) who find that systemically important banks operate with higher leverage.

Table 2.11: Equity capital ratios - Systemically important banks

	Model (1)	Model (2)	Model (3)	Model (4)
Dependent variable	**Market Capital Ratio**		**Book Capital Ratio**	
Market-to-Book Ratio	0.460***	0.460***	-0.004	-0.003
	(0.043)	(0.043)	(0.033)	(0.033)
Profitability	0.238	0.239	0.547***	0.551***
	(0.246)	(0.246)	(0.201)	(0.201)
Dividend	0.582	0.536	0.007	-0.048
	(0.520)	(0.518)	(0.452)	(0.451)
Market return volatility risk	2.853***	2.855***	2.196***	2.203***
	(0.487)	(0.490)	(0.466)	(0.470)
Collateral	-0.023	-0.022	-0.0360*	-0.0359*
	(0.019)	(0.020)	(0.021)	(0.021)
Inflation	-0.375*	-0.375*	-0.039	-0.037
	(0.194)	(0.195)	(0.225)	(0.225)
GDP Growth	0.251**	0.258**	-0.011	-0.004
	(0.113)	(0.113)	(0.120)	(0.120)
Systemically Important Banks – Assets dummy	-2.596***		-2.663***	
	(0.465)		(0.455)	
Systemically Important Banks – Liabilities dummy		-2.590***		-2.568***
		(0.483)		(0.473)
Constant	-35.15***	-35.28***	8.627**	8.490**
	(4.538)	(4.542)	(3.313)	(3.329)
Time fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	No	No	No	No
Clustering (bank)	Yes	Yes	Yes	Yes
Adjusted R-squared	0.705	0.705	0.373	0.368
Number of observations	1085	1085	1085	1085

Note: The table reports the regression results of estimating the relation between capital ratios and a set of bank-specific and country-level factors, taking into account systemic size. The dependent variables are: (i) market capital ratio (Columns (1)-(2)) and (ii) book capital ratio (Columns (3)-(4)). The independent bank-specific variables include: (i) market-to-book ratio; (ii) profitability; (iii) collateral; (iv) market return volatility risk; and (v) dividend dummy; all lagged by one year. The independent country-level variables include: (i) inflation; and (ii) GDP growth. Additionally, we incorporate the Systemically Important Banks – Assets dummy (columns (1) and (3)) and the Systemically Important Banks – Liabilities dummy (columns (2) and (4)). The regressions are run on the full sample of 149 publicly traded commercial banks and bank holding companies in EEA (excluding Iceland) covering the period of 2005-2014. Standard errors clustered at bank level are reported in parentheses. *, **,*** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

2.5.5 Robustness tests

In this section, we perform a number of robustness tests for our results. The findings described so far suggest that the regulatory (buffer) view does not fully explain the determinants of banks' capital structure. Therefore the first two robustness checks provide a test of the regulatory effect on the capital structure decision. Additionally, the endogeneity concern in the

previous empirical tests is addressed by using lagged explanatory variables. In the third robustness check we alternatively address the endogeneity problem by using a dynamic panel data approach.

In the first robustness check, we examine the effect of deposit coverage scheme on capital held by banks. The argument is that deposit insurance motivates banks to minimise equity capital to the minimum regulatory requirements. Therefore, we include in our baseline regression deposit insurance coverage in the country of residence of the bank divided by per capita GDP (Gropp and Heider, 2010). Table 2.12 presents the results of the test. The estimated coefficients for the deposit coverage variable are insignificant which suggests that the deposit insurance coverage does not have a significant impact on the capital structure decision of banks. This finding is in line with Gropp and Heider (2010) who find no evidence that deposit insurance has an impact on banks' book or market leverage.

As for the second robustness check, we further investigate the regulatory effect on banks' equity capital by including a number of country-specific regulatory factors that may impact the capital structure decision as in Brewer et al. (2008). These regulatory factors are obtained from the World Bank's Global banking database that provides country-specific regulatory data from different surveys for the years 2000, 2003, 2007, and 2010.[6] The estimation results of the market equity capital and book equity capital models incorporating different regulatory measures are presented in Tables 2.13-2.14, respectively.

[6] Banking regulatory factors are part of the World Bank Surveys on Bank Regulation (Barth et al., 2013).

Table 2.12: Equity capital ratios - Deposit coverage

	Model (1)	Model (2)
Dependent variable	**Market Capital Ratio**	**Book Capital Ratio**
Market-to-Book Ratio	0.470***	0.007
	-0.041	-0.028
Profitability	0.358	0.675***
	-0.259	-0.208
Size	-0.715***	-0.815***
	-0.098	-0.101
Dividend	1.244**	0.791*
	-0.492	-0.423
Market return volatility risk	2.323***	1.582***
	-0.41	-0.371
Collateral	0.001	-0.006
	-0.016	-0.018
Coverage limit to GDP per capita	0.0013	0.0014
	-0.0009	-0.0010
Inflation	-0.477**	-0.160
	-0.193	-0.192
GDP growth	0.234**	-0.026
	-0.108	-0.100
Constant	-26.19***	18.90***
	-4.798	-3.001
Time fixed effects	Yes	Yes
Country fixed effects	No	No
Clustering (bank)	Yes	Yes
Adjusted R-squared	0.733	0.503
Number of observations	1085	1085

Note: The table reports the regression results of estimating the relation between capital ratios and a set of bank-specific and country-level factors, taking into account deposit coverage. The dependent variables are: (i) market capital ratio (Column (1)) and (ii) book capital ratio (Column (2)). The independent bank-specific variables include: (i) market-to-book ratio; (ii) profitability; (iii) size; (iv) collateral; (v) market return volatility risk; and (vi) dividend dummy; all lagged by one year. The independent country-level variables include: (i) inflation; (ii) GDP growth; and (iii) Coverage of the deposit insurance scheme in a country per depositor divided by per capita GDP. The regressions are run on the full sample of 149 publicly traded commercial banks and bank holding companies in EEA (excluding Iceland) covering the period of 2005-2014. Standard errors clustered at bank level are reported in parentheses. *, **,*** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

The estimation results from the second robustness test (Tables 2.13 - 2.14) suggest that there is no significant regulatory impact on banks' capital structure decision as most of the regulatory variables coefficients are insignificant. This suggests that the regulatory (buffer) view does not fully explain the determinants of banks' capital structure. The only exception is the positive and significant relationship between declaring insolvency power and the market equity capital ratio (Model (5) of Table 2.13), suggesting that banks operating in countries with stricter regulation in terms of declaring insolvency have higher equity capital.

Table 2.13: Market equity capital ratio - Regulation

	Model (1) External governance index	Model (2) Supervisory forbearance discretion	Model (3) Various factors mitigating moral hazard	Model (4) Capital regulatory index	Model (5) Declaring insolvency power	Model (6) Financial statement transparency	Model (7) Independence of supervisory authority	Model (8) Official supervisory power	Model (9) Overall restrictions on banking activities
Market-to-book ratio	0.467***	0.464***	0.465***	0.464***	0.446***	0.464***	0.465***	0.466***	0.463***
	-0.0651	-0.042	-0.0417	-0.042	-0.045	-0.0427	-0.0421	-0.0417	-0.0424
Profitability	0.313	0.341	0.325	0.345	0.449*	0.331	0.328	0.319	0.289
	-0.311	-0.256	-0.255	-0.254	-0.236	-0.259	-0.257	-0.259	-0.258
Size	-0.797***	-0.724***	-0.684***	-0.717***	-0.716***	-0.715***	-0.746***	-0.729***	-0.726***
	-0.145	-0.103	-0.104	-0.0986	-0.112	-0.102	-0.108	-0.103	-0.104
Dividend	1.121*	1.190**	1.186**	1.176**	1.249**	1.239**	1.269**	1.221**	1.227**
	-0.582	-0.493	-0.486	-0.485	-0.527	-0.495	-0.508	-0.501	-0.499
Market return volatility risk	2.254***	2.382***	2.408***	2.391***	2.483***	2.412***	2.384***	2.402***	2.342***
	-0.478	-0.413	-0.414	-0.414	-0.463	-0.421	-0.42	-0.422	-0.423
Collateral	-0.0065	0.00164	0.00327	0.00146	0.0013	0.00195	-0.000436	0.000771	-0.000378
	-0.0244	-0.0168	-0.0168	-0.0168	-0.0171	-0.0169	-0.0182	-0.0176	-0.017
Inflation	-0.480*	-0.414**	-0.432**	-0.418**	-0.366	-0.421**	-0.450**	-0.455**	-0.418**
	-0.251	-0.192	-0.196	-0.191	-0.232	-0.194	-0.201	-0.209	-0.19
GDP growth	0.293**	0.265**	0.253**	0.265**	0.158	0.271**	0.265**	0.246**	0.287**
	-0.13	-0.109	-0.11	-0.11	-0.127	-0.11	-0.112	-0.111	-0.113
Regulatory variable	-0.193	0.0662	-0.527	0.0228	0.642**	0.0453	0.0268	0.102	0.0268
	-0.265	-0.198	-0.377	-0.104	-0.29	-0.332	-0.302	-0.147	-0.142
Constant	-20.22**	-25.58***	-25.13***	-25.72***	-24.95***	-25.84***	-25.04***	-26.35***	-25.47***
	-10.12	-4.847	-4.862	-4.821	-5.042	-5.902	-4.966	-4.737	-5.268
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	No	No	No	No	No	No	No	No	No
Clustering (bank)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.673	0.730	0.731	0.730	0.735	0.732	0.728	0.729	0.728
Number of observations	635	1065	1050	1065	951	1050	1006	1034	1027

Note: The table reports the regression results of estimating the relation between capital ratios and a set of bank-specific and country-level factors, taking into account regulation effect. The dependent variable is the market capital ratio (Columns (1)-(9)). The independent bank-specific variables include: (i) market-to-book ratio; (ii) profitability; (iii) size; (iv) collateral; (v) market return volatility risk; and (vi) dividend dummy; all lagged by one year. The independent country-level variables include: (i) inflation; (ii) GDP growth; and (iii) Regulatory variables: external governance index, supervisory forbearance discretion, various factors mitigating moral hazard, capital regulatory index, declaring insolvency power, financial statement transparency, independence of supervisory authority, official supervisory power and overall restrictions on banking activities. The regressions are run on the full sample of 149 publicly traded commercial banks and bank holding companies in EEA (excluding Iceland) covering the period of 2005-2014. Standard errors clustered at bank level are reported in parentheses. *, **,*** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

Table 2.14: Book equity capital ratio - Regulation

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)	Model (8)	Model (9)
	External governance index	Supervisory forbearance discretion	Various factors mitigating moral hazard	Capital regulatory index	Declaring insolvency power	Financial statement transparency	Independence of supervisory authority	Official supervisory power	Overall restrictions on banking activities
Market-to-book ratio	0.061	0.002	0.002	0.002	-0.005	0.002	0.001	0.004	0.000
	-0.042	-0.030	-0.030	-0.030	-0.031	-0.031	-0.030	-0.031	-0.030
Profitability	0.539**	0.668***	0.653***	0.667***	0.728***	0.653***	0.668***	0.646***	0.608***
	-0.225	-0.208	-0.208	-0.203	-0.250	-0.209	-0.206	-0.210	-0.199
Size	-0.806***	-0.815***	-0.784***	-0.812***	-0.823***	-0.809***	-0.848***	-0.823***	-0.838***
	-0.143	-0.104	-0.112	-0.100	-0.109	-0.103	-0.109	-0.106	-0.105
Dividend	0.838	0.753*	0.762*	0.748*	0.672	0.788*	0.915**	0.815*	0.818**
	-0.588	-0.426	-0.428	-0.425	-0.446	-0.432	-0.439	-0.436	-0.413
Market return volatility risk	1.477***	1.666***	1.685***	1.671***	1.773***	1.673***	1.690***	1.689***	1.640***
	-0.408	-0.373	-0.374	-0.369	-0.430	-0.377	-0.375	-0.377	-0.387
Collateral	-0.016	-0.005	-0.004	-0.005	-0.008	-0.005	-0.008	-0.007	-0.009
	-0.025	-0.019	-0.019	-0.019	-0.020	-0.019	-0.020	-0.019	-0.019
Inflation	0.038	-0.103	-0.115	-0.107	-0.110	-0.093	-0.162	-0.137	-0.105
	-0.220	-0.218	-0.214	-0.213	-0.253	-0.213	-0.215	-0.226	-0.208
GDP growth	0.024	0.005	-0.008	0.005	-0.081	0.013	0.012	-0.017	0.041
	-0.113	-0.101	-0.099	-0.101	-0.115	-0.102	-0.104	-0.097	-0.104
Regulatory variable	0.004	0.030	-0.456	-0.006	0.138	0.094	0.270	0.130	-0.021
	-0.235	-0.187	-0.421	-0.111	-0.274	-0.312	-0.346	-0.115	-0.147
Constant	13.54**	19.39***	19.71***	19.43***	20.50***	18.77***	19.62***	18.27***	20.15***
	-6.091	-3.045	-3.119	-2.916	-3.181	-3.841	-3.051	-3.322	-3.596
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	No	No	No	No	No	No	No	No	No
Clustering (bank)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.452	0.493	0.492	0.493	0.503	0.494	0.489	0.495	0.500
Number of observations	635	1065	1050	1065	951	1050	1006	1034	1027

Note: The table reports the regression results of estimating the relation between capital ratios and a set of bank-specific and country-level factors, taking into account regulation effect. The dependent variable is the book capital ratio (Columns (1)-(9)). The independent bank-specific variables include: (i) market-to-book ratio; (ii) profitability; (iii) size; (iv) collateral; (v) market return volatility risk; and (vi) dividend dummy; all lagged by one year. The independent country-level variables include: (i) inflation; (ii) GDP growth; and (iii) Regulatory variables: external governance index, supervisory forbearance discretion, various factors mitigating moral hazard, capital regulatory index, declaring insolvency power, financial statement transparency, independence of supervisory authority, official supervisory power and overall restrictions on banking activities. The regressions are run on the full sample of 149 publicly traded commercial banks and bank holding companies in EEA (excluding Iceland) covering the period of 2005-2014. Standard errors clustered at bank level are reported in parentheses. *, **,*** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

In the third robustness test, to address potential endogeneity concerns and reverse causality, we employ a dynamic panel data approach. Particularly, we employ a two-step robust system GMM estimator, where all bank specific variables are treated as endogenous, while country-level variables and time dummies are treated as exogenous. The second lags of the endogenous variables are used as instruments. Table 2.15 reports the results of the system-GMM estimations for our sample.

Table 2.15: Equity capital ratios - Two-step system GMM

	Model (1)	**Model (2)**
Dependent variable	**Market equity capital**	**Book equity capital**
L. equity capital	0.303***	0.779***
	-0.0818	-0.0582
Market-to-book ratio	0.470***	-0.0191
	-0.0523	-0.0125
Profitability	0.157	0.313***
	-0.237	-0.112
Size	-0.544***	-0.0719
	-0.153	-0.0712
Dividend	1.322**	-0.388
	-0.564	-0.276
Market return volatility risk	1.716***	0.736***
	-0.332	-0.197
Collateral	0.0053	-0.0215
	-0.0312	-0.0151
Inflation	-0.141	-0.0217
	-0.124	-0.0537
GDP growth	0.0493	0.0254
	-0.0594	-0.026
Constant	-33.97***	5.585***
	-4.478	-2.122
Time fixed effects	yes	yes
Country fixed effects	No	No
Number of observations	1109	1109

Note: The table reports the results of estimating the relation between capital ratios and a set of bank-specific and country-level factors using a two-step system GMM. The dependent variables are: (i) market capital ratio (Column (1)) and (ii) book capital ratio (Column (2)). The independent bank-specific variables include: (i) market-to-book ratio; (ii) profitability; (iii) size; (iv) collateral; (v) Market return volatility risk; and (vi) dividend dummy; all lagged by one year. The independent country-level variables include: (i) inflation; and (ii) GDP growth. The regressions are run on the full sample of 149 publicly traded commercial banks and bank holding companies in EEA (excluding Iceland) covering the period of 2005-2014. Standard errors clustered at bank level are reported in parentheses. *, **,*** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

The empirical results of the GMM estimations generally confirm our main results reported in Table 2.6. We find that bank-specific variables are mostly consistent with the predictions of the corporate finance view.

2.6 Conclusions

In this paper we extend the work of Gropp and Heider (2010) to identify the main capital structure determinants of the European Economic Area's listed commercial banks and bank holding companies. We contribute to the literature by extending the sample period to cover the global financial crisis and the Euro sovereign debt crisis and assess their effect on banks' capital structure. Further, we examine different measures of risk including market return volatility risk, credit risk, liquidity risk, and reputational risk exposure related to ESG issues. Finally, we investigate the capital structure for systemically important banks and test for the too-big-to-fail moral hazard effect. We use a sample of 149 commercial banks for the period 2005-2014. Our main hypotheses are: first, bank-specific variables are the main determinants of banks' capital structure. Second, the global financial crisis and the Euro sovereign debt crisis had a significant impact on the factors determining the capital structure decision. Third, banks hold higher equity capital to hedge against different types of risk. Finally, systemically important banks generally operate with lower equity capital.

We find that banks' capital structure is not solely determined by capital regulations and provide support for the corporate finance view on the bank-specific factors that affect the capital structure decision. Among the most important factors are size and market return volatility risk. Results show that crisis time diminishes the positive impact of profitability and growth on the market capital ratio. We confirm that systemically important banks hold significantly lower capital which provides support for the too-big-to-fail moral hazard hypothesis. Finally, we find that banks with higher ESG reputational risk exposure tend to hold more equity capital. However, credit risk does not seem to impact banks' capital choice significantly.

Our findings are robust to endogeneity tests. The study offers potentially important implications as the debate on the optimal capital structure of banks is still ongoing. It provides empirical evidence of the factors reliably related to banks' capital, which is particularly relevant for capital regulation.

3 ESSAY II: Financial Inclusion and CAMEL-Based Performance in Banks: High versus Low Income Countries

ABSTRACT

The paper explores the relationship between financial inclusion and CAMEL-based performance for banks operating in 131 countries over 2005-2014. We distinguish between high and low income countries to exploit cross-economies variations. Data on financial inclusion are obtained from the IMF's Financial Access Survey, measured by deposits to GDP, loans to GDP, number of borrowers from commercial banks per 1000 adults, and number of deposit accounts with commercial banks per 1000 adults. We then construct an aggregate bank performance index using principal component analysis and focus on a set of key bank performance indicators based on CAMEL rating analysis that includes solvency, asset quality, efficiency, profitability, and liquidity. Our main findings suggest that different inclusion measures can have a different impact on bank performance. Our evidence shows that for the full sample there seems to be a trade-off between bank performance and increased financial deepening. This is particularly true in high and upper middle income countries. In contrast, higher financial inclusion levels in low and lower middle income countries do not seem to adversely affect bank performance. In fact, we find that banks in these countries could achieve significant gains from improving financial access.

Keywords: Financial Inclusion; Bank Performance; CAMEL Ratios; Cross-country Analysis; High and Low Income Countries.

3.1 Introduction

Understanding the relationship between financial inclusion and bank performance is crucial for policy makers and bank managers, as both are primary objectives on their agendas. Financial inclusion refers to the ability of individuals and businesses to access useful and affordable financial products and services that meet their needs. There is significant variation in financial inclusion in banking sectors across countries and across groups in the same country (for instance, women, poor individuals in rural areas, and small firms). Recently, financial inclusion has become a key objective for regulators, policy-makers, and development agencies, as it is considered an important enabler for lower poverty and higher development. The World Bank Group states that around 1.7 billion people worldwide do not have a formal transaction account and has set a global goal to reach Universal Financial Access (UFA) by 2020 (World Bank, 2017).

As for bank performance, the last decade has shifted the focus towards promoting greater financial stability and preventing excessive risk taking by banks. This was expected as demand for regulation increased and international regulators such as the Basel Committee on Banking Supervision and the Financial Stability Board (FSB) had to provide a firm and credible reaction to the 2007-09 financial crisis given the profound effects it had on the financial sector and on the global economy. Indeed, the way the sub-prime crisis originated in the second half of the 2000s and how it ultimately affected banks' asset quality, liquidity, and solvency corroborates the existence of significant interrelations between profitability and stability.

The literature related to the impact of financial inclusion on bank performance is relatively thin, focuses mainly on the stability dimension of performance, and provides mixed evidence. One view is that financial inclusion can enhance banks' stability as broader financial access to bank deposits improves diversification in the deposits base and can mitigate correlated deposits withdrawals during crisis times (Han and Melecky, 2013). As for credit, Adasme et al.

(2006) and Morgan and Pontines (2014) find that increased lending to SMEs results in decreased probability of defaults and lower NPLs, as these diversified loans pose less credit risk than large loans. Another view is that the relationship between financial inclusion in terms of credit expansion and stability is negative, especially when this expansion is rapid or obtained through lowering the quality of the portfolio of loans. There is also a view that the relationship between financial inclusion and stability is determined and moderated by country characteristics such as the regulatory environment and level of income (Sahay et al., 2015b, Dabla-Norris et al., 2015).

Against this background, this paper sets out to explore the link between bank performance, broadly defined to include stability (hereafter CAMEL-based performance), and financial inclusion. Specifically, we assess the impact of financial inclusion on bank performance and check for potential differences across banks operating in countries characterised by different levels of income. Some of the key research questions we try to answer are: Is greater financial inclusion accompanied by an improvement or a decline in bank performance? How will an increase in different aspects of financial inclusion affect bank performance? Will the effects of greater financial inclusion be different for banks operating in high income countries compared to low income ones?

With this paper we make several contributions to the extant literature. First, we construct an aggregate index of banks' overall financial condition and performance based on CAMEL ratios using principle component analysis. We then use the index to examine the relationship between financial inclusion and bank performance at country level. The CAMEL rating framework is a method used by supervisory authorities in many countries in the world, including the US, that provide an easily comparable measure of different aspects of bank performance, that is not focused solely on profitability and margins. Specifically, CAMEL analysis relates to five important dimensions of performance; (C) Capital, (A) Asset quality, (M) Management, (E) Earnings, and (L) Liquidity. One of the advantages of using CAMEL is that it also allows to

address the interrelation between different dimensions of bank performance (Sahajwala and Van den Bergh, 2000).

To investigate the relationship between financial inclusion and bank performance we rely on the IMF's Financial Access Survey (FAS) and obtain financial inclusion data for a sample of 131 countries (88 high and upper middle income and 43 low and lower middle income) over the period 2005-2014. [7] We focus on the following financial inclusion indicators: deposits to GDP, loans to GDP, number of borrowers from commercial banks per 1000 adults, and number of deposit accounts with commercial banks per 1000 adults. Our chosen methodology is panel regression models with time and country fixed effects.

Second, we examine the relationship for different countries based on their income classifications, distinguishing between high and low income countries (where the former includes high and upper middle income countries and the latter includes lower middle and low income countries, according to the World Bank classification)[8] and explore the potential differences in the impact of financial inclusion on the banking industry in these regions. We also perform additional tests distinguishing between countries by the level of financial exclusion and inequality, testing the incremental effect of the regulatory environment, crisis, and business cycle, investigating a sub-sample of EU countries, and testing alternative measures of financial inclusion related to the geographical outreach aspect of inclusion.

Our evidence suggests that different inclusion measures relate differently to CAMEL-based bank performance measures, and that for the full sample there seems to be a trade-off between bank performance and increased credit deepening defined as outstanding loans from commercial banks as a % of GDP. In other words, a focus on improving financial inclusion through excessive credit growth can lead to deterioration in banks' stability. We find evidence

[7] The FAS is the source of global supply-side data on access to and use of financial services by households and firms. The indicators are grouped by the geographic outreach and use of financial services.

[8] The World Bank classifies economies based on estimates of gross national income (GNI) per capita. As of 1 July 2016, low income economies are defined as those with a GNI per capita of $1,025 or less in 2015; lower middle income economies are those with a GNI per capita between $1,026 and $4,035; upper middle income economies are those with a GNI per capita between $4,036 and $12,475; high income economies are those with a GNI per capita of $12,476 or more.

that benefits of financial inclusion for bank performance seem to arise in low and lower middle income countries, where banks on average hold higher capital and liquidity. In high income countries, on the contrary, performance gains from financial inclusion seem to be exhausted. Our results also demonstrate that banks operating in countries characterised by adequate capital supervision and/or low income inequality levels could gain more from financial inclusion. Hence, it is recommended that promoting financial inclusion be associated with improvements in the regulatory supervision and equality. Finally, we find that financial inclusion does not seem to adversely affect bank performance during the crisis. In terms of geographical outreach, we find a positive relationship between the number of ATMs and bank performance in high and upper middle income countries and between the number of branches and ATMs and bank performance in low and lower middle income countries. Overall, our findings provide support to the efforts to increase financial inclusion, particularly in low income countries and these efforts should be accompanied by improvements in regulation.

The remainder of the paper is structured as follows. Section 3.2 provides a background on financial inclusion and relevant measures. Section 3.3 reviews arguments for and against financial inclusion supported by the relevant theoretical and empirical literature. Section 3.4 develops the main hypotheses. Section 3.5 presents the data and descriptive statistics. Section 3.6 presents the empirical model. Section 3.7 presents and discusses the results. Finally, Section 3.8 concludes.

3.2 What is financial inclusion?

Financial inclusion is about making formal financial services accessible and affordable to all segments of the economy. The policies promoting financial inclusion target two main types of inclusion. First, inclusion of individuals that aims to ensure that all adults (regardless of their income or any other characteristics) are part of the formal banking system. Second, inclusion of businesses that aims to provide financial services to all firms (regardless of their size, age, and

other characteristics). There are several definitions and ways to measure financial inclusion provided by different policy-making bodies and these definitions and measurements might also vary based on the country's situation (e.g., inclusivity, development, and income).

Table 3.1 offers examples of definitions of financial inclusion. Many international policy-making bodies are responsible for advancing financial inclusion worldwide including: The World Bank, The Alliance for Financial Inclusion (AFI), Global Partnership for Financial Inclusion (GPFI), the Consultative Group to Assist the Poor (CGAP), The Organisation for Economic Co-operation and Development (OECD), and regional development banks. Among different bodies and development banks there seems to be agreed-on aspects to measure financial inclusion (as stated by the World Bank). The first aspect reflects the penetration and outreach of financial services (e.g., bank branches and ATMs) in addition to barriers faced by customers including transaction cost and information. The second aspect is usage, which measures the depth of use of financial services and products (such as the number of accounts, transactions and payments). The final dimension is the quality which measures the extent to which the financial products and services provided meet customers' needs and understanding. The GPFI has designed a basic set of financial inclusion indicators to be better able to set targets and monitor progress in financial inclusion. These indicators include: formally banked adults, adults with credit from regulated institutions, formally banked enterprises and enterprises with outstanding loans from a regulated financial institution as usage indicators and points of service including branches and ATMs as geographical access indicators.

Table 3.1: Financial inclusion definitions

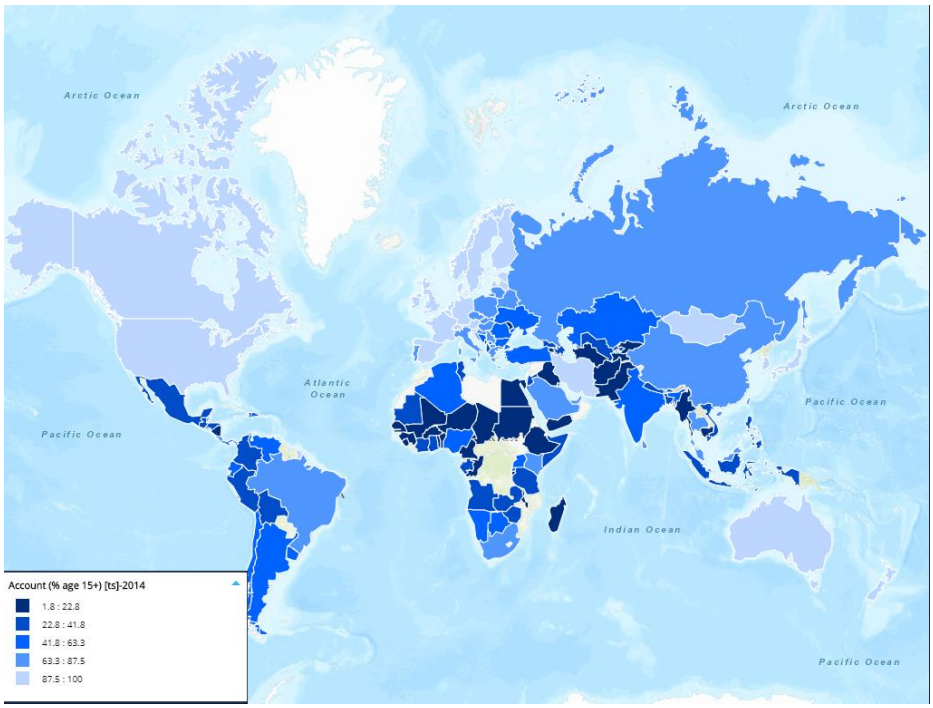
Source	Definition
The World Bank (The World bank, 2017, para 1)	"Financial inclusion means that individuals and businesses have access to useful and affordable financial products and services that meet their needs – transactions, payments, savings, credit and insurance – delivered in a responsible and sustainable way."
Global Partnership for Financial Inclusion (GPFI, n.d., p. 8)	"Refers to a state in which all working age adults, including those currently excluded by the financial system, have effective access to the following financial services provided by formal institutions: credit, savings (defined broadly to include current accounts), payments, and insurance."
OECD / INFE (Garcia et al., 2013, p. 17)	"The process of promoting affordable, timely and adequate access to a wide range of regulated financial products and services and broadening their use by all segments of society through the implementation of tailored existing and innovative approaches including financial awareness and education with a view to promote financial wellbeing as well as economic and social inclusion."

Note: This table provides examples of definitions of financial inclusion provided by policy-making bodies.

Data sources of such indicators include: the World Bank Global Findex database, IMF Financial Access Survey, and World Bank Enterprise Surveys. The Global Findex database provides in-depth data on individuals' access and use of financial services which is also classified by gender, income, and age. However, the database is based on surveys conducted every three years so the data currently available covers the years 2011, 2014, and 2017. The IMF's Financial Access Survey (FAS) is a source of global supply-side aggregate level data on access to and use of financial services by firms and households. FAS identifies separately indicators of financial inclusion for the availability (geographical outreach) and usage (account holders, number of accounts, and volume of accounts) dimensions as shown in Appendix A (IMF, 2017). Additionally, it provides the richest time-series inclusion data across countries. Lastly, the World Bank Enterprise survey provides firm-level data on financial access and loan requirements for a global sample of countries.

Figure 3.1 maps the variation among countries in access to accounts (in any financial institution) for individuals aged above 15 as taken from the World Bank Global Findex database for the year 2014. The map shows that developed and high income countries have high level of financial inclusion where more than 87.5% of the adults have a bank account, such as Canada, US, and northern Europe. While less than 23% of adults have a bank account in developing and lower income countries such as Sub-Saharan Africa, Afghanistan, and Pakistan.

Figure 3.1: Account ownership (2014)



Note: The map shows the percentage of the Findex survey respondents who report having an account (by themselves or together with someone else) at a bank or another financial institution in 2014.

Source: Global Findex database, World Bank (2017).

An alternative perception for measuring and evaluating the state of financial inclusion is to identify and evaluate forms of financial exclusion. Beck et al. (2009) distinguish between voluntary exclusion (self-exclusion) and involuntary exclusion. Voluntary exclusion can happen when individuals either state that they do not need financial services and products, or they exclude themselves for cultural or religious reasons; whereas involuntary exclusion relates to groups that are excluded due to their level of income, high lending risk for banks, a form of discrimination, lack of information, deficiencies in contracts and products features, price barriers, and regulatory issues.

In a review of policy and practice related to financial inclusion in the UK, Mitton (2008) also classifies financial exclusion according to a set of factors causing the problem. First, the geographical exclusion that relates to closures of bank branches or limited outreach. Second, the failure to qualify that might relate to poor credit rating or problems with providing the required documents. Third, the cost exclusion that relates to high costs of financial products and services.

Fourth, the self-exclusion that relates to other cultural (belonging to a certain ethnic/religious group) and psychological barriers. It is important to address the issue of financial exclusion (regardless of its source, i.e., demand side or supply side), to protect poor adults from financial problems related to high interest credit provided by the informal sector and lack of insurance.

The importance of financial inclusion is linked to the role it plays in the development of a country. Studies on financial inclusion indicate its positive impact on different social and economic indicators such as economic growth, income equality, wealth, households' well-being, innovation, employment, female empowerment, creation of firms, in addition to combating money-laundering and terrorist financing (Aportela, 1999, Honohan, 2004, Beck et al., 2007a, Guiso et al., 2009, Karlan and Zinman, 2009, Ashraf et al., 2010, Prasad, 2010, Force, 2011, Montgomery and Weiss, 2011, Khan, 2011).

3.3 Literature review

As previously mentioned, studies on financial inclusion have focused mainly on its positive impact on social and economic indicators. However, little is known about the impact of financial inclusion on bank performance including stability. Since financial inclusion has many potentially positive outcomes on many aspects of the economy (such as lowering poverty, driving economic growth, and helping disadvantaged groups), one should expect a positive impact on the banking sector as well. On the other hand, the recent global financial crisis illustrated the negative outcomes of rapid growth in inclusion, especially in credit growth. In other words, the starting point of the crisis was the high mortgage approval rates in the US that turned into high default rates on sub-prime mortgages leading to high instability in the financial system, which proves that providing credit needs careful consideration (Čihák et al., 2016).

In this section we review studies on the possible links between financial inclusion / exclusion and banks' CAMEL-based performance. First, we review policy papers providing

arguments for and against financial inclusion. Second, we review theories related to the relationship between financial inclusion and bank performance. Third, we provide an overview of selected empirical studies carried out to date on the relationship between financial inclusion and different aspects of bank performance.

3.3.1 Arguments for and against financial inclusion

There are positive and negative effects derived from greater financial inclusion in the financial system. In this section, we provide an overview of some of the most relevant policy papers looking at advantages and drawbacks from financial inclusion and present a summary of the main arguments for and against it (Table 3.2). Hannig and Jansen (2010) discuss potential effects of increased financial inclusion on financial stability. First, they state that financial inclusion could expose financial institutions to new risks from low income groups that are usually excluded from the financial system. However, since this lower-end market represents a relatively small manageable share of the financial system assets it poses a very limited default risk, if any, and that is evident in the high repayment rates of microfinance customers. Second, the authors argue that financial inclusion might increase the problem of information asymmetry between banks and new inexperienced customers. However, they mention the role the regulators can play in consumer protection and education (financial literacy) to help reduce this problem. The authors also highlight the importance of regulation and supervision to manage the risks previously mentioned and suggest the use of financial inclusion policies to foster financial stability through building a diversified financial sector balance sheet that is mainly focused on increased access to savings.

Prasad (2010) argues that increasing financial inclusion is a key component for achieving higher macroeconomic and financial stability, mainly through increased lending to SMEs and small entrepreneurs which helps in achieving higher employment rates. Additionally, limited

access to finance limits risk sharing and savings diversification. The author points out that higher inclusion should not only be viewed as a social goal, but also as a way for financial institutions to enhance performance and to achieve scale efficiency. The use of technology (such as mobile banking, ATMs, and using small grocery stores to provide retail banking services) can play an important role in increasing financial inclusion. Nonetheless, informal financial services might have potential negative impact on financial stability as the service providers might not have enough information on their customers. Hence, the difficulty remains in bringing these providers into the regulatory net or encouraging formal financial institutions to broaden the reach of their basic financial services to bigger segments of the population.

Khan (2011) discusses potential links between increased financial inclusion and the financial system health. The author suggests several ways in which higher financial inclusion can positively affect financial stability. First, financial inclusion can increase efficiency and diversification of the financial sector which contributes to a more resilient financial system. Second, greater dependence on retail deposits against borrowing can reduce volatility and moderate the impact of a crisis as retail depositors tend to have a steady financial behaviour in terms of depositing and borrowing regardless of the business cycle. Third, higher inclusion leads to an increased efficiency of the monetary policy transmission resulting in higher stability. Fourth, financial access facilitates payment services, government transfers and surplus accumulation in addition to reducing dependence on high cost informal sector and better access to finance for small businesses. That translates into enhanced health of the household, business, and the economy. The author also points out several risks to financial stability resulting from higher financial inclusion. First, if financial institutions lower their credit standards to increase financial inclusion that might reduce the quality of their lending portfolio. Second, increased informational inefficiencies and operating costs from an increased number of individual borrowers. Khan (2011) also emphasises the role of regulation including micro-finance institutions regulation,

financial literacy, and consumer protection in managing the risks associated with higher financial inclusion.

Cull et al. (2012) provide an overview on the linkage between financial inclusion, financial consumer protection, financial integrity, and financial stability. They point out that effective regulation and supervision of financial development can enhance economic growth and lower poverty and income inequality over long time periods. They argue that greater financial inclusion can lead to improvements in the household and small businesses, conditioned on the existence of effective consumer protection. Additionally, higher credit inclusion in terms of the provision of small frequent rather than large infrequent loans leads to higher stability in the financial system and has a positive effect on the entry and growth rate of new non-financial firms through efficient allocation of capital. On the macro level, the authors argue that financial inclusion increases the financial intermediation efficiency (i.e., greater domestic savings lead to stronger investment cycles and greater diversification hence more stable economy). They also point out the costs of financial exclusion such as large opportunity costs in terms of financial development, negative effects on low income households and small businesses, and negative impact on financial integrity (e.g., terrorist financing and money-laundering as stated by the Financial Action Task Force (Force, 2011)).

Rahman (2014) highlights the importance of financial inclusion in giving individuals the opportunity to deal with rule-based regulated financial institutions. These institutions have higher transparency and lower probability to overprice their services. The author also points out direct and indirect links between financial inclusion and the financial system health. In terms of direct links: first, financial inclusion helps in establishing a diversified stable funding base, limiting the risks associated with counting on the funds of large depositors and wholesale funders. Second, financial inclusion improves the assets side by establishing a diversified loan base. Small loans are less likely to cause aggregate loan losses or threaten the systemic health. Third, a more

inclusive financial system limits the existence of unstable saving options and unreliable schemes (e.g., pyramid schemes)[9]. Fourth, increasing financial inclusion can have a positive impact on the political and public legitimacy of the financial sector. In other words, financial inclusion can enhance the image of banks that are traditionally viewed as "rich people working for the benefit of rich people" if banks customer base was more representative of the general public. The author also discusses indirect links: first, financial inclusion promotes household stability by encouraging savings, smoothing out consumption, and financing emergencies. Second, income inequality and poverty can be lowered by financial inclusion which in turn can promote social and financial stability. Lastly, the author discusses the possible feedback effects from financial stability to increased inclusion as people are more attracted to be a part of a financial system that is stable and able to reduce fees of accounts and transactions.

More recently, Mehrotra and Yetman (2015) also discuss the impact of financial inclusion on monetary stability and financial stability. First, in terms of monetary policy, the authors suggest that financial inclusion makes policy tools used by central banks such as interest rate more effective in maintaining price stability. The authors also state that financial inclusion lowers the aggregate consumption volatility as households are able to adjust their savings and borrowing easily in case of unexpected shocks which in turn improves the economic stability. Second, in terms of financial stability there are two arguments mentioned by the authors. On the positive side the diversification in the depositors and borrowers base can enhance financial stability. Especially when including low income customers that are less likely to have huge swings in their accounts (confirming the point earlier made by Khan (2011)). However, on the negative side the authors point out that if financial inclusion was achieved by excessive credit expansion (which can be done by lowering credit standards and offering credit to households that are poorer, previously excluded and lack collateral and credit history) or by the rapid growth of the

[9] In countries with low penetration of formal financial institutions and low financial literacy, alternative savings channels arise such as pyramid schemes. Pyramid scheme fraud involves an unsustainable business model that rewards people for enrolling others into a business that offers a non-existent or low quality product and typically requires a payment to join.

unregulated part of the financial system then it can increase the financial risk. This rapid expansion would lower credit quality and create potential trade-off between financial inclusion and financial stability. Hence, growing financial inclusion might be accompanied by structural changes in the system and it is important that regulators and supervisors have the capacity to monitor financial institutions through these changes.

The policy papers reviewed in this section provide possible positive and negative links between financial inclusion and financial stability; we present a summary of the main arguments for and against financial inclusion in Table 3.2.

Table 3.2: Arguments for and against financial inclusion

For	Against
Financial inclusion enables building a diversified financial sector balance sheet (deposit base and loan base) which in turn enhances stability.	Financial inclusion may expose financial institutions to new risks from low-income groups that are usually excluded from the financial system.
Financial inclusion can be a way for financial institutions to enhance performance by achieving scale efficiency.	Financial inclusion might increase the problem of information asymmetry between banks and new inexperienced customers (informational inefficiencies)
Greater dependence on retail deposits against borrowing can reduce volatility and moderate the impact of a crisis.	If financial institutions lower their credit standards to increase financial inclusion it might reduce the quality of their lending portfolio.
Financial access reduces dependence on high cost informal sector and decreases the power of loan sharks and payday lenders.	Increased operating costs from an increased number of individual savers and borrowers.
Financial inclusion facilitates payment services, government transfers and surplus accumulation.	Rapid growth of the unregulated part of the financial system (if financial inclusion was achieved by unregulated institutions) can increase the financial risk.
Financial inclusion gives individuals the opportunity to deal with rules-based regulated financial institutions that have higher transparency.	
A more inclusive financial system limits the existence of unstable saving options and unreliable schemes.	
Increasing financial inclusion can have a positive impact on the political and public legitimacy of the financial sector.	
Financial inclusion promotes household stability by encouraging savings, smoothing out consumption, and financing emergencies.	
Financial inclusion makes policy tools used by central banks such as interest rate more effective in maintaining price stability. (increased efficiency of the monetary policy transmission)	

Note: The table provides a summary of the arguments for and against financial inclusion in terms of the impact on the participants of the financial sector: customers, financial institutions, and regulators (as reviewed in the policy papers above).

3.3.2 Theoretical background

From the previous section we can see that there seems to be an agreement on the potential positive impact of financial inclusion on the diversification of the financial sector balance sheet.[10] In other words, financial inclusion can translate into a wider scope of borrowers and depositors served by banks and hence into greater diversification in terms of loans, deposits, and geographical outreach. Thus, financial inclusion might allow banks to gain the benefits of diversification, particularly in risk reduction and returns improvement. Additionally, according to the law of large numbers, the larger the deposits base the better the banks' ability to anticipate deposits fluctuations and reserve needs, hence lower their risk exposure (Baltensperger et al., 1972).

Second, low income depositors and small borrowers that are targeted by financial inclusion policies tend to have a steady behaviour in terms of savings and borrowing even through a crisis period compared to wholesale funders. Huang and Ratnovski (2011) argue that retail depositors are insensitive to risk mainly because they are insured. On the other hand, wholesale funders withdraw their financing based on negative signals from the market leading to inefficient liquidation. This suggests that the reliance on diversified retail deposits for funding rather than wholesale funding improves banks' stability and ability to withstand shocks.

Another theoretical perspective by Dell'Ariccia and Marquez (2006) shows that lowering the lending standards to attract more customers may negatively affect the quality of banks' portfolios and lead to a lending boom. This results in lower and highly volatile profits thereby making banks more sensitive to economic shocks.

Overall, the theoretical literature provides mixed expectations in terms of the relationship between financial inclusion and bank performance. First, financial inclusion can have a positive

[10] We can relate financial inclusion to the modern portfolio theory (MPT) that states the benefits of investment diversification on risk and return.

impact on banks performance through balance sheet diversification and increased dependence on retail deposits (that are more stable) for funding. On the other hand, financial inclusion can be expected to have a negative impact on bank performance, as including more individuals and businesses in the banking system might require lowering credit standards which might in turn negatively impact banks' profitability and stability.

3.3.3 Empirical studies

In this section we provide an overview of the existing empirical studies on the following aspects. First, studies with a focus on measuring and analysing financial inclusion across countries. Second, studies analysing the relationship between financial inclusion and different aspects of bank performance. Third, studies related to constructing a performance index.

3.3.3.1 Measuring and analysing financial inclusion

In this section we review selected empirical studies that focus on measuring financial access and geographical outreach, analysing cross-country variations, in addition to investigating the determinants of financial inclusion across countries.

Beck et al. (2007b) construct geographic and demographic outreach and use of loans and deposits indicators to assess banking sectors outreach. Specifically, they present data on the number of branches and ATMs per capita and per square kilometre. Additionally, they present indicators on the number of loan and deposit accounts per capita and on their sizes relative to GDP per capita as measures of the use of financial services. Moreover, they find that the financial access and depth indicators are positively correlated with economic development and the quality of institutional environment and negatively correlated with government ownership. By the same token, Honohan (2008) presents estimates of financial services usage across 162 countries presenting a composite indicator of adults access to formal and semi-formal financial accounts (this is done using information on account numbers at banks and microfinance institutions).

Additionally, the author empirically investigates the relationship between the access indicator and poverty across countries and finds that these variables are negatively correlated but the relationship is insignificant. The author, however, provides evidence that financial depth helps in lowering poverty rates significantly.

Pearce (2011) performs an analysis on financial inclusion focusing on the Middle East and North Africa (MENA) region. The author states that the financial depth in this region is not matched with financial access, as the level of financial deepening is relatively high, but it is not reflected in higher access to financial services and that is especially true for SMEs lending. The author also points out that lending depth significantly decreased in the region following the global financial crisis. Hence, it is recommended that governments and regulators in the region set financial inclusion as a goal accompanied by a supervisory framework that ensures sustaining the financial system stability.

Demirgüç-Kunt and Klapper (2013), van Oudheusden et al. (2015), and Demirguc-Kunt et al. (2018) provide summaries of the Global Financial Inclusion "Global Findex" Indicators for the years 2011, 2014, and 2017 respectively. These indicators measure the ownership / use of accounts, savings, and borrowings of adults in more than 140 countries around the world. Generally, these studies show an increase in the percent of adults having a bank account from 51 percent in 2011 to 69 percent in 2017. Nonetheless, the studies point out to the differences in financial inclusion levels between high income and developing countries. Additionally, at the individual level, they show variation across different income groups. Demirgüç-Kunt and Klapper (2013) also report several barriers to financial inclusion such as cost, insufficient money, distance, and documentation requirements.

3.3.3.2 Financial inclusion and bank performance

In this section we review studies related to the relationship between financial inclusion / depth and different measures of bank performance. We start with the stability aspect of bank

performance as most prior studies focus on the impact of financial inclusion on bank stability. The empirical research on this relationship provides mixed evidence; hence, we distinguish between studies based on their findings (i.e., positive or negative relationship). We then review studies that provide evidence on other performance indicators.

Inclusion-Stability:

One strand of the literature supports the inclusion-stability view. Specifically, Adasme et al. (2006) study the link between access to credit and bank stability. They empirically analyse this relationship for a sample of Chilean banks for the period 1999-2005. The study suggests that the loan size plays an important role in determining the credit losses distribution. They find that systemic risk from lending to SMEs is lower than that of large firms that require larger loans. This implies a positive relationship between SMEs lending and overall financial stability. More recently, Han and Melecky (2013) analyse the hypothesis that there is a positive effect of broader financial inclusion in terms of access to bank deposits on financial stability measured by stability of deposit growth during the 2008 financial crisis, in the sense that higher diversification in the deposits base can mitigate correlated deposits withdrawals during crisis times. Estimating a cross-sectional OLS regression for a sample of 95 countries the authors find that a decline in deposits growth can be reduced by 3 to 8 percentage points through a 10 percent increase in the share of people that have access to or use bank deposits. This finding is stronger for middle income countries where the trust in the banking system is still developing and the integration in global finance is high consequently the financial system is subject to greater confidence shocks. Controlling for a number of variables to capture variation in financial sector structure, openness, and development, Han and Melecky (2013) show that the level of a country's economic development, previous experience of a banking crisis, and the stability of the banking sector measured by the z-score are consistently significant factors in explaining the decline in deposit

growth during the crisis time. Interestingly, they find that stable banking sectors experience significantly lower deposit withdrawals.

Morgan and Pontines (2014) study the relationship between financial stability and financial inclusion over the period 2005-2011 with a focus on SMEs. In line with the literature, they find a positive correlation between income measured by GDP per capita and financial inclusion. They use a system-GMM dynamic panel estimator to examine the relationship between financial stability measured alternatively by banks' z-scores and NPLs and financial inclusion measured alternatively by SME loans to total loans of commercial banks and the number of SME borrowers to the total number of borrowers from commercial banks. The authors also control for a vector of variables such as GDP per capita, financial openness, liquid assets to deposits and short-term funding among others. Their results show a positive effect of increased financial inclusion of SMEs on financial stability, showing that increased lending to SMEs result in decreased probability of defaults and lower NPLs. It is worth mentioning that one of the limitations of such studies is that there is a limited availability of financial inclusion measures and short time span with some variables having one or two observations.

Inclusion-Fragility:

Another strand of the literature supports the inclusion-fragility view. Specifically, Demirgüç-Kunt and Detragiache (2005) investigate the determinants of banking crisis using multivariate logit regressions for a sample of 94 countries covering the period 1980-2002. The authors show that countries with high credit exposure or high lagged credit growth are more vulnerable to banking crisis related to risky assets and solvency issues. They explain their results by mismanaged liberalisation in the sector. The potential negative impact of financial inclusion on bank stability is also supported by Sahay et al. (2015b) who use financial inclusion variables from the Financial Access Survey (FAS) and, similar to Morgan and Pontines (2014) the z-score as a measure of financial stability. The authors employ a panel regression model with country

fixed effects for a sample of 39 countries over the period 2004-2011. Controlling for various macroeconomic and banking market factors such as real GDP per capita, population, inflation, Lerner index, and banking crisis among others, they find that the relationship between credit expansion (measured by the number of borrowers per 1,000 adults) and stability is negative. When they use an interaction term of the inclusion variable with a proxy for the quality of bank supervision (the degree of compliance with Basel Core Principles (BCP)) they find that there is a positive relationship between financial inclusion and bank stability in countries with proper supervision. Sahay et al. (2015b) also note the supervisory gaps between countries and highlight the importance of a prudent strategy for broadening the access to credit. Similarly, Dabla-Norris et al. (2015) show that lowering collateral requirements and costs of monitoring to increase firms' financial inclusion in terms of credit access can result in higher non-performing loans in the banking business posing instability risk. Yet, they show that increased access to credit can have a positive impact on growth. Another important finding of Dabla-Norris et al. (2015) is that country characteristics such as income and economic development play an important role in determining the relationship between financial inclusion and different macroeconomic indicators including inequality, GDP, and gains and losses distribution.

Similarly, a few studies posit that the existence of trade-offs or synergies between financial development / inclusion and stability depends on specific country characteristics such as the supervisory and regulatory strength, income group, and whether the country is developed or emerging. For example, Sahay et al. (2015a) construct a financial development index that is a combination of depth, access, and efficiency of the financial system. Using panel estimations from 1980 to 2013, they find the relationship between the index and stability to be non-linear. The authors find that emerging economies can benefit from higher financial development including financial deepening, access, and efficiency in terms of enhancing financial stability and growth and reducing macroeconomic volatility. However, after a certain level of financial development (e.g., high income countries) further development increases the system's instability

(trade-off region). They also show that the pace of financial development in terms of deepening matters. In other words, economies with high-speed development are more vulnerable to risks from financial deepening, probably due to outpacing regulatory frameworks.

A recent study by Čihák et al. (2016) investigates possible synergies and trade-offs between financial inclusion and financial stability and they mainly use correlations to test the interactions between these two financial objectives. The authors find that on average trade-offs dominate the relationship between inclusion and stability. They show that higher financial inclusion is correlated with lower bank solvency and higher costs of financial crisis; they also argue that this negative relationship is mainly derived by individuals' inclusion rather than firms' inclusion. However, synergies could occur; they find that higher financial inclusion in terms of account ownership, electronic payments, and credit is associated with low NPL ratios. Their results show that country characteristics play an important moderation role in the relationship: low tax rates, education, and credit information depth produce synergies between financial inclusion and financial stability while financial openness increases the trade-offs between them.

Inclusion and other performance indicators:

The majority of previous studies focus on the relationship between financial inclusion and bank stability while the literature relating financial inclusion and other indicators of bank performance is very limited. In this section, we review empirical studies that consider the relationship between different indicators of financial inclusion (or deepening) and the performance measures that are relevant for our study, that is, profitability, liquidity, and efficiency.

In terms of profitability, Demirgüç-Kunt and Huizinga (1999) studying the determinants of banks' net interest margins and profitability for 80 countries over the period 1988-1995, find that greater financial development / deepening measured by assets (loans) to gross domestic product ratio has a negative impact on banks' profitability. They conclude that countries with

high financial development (measured by credit deepening) also have high competition, and that high competition maybe associated with lower profitability as banks have lower prices in competitive markets. On the other hand, using a sample of leading micro-banks in 49 countries, Cull and Morduch (2007) provide evidence that banks can earn profits by reaching out for the poor; however, they suggest that there might be a trade-off between profitability and reaching out for the poorest (outreach for the poor is proxied by loan size). Dietrich and Wanzenried (2014) study the determinants of bank profitability in three different groups of countries according to their income level (i.e., high income, middle income, and low income countries) over the period 1998-2012 and show that the determinants vary significantly across countries with different income level. Their results indicate that higher deposits growth has a positive impact on banks' profitability in all income regions; nonetheless financial development has a positive impact on banks profitability in low income countries but negative impact in high income countries.

As discussed earlier, studies on the relationship between financial inclusion and bank performance are very limited, especially related to liquidity and efficiency. In terms of liquidity, Acharya et al. (2009) find a significantly negative relationship between financial development measured by domestic credit to GDP and deposits to GDP and banks' liquidity. They explain their results by stating that financial development is accompanied by higher ease in getting external finance which lowers the attractiveness of holding high level of liquid assets. Deng and Elyasiani (2008) find that geographic diversification is positively associated with BHC value (relating this finding to economies of scale) and negatively associated with total risk. This finding, although not directly linked to the financial inclusion and bank performance relationship, it provides support to a potential positive association between financial inclusion or/and geographic outreach and banks' efficiency through achieving economies of scale.

3.3.3.3 Bank performance index

Turning to the construction of a banking performance index, central banks and researchers presented several methods for constructing a single quantitative measure that can be used to capture the performance of the banking system (most of the studies refer to these measures as stability indices). The index can be a simple aggregate indicator of weighted average performance / soundness sub-indicators such as the financial strength index (FSI) used by the Turkish central bank and consisting of six indicators: asset quality, liquidity, exchange rate risk, interest rate risk, profitability, and capital adequacy (CBRT, 2006). The same indicators are used by Gersl and Hermanek (2007) and bank of Albania (2010) to construct an aggregate banking stability index / financial strength index for Czech Republic / Albania, respectively . It is worth mentioning that these are the Financial Soundness Indicators suggested by the international monetary fund (all normalised), but the weights given to sub-indicators are based on expert judgements. Similarly, Ginevičius and Podviezko (2013) construct an index to evaluate the soundness and stability of commercial banks in Lithuania. The authors use the CAMEL approach to evaluate all five categories of soundness: capital, asset quality, efficiency, profitability, and liquidity. The weights are obtained by taking an average value of the weights assigned by seven experts in Lithuania. This approach is also used by Mishra et al. (2013) who construct a banking stability index using CAMEL ratios for India.

Petrovska and Mihajlovska (2013) construct an aggregate banking stability index for Macedonia using a weighted sum approach of banks' financial soundness indicators. These indicators represent different bank risks: (i) insolvency risk represented by capital buffer size, (ii) credit risk represented by NPLs rate and annual growth rate of NPLs. (iii) Profitability and (iv) efficiency represented by return on equity and noninterest expenses / gross income respectively, (v) liquidity risk by short-term assets / short-term obligations ratio and liquid assets / total assets ratio and finally, (vi) currency risk by share of net open position in foreign exchange position /

banks' own funds. These indicators are adjusted and normalised, with the resulting index closer to its maximum value of one indicating lower risk. The results of the index for the period 2005-2012 show that the lowest value of the index was exhibited in the global crisis period. They also construct using a principal component analysis a financial condition index which provides a signal for the financial system's health to assess system-wide risks to financial markets. They first separate the economic conditions from financial conditions, then standardise the variables, and finally sum the principal components weighted by the share of total variability explained by them.

Kočišová (2014) attempts to construct an aggregate banking stability index for EU countries using four performance indicators: capital adequacy, asset quality, earnings, and liquidity. The author assigns equal weights to all indicators, indicating equal importance of these indicators in measuring banks' stability. The author notes the decline of the index during the global crisis period and an improvement afterwards.

In summary, the literature provides mixed evidence in terms of the relationship between financial inclusion and bank performance, and mainly focuses on the stability aspect of performance. This mixed evidence can be attributed to the indicator used in measuring financial inclusion, and / or to certain country characteristics that may moderate the relationship. In this paper we investigate the relationship between financial inclusion and bank performance using different measures of financial inclusion and considering different country characteristics that may impact the relationship; and we build expectations on these relationships in the next section. In terms of constructing a bank performance measure, previous studies provided several methodologies that can be used to capture the performance / soundness of the banking system at country level. We construct a banking system performance index for a global sample of countries using principal component analysis as discussed in section 3.5.

3.4 Hypotheses development

In this paper we examine the relationship between financial inclusion and bank performance. While it is well documented in the literature that there is a positive link between financial inclusion and various development and social indicators in any economy (as discussed in Sections 3.2 and 3.3), theoretical and empirical studies have contradicting views on the relationship between financial inclusion and bank performance including profitability and solvency. Hence the net impact of financial inclusion remains ambiguous.

To build an expectation on the potential relationship between financial inclusion and bank performance, we can assume that different financial services provided (deposits or loans in this case) might have a different impact on bank performance. In terms of financial inclusion linked to deposits, the policy papers reviewed provided arguments for the potential positive impact of inclusion in deposits on bank performance. The argument that seems to be agreed on in these papers states that banks' dependence on a diversified base of retail deposits can reduce volatility and lower the impact of a crisis and relates that to the steady behaviour of depositors compared to other providers of funding (Khan, 2011, Rahman, 2014, Mehrotra and Yetman, 2015). Empirically, Han and Melecky (2013) provided evidence that there is a positive effect of broader financial inclusion in terms of access to bank deposits on financial stability that is measured by stability of deposit growth during the 2008 financial crisis. Another argument provided by the literature concerns the fact that financial inclusion can be a way for financial institutions to enhance performance by achieving scale efficiency and earning higher returns (Prasad, 2010, Khan, 2011). The empirical research by Dietrich and Wanzenried (2014) provides evidence that banks can increase their profits by increasing deposits; they show that faster growing banks in terms of deposits are better able to expand their business and convert deposits to high earning assets. Hence, we hypothesise that a higher degree of financial inclusion in terms of deposits is

likely to have a positive effect on the banking system. This hypothesis can be formulated as follows:

H1. The relationship between deposit inclusion and bank performance is positive and significant.

In terms of financial inclusion linked to lending, the literature provides mixed arguments. On one hand, financial inclusion through lending could expose banks to new risks from low income groups (Hannig and Jansen, 2010). If financial institutions lower their credit standards to increase financial inclusion, it might reduce the quality of their lending portfolio and negatively affect their asset quality, profitability, and solvency (Khan, 2011, Mehrotra and Yetman, 2015, Dell'Ariccia and Marquez, 2006). Empirically, Sahay et al. (2015b) find a negative relationship between increased number of borrowers and banks stability. On the other hand, some argue that financial inclusion through lending also improves the assets side of banks' balance sheets by establishing a diversified loan base. Small frequent loans are less likely to cause aggregate loan losses or threaten the systemic health than large infrequent ones (Cull et al., 2012, Rahman, 2014). Morgan and Pontines (2014) provide empirical evidence in support of this argument with a focus on SMEs. They show that increased lending to SMEs results in decreased probability of defaults and lower NPLs. In this paper we do not focus on SMEs lending, and typically for banks to increase financial inclusion in terms of lending credit standards and collateral requirements might be reduced, which might have a negative impact on different aspects of bank performance. Hence, we hypothesise that a higher degree of financial inclusion in terms of lending is likely to have a negative impact on bank performance. This hypothesis can be formulated as follows:

H2. The relationship between lending inclusion and bank performance is negative and significant.

We are also interested in assessing the impact of financial inclusion on bank performance by countries with different income levels. We expect that the effects of greater financial inclusion differ across countries, as countries have different characteristics (in terms of development,

income, education, etc.) and these characteristics might play an intermediate role in the relationship. Sahay et al. (2015a) find that emerging economies can benefit from higher financial development (including financial deepening, access, and efficiency) in terms of enhancing financial stability and growth; however, in developed economies further financial access and development can increase the banking system's instability. Other studies suggest that the relationship between inclusion and bank performance depends on the income group the country belongs to. Dietrich and Wanzenried (2014) show that the determinants of banks' profitability vary significantly across countries with different income level. They also find that deposits growth and financial development have a positive impact on banks' profitability mainly in low income countries. Hence, our third hypothesis is that the relationship between financial inclusion and bank performance differs across countries of different income, and we expect financial inclusion in low and lower middle income countries to have a positive effect on bank performance.

H3. The relationship between inclusion and bank performance differs significantly across income regions and benefits from financial inclusion arise mainly in low and lower middle income countries.

3.5 Data, variables, and descriptive statistics

In this section we present the data sources and sample selection, the variables related to bank performance (and the index construction), financial inclusion, and other control variables used in this study. Additionally, we provide descriptive statics and correlations of the variables.

3.5.1 Data

To test our hypotheses, we collect data from different sources: the country-level performance data are drawn from the Global Financial Development Database (GFDD), the country-level financial inclusion data are obtained from the IMF Financial Access Survey (FAS),

and the data for the control variables are drawn from the World Bank Development Indicators (WDI).

Our sample period starts in 2005 and ends in 2014, thereby covering the global financial crisis and the Euro sovereign debt crisis. To construct the sample, we start with 184 countries with available data on aggregate bank performance indicators from the Global Financial Development Database. We then drop countries with missing data on financial inclusion, and arrive at the final sample of 131 countries, of which 88 countries are classified by the World Bank as high income or upper middle income countries and 43 countries are classified as low income or lower middle income. The countries included in the sample and their income classifications are listed in Appendix B.

3.5.2 Variables

3.5.2.1 Bank performance index

We start by constructing an index that represents the overall performance of banks using the principal component analysis (PCA). Principal component analysis is a multivariate statistical method that summarises several correlated variables into a smaller number of uncorrelated factors (components) or dimensions that explain the variation in the data. The benefit of using this method is its ability to determine the importance of each indicator so that the weight it receives is consistent with the role it plays in explaining historical fluctuations in the broader performance.

The performance index we construct uses selected quantitative indicators from the CAMEL ratios. The choice of indicators is based on the previous literature (e.g. Ginevičius and Podviezko (2013) and Mishra et al. (2013)). The indicators used in constructing the bank performance index represent the following five aspects of bank performance: (i) profitability, (ii) solvency, (iii) asset quality, (iv) liquidity, and (v) efficiency. Bank profitability is measured as return on assets (ROA). The ratio is intended to measure banks' efficiency in using their assets; a low value of this ratio indicates low profitability and poor performance. Bank solvency is

measured as regulatory capital to risk weighted assets (Regulatory capital to RWA). This indicator represents banks' ability to absorb losses; low levels of capital indicate higher insolvency risk and poor performance. Asset quality is measured using non-performing loans to gross loans ratio (NPLs ratio). High value of this ratio indicates higher credit risk which can in extreme cases turn into a solvency problem; hence, lower NPLs indicate better bank performance. We measure bank liquidity using the liquid assets to deposits and short-term funding ratio (Liquidity ratio). A high value of this ratio indicates that a bank is better able to meet depositors' demands and short-term obligations which lowers the bank's liquidity risk and enhances its performance. As for efficiency, we use the cost to income ratio (CI ratio). The lower the ratio the more efficient a bank is being run which indicates better performance.

Before constructing the performance index, we adjust the indicators to facilitate the aggregation of data. First, the indicators that have an opposite direction with performance (i.e., asset quality and efficiency) are adjusted by taking the reciprocal value so that a higher value means better performance.

Second, all the indicators are normalised through empirical normalisation to have a common scale ranging from 0 to 1:

$$\boldsymbol{I_{itc}^{n}} = \frac{\boldsymbol{I_{itc}} - \boldsymbol{Min}\,(\boldsymbol{I_{ic}})}{\boldsymbol{Max}\,(\boldsymbol{I_{ic}}) - \boldsymbol{Min}\,(\boldsymbol{I_{ic}})} \tag{3.1}$$

where I_{itc} is the value of the indicator *i* in period *t* for country *c*. $Min\ (I_{ic})$ is the minimum value for the indicator for a certain country for the analysed period, and $Max\ (I_{ic})$ is the maximum value for the indicator for a certain country for the analysed period. The normalised value represents the indicator's deviation from the minimum and maximum limit in each country. A higher value within the [0; 1] range indicates better bank performance.

We use principal components to extract the factors that govern bank performance from the indicators used. To account for sample heterogeneity in terms of the factors that could have an impact on the overall bank performance, we split the sample into high and upper middle and low and lower middle income countries. The first principal component accounts for the largest share of variation in our data. To decide on the number of factors to include in the construction of our performance index, we set the threshold for total variance explained to a minimum of 70% (Petrovska and Mihajlovska, 2013). Using this criterion, we find 3 components that account for 72% and 75% of the total variance in the data for high and upper middle income and low and lower middle income countries, respectively. The results of PCA for high and upper middle income and low and lower middle income countries are presented in Tables 3.3 and 3.4, respectively.

Table 3.3 shows that in high and upper middle income countries the first component accounts for 25% of the total variance in the data. For this component, efficiency and profitability show high positive loadings. The second component accounts for 24% of the variation. Capital shows a high positive loading on this component while loans to non-performing loans show a negative factor loading indicating an inverse impact on the factor. As for the third component, it accounts for 23% of the variation and shows a high positive liquidity loading.

Table 3.3: PCA high and upper middle income countries

	Component1	**Component2**	**Component3**
Eigen value	1.53	1.11	0.93
% of variance	25%	24%	23%
Variable			
Profitability	**0.5757**		0.3545
Solvency		**0.8008**	
Asset quality		**-0.5946**	
Liquidity			**0.8375**
Efficiency	**0.7849**		

Total explained variation = 72%

Note: The table reports results from using principal component analysis on a sub-sample of high (and upper middle) income countries. The results for each component include Eigen values, share of explained variation, and loadings from original variables. Bold figures show high loadings from the variable.

Turning to the PCA results for low and lower-middle income countries in Table 3.4, we find that the first component accounts for 32% of the total variance in the data. Similar to the high and (upper middle) income group, efficiency and profitability show high positive loadings. The second component accounts for 22% of the variation. Liquidity show high positive loading on this component while loans to non-performing loans show negative loading. For the third component, it accounts for 21% of the variation and shows high positive loading from capital.

Table 3.4: PCA low and lower middle income countries

	Component1	**Component2**	**Component3**
Eigen value	1.58	1.07	1.03
% of variance	32%	22%	21%
Variable			
Profitability	**0.6452**		
Solvency			**0.897**
Asset quality	0.4024	-0.4508	-0.4054
Liquidity		**0.872**	
Efficiency	**0.6411**		

Total explained variation = 75%

Note: The table reports results from using principal component analysis on a sub-sample of low (and lower middle) income countries. The results for each component include Eigen values, share of explained variation, and loadings from original variables. Bold figures show high loadings from the variable.

We then estimate the scores of components to construct the single index. As the estimated importance of the components in measuring the overall bank performance varies, we use a sum of the components weighted by the total variation explained by them. We follow these steps for the two groups of countries (i.e., high income group composed of high income and upper middle income countries and low income group composed of low income and lower middle income countries) separately and then merge the index scores for both groups in one variable. As a final step, we normalise the index same way we normalise the separate performance indicators and convert it to percentage.

3.5.2.2 Financial inclusion indicators

Financial inclusion indicators are our main variables of interest. We use alternatively four indicators of financial inclusion from the Financial Access Survey: (i) outstanding deposits with commercial banks as a percent of GDP (Deposits to GDP), (ii) outstanding loans from commercial banks as a percent of GDP (Loans to GDP)[11], (iii) number of deposit accounts with commercial banks per 1000 adults (Number of deposits), and (iv) number of borrowers from commercial banks per 1000 adults (Number of borrowers).

We expect the financial inclusion indicators related to deposits to have a positive effect on bank performance; by widening the deposit base banks will have a more stable funding source derived from diversification and might benefit from scale economies. However, we expect financial inclusion indicators related to lending to have a negative effect on bank performance as increased credit access can result in higher credit risk in the banking business posing negative effects on banks' asset quality, solvency, and profitability.

3.5.2.3 Control variables

A set of country-specific variables is included in all models as controls. Specifically, we include GDP growth (*GDP growth*) to account for economic fluctuations. It is expected to have a positive relationship with bank performance as banks face less risk when the economic growth is high. The positive association between economic growth and bank performance including profitability and stability is well established in the previous literature (Pasiouras and Kosmidou, 2007). Benign economic conditions increase the demand for banks' services, however adverse economic conditions can increase poor quality loans and negatively affect bank profitability (Albertazzi and Gambacorta, 2009). We also include inflation (*Inflation*) as an economic indicator. The effect of inflation on bank performance depends on the banks' ability to anticipate future inflation and adjust their interest rates accordingly (Perry, 1992).

[11] The first two inclusion variables, namely outstanding deposits to GDP and outstanding loans to GDP, are also considered to be financial deepening and financial development measures.

To take into account the banking market characteristics we use the Lerner index (*Lerner index*) as a measure of market power and competition. This indicator has an ambiguous effect on bank performance as the empirical literature provides evidence of two streams: the traditional competition-fragility view that states that banks in competitive markets have lower pricing power that leads to lower profitability, higher risk taking, and hence lower performance (Keeley, 1990, Marcus, 1984); on the other hand, the competition-stability view suggests that lower competition and higher market power allow banks to become too-big-to-fail and thus increase their risk taking motivated by government safety nets (Boyd and De Nicolo, 2005).

We also control for a country's population density (*Population density*). The effect of population on bank performance can be positive or negative. It can be expected to be positive if higher population increases banks' business opportunities and hence increases profitability. It can be negative if these business opportunities attract higher competition and hence lower profit margins thereby negatively affecting bank performance (Dietrich and Wanzenried, 2009). This indicator is usually linked to the banking sector capacity and might influence the costs of financial services distribution (Beck and Feyen, 2013).

Appendix C displays the definition of the variables as well as the data sources used in the study.

3.5.3 Descriptive statistics

Table 3.5 provides descriptive statistics for the main variables used in the study for the full sample, while Table 3.6 provides descriptive statistics by income region and the difference in means tests.

Table 3.5: Descriptive statistics for the full sample

Variable	Observations	Mean	Std. Dev.	Min	Max
Bank performance					
Bank Performance Index %	1,124	54.598	31.733	0.000	100.000
ROA %	1,767	1.425	1.415	-9.770	7.880
Regulatory Capital to RWA %	1,171	16.719	5.133	1.750	45.280
NPLs ratio %	1,156	5.932	5.9893	0.010	45.300
Liquidity ratio %	1,791	36.737	19.926	5.320	224.560
CI ratio %	1,777	58.254	18.643	20.000	166.250
Financial inclusion					
Deposits to GDP %	1,672	52.845	47.894	2.224	479.673
Loans to GDP %	1,702	45.491	37.818	0.736	318.596
Number of deposits (per 1000 adults)	997	1138.456	1171.312	1.633	7824.948
Number of borrowers (per 1000 adults)	795	183.489	213.249	0.054	1156.048
Control variables					
GDP growth %	1,796	4.050	5.343	-62.076	104.487
Inflation %	1,695	20.989	593.433	-35.837	24411.000
Lerner index %	1,190	28.299	13.171	-17.335	93.866
Population density (people / square kilometres)	1,837	321.165	1491.267	1.626	19073.100

Note: The table presents summary statistics for the full sample of 131 countries covering the period from 2005 to 2014. We categorise the variables in three groups: (i) the aggregate bank performance indicators; (ii) the aggregate financial inclusion indicators (these are our main variables of interest and will be used alternatively in the empirical analysis); and (iii) a set of country-level control variables.

The data in Table 3.5 show high variation in bank performance indicators including profitability, stability (solvency and asset quality), liquidity, and efficiency and the financial inclusion variables in the sample. In terms of bank performance, the sample mean for the performance index is 54.6%.The profitability measure shows that the sample banks on average are generating around 1.4% after tax returns on their assets. On average, the banks hold 16.8% regulatory capital (which is well above the regulatory minimum) and 6% of their gross loans are non-performing[12]. The liquidity ratio mean shows that the banks hold on average 37% of their deposits and short-term funding as liquid assets. Additionally, the banks' costs account for 58% of their income on average.

As for the financial inclusion indicators, the largest variation is in the banks' deposits to GDP variable where the minimum is around 2% (Congo) and the maximum is around 480%

[12] The NPLs to gross loans maximum value is striking with almost 45% of loans considered as non-performing loans; this figure belongs to Mauritania in 2010.

(Luxembourg), followed by loans to GDP with a minimum value of around 0.74% (Liberia) and a maximum value of around 319% (Hong Kong, China). These indicators are also proxies for the financial system development and deepening, thus this range shows a high diversity in the countries' development, that is, the financial deepening in some economies is still well below others in the sample. The same applies to the other financial inclusion indicators: the maximum value for the number of deposit accounts per 1000 adults shows that in some sample countries an adult can have up to 7 accounts (Japan) while the minimum shows that in other sample countries only 1.6 in 1000 adults have deposit accounts (Cameroon). The number of borrowers in the system is on average lower than depositors but still shows a relatively large variation among the countries in the sample. Macroeconomic controls and banking market characteristics also show high variations across the sample, showing positive and negative figures for GDP growth, inflation, and Lerner index.

The regional analysis in terms of income reported in Table 3.6 shows significant differences between high and low income regions. The difference in means in the bank performance index is insignificant. However, looking at the indicators composing the index, we find significant differences. Specifically, banks in low and lower middle income countries seem to have higher profitability, capital, and liquidity; while banks in high and upper middle income countries have better performance in terms of average asset quality and efficiency. In terms of financial inclusion, high and upper middle income countries seem to have, on average, a significantly higher deepening and inclusion as shown by the inclusion variables. As for the control variables, low and lower middle income group seems to have a higher GDP growth which is expected as these economies have the potential to grow faster utilizing mechanisms and technologies already provided and utilised by developed countries.

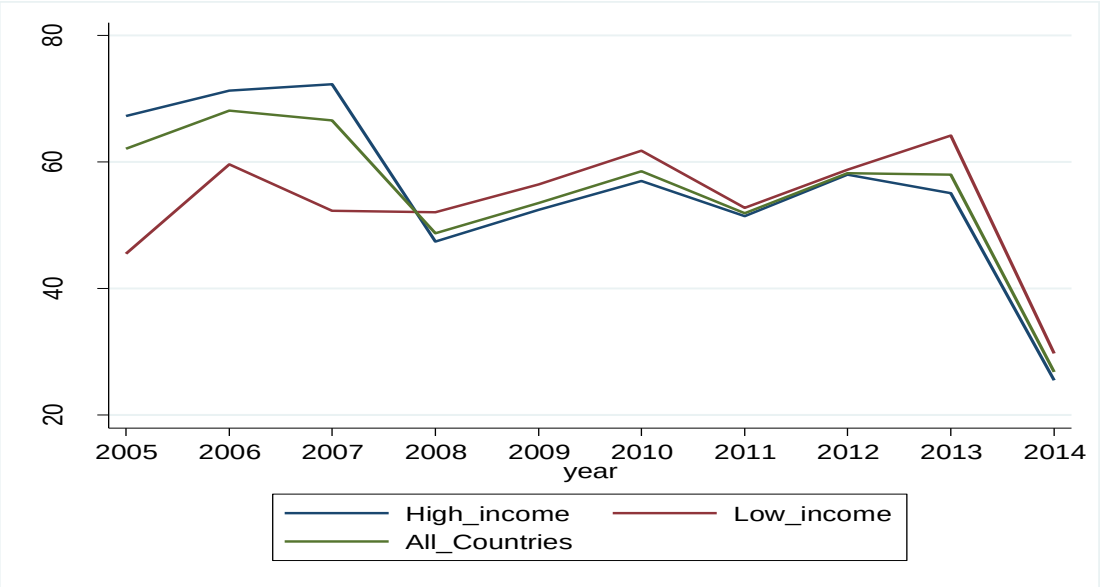
Table 3.6: Descriptive statistics by income region

	High income		Low income		Difference in means
Variable	**Observations**	**Mean**	**Observations**	**Mean**	
Bank performance					
Bank Performance Index %	787	54.960	373	53.752	1.208
ROA %	1,062	1.204	705	**1.758**	-0.554***
Regulatory Capital to RWA %	823	15.824	348	**18.835**	-3.011***
NPLs ratio %	810	**5.062**	346	7.968	-2.906***
Liquidity ratio %	1,077	34.802	714	**39.657**	-4.853***
CI ratio %	1,071	**56.351**	706	61.141	-4.790***
Financial inclusion					
Deposits to GDP %	1,001	**66.988**	671	31.747	35.241***
Loans to GDP %	1,023	**60.001**	679	23.629	36.372***
Number of deposits (per 1000 adults)	554	**1633.172**	443	519.781	1113.391***
Number of borrowers (per 1000 adults)	419	**290.279**	376	64.486	225.793***
Control variables					
GDP growth %	1,075	3.370	721	5.064	-1.694***
Inflation %	1,011	4.576	684	45.249	-40.673
Lerner index %	768	28.313	422	28.273	0.040
Population density (people / square kilometres)	1, 100	453.041	737	124.335	328.706***

Note: The table presents the mean and number of observations statistics for the sub-samples of high income and low income countries covering the period from 2005 to 2014. We categorise the variables in three groups. (i) The aggregate bank performance indicators. (ii) The aggregate financial inclusion indicators (these are our main variables of interest and will be used alternatively in the empirical analysis). (iii) A set of country level control variables. High income group is composed of high income and upper middle income countries and low income group is composed of low income and lower middle income countries as classified by the World Bank. We report the difference in means test that is calculated as the difference between high income countries and low income countries. *, **, *** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively. Bold figures indicate better performance/ higher inclusion.

Figure 3.2 illustrates the time trend of the bank performance index for the full sample and income sub-samples over the period 2005-2014. The graph shows that in general the performance index was significantly higher prior to the global financial crisis. Looking at high income versus low income countries, the performance index for the former was higher than that for the latter before the crisis; however, after the crisis the trend for both groups is similar.

Figure 3.2: Bank performance index trend



Note: The graph illustrates the bank performance index trend for the 131 sample countries by income region for 2005-2014.

Finally, we examine the correlation between the main variables in our baseline model. The results are reported in Table 3.7. In general, the data show a negative correlation between the inclusion variables and the bank performance index. However, this correlation is insignificant. The data reveal a positive correlation between GDP growth and the market power indicator (Lerner index) and bank performance. It is likely that banks perform better in good economic conditions and when they have higher market power. As expected, the inclusion variables are highly positively correlated with each other.

Table 3.7: Correlation matrix for selected aggregated variables

	Bank performance index	Deposits to GDP	Loans to GDP	Number of deposits	Number of borrowers	GDP growth	Inflation	Lerner index
Deposits to GDP	-0.038							
Loans to GDP	-0.031	0.658***						
Number of deposits	-0.014	0.615***	0.552***					
Number of borrowers	0.001	0.471***	0.583***	0.786***				
GDP growth	0.105***	-0.171***	-0.207***	-0.265***	-0.156***			
Inflation	0.021	-0.186***	-0.270***	-0.029	-0.035	-0.037		
Lerner index	0.165***	-0.014	-0.021	-0.074*	0.116***	0.228***	0.062**	
Population density	-0.048	0.267***	0.195***	0.287***	0.418***	0.080**	-0.005	0.174***

Note: The table presents the correlation between the bank performance index, inclusion variables, and control variables for the sample of 131 countries covering the period from 2005 to 2014. *, **, *** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

3.6 Empirical model

To analyse the link between financial inclusion and bank performance on a country level, we use the following regression model:

$$PI_{ct} = \beta_0 + \beta_1 Financial\ Inclusion_{ct-1} + \beta_2 GDP\ Growth_{ct} + \beta_3 Inflation_{ct} + \beta_4 Lerner\ Index_{ct} + \beta_5 Population\ Density_{ct} + c_c + c_t + u_{ct} \quad (3.2)$$

where the dependent variable *PI* is the bank performance index of country *c* at time *t*. Our main variable of interest, *Financial Inclusion*, is measured alternatively as: (i) the deposits to GDP, (ii) the loans to GDP, (iii) the number of deposits, and (iv) the number of borrowers. lagged by one year to control for endogeneity issues. Control variables include GDP growth, Inflation, Lerner index, and Population density. The model includes country and time fixed effects (c_c and c_t, respectively) to account for heterogeneity across time and regions which may be correlated with the independent variables. Standard errors are clustered at the country level to control for serial correlation of errors and heteroscedasticity (Petersen, 2009). The model is estimated using ordinary least squares (OLS).

Next, we divide the countries into high and upper middle income (also referred to as high income) and low and lower middle income (also referred to as low income) groups to examine whether there are differences in the effect of financial inclusion on bank performance across the two groups. To test this relationship, we estimate the baseline regression in Equation (3.2) replacing the financial inclusion indicator with two interaction terms: (i) between the financial inclusion indicator (lagged by one year) and high income dummy $(Financial\ Inclusion_{ct-1} * high\ income\ dummy_{ct})$ (ii) between the financial inclusion indicator (lagged by one year) and the low income dummy $(Financial\ Inclusion_{ct-1} * low\ income\ dummy_{ct})$. This specification

allows financial inclusion to have different effects on bank performance in high and low income countries. We estimate the following regression specification:

$$\begin{aligned} \boldsymbol{PI_{ct}} = \; & \boldsymbol{\beta_0} + \boldsymbol{\beta_1 Financial\ Inclusion_{ct-1} * high\ income\ dummy_{ct}} \\ & + \boldsymbol{\beta_2 Financial\ Inclusion_{ct-1} * low\ income\ dummy_{ct}} \\ & + \boldsymbol{\beta_3 GDP\ Growth_{ct}} + \boldsymbol{\beta_4 Inflation_{ct}} + \boldsymbol{\beta_5 Lerner\ Index_{ct}} \\ & + \boldsymbol{\beta_6 Population\ Density_{ct}} + \boldsymbol{c_c} + \boldsymbol{c_t} + \boldsymbol{u_{ct}} \end{aligned} \tag{3.3}$$

We perform a number of additional tests. First, we examine if there are differences in the relationship between financial inclusion and bank performance depending on the level of financial inclusion already existing in the country. In other words, we test whether the impact of financial inclusion on bank performance is different when distinguishing between countries with high and low level of inclusion. We do so by constructing a dummy variable for the upper level of financial inclusion that is equal to one if the value of the indicator is above the mean value for the full sample and zero otherwise ($upper\ level\ dummy$), and another dummy variable for the lower level of financial inclusion that is equal to one if the value of the indicator is below the mean value for the full sample and zero otherwise ($lower\ level\ dummy$). We use the baseline regression Equation (3.2) replacing the financial inclusion indicator with two interaction terms: (i) between the financial inclusion indicator (lagged by one year) and upper level of financial inclusion dummy ($Financial\ Inclusion_{ct-1} * upper\ level\ dummy_{ct}$), (ii) between the financial inclusion indicator (lagged by one year) and the lower level of financial inclusion dummy ($Financial\ Inclusion_{ct-1} * lower\ level\ dummy_{ct}$). We estimate the following regression specification:

$$\begin{aligned} \boldsymbol{PI_{ct}} = \; & \boldsymbol{\beta_0} + \boldsymbol{\beta_1 Financial\ Inclusion_{ct-1} * upper\ level\ dummy_{ct}} \\ & + \boldsymbol{\beta_2 Financial\ Inclusion_{ct-1} * lower\ level\ dummy_{ct}} \\ & + \boldsymbol{\beta_3 GDP\ Growth_{ct}} + \boldsymbol{\beta_4 Inflation_{ct}} + \boldsymbol{\beta_5 Lerner\ Index_{ct}} \\ & + \boldsymbol{\beta_6 Population\ Density_{ct}} + \boldsymbol{c_c} + \boldsymbol{c_t} + \boldsymbol{u_{ct}} \end{aligned} \tag{3.4}$$

We estimate the model for the full sample and separately for the high income and low income sub-samples. The latter allows us to test if the level of financial inclusion has a different impact on the relationship between financial inclusion and bank performance across countries with different levels of income.

In the second additional test we examine the impact of the level of income inequality in the country on the financial inclusion and bank performance relationship. We use the Gini index (obtained from the World Bank data) that measures the extent to which the distribution of income among individuals or households within an economy deviates from a perfectly equal distribution. Gini index ranges between 0 (perfect income equality) and 100 (perfect income inequality). To distinguish between countries with high and low levels of income inequality, we create a high equality dummy variable that is equal to 1 if the country's Gini index is below its sample mean value and zero otherwise ($high\ equality\ dummy$). We then use the baseline model in Equation (3.2) adding an interaction term between the financial inclusion indicator (lagged by one year) and the high equality dummy variable ($Financial\ Inclusion_{ct-1} * high\ equality\ dummy_{ct}$), which allows us to estimate the incremental effect of the income equality on the relationship between financial inclusion and bank performance. We use the following model specification:

$$\begin{aligned} \boldsymbol{PI_{ct}} = \ & \boldsymbol{\beta_0} + \boldsymbol{\beta_1 Financial\ Inclusion_{ct-1}} + \boldsymbol{\beta_2 Financial\ Inclusion_{ct-1}} \\ & * \boldsymbol{high\ equality\ dummy_{ct}} + \boldsymbol{\beta_3 GDP\ Growth_{ct}} + \boldsymbol{\beta_4 Inflation_{ct}} \\ & + \boldsymbol{\beta_5 Lerner\ Index_{ct}} + \boldsymbol{\beta_6 Population\ Density_{ct}} \\ & + \boldsymbol{high\ equality\ dummy_{ct}} + \boldsymbol{c_c} + \boldsymbol{c_t} + \boldsymbol{u_{ct}} \end{aligned} \tag{3.5}$$

In the third additional test we are interested in the impact of the regulatory environment of the country on the relationship between financial inclusion and bank performance. The main regulatory variable we use is the bank capital regulation index constructed by Barth et al. (2012). This index measures the stringency of capital regulation in the country and ranges from 0 to 10.

The data are available for 2003, 2007, and 2011; we therefore fill in the missing years in our sample with the index data of the preceding date[13]. To distinguish between countries with high and low levels of capital regulation, we create a dummy variable that is equal to 1 if the country's capital regulation index is above its mean value and zero otherwise ($high\ regulation\ dummy$). We then use the baseline model in Equation (3.2) adding an interaction term between the financial inclusion indicator (lagged by one year) and the capital regulation dummy variable ($Financial\ Inclusion_{ct-1} * high\ regulation\ dummy_{ct}$). This allows us to estimate the incremental effect of the regulatory environment on the relationship between financial inclusion and bank performance. We use the following model specification:

$$\begin{aligned} \boldsymbol{PI_{ct} =\ } & \boldsymbol{\beta_0 + \beta_1 Financial\ Inclusion_{ct-1} + \beta_2 Financial\ Inclusion_{ct-1}} \\ & \boldsymbol{* high\ regulation\ dummy_{ct} + \beta_3 GDP\ Growth_{ct} + \beta_4 Inflation_{ct}} \\ & \boldsymbol{+ \beta_5 Lerner\ Index_{ct} + \beta_6 Population\ Density_{ct} + c_c + c_t + u_{ct}} \end{aligned} \tag{3.6}$$

In our fourth additional test we consider the impact of banking crisis on the relationship between financial inclusion and bank performance. We use a crisis dummy variable for the years of banking crisis[14] for each country using the data from the World Bank's Global Financial Development Database ($crisis\ dummy$). We then augment the baseline model in Equation (3.2) with an interaction term between the financial inclusion indicator (lagged by one year) and the crisis dummy variable ($Financial\ Inclusion_{ct-1} * crisis\ dummy_{ct}$); this allows us to estimate the incremental effect of the crisis on the relationship between financial inclusion and bank performance. We estimate the following model specification:

[13] For example, if the index score for a certain country was 4 in 2003, we fill in the years 2004-2006 with the same score (i.e., 4).

[14] The banking crisis dummy is country-specific and equal to one in the presence of a banking crisis, that is, when there are significant signs of financial distress in the banking system or when there are significant policy interventions in response to significant losses in the system (Laeven and Valencia, 2013).

$$\begin{aligned} \boldsymbol{PI_{ct}} = \; & \boldsymbol{\beta_0 + \beta_1 Financial\ Inclusion_{ct-1} + \beta_2 Financial\ Inclusion_{ct-1}} \\ & \boldsymbol{* crisis\ dummy_{ct} + \beta_3 GDP\ Growth_{ct} + \beta_4 Inflation_{ct}} \\ & \boldsymbol{+ \beta_5 Lerner\ Index_{ct} + \beta_6 Population\ Density_{ct} + c_c + c_t + u_{ct}} \end{aligned} \tag{3.7}$$

The fifth additional test involves testing if the relationship between financial inclusion and bank performance is affected by the business cycle. Essentially, we test whether there is an incremental effect of economic expansion on this relationship. To do so we use the baseline model in Equation (3.2) adding an interaction term between the financial inclusion indicator (lagged by one year) and GDP growth ($Financial\ Inclusion_{ct-1} * GDP\ growth_{ct}$) as shown in the specification below:

$$\begin{aligned} \boldsymbol{PI_{ct}} = \; & \boldsymbol{\beta_0 + \beta_1 Financial\ Inclusion_{ct-1} + \beta_2 Financial\ Inclusion_{ct-1} * GDP\ Growth_{ct}} \\ & \boldsymbol{+ \beta_3 GDP\ Growth_{ct} + \beta_4 Inflation_{ct} + \beta_5 Lerner\ Index_{ct}} \\ & \boldsymbol{+ \beta_6 Population\ Density_{ct} + c_c + c_t + u_{ct}} \end{aligned} \tag{3.8}$$

In the sixth test we examine the relationship between financial inclusion and bank performance in the EU countries. We do so estimating the baseline model in Equation (3.2) on a sub-sample of EU countries to investigate whether there are different regional characteristics that affect the results.

We also test additional measures of financial inclusion in the seventh additional test using the baseline model Equation (3.2). Specifically, we examine the geographical outreach aspect of financial inclusion measured by the number of ATMs and branches in the country[15].

[15] As an additional test, we decompose the performance index into its component indicators to analyse the relationship between each indicator and financial inclusion. To do so, we estimate Equation (3.2) using alternatively return on assets, regulatory capital to risk weighted assets, gross loans to non-performing loans, and income to cost ratio as the dependent variable. The results are reported in Appendix D.

3.7 Results

3.7.1 Financial inclusion and bank performance index

Table 3.8 reports the results of estimating Equation (3.2). Models (1), (3), (5), and (7) test the relationship between financial inclusion measured by deposits to GDP, loans to GDP, number of deposit accounts, and number of borrowers, respectively, and bank performance measured by the aggregate performance index. Models (2), (4), (6), and (8) additionally control for a set of country-specific variables. All models are estimated on the full sample using ordinary least squares (OLS) with country and time fixed effects; in all regression estimations we use standard errors clustered at the country level.

We find that deposits to GDP, number of deposits, and number of borrowers have no significant effect on our aggregated measure of bank performance. However, Models (3) and (4) show a significant negative association between banks' loans to GDP and the performance index. These results indicate that there might be a trade-off between level of credit provided by banks and their profitability and stability. The trade-off could rise when higher financial inclusion is achieved through excessive credit growth and lowering credit standards and hence asset quality, as witnessed in the recent financial crisis when high growth in credit (mortgages) led to high growth in default (this was linked to expanding the pool of loans to sub-prime borrowers in the US) and caused instability. Additionally, increased informational inefficiencies and operating costs could accompany increased lending and lead to deterioration in bank performance as suggested by Khan (2011) and Dabla-Norris et al. (2015). Demirgüç-Kunt and Detragiache (2005) and Sahay et al. (2015b) also find evidence suggesting that there is a trade-off between increased credit / number of borrowers and bank performance.

As for the control variables, in line with our expectations, GDP growth is positively and significantly related to bank performance, as banks face lower risks when the economic growth is

high (Pasiouras and Kosmidou, 2007). Model (8) shows a negative association between inflation and bank performance which is expected only if banks are unable to anticipate future inflation and adjust their interest rates accordingly (Perry, 1992). There is a highly positive and significant relationship between Lerner index and bank performance, providing evidence for the competition-fragility theory, where higher market power enables banks to generate monopoly profits (Molyneux and Thornton, 1992, Beck et al., 2006), also this result can be explained by the assumption that larger banks with higher market power are better able to exploit economies of scale and able to pass on to customers potential inefficiencies (Flamini et al., 2009). The population density variable is mostly insignificant except for Model (6) where the inclusion variable is measured by the number of deposit accounts.

Table 3.8: Financial inclusion and bank performance index

	Model (1)	**Model (2)**	**Model (3)**	**Model (4)**	**Model (5)**	**Model (6)**	**Model (7)**	**Model (8)**
L. deposits to GDP	-0.1410	-0.1851						
	(-1.17)	(-0.97)						
L. loans to GDP			-0.4682**	-0.4950**				
			(-3.01)	(-3.46)				
L. number of deposits					-0.0056	0.0121		
					(-0.58)	(1.10)		
L. number of borrowers							-0.0109	0.0145
							(-0.28)	(0.35)
GDP growth		0.9848**		0.8259**		1.0324**		1.2322**
		(2.52)		(2.12)		(2.10)		(2.41)
Inflation		0.1818		0.2390		0.7436		-0.6751**
		(0.45)		(0.58)		(1.37)		(-2.39)
Lerner index		1.7683**		1.7328**		1.5718**		1.5215**
		(7.32)		(7.55)		(6.05)		(5.26)
Population density		-0.0116		-0.0028		0.5342**		-0.0244
		(-0.59)		(-0.16)		(5.40)		(-1.64)
Time fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Clustering	yes	yes	yes	yes	yes	yes	yes	yes
Observations	982	732	1,017	750	631	449	513	352
Adjusted R-squared	0.172	0.296	0.187	0.312	0.182	0.315	0.199	0.327

Note: The table reports the regression results of estimating the relation between financial inclusion and bank performance (Equation (3.2)). The dependent variable is the performance index. The main independent variables are lagged financial inclusion indicators: (i) deposits to GDP, (ii) loans to GDP, (iii) number of deposits, and (iv) number of borrowers. Control variables include a set of country-specific characteristics: (i) GDP growth, (ii) inflation, (iii) Lerner index, and (iv) population density. The regressions are run on the full sample of 131 countries covering the period of 2005-2014. Robust t-statistics are reported under the coefficients in parentheses. Standard errors are clustered at the country level. *, **,*** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

3.7.2 High versus low income countries

In this section we test whether there are differences in the relationship between financial inclusion and bank performance depending on the country's income group. We estimate the regression in Equation (3.3) where we replace the financial inclusion indicator with two interaction terms: (i) between the financial inclusion indicator and high income dummy and (ii) between the financial inclusion indicator and the low income dummy. This specification allows financial inclusion to have different effects on bank performance in high and upper middle and low and lower middle income countries.

Table 3.9 reports the estimation results for the high income versus low income groups. Models (1)-(4) test the relationship between banks' deposits to GDP, loans to GDP, number of deposits, and number of borrowers interacted with the high / low income dummies and the performance index, respectively. All models are estimated using ordinary least squares (OLS) with country and time fixed effects; in all regression estimations we use standard errors clustered at the country level.

Table 3.9: Financial inclusion and bank performance index: High income versus low income

	Model (1)	Model (2)	Model (3)	Model (4)
L. deposits to GDP * high income dummy	-0.2599 (-1.22)			
L. deposits to GDP * low income dummy	1.2156* (1.88)			
L. loans to GDP * high income dummy		-0.6012** (-4.39)		
L. loans to GDP* low income dummy		0.2230 (0.62)		
L. number of deposits * high income dummy			0.0072 (0.74)	
L. number of deposits * low income dummy			0.0330** (2.07)	
L. number of borrowers * high income dummy				-0.0247 (-0.61)
L. number of borrowers * low income dummy				0.1294** (2.27)
GDP growth	0.8502** (2.20)	0.7768** (2.05)	0.9652** (2.02)	1.2447** (2.37)
Inflation	0.1812 (0.44)	0.2296 (0.55)	0.9060* (1.80)	-0.5708* (-1.86)
Lerner index	1.8157** (7.92)	1.7790** (7.89)	1.6244** (6.24)	1.5344** (5.23)
Population density	-0.0091 (-0.50)	0.0018 (0.11)	0.5152** (5.36)	-0.0137 (-0.88)
Time fixed effects	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes
Clustering	yes	yes	yes	yes
Observations	732	750	449	352
Adjusted R-squared	0.307	0.318	0.318	0.339

Note: The table reports the regression results of estimating the relation between financial inclusion and bank performance for high income versus low income countries (Equation (3.3)). The dependent variable is the bank performance index. The main independent variables are the interaction terms between lagged financial inclusion indicators: (i) deposits to GDP, (ii) loans to GDP, (iii) number of deposits, and (iv) number of borrowers and high / low income dummies. Control variables include a set of country-specific characteristics: (i) GDP growth, (ii) inflation, (iii) Lerner index, and (iv) population density. The regressions are run on the full sample of 131 countries covering the period of 2005-2014. Robust t-statistics are reported under the coefficients in parentheses. Standard errors are clustered at the country level. *, **,*** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

The results show that the estimated negative relationship between financial inclusion and bank performance is mainly driven by high income countries where credible depositors and borrowers are already included in the financial system. Specifically, Model (2) shows a significant negative association between loans to GDP and the performance index in high and upper middle income countries. This financial inclusion measure is also a proxy for financial deepening and financial development; well developed economies already have high rates of

financial inclusion, so it might be suboptimal for banks in these countries to increase their financial inclusion as this might require lowering their credit standards. Hence, it seems that in high income countries performance gains from financial inclusion might be exhausted. On the other hand, the results suggest that higher financial inclusion in low and lower-middle income countries does not seem to adversely affect bank performance and stability (one financial inclusion/deepening variable have insignificant coefficient that is loans to GDP). In fact, banks in these countries could achieve some gains from further financial access to deposits and loans, as shown by the positive and significant coefficients on the number of deposits and number of borrowers in addition to deposits to GDP. Hence, we find evidence to suggest that benefits from financial inclusion for bank performance seem to arise in low and lower middle income countries where banks on average hold higher capital and liquidity. These economies have scope for greater financial inclusion that would have a positive impact on the banking system. Thus, the country income level has an important impact on the relationship between financial inclusion and bank performance. This is consistent with Dabla-Norris et al. (2015), who suggest that the impact of financial inclusion on macroeconomic indicators such as economic growth and income inequality depends on country characteristics and differ between high, middle, and low income countries.

3.7.3 Additional tests

3.7.3.1 High versus low financial inclusion

As an additional test, we examine whether there are differences in the relationship between financial inclusion and bank performance depending on the country's existing level of financial inclusion. We estimate the baseline regression replacing the financial inclusion indicator with two interaction terms: (i) between the financial inclusion indicator and upper level of financial inclusion dummy, (ii) between the financial inclusion indicator and the lower level of financial inclusion dummy (Equation (3.4)). This specification allows us to test whether financial inclusion has a different impact on bank performance in countries that already have high financial inclusion compared to those with a low level of financial inclusion.

Table 3.10 reports the estimation results for the high inclusion versus low inclusion groups. Models (1)-(4) test the relationship between banks' deposits to GDP, loans to GDP, number of deposits, and number of borrowers interacted with: (i) the upper level (of inclusion) dummy, and (ii) the lower level (of inclusion) dummy (for the full sample) and performance index, respectively. We then examine the same relationship for sub-samples of high and upper middle and low and lower middle income countries (Models (5)-(12)). In these tests the financial inclusion threshold is determined for each sub-sample separately to control for potential differences between these two groups. The models are estimated using ordinary least squares (OLS) with country and time fixed effects; in all regression estimations we use standard errors clustered at the country level.

Table 3.10: Financial inclusion and bank performance index: High versus low inclusion

	Full sample				High income sub-sample				Low income sub-sample			
	Model (1)	**Model (2)**	**Model (3)**	**Model (4)**	**Model (5)**	**Model (6)**	**Model (7)**	**Model (8)**	**Model (9)**	**Model (10)**	**Model (11)**	**Model (12)**
L. deposits to GDP * upper-level dummy	-0.1756 (-0.93)				-0.2313 (-1.06)				1.0049 (1.65)			
L. deposits to GDP * lower-level dummy	-0.0607 (-0.25)				-0.2863 (-1.12)				1.3634* (1.79)			
L. loans to GDP * upper-level dummy		-0.5132** (-3.64)				-0.5356** (-3.72)				0.2321 (0.63)		
L. loans to GDP* lower-level dummy		-0.6232** (-3.28)				-0.6433** (-3.35)				1.3627* (1.79)		
L. number of deposits * upper-level dummy			0.0121 (1.10)				0.0046 (0.45)				0.0421** (2.97)	
L. number of deposits * lower-level dummy			0.0101 (0.80)				-0.0046 (-0.36)				0.0586** (2.30)	
L. number of borrowers * upper-level dummy				0.0029 (0.07)				-0.0246 (-0.59)				0.1600** (2.47)
L. number of borrowers * lower-level dummy				-0.0416 (-0.53)				-0.0982* (-1.82)				0.4142 (1.48)
GDP growth	0.9957** (2.53)	0.8542** (2.21)	1.0340** (2.10)	1.2737** (2.44)	1.0260** (2.18)	0.9169* (1.96)	1.0678 (1.43)	1.0781 (1.63)	0.4879 (0.81)	0.6269 (1.02)	1.0500* (1.88)	1.1638 (1.11)
Inflation	0.1722 (0.43)	0.2329 (0.56)	0.7560 (1.38)	-0.6763** (-2.39)	0.6245 (1.31)	0.8012* (1.75)	1.9991** (2.60)	-0.5058 (-0.56)	-0.4506 (-1.15)	-0.5807 (-1.52)	0.5744 (0.91)	-0.4907 (-1.63)
Lerner index	1.7717** (7.34)	1.7342** (7.65)	1.5717** (6.05)	1.5304** (5.33)	1.9920** (6.68)	1.9551** (6.94)	1.7914** (6.05)	1.7382** (4.73)	1.4153** (3.63)	1.4478** (3.13)	1.3520** (2.56)	1.3597** (2.48)
Population density	-0.0115 (-0.58)	-0.0023 (-0.13)	0.5373** (5.39)	-0.0223 (-1.51)	-0.0111 (-0.61)	-0.0022 (-0.13)	0.4954** (4.14)	-0.0157 (-0.96)	0.2977 (0.88)	0.2163 (0.84)	0.5842** (2.35)	0.6526** (2.32)
Time fixed effects	yes	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country fixed effects	yes	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Clustering	yes	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	732	750	449	352	534	544	285	226	198	206	164	126
Adjusted R-squared	0.296	0.312	0.313	0.326	0.350	0.371	0.353	0.404	0.212	0.236	0.258	0.272

Note: The table reports the regression results of estimating the relation between financial inclusion and bank performance for high versus low financial inclusion countries (Equation (3.4)). The dependent variable is the bank performance index. The main independent variables are the interaction terms between lagged financial inclusion indicators: (i) deposits to GDP, (ii) loans to GDP, (iii) number of deposits, and (iv) number of borrowers and upper-level / lower-level of inclusion dummies. Control variables include a set of country-specific characteristics: (i) GDP growth, (ii) inflation, (iii) Lerner index, and (iv) population density. Models (1)-(4) the regressions are run on the full sample of 131 countries using the full sample threshold, Models (5)-(8) regressions are run on a subsample of high and upper-middle income countries, and Models (9)-(12) regressions are run on a sub-sample of low and lower-middle income countries (using sub-samples thresholds). The sample covers the period of 2005-2014. Robust t-statistics are reported under the coefficients in parentheses. Standard errors are clustered at the country level. *, **,*** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

The results for the full sample (Table 3.10) are similar to the baseline regression results (Table 3.8), where the relationship between bank loans to GDP and bank performance is negative and significant in both upper and lower levels of financial inclusion (Model (2) of Table 3.10). Results for the high and upper middle income sub-sample are consistent with the results obtained in the previous high versus low income countries. Results obtained from Model (6) of Table 3.10 show that the negative relationship between loans to GDP and bank performance holds for high and upper middle income countries despite the prevailing inclusion level. However, results of the low and lower middle income sub-sample confirms that these countries might benefit from financial inclusion and that is specifically true for countries that are in the lower-level of financial inclusion. Models (9)-(11) of Table 3.10 show that there is a positive and significant association between deposits to GDP, loans to GDP, and number of deposits, respectively, and bank performance in low (and lower middle) countries that are in the lower level of inclusion category (the financial inclusion indicator is below the mean of the sub-sample). Hence, banks in these countries might achieve gains from increased financial inclusion.

3.7.3.2 Income equality

We next test whether the equality of income in a country has an impact on the relationship between financial inclusion and bank performance. We estimate the baseline regression adding an interaction term between each financial inclusion indicator and high equality dummy (Equation (3.5)). The high equality dummy is equal to one if the Gini index score for a certain country in a certain year is below the mean value of the index for the full sample. This specification allows us to examine whether the effect of financial inclusion on bank performance differs in countries with different levels of income equality. Table 3.11 reports the estimation results.

Table 3.11: Financial inclusion and bank performance index: Income equality

	Model (1)	Model (2)	Model (3)	Model (4)
L. deposits to GDP	-0.4516			
	(-1.58)			
L. deposits to GDP * high equality dummy	0.2658			
	(1.33)			
L. loans to GDP		-1.0353**		
		(-3.19)		
L. loans to GDP * high equality dummy		0.4190**		
		(4.46)		
L. number of deposits			0.0078	
			(0.54)	
L. number of deposits * high equality dummy			0.0075	
			(0.81)	
L. number of borrowers				0.0975*
				(2.01)
L. number of borrowers * high equality dummy				0.1252**
				(4.41)
GDP growth	1.2881**	0.9698*	1.0595	0.9568
	(2.23)	(1.71)	(1.58)	(1.03)
Inflation	0.0343	0.1700	1.0154	1.2882
	(0.14)	(0.66)	(1.12)	(1.24)
Lerner index	2.1654**	2.1611**	1.7883**	2.5072**
	(7.23)	(7.81)	(5.27)	(6.56)
Population density	0.0447	0.0762	0.5779	0.5638
	(0.04)	(0.07)	(0.45)	(0.63)
high equality dummy	20.8485**	15.5208**	11.9479**	18.6124**
	(-3.77)	(-3.68)	(-2.04)	(-2.80)
Time fixed effects	Yes	yes	yes	yes
Country fixed effects	Yes	yes	yes	yes
Clustering	Yes	yes	yes	yes
Observations	351	361	215	160
Adjusted R-squared	0.342	0.369	0.302	0.419

Note: The table reports the regression results of estimating the effect of high equality in income on the relationship between financial inclusion and bank performance (Equation (3.5)). The dependent variable is the bank performance index. The main independent variables are lagged financial inclusion indicators: (i) deposits to GDP, (ii) loans to GDP, (iii) number of deposits, and (iv) number of borrowers; and the interaction terms between these variables and the high equality dummy. Control variables include a set of country-specific characteristics: (i) GDP growth, (ii) inflation, (iii) Lerner index, and (iv) population density. The regressions are run on the full sample of 131 countries covering the period of 2005-2014. Robust t-statistics are reported under the coefficients in parentheses. Standard errors are clustered at the country level. *, **,*** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

The results show that income equality in a country has a positive impact on the relationship between financial inclusion and bank performance. Specifically, Model (2) of Table 3.11 shows that high income equality in a country lowers the negative association between credit deepening (measured by loans to GDP) and bank performance. Model (4) shows a significant positive effect of high equality of income on the relationship between the number of borrowers and bank performance. This indicates a stronger positive effect of the number of borrowers on

bank performance in countries with higher income equality. Hence, we can conclude that improvements in income equality in a country can enhance the relationship between financial inclusion and bank performance and that banks operating in countries with low income inequality achieve more gains from financial inclusion. This could be due to borrowers' enhanced ability to repay credit in countries with lower levels of income inequality as these countries will offer more equal opportunities and healthier social and economic conditions.

3.7.3.3 Capital regulation

To test whether the quality of capital regulation has an impact on the relationship between financial inclusion and bank performance, we estimate the baseline regression adding an interaction term between each financial inclusion indicator and high quality capital regulation dummy (Equation (3.6)). The high quality capital regulation dummy is equal to one if the capital regulation index score for a certain country in a certain year is above the mean value of the capital regulation index for the full sample. This specification allows us to examine whether the effect of financial inclusion on bank performance differs in countries with different quality of capital regulation. Table 3.12 reports the estimation results.

We find that the regulatory environment of a country has a positive impact on the relationship between financial inclusion and bank performance. Specifically, Models (1) and (2) of Table 3.12 show that high quality capital regulation in a country lowers the negative association between financial depth and bank performance. In other words, the negative impact of financial depth on bank performance can be counteracted with the impact of high quality regulation. Additionally, results from Models (3) and (4) indicate that there is a stronger positive effect of the number of depositors and borrowers on bank performance when the quality of capital regulation is high. These results are consistent with Sahay et al. (2015b) who find that there is a positive relationship between financial inclusion and bank stability only in countries

with high quality regulation. This implies that banks operating in countries with strong capital supervision could achieve more gains from financial inclusion. This is mainly due to the fact that capital buffers can mitigate the risks associated with increased expansion of banking services (particularly credit risk). As suggested by Sahay et al. (2015b) it is recommended that promoting financial inclusion be associated with improvements in the regulatory supervision.

Table 3.12: Financial inclusion and bank performance index: Capital regulation

	Model (1)	**Model (2)**	**Model (3)**	**Model (4)**
L. deposits to GDP	-0.3331** (-2.48)			
L. deposits to GDP * High-quality capital regulation dummy	0.2226** (4.09)			
L. loans to GDP		-0.5006** (-3.96)		
L. loans to GDP * High -quality capital regulation dummy		0.1306** (2.18)		
L. number of deposits			0.0039 (0.32)	
L. number of deposits * High-quality capital regulation dummy			0.0076** (3.01)	
L. number of borrowers				-0.0001 (-0.00)
L. number of borrowers * High-quality capital regulation dummy				0.0358** (2.48)
GDP growth	1.0720** (2.66)	0.9831** (2.45)	0.9731* (1.82)	0.3992 (0.73)
Inflation	0.5317 (1.23)	0.6439 (1.50)	1.1904* (1.96)	-0.2254 (-0.31)
Lerner index	1.8037** (6.45)	1.7936** (6.77)	1.6863** (5.80)	1.5282** (4.17)
Population density	-0.0062 (-0.29)	-0.0046 (-0.24)	0.5498** (4.83)	-0.0390** (-2.58)
Time fixed effects	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes
Clustering	yes	yes	yes	yes
Observations	623	637	368	286
Adjusted R-squared	0.344	0.346	0.336	0.343

The table reports the regression results of estimating the effect of high capital regulation on the relation between financia1 inclusion and bank performance (Equation (3.6)). The dependent variable is the bank performance index. The main independent variables are lagged financial inclusion indicators: (i) deposits to GDP, (ii) loans to GDP, (iii) number of deposits, and (iv) number of borrowers; and the interaction terms between these variables and the high-quality capital regulation dummy. Control variables include a set of country-specific characteristics: (i) GDP growth, (ii) inflation, (iii) Lerner index, and (iv) population density. The regressions are run on the full sample of 131 countries covering the period of 2005-2014. Robust t-statistics are reported under the coefficients in parentheses. Standard errors are clustered at the country level. *, **,*** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

3.7.3.4 Banking crisis

As discussed in section 5.3, increased financial inclusion is expected to moderate the impact of a crisis as retail depositors and borrowers are expected to have a steady behaviour regardless of the economic situation. Therefore, we test the effect of financial inclusion on bank performance in crisis years. We estimate the baseline regression adding an interaction term between each financial inclusion indicator and the crisis dummy (Equation (3.7)). The crisis dummy is country-specific and is equal to one in crisis years and zero otherwise. This specification allows us to examine whether the effect of financial inclusion on bank performance differs in crisis or extreme recession periods. Table 3.13 reports the estimation results.

The results are similar to the baseline regression results, where Model (2) of Table 3.13 shows a significant negative association between banks' loans to GDP and the performance index. This indicates that, on average, increased lending led to lower bank performance in our sample period. However, the interaction term between loans to GDP and the crisis dummy is statistically insignificant, indicating that there is no further effect on bank performance during the crisis (Model (2)). Moreover, the results in Model (4) show a positive and statistically significant association between the number of borrowers interacted with the crisis dummy and bank performance. This suggests that an increased number of borrowers can enhance bank performance during a crisis. This might be explained by the diversification effect of having a larger number of borrowers in reducing bank risk as banks in this case will have a more diversified base of borrowers. This is also consistent with Han and Melecky (2013) who find that broader access to bank deposits can enhance the deposit funding base of banks and make them more resilient (in terms of mitigating the deposit growth declines) in times of crisis. It is important to highlight that financial inclusion does not seem to adversely affect bank performance during crisis.

Table 3.13: Financial inclusion and bank performance index: Banking crisis

	Model (1)	Model (2)	Model (3)	Model (4)
L. deposits to GDP	-0.3358			
	(-0.94)			
L. deposits to GDP * Crisis dummy	-0.0789			
	(-1.47)			
L. loans to GDP		-0.5780**		
		(-2.35)		
L. loans to GDP * Crisis dummy		-0.0472		
		(-0.59)		
L. number of deposits			0.0139	
			(0.96)	
L. number of deposits * Crisis dummy			-0.0015	
			(-0.38)	
L. number of borrowers				-0.0264
				(-0.39)
L. number of borrowers * Crisis dummy				0.1117**
				(2.94)
GDP growth	1.3362**	1.2583**	0.8975*	1.8855**
	(3.20)	(3.07)	(1.91)	(3.45)
Inflation	-0.1554	-0.1055	1.1302*	-0.6415**
	(-0.46)	(-0.31)	(1.89)	(-2.36)
Lerner index	1.8201**	1.7307**	1.6891**	1.8072**
	(7.11)	(7.11)	(5.31)	(5.12)
Population density	-0.0139	-0.0252**	0.8004**	-0.0243
	(-0.73)	(-2.27)	(2.47)	(-1.64)
Time fixed effects	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes
Clustering	yes	yes	yes	yes
Observations	525	535	302	237
Adjusted R-squared	0.306	0.312	0.300	0.302

Note: The table reports the regression results of estimating the effect of crisis on the relation between financial inclusion and bank performance (Equation (3.7)). The dependent variable is the bank performance index. The main independent variables are lagged financial inclusion indicators: (i) deposits to GDP, (ii) loans to GDP, (iii) number of deposits, and (iv) number of borrowers; and the interaction terms between these variables and the crisis dummy. Control variables include a set of country-specific characteristics: (i) GDP growth, (ii) inflation, (iii) Lerner index, and (iv) population density. The regressions are run on the full sample of 131 countries covering the period of 2005-2014. Robust t-statistics are reported under the coefficients in parentheses. Standard errors are clustered at the country level. *, **,*** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

3.7.3.5 Business cycle

We further analyse the impact of the economic conditions on the relationship between financial inclusion and bank performance by testing whether the relationship is affected by the business cycle. We estimate the baseline regression adding an interaction term between each

financial inclusion indicator and GDP growth (Equation (3.8)). This specification allows us to examine whether the effect of financial inclusion on bank performance differs in good times. It is expected that the relationship is improved in good times and impaired in bad times as there are higher chances that newly included customers will be unable to increase savings or repay debt in recessions which in turn might negatively impact bank performance. Table 3.14 reports the estimation results.

The results of the test are similar to the baseline regression results, where the financial inclusion indicator (loans to GDP) is negative and statistically significant at 5% level (Model (2) of Table 3.14). This suggests that increased lending might distort bank performance irrespective of the business cycle. All the interaction terms between the financial inclusion indicators and the GDP growth are statistically insignificant, indicating that there is no effect of the business cycle on the relationship between financial inclusion and bank performance.

Table 3.14: Financial inclusion and bank performance index: Business cycle

	Model (1)	Model (2)	Model (3)	Model (4)
L. deposits to GDP	-0.1653 (-0.82)			
Deposits to GDP * GDP growth	0.0047 (1.42)			
L. loans to GDP		-0.4941** (-3.48)		
Loans to GDP * GDP growth		0.0133) (1.75)		
L. number of deposits			0.0119 (1.07)	
Number of deposits * GDP growth			0.0001 (0.18)	
L. number of borrowers				0.0118 (0.28)
Number of borrowers * GDP growth				0.0007 (0.52)
GDP growth	0.7356 (1.63)	0.1606 (0.30)	0.9389 (1.45)	1.0690 (1.62)
Inflation	0.1691 (0.42)	0.2073 (0.53)	0.7444 (1.37)	-0.6682** (-2.36)
Lerner index	1.7800** (7.37)	1.7367** (7.53)	1.5703** (6.08)	1.5271** (5.17)
Population density	-0.0101 (-0.49)	-0.0029 (-0.16)	0.5332** (5.41)	-0.0238 (-1.59)
Time fixed effects	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes
Clustering	yes	yes	yes	yes
Observations	732	750	449	352
Adjusted R-squared	0.297	0.314	0.313	0.325

Note: The table reports the regression results of estimating the effect of the business cycle on the relation between financial inclusion and bank performance (Equation (3.8)). The dependent variable is the bank performance index. The main independent variables are lagged financial inclusion indicators: (i) deposits to GDP, (ii) loans to GDP, (iii) number of deposits, and (iv) number of borrowers; and the interaction terms between these variables and GDP growth as a proxy for the business cycle. Control variables include a set of country-specific characteristics: (i) GDP growth, (ii) inflation, (iii) Lerner index, and (iv) population density. The regressions are run on the full sample of 131 countries covering the period of 2005-2014. Robust t-statistics are reported under the coefficients in parentheses. Standard errors are clustered at the country level. *, **,*** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

3.7.3.6 EU sub-sample

In this section we report the results of estimating Equation (3.2) for a subset of the countries in the European Union (EU).[16] We investigate whether there are different regional characteristics that affect the relationship between financial inclusion and bank performance. EU

[16] We do not report the results of estimating the relationship between financial inclusion measured by number of borrowers and bank performance for the EU subsample due to insufficient number of observations.

countries have deep integration in their banking systems due to the fact that they are part of the European Single Market. EU banks compete on even ground and can sell their products and services to a larger and more diversified customer base. We expect this integration to increases banks' business opportunities and improve the inclusion-performance relationship. Table 3.15 reports the estimation results for the 28 countries in the European Union area[17].

The results for the EU sub-sample show that there is a positive and statistically significant association between the number of deposits and bank performance (Model (3) of Table 3.15). This suggests that an increased number of deposits in the EU region can enhance bank performance. Another difference between the full sample and the EU sub-sample is that the coefficient of loans to GDP is statistically insignificant (Model (2)). In other words, increased credit deepening does not seem to adversely affect bank performance in these countries. This improvement in the relationship between financial inclusion and bank performance could be related to the banking system integration in these countries where banks and customers are offered wider choices. The results for GDP growth and Lerner index seem to hold in these specifications. Bank performance is positively associated with market power and economic growth.

[17] Included countries are: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom.

Table 3.15: Financial inclusion and bank performance index: EU sub-sample

	Model (1)	Model (2)	Model (3)
L. deposits to GDP	-0.0503		
	(-0.45)		
L. loans to GDP		-0.0715	
		(-0.29)	
L. number of deposits			0.0419**
			(2.60)
GDP growth	1.7972*	1.6295	1.8275
	(1.87)	(1.69)	(1.04)
Inflation	0.8989	0.9100	2.2186*
	(0.79)	(0.85)	(1.75)
Lerner index	1.5813**	1.6451**	1.1032**
	(2.92)	(3.07)	(2.50)
Population density	-0.4628	-0.5170	0.7850
	(-0.53)	(-0.71)	(0.72)
Time fixed effects	Yes	yes	yes
Country fixed effects	Yes	yes	yes
Clustering	yes	yes	yes
Observations	202	211	102
R-squared	0.4825	0.5035	0.5174
Adjusted R-squared	0.358	0.387	0.332

Note: The table reports the regression results of estimating the relation between financial inclusion and bank performance for the EU sub-sample (Equation (3.2)). The dependent variable is the performance index. The main independent variables are lagged inclusion indicators: (i) deposits to GDP, (ii) loans to GDP, and (iii) number of deposits. Control variables include a set of country-specific characteristics: (i) GDP growth, (ii) inflation, (iii) Lerner index, and (iv) population density. The regressions are run on a sub-sample of EU 28 countries covering the period of 2005-2014. Robust t-statistics are reported under the coefficients in parentheses. Standard errors are clustered at the country level. *, **,*** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

3.7.3.7 Additional measures of financial inclusion

We next consider alternative measures of financial inclusion by focusing on its geographical outreach aspect. We estimate the baseline regression (Equation (3.2)) replacing the previous four inclusion measures with the following measures: (i) bank branches per 100k adults, (ii) ATMs per 100k adults, (iii) bank branches per 1000 km², and (iv) ATMS per 1000 km². This specification allows us to examine whether different indicators of financial inclusion provide different results in terms of the impact on bank performance. We then test whether there are differences in the relationship between these financial inclusion measures and bank performance depending on the country's income group.

Table 3.16 reports the estimation results for alternative measures of financial inclusion for the full sample and for the high income versus low income groups. Models (1)-(4) test the

relationship between banks' branches per 100k adults, ATMs per 100k adults, branches per 1000 km², and ATMS per 1000 km² and the performance index, respectively. Models (5)-(8) test the relationship between the same inclusion variables interacted with the high and low income dummies and the performance index.

We find that the number of banks' branches per 100k adults, ATMs per 100k adults, and branches per 1000 km² have no significant effect on bank performance (Models (1)-(3) of Table 3.16). However, Model (4) shows a significant positive association between banks' number of ATMS per 1000 km^2 and the performance index. This result indicates that banks can benefit from further geographical outreach through increasing the number of ATMs, especially that it is considered as a cost efficient tool in reducing the distance to customers (Holden and El-Bannany, 2004).

The results for high versus low income countries show a positive and statistically significant association between banks' number of ATMs per 100k adults and branches per 1000 km^2 and bank performance in low and lower-middle income countries (Models (6)-(7)). On the other hand, banks in high and upper-middle income countries could achieve some gains from further financial access in terms of increased number of ATMs (Model (8)). Hence, we find evidence that benefits of financial inclusion for bank performance seem to arise in both low and lower middle and high and upper-middle income countries but depending on the tool used for customers outreach.

Table 3.16: Financial inclusion and bank performance index: Alternative measures of financial inclusion

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)	Model (8)
L. bank branches per 100k adults	-0.102							
	(-1.01)							
L. ATMs per 100k adults		0.1606						
		(1.00)						
L. bank branches per 1000 km²			-0.006					
			(-0.04)					
L. ATMs per 1000 km²				0.0082**				
				(5.91)				
L. bank branches per100k adults * high income dummy					-0.1173			
					(-1.14)			
L. bank branches per100k adults * low income dummy					1.4938			
					(1.37)			
L. ATMs per 100k adults * high income dummy						0.1152		
						(0.73)		
L. ATMs per 100k adults * low income dummy						0.6536*		
						(1.86)		
L. bank branches per 1000 km²* high income dummy							-0.0133	
							(-0.08)	
L. bank branches per 1000 km²* low income dummy							2.1025**	
							(2.39)	
L. ATMs per 1000 km² * high income dummy								0.0083**
								(6.00)
L. ATMs per 1000 km²* low income dummy								0.6301
								(1.52)
GDP growth	0.9690**	1.0536**	0.9507**	1.0854**	0.9616**	1.0610**	0.9269**	1.0852**
	(2.52)	(2.74)	(2.46)	(2.84)	(2.50)	(2.76)	(2.42)	(2.86)
Inflation	0.1315	0.4815	0.1307	0.4681	0.142	0.5505	0.1482	0.5299
	(0.33)	(1.19)	(0.32)	(1.16)	(0.35)	(1.38)	(0.36)	(1.33)
Lerner index	1.7644**	1.8557**	1.7584**	1.8085**	1.7896**	1.8946**	1.7969**	1.8557**
	(7.66)	(7.66)	(7.63)	(7.56)	(7.64)	(7.72)	(7.66)	(7.72)
Population density	-0.0181	-0.0099	-0.0157	-0.0341**	-0.0173	-0.0083	-0.0151	-0.0335**
	(-0.91)	(-0.47)	(-1.01)	(-2.93)	(-0.88)	(-0.39)	(-1.01)	(-2.99)
Time fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Clustering	yes	yes	yes	yes	yes	yes	yes	yes
Observations	732	707	732	706	732	707	732	706
Adjusted R-squared	0.314	0.321	0.316	0.321	0.315	0.324	0.319	0.325

Note: The table reports the regression results of estimating the relation between financial inclusion and bank performance using the geographical outreach indicators (Equation (3.2)). The dependent variable is the performance index. The main independent variables are lagged alternative inclusion indicators: (i) branches per 100k adults, (ii) ATMs per 100k adults, (iii) branches per 1000 km², and (iv) ATMS per 1000 km²; and the interaction terms between these indicators and high / low income dummies. Control variables include a set of country-specific characteristics: (i) GDP growth, (ii) inflation, (iii) Lerner index, and (iv) population density. The regressions are run on the full sample of 131 countries and for high income versus low income countries covering the period of 2005-2014. Robust t-statistics are reported under the coefficients in parentheses. Standard errors are clustered at the country level. *, **,*** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

Overall, it seems that country characteristics such as the level of income, level of financial inclusion, equality, and quality of capital regulation impact the relationship between financial inclusion and bank performance. We also show that the type of the financial service used to improve financial inclusion matters.

3.8 Conclusions

In this paper we examine the relationship between financial inclusion and bank performance proxied by a performance index constructed using PCA from quantitative indicators related to CAMEL ratios. We use alternative measures of financial inclusion and find that different indicators provide different results. Specifically, we find that there seems to be a trade-off between bank performance and credit deepening, while other financial inclusion indicators show no significant association with bank performance for the full sample. We examine whether this relationship differs between high income and low income countries and find evidence to suggest that benefits from financial inclusion for bank performance seem to arise in low and lower middle income countries where banks on average hold higher capital and liquidity. In high income countries performance gains from financial inclusion appear to be exhausted.

We perform a number of additional tests to gain more insights into the conditions that underlie the relationship between financial inclusion and bank performance. We find that banks operating in countries with lower level of inclusion, higher level of income equality, and higher capital stringency can achieve more gains from financial inclusion. These results indicate that certain country characteristics impact the relationship between financial inclusion and bank performance.

Focusing on a sub-sample of EU countries we find a positive association between the number of deposits and bank performance. Additionally, we test alternative measures of financial inclusion related to the geographical outreach aspect. We find that the number of ATMs is

positively associated with bank performance, particularly in high income countries. Banks in low income countries could achieve gains in terms of performance from further geographical expansion of branches and ATMs.

Our study provides important policy implications. Our results suggest that the benefits of advancing financial inclusion in low and lower middle income countries are not limited to improvements in economic and social development, but also in the banking system performance. Hence, we recommend that policy makers focus on promoting the use of bank deposits and borrowing in these countries. On the other hand, a strong focus on credit deepening in high and upper middle income countries might increase banks' risk and lead to a deterioration in their performance. Therefore, in these countries financial inclusion can be carried out by non-profit organisations such as credit unions or by utilizing existing post offices. Additionally, we argue that the relationship between financial inclusion and bank performance is sensitive to a number of country characteristics including the level of income, equality, and quality of regulation. Therefore, these characteristics should be taken in consideration when setting policies for promoting financial inclusion. We recommend that improvements in financial inclusion be accompanied with proper regulation, supervision, and equality considerations.

4 ESSAY III: What Explains Differences in Financial Inclusion? A Cross-Country Analysis

ABSTRACT

Recent years have witnessed a global commitment to advancing financial inclusion as a key enabler for equal opportunity and reducing poverty. In this paper, we use a principal component analysis and six indicators drawn from the IMF's Financial Access Survey to construct a financial inclusion index for a sample of 95 countries over the period 2004-2015. Our financial inclusion index shows an overall progress over the sample period, most markedly in the accessibility and usage dimensions. Further analysis suggests that the level of financial inclusion is related to specific banking market conditions, technology and infrastructure, macroeconomic factors, institutional quality, and social variables. In particular, financial inclusion seems to be positively associated with the national level of income, banking industry competition, the level of human development, regulatory quality, and internet usage and negatively related to gender inequality.

Keywords: Financial Inclusion; Banking Conditions; Cross-country Analysis; Principal Component Analysis.

4.1 Introduction

Access to financial services is recognised internationally as an important factor for economic and social development. Individuals and businesses excluded from mainstream financial services are prone to different types of risk, e.g. social exclusion and missed opportunities for business. Empirical studies have emphasised the importance of financial inclusion and the role it plays in achieving high level of well-being and development through lowering income inequality, poverty, and consumption smoothing after adverse events such as health shocks (Aslan et al., 2017, Burgess and Pande, 2005, Gertler et al., 2009). Hence, there has been a global commitment to advance financial inclusion and many countries have accelerated their efforts to have more inclusive financial systems.

According to the World Bank, there has been a significant improvement in financial inclusion as the share of adults owning an account increased from 51 percent in 2011 to 62 percent in 2014 and reached 69 percent in 2017. This progress has been mainly driven by government policies and the use of technology (mobile phones and the internet). However, the variation across countries is still considerably high; as of 2017, 94 percent of adults have an account in high income countries, compared to 65 percent in middle income countries and only 35 percent in low income countries (Demirguc-Kunt et al., 2018). In some economies and particularly in the Sub-Saharan Africa region, the progress has been achieved mainly through new mobile accounts. Other emerging economies such as India have progressed significantly in increasing the account ownership through financial institutions. High income economies such as the UK have more inclusive financial systems not only in terms of having a bank account but also in terms of using different financial services including savings and borrowings. In fact, financial inclusion is not only about having an account; the actual use of the account is what matters for achieving the benefits of financial inclusion.

This heterogeneity in financial inclusion highlights the need for a multidimensional measure that is comparable across economies in order to identify the current state of financial inclusion, to set targets and policies, and to monitor progress. In this paper we construct a financial inclusion index that incorporates three main dimensions: availability, accessibility, and usage of financial services, for a sample of 95 countries over the period 2004-2015. Different approaches have been proposed in the literature to constructing a multidimensional financial inclusion index. We follow Cámara and Tuesta (2014) and Park and Mercado Jr (2018b) and use principal component analysis to avoid the problem of exogenous or equal weight assignment needed to construct previous indicators such as Sarma (2008) and Park and Mercado JR (2018a). Additionally, we use six indicators from the IMF's Financial Access Survey that provides the longest time-series of financial inclusion indicators that is important in observing the time trend in the index at a global level. Hence, we contribute to the literature by providing a financial inclusion index for a large number of economies over a relatively long time period that enables us to analyse progress trends and perform regression analysis.

Our financial inclusion index shows an overall progress over the 12 years under investigation, most markedly in the accessibility and usage dimensions, and to a lesser extent in the availability dimension. We also find high variation in financial inclusion between countries and across different macro-regions. Although financial inclusion is a universal goal, there have been initiatives focusing on countries from certain macro-regions with high level of financial exclusion. These regions include BRIC (Brazil, Russia, India, and China), SSA (Sub-Saharan Africa) and MENA (Middle East and North Africa). Analysing regional trends in our financial inclusion index, we find improvements in all these regions over the sample period. However, European countries over-rank other regions, SSA region ranks the lowest, and BRICs have the most rapid growth.

These variations motivate the need to investigate factors that can help explain the level of financial inclusion. A number of studies documented the importance of macro-economic conditions, social development, technological advancements, and institutional quality in advancing financial inclusion (Honohan, 2008, Rojas-Suarez, 2010, Allen et al., 2012, Demirgüç-Kunt and Klapper, 2013). We contribute to the understanding of financial inclusion by analysing a wider range of country characteristics that may be related to the level of financial inclusion, including banking system conditions.

The results show that banking systems that are concentrated but more competitive, are characterised by greater financial freedom, and are generally more stable (in terms of capital stringency) seem to be more inclusive. We also find that in addition to the level of national income, other factors that matter greatly in explaining the variation in financial inclusion across countries are: the level of human development, education, gender inequality, income inequality (Gini index), and technology. This is a useful set of results for policy makers particularly in relation to banking market features, social, and technological factors that should be prioritised to achieve greater financial inclusion.

The remainder of the paper is structured as follows. Section 4.2 provides a review of the literature relevant to constructing a financial inclusion index and the determinants of financial inclusion. Section 4.3 presents the empirical framework related to the methodology of the index construction, the factors that explain the variation in financial inclusion, and the empirical model. Section 4.4 describes the data. Section 4.5 presents results. Finally, Section 4.6 concludes.

4.2 Literature review

The construction of a multidimensional measure of financial inclusion is motivated by the inadequacy of focusing on a single measure to represent and summarise the extent of financial inclusion in a country. The nature of financial inclusion is complex and multidimensional;

additionally, there is high variation and diversity across countries. Hence, a suitable financial inclusion index that is comparable across economies and time can help monitor the progress in reaching the financially excluded, better understand the problem, and study the relationship between financial inclusion and other important socio-economic indicators such as poverty and sustainable growth. The first part of this section reviews recent attempts to construct a financial inclusion index. In the second part we review studies that focus on determinants, enablers, and barriers to financial inclusion.

4.2.1 Financial inclusion index

Recent papers have proposed alternative approaches to the construction of a composite financial inclusion measure providing a single indicator that combines different dimensions of financial inclusion. Sarma (2008, 2012) constructs a multidimensional financial inclusion index across a number of countries using three dimensions of financial inclusion, namely: penetration measured by the number of people having a bank account, availability measured by the number of ATMs, and usage measured by the volume of loans and deposits to the country's GDP. To construct the index, the author uses a dimension index for each dimension of financial inclusion[18] and then a distance-based approach to obtain the financial inclusion index from the three dimensions. Remarkably, due to missing values in the banking penetration dimension the author also calculates the financial inclusion index using the other two dimensions to get another set of data for an increased number of countries. Sarma (2008) constructs the index using 2004 data, while Sarma (2012) uses data for the period 2004-2010. Similarly, Chakravarty and Pal (2013) develop a measure of financial inclusion by aggregating data on different attributes of financial inclusion in various states in India over 1972-2009. The authors rely on the axiomatic approach usually applied in human development and consider indicators related to geographic and

[18] The author standardises each dimension using the minimum-maximum approach.

demographic penetration, deposit and credit accounts, and deposit/credit to income ratios. They find a wide variation in financial inclusion across sub-national regions in India and over time.

Other recent papers introduced indices of financial inclusion using principal component analysis to assign weights in aggregating different inclusion indicators. Cámara and Tuesta (2014) rely on the World Bank's Findex database for the year 2011 to construct a financial inclusion index for 82 developed and developing countries. The authors consider three dimensions of financial inclusion: (i) usage dimension measured by having an (loan or savings) account, (ii) access dimension measured by the number of ATMs and branches, and (iii) barriers dimension measured by distance / affordability / documentation / lack of trust. A two-stage principal component methodology is used first to obtain the weights and estimate a sub-index for each dimension (resulting in three sub-indices) and then to estimate the overall financial inclusion index using these sub-indices. The resulting financial inclusion index ranks developed countries as the most inclusive with few exceptions, with the index being mainly explained by the access dimension.

De Sousa (2015) constructs two indices of financial inclusion distinguishing between traditional instruments of financial inclusion (having an account at a financial institution, using debit cards, using electronic payments, having a loan, and saving at a financial institution) and innovative instruments (using cell phones to pay bills and transfer money). The author applies a principal component analysis to nine indicators from the Global Findex database (2011) for 90 developing and emerging countries. This analysis resulted in two components that represented the two distinct dimensions (traditional and innovative) of financial inclusion.

More recently, Mialou et al. (2017) construct a financial inclusion index using Common Factor Analysis. The authors use the IMF's Financial Access Survey data covering the following dimensions of financial inclusion: outreach dimension measured by the number of ATMS and financial institutions branches, and the usage dimension measured by the number of depositors

and borrowers. To construct the financial inclusion index, the variables are first normalised and then grouped into the two dimensions using factor analysis. The authors then assign weights to the financial inclusion variables and sub-indices based on the proportion of the variance explained by the corresponding factor to the total variance. Finally, these weights are used to find the aggregate weighted index that ranks 23-31 countries over the period 2009-2012 based on the extent of financial inclusion.

Park and Mercado JR (2018a) construct a financial inclusion indicator for 176 countries using data on five different measures of financial inclusion related to the availability and usage dimensions (number of ATMs, branches, depositors, borrowers, and domestic credit to GDP). The authors use an average value for each indicator and each economy over the period 2004-2012 that they obtain from the World Bank Development Indicators. They follow Sarma (2008)'s approach in calculating a dimensions index for the two dimensions of financial inclusion considered, and then a distance-based approach to obtain the financial inclusion index from the two dimensions. In another study, Park and Mercado Jr (2018b) use the World Bank's Findex database 2011 and 2014 to construct a financial inclusion index for 151 countries. The authors use three dimensions of financial inclusion: access measured as percentage of adults with financial accounts (that also includes having a credit/debit card or mobile money account), availability measured as the number of branches and ATMs, and usage measured as the number of borrowers/savers and credit to GDP. In computing the index, the variables are first standardised using the minimum-maximum approach and then a principal component analysis is used to obtain weights in each dimension to construct three sub-indices. Finally, the authors run the second stage of principal component analysis to derive each dimension weight and obtain the overall financial inclusion index. The availability dimension receives the highest weight and is mainly explained by the number of branches.

In this paper, we expand the coverage and period of the sample to include a global sample over 12 years in order to analyse financial inclusion evolution. Additionally, we use principal component analysis to avoid prejudging the importance of each indicator. In other words, the main advantage of using this method is that we do not have to make subjective decision on the relative importance of the financial inclusion indicators or dimensions (Ellul and Yerramilli, 2013). Appendix E summarises the studies that construct a financial inclusion index through selected indicators.

4.2.2 Financial inclusion determinants

Some studies on the determinants of financial inclusion / exclusion focus on the individual-level characteristics[19] and others look at country-level characteristics. We focus on studies examining country-level determinants of financial inclusion as these are more relevant to our research topic.

Beck et al. (2007b) attempt to measure the financial sector's outreach and analyse its determinants. They present cross-country outreach indicators across 99 countries using data aggregated from regulators including geographic and demographic branch and ATMs penetration and other usage indicators such as number of loans and deposits. Analysing outreach determinants, the authors find that factors such as economic development, institutional environment, credit information sharing, and physical infrastructure are positively associated with outreach and depth measures. To test whether their outreach indicators relate to the financing obstacle, the authors regress an indicator of firm financing constraints (obtained from the World Business Environment Survey) on these indicators. The firm financing constraint is a rating of financing obstacles faced by firms, hence the authors estimate an ordered probit model. Their

[19] Studies examining individual-level factors that influence financial exclusion show that the most important factors are employment, income, housing tenure, marital status, age, gender, and education (Devlin, 2005, Demirgüç-Kunt et al., 2013). Also, geographic research on financial exclusion suggests that neighbourhood dynamics and location play an important role in determining financial access. For instance, disenfranchised areas and areas with increased number of minorities and immigrants tend to be neglected by banks (Graves, 2003, Joassart-Marcelli and Stephens, 2009).

findings confirm that in countries with greater financial outreach firms report less obstacles in getting financing.

Honohan (2008) estimates the percentage of adults using financial intermediaries in 162 countries using information about accounts at commercial banks, microfinance institutions, and survey data. The proposed access indicator is then regressed on a set of country-level characteristics to investigate the factors that enable higher financial access. These cross-sectional regressions include GNI per capita, demographic characteristics (age dependency ratio, populations, and birth rate), production (share of agriculture in GNI), technology (mobile phone subscriptions), and institutional quality (governance indicators and illiteracy). Results show a strong positive association between financial access, mobile phone penetration, and governance indicators. Nonetheless, the relationship between financial access, agricultural production, population density, and age dependency seems to be negative and significant.

Rojas-Suarez (2010) examines obstacles to financial access for a cross-section of countries with a special focus on emerging powers (that is, Brazil, China, India, Egypt, Indonesia, Korea, Mexico, Russia, South Africa, Turkey and Thailand). The author estimates the effect of country-level obstacles and deficiencies on financial access using Weighted Least Squares. These obstacles are classified as macroeconomic, socio-economic, regulatory, institutional, and those related to the financial sector, and estimated as averages for the sample period (1999-2007). The author finds that macroeconomic, social, institutional, and regulatory variables have significant association with financial access. Results show that high volatility in the GDP growth, greater income inequality, social under-development (a component of human development index), high regulatory constraints, and weak rule of law significantly deter financial inclusion. Nonetheless, results for the banking system variables including concentration, bad loans, and inefficiency (overhead costs to total assets) were insignificant. The author shows that financial access

obstacles differ significantly between emerging powers, developed countries, middle-income and lower-income countries.

Ardic et al. (2011) use the Financial Access database introduced by the CGAP[20] and the World Bank Group to estimate the number of unbanked adults around the world. The authors also test associations between the number of deposit accounts / loan penetration and a number of country characteristics. They control for GDP per capita and population density and test partial associations with different macroeconomic variables, infrastructure indicators, financial sector infrastructure, legal environment, and banking sector competition. They find that deposit penetration is significantly and positively associated with GDP per capita, population density, number of landline and mobile users, number of branches, strength of legal rights index, and competition. As for loan penetration, it is found to be positively associated with GDP per capita, branch penetration, physical infrastructure, creditors' rights, credit information, and deposit insurance, while negatively associated with inflation and banking sector concentration.

A study by Allen et al. (2012) examines determinants of financial inclusion for a sample of 123 countries, where financial inclusion is measured by having a deposit account using the Global Findex database for year 2011. The authors find that lower costs of opening and using bank accounts, higher branch penetration, better legal rights and political stability are associated with greater financial inclusion.[21]

Demirgüç-Kunt and Klapper (2013) summarise the global financial inclusion index ("Global Findex") database for 148 countries for the year 2011. The authors identify four country-level obstacles to financial inclusion, namely: socioeconomic factors, macroeconomic variables, formal financial system characteristics, and institutional factors. The authors find that account penetration is positively correlated with social development related to health and

[20] CGAP is the Consultative Group to Assist the Poor. It is a global partnership of leading organizations that seek to advance financial inclusion.

[21] The authors also examine individual-level characteristics and find that individuals that are richer, older, employed, educated, married, and live in urban areas are more likely to own an account.

education. On the other hand, they show a negative correlation between financial inclusion and macroeconomic instability measured by the volatility of inflation, banking system inefficiency measured by overhead costs to total assets, and the banking system concentration. However, they find that the relationship between banking concentration and financial inclusion is adjusted with institutional quality; the interaction term between banks' concentration and rule of law is positively associated with account penetration. The authors also show in a regression analysis that the national level of income per capita and financial development measured by domestic credit to GDP are positively associated with account penetration. They also highlight the significant gap in financial inclusion between low-income, lower-middle income and upper-middle income countries, which can be explained by the differences in economic inequality measured by the Gini index between these countries. A higher value of the Gini index (more unequal income distribution) is positively associated with inequality in the use of formal accounts despite the country's level of income. That partially explains differences between countries from the same income group.

Love and Martínez Pería (2014) analyse the impact of bank competition on firms' access to finance across 53 countries over the period 2002-2010. The authors find that low competition (high market power) measured by Lerner index and Boone indicator reduces firms' access to bank finance (loans, overdrafts, and lines of credit). On the other hand, they find concentration measures to have no significant effect.

De Sousa (2015) represented two distinct dimensions (traditional and innovative) of financial inclusion (as discussed in the previous section) and used these two dimensions as dependent variables to assess the enablers and barriers to financial inclusion. In particular, the author investigates whether the adoption of post-crisis global regulatory standards helped or deterred financial inclusion. The regulatory reforms proxies were obtained from the World Bank's Database on Bank Regulation and Supervision (2012) and were categorised into four

clusters, namely: dynamic provisioning, macro-prudential regulation, capital adequacy ratio, and information disclosure. These proxies were used as explanatory variables along with the log of GDP per capita, inflation, real interest rate, banks' credit to the private sector to GDP, bank z-score, and bank concentration. Results show that financial inclusion is positively associated with higher information disclosure requirements, GDP per capita, and bank credit to the private sector. Nonetheless, the results also indicate a negative association between financial inclusion and greater macro-prudential regulation, capital stringency (only via innovative instruments), and banks z-score. The author argues that including market and operational risks in addition to credit risk in the capital adequacy ratios calculation may deter the inclusion of disadvantaged groups in the financial system.

Owen and Pereira (2016) study the banking structure as a determinant of cross-country variation in financial inclusion. The authors employ panel data from 83 countries over the period 2004-2013 to investigate the relationship between the banking system concentration / competition and different indicators of financial inclusion obtained from the IMF's Financial Access Survey (FAS). The authors find that a greater access to deposit and loan accounts is associated with higher banking concentration, provided that the market power measured by Lerner index is limited. The results also show a strong positive association of financial inclusion with GDP per capita and financial depth and a negative association with higher restrictions on banking activities.

Park and Mercado JR (2018a) examine the determinants of financial inclusion and the effect of financial inclusion on two economic indicators, namely, poverty (measured by poverty headcount ratio at the national poverty line as percent of total population) and income inequality (measured by the Gini index). The authors construct a financial inclusion indicator for 176 countries (as explained in the previous section) and they estimate the impact of financial inclusion on poverty and income inequality using a cross-sectional analysis for the full sample and a

subsample of Asian countries. The authors find that income per capita, rule of law, dependency ratio, education, and literacy are determinants of financial inclusion. They also find a negative relationship between financial inclusion and income inequality and poverty. In their other study, Park and Mercado Jr (2018b) also attempt to test empirically the relationship between the change in the financial inclusion index that they construct using Findex data (as explained in the previous section) and economic growth, financial sector development, technology, and the country being an AFI[22] member. Their results show that economic growth and financial sector development are positively correlated with financial inclusion, specifically in higher income economies. The authors also investigate the impact of financial inclusion on lowering poverty and income inequality and show that countries with higher financial inclusion have lower poverty rates and that this relationship is weaker for countries with high rule of law.

Kabakova and Plaksenkov (2018) investigate country-level factors enabling financial inclusion in 43 developing economies by analysing their ecosystems using a method called fussy-set Qualitative Comparative Analysis. The authors construct a number of indicators: (i) a socio-demographic factor that is constructed using a socio-demographic index (that includes income, education, and fertility rate), literacy, and urbanisation; (ii) a technological factor that includes internet and mobile usage and E-government development; (iii) an economical factor that includes GDP per capita, employment, and business freedom; and (iv) a political development factor that includes government support, regulatory capacity, and electronic payment regulation. They measure financial inclusion using the percentage of population with a bank account and distinguish configurations to cause financial inclusion as follows: (i) high social and political development without economic development; (ii) high social, technological, and economic development in the absence of political development; and finally (iii) high economic and political development without technological and social development. The results show that two

[22] AFI is the alliance for financial inclusion. Members are central banks and regulatory institutions from 90 developing countries that aim to extend the financial system to the unbanked while balancing stability.

combinations lead to high financial exclusion: the absence of social and economic development and lastly the absence of social, technological and political development.

The empirical research reviewed above generally shows that the level of financial inclusion is positively associated with good economic conditions (such as income and equality), social development (such as education and health), better institutional quality (such as rule of law and political stability), and improved technological infrastructure (such as mobile and internet usage). In terms of banking conditions, the link between market structure, competition, banking regulation and financial inclusion is not as clear. Previous studies suggest that higher degree of competition is associated with higher financial inclusion, as competitive financial systems are more efficient, focus more on the quality of financial services and innovation, which in turn improves the availability and the variety of financial services provided to customers (Love and Martínez Pería, 2014, Owen and Pereira, 2016). The literature provides mixed evidence regarding the relationship between concentration and financial inclusion. On the one hand, studies suggest that high level of bank concentration may deter the competitive incentive for banks to provide services to smaller businesses and riskier individuals (Ardic et al., 2011, Demirgüç-Kunt and Klapper, 2013). On the other hand, larger banks in concentrated markets can be more efficient through economies of scale which in turn can motivate these banks to provide more financial services to households and small enterprises (Owen and Pereira, 2016). Additionally, other studies find no significant relationship between concentration and financial inclusion (Rojas-Suarez, 2010). Lastly, previous studies suggest that restrictions on banking activities can limit creation of new products and services and that would impair financial inclusion and capital stringency may decrease the use of innovative financial instruments (De Sousa, 2015, Rojas-Suarez, 2010).

In summary, previous studies propose composite indices of financial inclusion that incorporate different measures of the banking sector's services accessibility, availability, and

usage. However, there are a number of shortcomings that we attempt to address in our paper. First, we use a principal component analysis to avoid assigning equal or exogenous weights to all variables and dimensions. Second, we use the IMF's Financial Access Survey that provides the longest time-series of financial inclusion indicators that is important in observing the time trend in the index at a global level. We also contribute to the growing literature that examines the determinants of financial inclusion. Prior research demonstrates the importance of macro-economic conditions, social development, technological advancements, and institutional quality on advancing financial inclusion. We extend this research by analysing a wider range of factors that may impact the level of financial inclusion, including banking system conditions.

4.3 Empirical framework

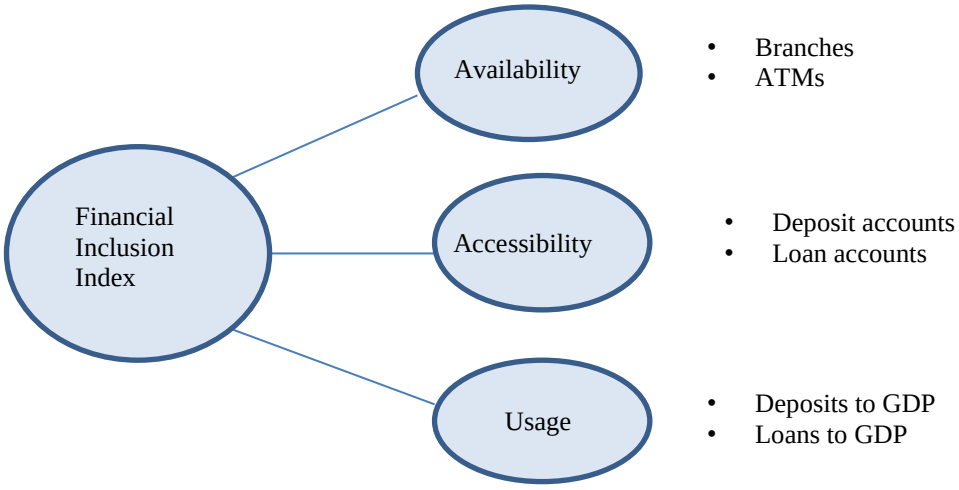
In this section we lay out our empirical framework including the construction of our financial inclusion index, the definition of the determinants of financial inclusion examined in this study, and the specification of our empirical model.

4.3.1 Financial inclusion index: Definition and construction

Constructing an appropriate financial inclusion measure is crucial for identifying the current state of financial inclusion, setting targets and policies, and monitoring the progress. Definitions and dimensions of financial inclusion vary across studies and policymakers. In this study we attempt to combine in one index three dimensions of financial inclusion: availability, access, and usage. For the availability dimension, we consider demographic outreach of banks' physical outlets measured by the number of branches or ATMs (per 100,000 adults). The accessibility dimension is used to reflect the outreach of financial services to adults (customers), which we measure as the number of deposit or loan accounts (per 1,000 adults). The third dimension refers to the actual usage of financial services (to differentiate between merely having an account and utilising the account) measured as bank deposits or credit to GDP. The choice of

these dimensions and proxies is mainly motivated by the availability of relevant and time-consistent data for many countries in order to derive a comparable financial inclusion index. Figure 4.1 summarises the indicators used to construct these three dimensions.

Figure 4.1: Financial inclusion dimensions and indicators



Note: The figure summarises the dimensions and indicators used to construct the financial inclusion index.

To construct the financial inclusion index, we use a three-step sequence commonly found in the literature: (i) normalising the variables to control for their scale differentials; (ii) constructing sub-indices that represent each dimension using the normalised variables; and (iii) aggregating the dimensional sub-indices into the final inclusion index. This approach has been followed in the literature to construct well-being indices (such as the Human Development Index), financial development indices (IMF's index of financial development by Svirydzenka (2016)), and other financial inclusion indices (Park and Mercado Jr, 2018b).

Specifically, in the first step, we normalise the variables using empirical normalisation to arrive at a common scale ranging from 0 to 1:

$$I^{n}_{itc} = \frac{I_{itc} - Min\,(I_i)}{Max\,(I_i) - Min\,(I_i)} \quad \textbf{(4.1)}$$

where I_{itc} is the actual value of the inclusion indicator i in period t for country c. Min (I_i) is the minimum value for the indicator for the analysed period for all countries, and Max (I_i) is the

maximum value for the indicator for the analysed period for all countries. The normalised value represents the indicator's deviation from the minimum and maximum limit across countries, that is, it relates country performance in financial inclusion to the global minimum and maximum across all countries and years. A higher value within the [0; 1] range indicates higher financial inclusion.

In the second step, the indicators are aggregated into three sub-indices: availability sub-index, accessibility sub-index, and usage sub-index. We determine the relevant variables that will be included in each dimension (sub-index) and then use a principal component analysis to assign the weights for each factor in the sub-index (this is, the first stage PCA).

In the final third step, the availability, accessibility, and usage sub-indices are aggregated into the final financial inclusion index using the second stage PCA to assign weights for the sub-indices following Cámara and Tuesta (2014) and Park and Mercado Jr (2018b). We denote $\lambda_j (j = 1, \ldots, p)$ as the *j*-th eigenvalue, subscript *j* is the number of principal components which is also the number of normalised indicators. The weights given to each principal component are decreasing, so the first principal component accounts for the largest share of variation in the data and receives the highest weight; we account for 100% of total variation in constructing the indices to avoid discarding any relevant information. Denoting $P_k (k = 1, \ldots, p)$ as the *k*-th principal component, we estimate each dimension index according to the weighted averages:

$$\boldsymbol{D_d} = \frac{\sum_{j=1}^{p} \boldsymbol{\lambda_j P_k}}{\sum_{j=1}^{p} \boldsymbol{\lambda_j}} \tag{4.2}$$

where D_d is dimension d index and $P_k = X\lambda_j$. λ_j is the variance of the *k*-th principal component (weight of each indicator) and X is the indicators matrix. After deriving the dimension sub-indices we re-normalised them using equation (4.1), so that there range remains between 0 and 1. We then run the second principal component analysis to derive the dimension weights for the overall financial inclusion index (FII):

$$FII_c = \frac{\sum_{j=1}^{p} \lambda_j P_{kc}}{\sum_{j=1}^{p} \lambda_j} \quad \textbf{(4.3)}$$

where FII_c is the aggregate financial inclusion index for country c and $P_{kc} = X\lambda_j$. λ_j is the variance of the k-th principal component (weight of each dimension) and X is the dimensions matrix. This can also be represented as:

$$FII_c = W_1 D_1 + W_2 D_2 + W_3 D_3 \quad \textbf{(4.4)}$$

where W are the weights resulting from principal component analysis and D are the dimension sub-indices. The financial inclusion index is again re-normalised using equation (4.1), to keep its range between 0 and 1.

In addition to the three-dimensional index described above, we construct an alternative two-dimensional financial inclusion index composed of the availability and usage dimensions only, which allows us to expand the sample (due to missing values in the accessibility dimension). To construct the two-dimensional index, we follow the three steps explained in this section.

4.3.2 Factors that explain the variation in financial inclusion

The empirical literature reviewed in section 2.2 points to certain country characteristics that play a role in determining the level of financial inclusion. We categorise these characteristics into: macro-economic factors, banking system conditions, institutional quality, technology, and social factors.

Macro-economic factors

Intuitively, it seems probable that development in the economy should lead to higher financial inclusion. We use GDP per capita as a measure of income, and we expect that people in countries with high level of income are more integrated in the financial system. Indeed, the empirical literature has shown a positive and significant association between GDP per capita and financial inclusion (Ardic et al., 2011, Owen and Pereira, 2016).

We also include the level of unemployment in the country, as the unemployed population is less likely to be included or even motivated to participate in the financial sector while formally employed population usually needs a bank account to receive salary (Allen et al., 2012). Hence, we expect a negative association between financial inclusion and unemployment.

Additionally, we test the relationship between income inequality measured by the Gini index and financial inclusion. It can be expected that high inequality in terms of income in the economy can lead to lower level of financial inclusion as a sizeable proportion of the population fail to afford the costs of banking services (Rojas-Suarez, 2010, Demirgüç-Kunt and Klapper, 2013).

Lastly, we investigate the effect of the business cycle proxied by the GDP growth on the financial inclusion index. We expect financial inclusion to be positively associated with output growth. Park and Mercado Jr (2018b) find that economic growth is positively associated with higher financial inclusion in high and middle-income countries.

Banking system conditions: concentration, competition and regulation

We also investigate banking system conditions that may be related to financial inclusion. These factors include a structural measure that is the banking system concentration. The literature provides mixed evidence in terms of the relationship between concentration and financial inclusion. High levels of concentration can be negatively associated with financial inclusion if

banks become less motivated to assess riskier individuals and SMEs due to the lack of competitive incentives (Demirgüç-Kunt and Klapper, 2013). On the other hand, highly concentrated banks can achieve higher efficiency through economies of scale and thus be more motivated to invest in information acquisition and hence provide more opportunities for risky individual and younger/smaller firms (Owen and Pereira, 2016, Petersen and Rajan, 1995).

Although concentration can be closely related to competition, more concentration does not necessarily mean lower competition, that is why banks' competitive behaviour is more appropriately captured by specific measures of competition like the Lerner index, which is a measure of market power that compares output pricing and marginal costs. Another measure commonly used is the Boone indicator that is calculated as the elasticity of profits to marginal costs. We use the Lerner index and expect banking systems where banks have a higher market power (less competitive) to be less motivated to focus on the quality of financial services and innovation and hence to be less inclusive (Owen and Pereira, 2016). This can be linked to the market power hypothesis that refers to the bank's ability to control the price of a service and thereby control its profit margin. Suggesting that banks in highly competitive systems have low market power and hence low profit margins, which in turn may motivate banks to reach out more customers (individuals and firms) to increase their efficiency and profitability.

As for the regulatory aspects of the banking industry, we test whether the stringency of capital regulation and financial freedom can explain variations in financial inclusion across countries. For the stringency of capital regulation we use the capital regulatory index by Barth et al. (2013). On the one hand, it can be expected that higher stringency in terms of capital regulation can increase banks' costs and hence discourage them from investing in riskier/smaller customers, subsequently leading to lower financial inclusion (De Sousa, 2015). On the other hand, it can be argued that banking systems that are better capitalised can find cheaper funding and hence have more resources for their customers. Additionally, capital stringency can be

considered as a sign of banks' safety, which in turn might encourage customers to engage in the financial system if they believe that banks are more stable (Rahman, 2014).

An additional aspect of the banking regulatory environment that we consider is the financial freedom provided by the Heritage foundation that measures banks' efficiency, openness to foreign competition, and independence from government control. This indicator is expected to have a positive association with financial inclusion as government control can deter the ease of access and level of financial services while efficiency and foreign competition can enhance financial inclusion as discussed previously (Rojas-Suarez, 2010).

Overall, we expect that banking systems that are more competitive and are characterised by greater financial freedom to be more inclusive. Nonetheless, the relationship between both concentration and the stringency of capital regulation, and financial inclusion is not as straightforward given the discussion above.

Institutional quality

Countries with effective government, rule of law, high regulatory quality, and political stability can facilitate better reach of the financial system to a wider segment of the population where there will be higher respect to their rights and contracts will be observed and enforced. These indicators were found to be good instruments to promote financial inclusion (Rojas-Suarez, 2010, Demirgüç-Kunt and Klapper, 2013, Honohan, 2008). We employ the variable *POLITY* as an indicator of the governance quality, and a measure of democracy. We expect democratic countries to have lower power of the elite and higher distribution of wealth and legal rights and hence to have higher financial inclusion. To the best of our knowledge, this is the first study to include a measure of democracy in the analysis of financial inclusion. However, Filippidis and Katrakilidis (2015) use polity index as a proxy of political institutional quality and find a positive association between institutional quality and the banking system development.

Technological factors: the importance of infrastructure for accessibility

Technology and innovation go hand in hand with offering affordable and more convenient financial services. Some of the recent initiatives to enhance financial inclusion rely on technological advancements, especially in rural areas in developing countries where there is a weaker bank infrastructure and technology can help in lowering the cost of reaching people that wish to be integrated in the banking world. Mobile phones are being used to boost the use of accounts among the unbanked in many countries in Africa, and digital identification is also important to overcome the documentation barriers faced by people who lack identity proof when applying for a bank account (Demirguc-Kunt et al., 2018). We proxy technology by the number of individuals using the internet to capture the technology infrastructure aspect and we expect this indicator to have a positive association with financial inclusion (Kabakova and Plaksenkov, 2018, Honohan, 2008, Park and Mercado Jr, 2018b).

Social factors

Social development plays an important role in determining people's decision-making and behaviour towards the financial system (Kabakova and Plaksenkov, 2018). In this paper we consider education as the first indicator related to social characteristics of the country proxied by the education index by the UN Human Development reports. We expect a lower education level in the country to be associated with lower financial inclusion as people will avoid innovative financial services and prefer holding cash or borrowing from their social circles. In other words, we expect a higher level of education to be associated with higher financial literacy and generally higher standards of living which can lead to a higher level of financial inclusion (Allen et al., 2012, Rojas-Suarez, 2010, Park and Mercado JR, 2018a). Age dependency ratio is also included as an important social factor considering that countries that have high proportion of people that do

not earn income duo to being too old (and do not have retirement) or too young are expected to have lower level of financial inclusion (Park and Mercado JR, 2018a, Honohan, 2008).

Finally, we include a broad measure of social development, that is, the human development index. Since the human development index includes information on people's health, education, and living standards, we conjecture that this indicator is positively associated with financial inclusion (Nanda and Kaur, 2016).

4.3.3 Empirical model

To identify macro-level factors that are associated with financial inclusion, we run several regression models. In our baseline analysis, we regress the three-dimensional financial inclusion index on a set of variables related to the five categories of country-level indicators explained in section 3.2. To account for the heterogeneity in our panel dataset we use time and country fixed effects. Specifically, we run the following regression equation:

$$\boldsymbol{FI_{ct} = \beta' X_{ct-1} + c_c + c_t + u_{ct}} \quad \textbf{(4.5)}$$

where the dependent variable *FI* is the financial inclusion index of country *c* at time *t*. *X* represents a vector of independent variables that are selected proxies of the country-level factors lagged by one year to control for potential endogeneity issues, β' is the matrix of the coefficients for the independent variables. $c_c$and c_t are country and time fixed effects, respectively, and u_{ct} is the error term. Standard errors are clustered at the country level to control for serial correlation of errors and heteroscedasticity (Petersen, 2009). The model is estimated using ordinary least squares (OLS).

The independent variables are: (i) log GDP per capita, unemployment, GDP growth, and Gini index representing macro-economic factors; (ii) bank concentration, Lerner index, capital regulatory index, and financial freedom representing the banking market conditions; (iii) we

select the variable polity to represent political institutional quality; (iv) individuals using the internet representing the technological factors; and (v) education index, age dependency ratio, and human development index representing the social factors. Across these categories and in some cases within a category, there are variables that are highly correlated. For example, log GDP per capita, individuals using the internet, human development index, age dependency, and education index. Hence, we do not include these variables in the same model to avoid multicollinearity.

4.4 Data and descriptive statistics

To examine the determinants of financial inclusion, we use a cross-country sample for the period 2004-2015 limited by data availability on financial inclusion. The data are compiled from several sources. The financial inclusion data for constructing the index are drawn from the IMF Financial Access Survey (FAS) that currently contains supply-side cross-country annual data and covers the accessibility and availability dimensions; for the usage dimension we use the Global Financial Development database. The data on the macro-economic, technological, and some social factors are obtained from the World Bank Development Indicators (WDI). Banking structure and competition data are extracted from the Global Financial Development Database (GFDD), while banking regulation and concentration data are drawn from the World Bank Surveys on Bank Regulation (by Barth et al., 2012). The Bank Regulation Surveys were conducted in 1999, 2003, 2007, and 2011; therefore we fill in the missing years during our sample period with data from the previous survey. We also obtain data on banks' financial freedom from the Heritage foundation, and the polity indicator from the Polity IV Project by the Centre for Systemic Peace. Alternative measures of institutional quality are obtained from the Worldwide Governance Indicators by the World Bank. Finally the education index and the human development index are obtained from the UN Human Development reports. Appendix F provides variables definition and data sources.

When compiling the dataset, we start with all the 189 countries included in the Financial Access Survey. To avoid miscalculations in the number of accounts per 100,000 adults, we exclude countries with population lower than 100,000 adults. We then drop observations with missing values for any of the variables used to construct the indices. This selection procedure results in a sample of 95 countries for the three-dimensional index and a sample of 173 countries for the two-dimensional index. To mitigate the influence of outliers, the financial inclusion variables are winsorised at the top and bottom 1% of the distribution. Other variables are not winsorised as there are no noticeable outliers. Table 4.1 provides descriptive statistics for the variables used in this study. The data show that the average number of branches and ATMs is 17 and 41 per 100,000 adults, respectively, across countries in the sample. The number of deposit accounts is, on average, much higher than that of loan accounts, and the average of bank deposits/credit is approximately 50% of the countries' GDP.

The table also shows a high variation in the level of financial inclusion between countries, most noticeably in the number of deposit accounts where the minimum is 1 (Cameroon) and the maximum is 7,987 (Japan) per 1000 adults. It also shows that the number of observations for the accessibility dimension is lower than the number of observations for proxies in other dimensions, which motivates the construction of the additional two-dimensional index excluding accessibility. The average financial inclusion index is 0.27 which is relatively low compared to the maximum of 1 belonging to Spain. The data also shows considerable heterogeneity in the cross-section in terms of macro-economic, social, and technological indicators – most importantly, in terms of GDP per capita (highest in Luxemburg), income inequality (highest in South Africa), human development (highest in Norway), and education index (highest in Australia). The sample countries also vary in terms of the banking system structure, competition, and regulation, which motivates the need to investigate the banking conditions that lead to higher financial inclusion. The highest Lerner index (lowest competition) is observed in Singapore (0.94), whereas the

concentration measure reaches its maximum value of 100 in a number of countries such as Afghanistan.

Table 4.1: Descriptive statistics

Variables	Observations	Mean	Std. Dev.	Min	Max
Branches of commercial banks per 100,000 adults	2185	17.36	19.08	0.13	257.7
Automated Teller Machines (ATMs) per 100,000 adults	2016	41.63	44.44	0	288.63
Deposit accounts with commercial banks per 1,000 adults	1312	1109.63	1157.69	1.3	7987.93
Loan accounts with commercial banks per 1,000 adults	1028	297.79	330.55	0.41	2888.42
Bank deposits to GDP (%)	2038	50.4	47.3	2.22	479.67
Domestic credit to private sector by banks (% of GDP)	2200	49.05	42.17	0.19	312.12
Financial inclusion Index	779	0.27	0.22	0	1
Financial inclusion Index (2 dimensions)	1,745	0.25	0.2	0	1
GDP growth	2,290	4.05	5.01	-62.08	54.16
Unemployment	1,501	8.97	6.69	0.1	47.5
GDP per capita	2,278	12,624.70	18,638.21	127.43	119,225.00
Income inequality	827	37.13	8.79	16.2	64.8
Bank concentration (Deposits)	1,422	72.87	19.4	3.8	100
Lerner index	1,437	0.27	0.36	-0.17	0.94
Capital Regulatory Index	1,697	6.53	1.95	1	10
Financial freedom	2,097	50.95	18.9	10	90
Polity	2,034	4.25	6.02	-10	10
Individuals using the Internet (% of population)	2,274	32.83	28.22	0.02	98.24
Education index	2,083	0.6	0.18	0.12	0.94
Age dependency ratio	2,301	61.15	18.93	16.45	111.78
Human development index (HDI)	2,088	0.67	0.16	0.28	0.95

The table presents the descriptive statistics for the dependent variable that is the financial inclusion index, the index components, and the main independent variables for the full sample over the period 2004-2015.

Table 4.2 presents the mean values of the variables used in computing the financial inclusion index over the years 2004-2015. On average, there seems to be a year-on-year positive growth in all the variables over the period, except for 2009-2012 where the financial inclusion indicators remain stable or decline in different years which could be explained by the global crisis and the Euro sovereign crisis. The decline is mostly noticeable for the number of loan accounts in 2010-2011 and domestic credit to GDP over the years 2010-2012. The highest growth seems to be in loan accounts and number of ATMs and the lowest in the number of branches over the period.

Table 4.2: Financial inclusion indicators by year

Dimensions	Proxy	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Availability	Branches of commercial banks per 100,000 adults	16.2	16.2	16.4	17	17.7	17.4	17.4	17.3	17.4	17.6	18.2	18.2
	Automated Teller Machines (ATMs) per 100,000 adults	32.4	33.2	34.6	38.3	39.4	41.2	40.6	41.4	42.5	45.2	47.1	49.1
Accessibility	Deposit accounts with commercial banks per 1,000 adults	926	957	967	1015	1029	1030	1078	1114	1126	1151	1213	1253
	Loan accounts with commercial banks per 1,000 adults	172	213	224	277.5	295	302.5	286.1	287.4	312.9	310	326.8	339
Usage	Bank deposits to GDP (%)	44.1	44.7	45.4	47.3	49.5	52.7	51.6	51.6	51.9	53.3	55.4	58.4
	Domestic credit to private sector by banks (% of GDP)	38.6	41.8	44.2	47.4	49.8	51.7	51.4	50.5	50.7	51.5	52.1	53.6

The table presents the annual mean values of the variables used in computing the financial inclusion index for the years 2004-2015.

Key correlations are reported in Appendix G. The coefficients are largely in line with our expectations. Few variables are highly correlated (log GDP per capita, individuals using the internet, human development index, age dependency, and education index) and are not included in the same model to avoid multicollinearity.

4.5 Results

In this section we present the financial inclusion index results including the weights obtained from principal component analysis, the countries ranking, and the trend in the progress of financial inclusion over the sample period. Additionally, we present the regression analysis of the determinants of financial inclusion.

4.5.1 Index results

Table 4.3 presents the computed weights for each indicator in the sub-indices and for each sub-index in the aggregate financial inclusion index. [23]The data shows that the weight of number

[23] The principal component analysis results for the two-dimensional financial inclusion index are reported in appendix H. The weights for the variables in the two dimensional sub-indices remain the same but the weights of these sub-indices in the aggregate financial inclusion index change; however, the availability dimension still obtains a larger weight than the usage dimension.

of branches is greater than the weight of number of ATMs in the availability dimension; similarly, the number of deposit accounts outweighs the number of loan accounts in the accessibility dimension and the domestic credit to GDP outweighs deposits to GDP in the usage dimension. Looking at the aggregate financial inclusion index, the weight of the availability dimension is larger than that of the usage and accessibility dimensions.

Table 4.3: Principal component analysis results

Indices	Indicators	Normalised weight
Availability	Branches of commercial banks per 100,000 adults	0.632
	Automated Teller Machines (ATMs) per 100,000 adults	0.368
Accessibility	Deposit accounts with commercial banks per 1,000 adults	0.594
	Loan accounts with commercial banks per 1,000 adults	0.406
Usage	Bank deposits to GDP (%)	0.416
	Domestic credit to private sector by banks (% of GDP)	0.584
Financial inclusion index	Availability	0.400
	Accessibility	0.275
	Usage	0.325

Note: The table reports the weights of indicators in the dimension sub-indices and weights of the dimensions in the financial inclusion index obtained from principal component analysis.

Table 4.4 presents the average score of our financial inclusion index for the 95 countries included in our sample over the period 2004-2015, ordered from highest to lowest.[24] The data shows that Spain and Portugal have the highest financial inclusion over the period reaching an index score of 0.92 and 0.87, respectively; while Congo and South Sudan have the lowest index scores of 0.006 and 0.007, respectively. As expected, the ten most inclusive systems are developed countries that have high or upper-middle income. Sub-Saharan Africa countries seem to have the lowest scores on average. India ranks 49th with an index score of 0.21; however, India ranks 2nd in the world in terms of financially excluded households after China if one considers

[24] The ranking for the two-dimensional financial inclusion index is reported in appendix I that presents the index scores for 173 countries over the period 2004-2015, ordered from highest to lowest. Excluding the accessibility dimension, it seems that Luxembourg outranks Spain and Portugal scoring the highest average over the period, while South Sudan, Congo, and Chad have the lowest rank on average. The 20 most inclusive financial systems belong to developed high income countries, with the exception of Bulgaria that is classified as upper-middle income country. Some high income/developed countries do not appear in the top ranked financial systems due to the fact that it is less likely that a country scores high in all indicators used to construct the index.

absolute numbers. In fact, the index scores suggest that the majority of the African countries are behind India.

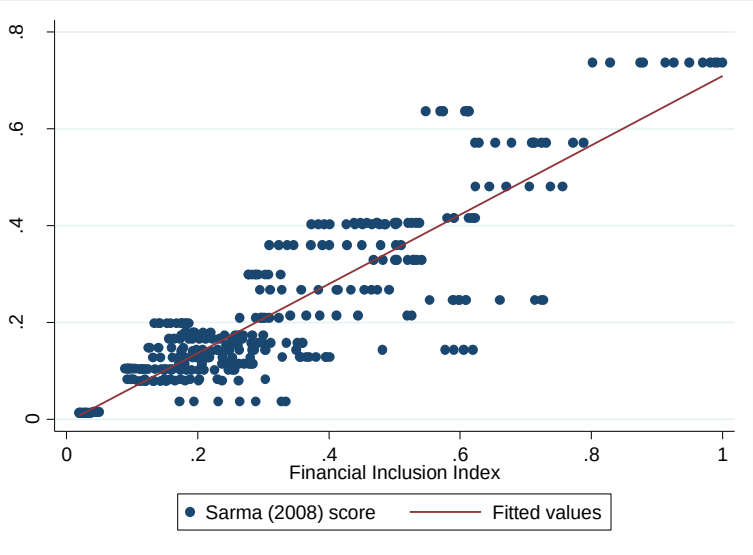
Table 4.4: Financial inclusion index ranking

Country	Index mean	Rank	Country	Index mean	Rank	Country	Index mean	Rank
Spain	0.926	1	Sao Tome and Principe	0.266	35	Djibouti	0.112	69
Portugal	0.878	2	Republic of Armenia	0.259	36	Cambodia	0.101	70
Japan	0.790	3	Kosovo, Republic	0.258	37	Pakistan	0.096	71
Malta	0.703	4	Suriname	0.255	38	Algeria	0.096	72
Greece	0.690	5	El Salvador	0.248	39	Nigeria	0.094	73
Bulgaria	0.634	6	Namibia	0.245	40	Solomon Islands	0.086	74
Italy	0.605	7	Honduras	0.243	41	Lesotho	0.074	75
Belgium	0.591	8	Fiji	0.243	42	Haiti	0.065	76
Bahamas, The	0.543	9	Samoa	0.240	43	Gabon	0.060	77
Netherlands	0.533	10	Saudi Arabia	0.233	44	Comoros	0.057	78
Lebanon	0.513	11	Tonga	0.229	45	Zambia	0.056	79
Estonia	0.506	12	Moldova	0.218	46	Malawi	0.050	80
Malaysia	0.493	13	Maldives	0.212	47	Liberia	0.049	81
Poland	0.487	14	Paraguay	0.211	48	Tanzania	0.047	82
Montenegro	0.481	15	India	0.206	49	Rwanda	0.045	83
Brunei Darussalam	0.458	16	Argentina	0.204	50	Uganda	0.045	84
Latvia	0.457	17	Botswana	0.202	51	Myanmar	0.044	85
Colombia	0.447	18	Dominican Republic	0.197	52	Burundi	0.035	86
Mauritius	0.440	19	West Bank and Ga	0.194	53	Equatorial Guinea	0.028	87
Brazil	0.428	20	Bhutan	0.184	54	Madagascar	0.026	88
Macedonia, FYR	0.406	21	Nepal	0.183	55	Cameroon	0.026	89
Thailand	0.404	22	Ecuador	0.182	56	Afghanistan	0.024	90
Chile	0.402	23	Bolivia	0.181	57	Guinea	0.016	91
Panama	0.393	24	Jamaica	0.174	58	Central African	0.012	92
Bosnia and Herzegovina	0.372	25	Indonesia	0.166	59	Chad	0.011	93
Hungary	0.355	26	Guyana	0.164	60	South Sudan	0.007	94
Costa Rica	0.352	27	Peru	0.164	61	Congo (Democratic Rep)	0.006	95
South Africa	0.348	28	Kenya	0.146	62			
Guatemala	0.324	29	Micronesia	0.143	63			
Belize	0.319	30	Bangladesh	0.134	64			
Vanuatu	0.314	31	Angola	0.131	65			
Trinidad and Tobago	0.297	32	Nicaragua	0.128	66			
Jordan	0.294	33	Egypt	0.127	67			
Georgia	0.273	34	Swaziland	0.126	68			

Note: The table reports the average financial inclusion index by country over the period 2004-2015 for 95 countries. The countries are ranked from the most inclusive (highest index score) to the least inclusive (lowest index score).

Figure 4.2 compares our financial inclusion index with Sarma (2008)'s index. The figure illustrates that our financial inclusion index is positively associated with Sarma's measure. In other words, countries that have a high average score in our index also have a high score in Sarma's measure. We choose to compare with Sarma's measure as the author uses similar indicators of financial inclusion, that is, number of branches and ATMs, number of deposit accounts, and domestic credit/bank deposits to GDP. Sarma's data pertain to the year 2004 and for 55 countries only, hence it is not surprising that there are some differences in the scores.

Figure 4.2: Financial inclusion index and Sarma (2008) index

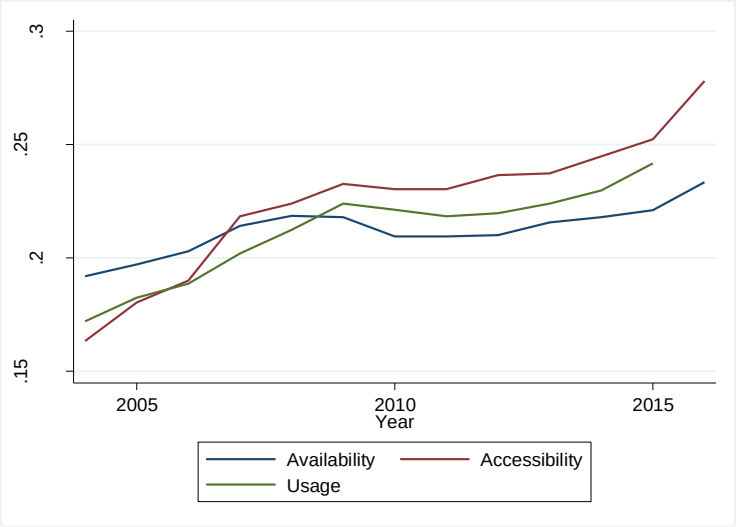


Note: The graph plots the comparison between our financial inclusion index and Sarma (2008) measure.

In addition to ranking the countries based on their financial inclusion index, we analyse the trend in the progress over the sample period across the three dimensions of financial inclusion (Figure 4.3), different income regions (Figure 4.4), and different important macro regions (Figure 4.5). We focus on the following regions: BRIC (Brazil, Russia, India, and China), SSA (Sub-Saharan Africa) MENA (Middle East and North Africa) as a high percentage of the financially excluded live in these countries, we also compare these regions with European countries that are on average in a better position in terms of financial inclusion.

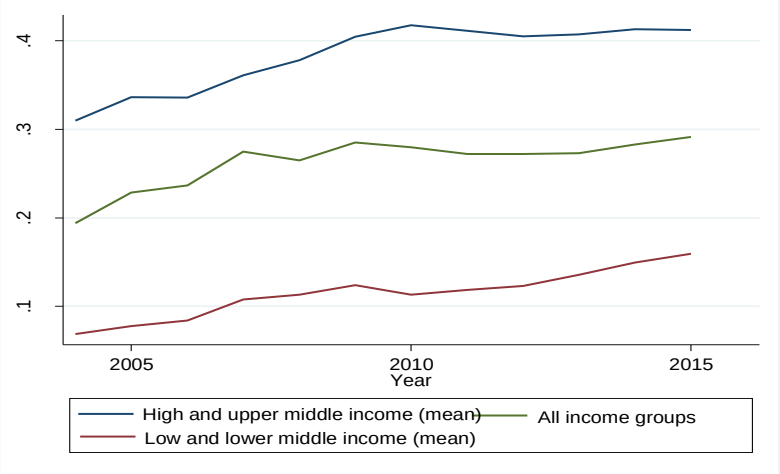
Figure 4.3 shows progress in financial inclusion over the sample period, the progress is most prominent in the accessibility and usage dimensions, and to a lesser extent in the availability dimension. High and upper-middle income countries on average over-rank low and lower-middle income countries (Figure 4.4). Figure 4.5 shows that on average European countries over-rank other regions, Sub-Saharan Africa region ranks the lowest, and BRICs have a rapid increase in financial inclusion (most markedly in India and Brazil).

Figure 4.3: Financial inclusion index trend by dimension



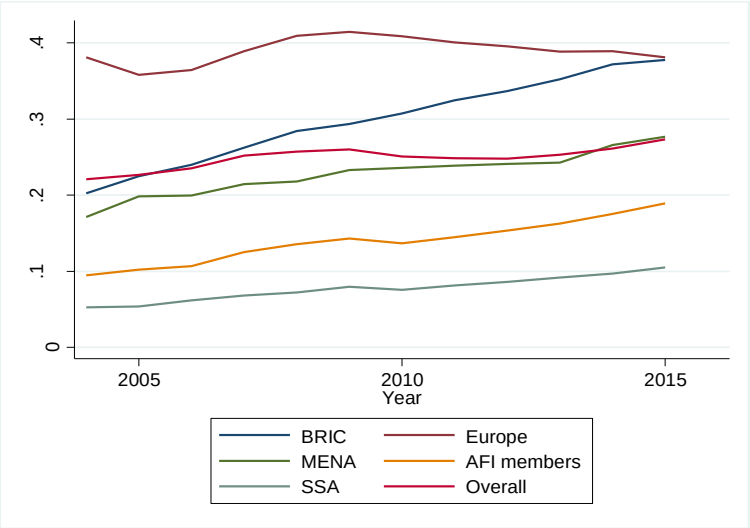
Note: The graph plots the trend of financial inclusion by dimension over the period 2004-2015. The financial inclusion dimensions are: availability, accessibility, and usage.

Figure 4.4: Financial inclusion index trend by income region



Note: The graph plots the trend of financial inclusion by income region over the period 2004-2015. The income regions are grouped into high and upper-middle income region and low and lower-middle income region.

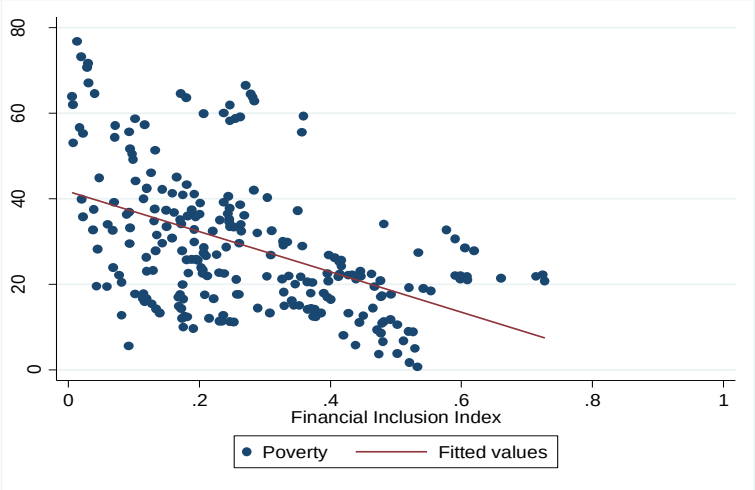
Figure 4.5: Financial inclusion index trend by macro region



Note: The graph plots the trend of financial inclusion by macro region over the period 2004-2015. The macro regions are grouped into: BRIC (Brazil, Russia, India, and China), Europe (countries in Europe), MENA (Middle East and North Africa), AFI members (members of the Alliance for Financial inclusion), and SSA (Sub-Saharan Africa).

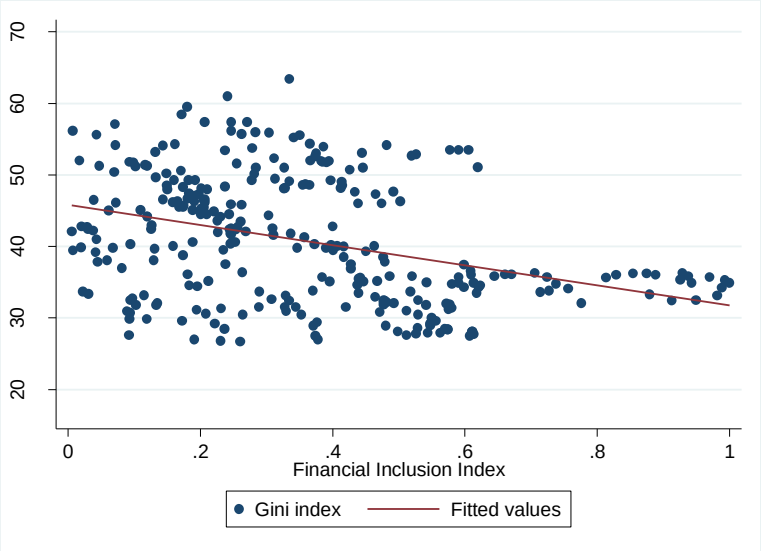
We also plot the relationship between the financial inclusion index and different indicators: poverty (Figure 4.6), income inequality measured by Gini index (Figure 4.7), and gender inequality index (Figure 4.8). The figures illustrate a negative relationship between financial inclusion and poverty rates, income inequality, and, last but not least, gender inequality, where the steepest slope can be clearly identified.

Figure 4.6: Financial inclusion and poverty



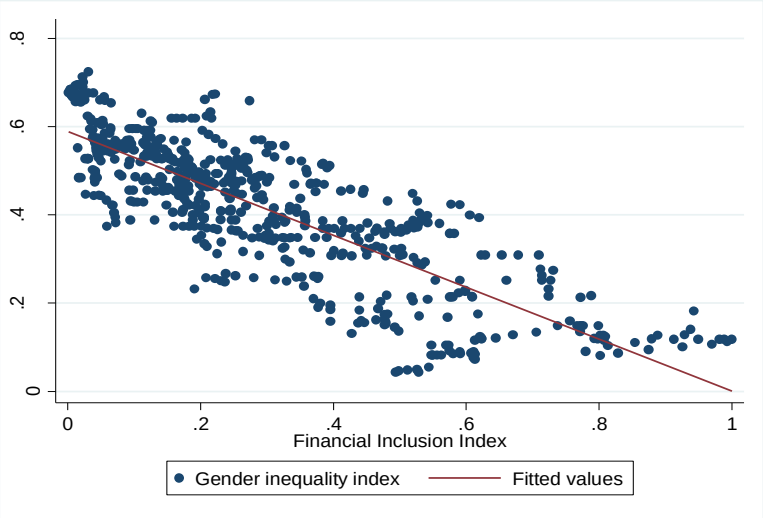
Note: The graph plots the relationship between our financial inclusion index and poverty measured by headcount ratio at national poverty lines (% of population).

Figure 4.7: Financial inclusion and income inequality



Note: The graph plots the relationship between our financial inclusion index and income inequality measured by Gini index.

Figure 4.8: Financial inclusion and gender inequality



Note: The graph plots the relationship between our financial inclusion index and gender inequality measured by the gender inequality index.

4.5.2 What factors explain differences in financial inclusion?

In this section we analyse the factors that are associated with financial inclusion by estimating Equation (4.5) using the three-dimensional financial inclusion index as the dependent variable. The results are reported in Table 4.5. In Model (1) we regress the financial inclusion index on macro-economic indicators including the level of unemployment, income inequality,

GDP growth, and GDP per capita. In Model (2) we introduce banking conditions related to the structure and competition in the sector, while controlling for macro-economic indicators. In Model (3), we augment the indicators of banking conditions with those related to capital regulation and financial freedom. In Model (4), we add political institutional quality measured by polity and technology measured by individuals using the internet. In Models (5)-(7) we additionally test the relationship between financial inclusion and social factors measured by the education index, age dependency ratio, and human development index alternatively (due to high correlation among these variables). All model specifications are estimated using ordinary least squares (OLS) with country and time fixed effects, in all regression estimations we use standard errors clustered at the country level.[25]

We find that among the macro-economic indicators, the country's level of income measured by the log of GDP per capita is positively associated with financial inclusion. This finding is in line with the literature that posits that wealthier people are more integrated in the financial system as they demand and utilise more financial services (Ardic et al., 2011). Demirgüç-Kunt and Klapper (2013) also find that national income per capita accounts for much of the financial inclusion variation across countries. A country's level of unemployment, on the other hand, is negatively associated with financial inclusion. Unemployed adults are less likely to have a bank account because they often do not have enough money and do not receive salaries (Allen et al., 2012). Similarly, and in line with our expectation, high income inequality has a negative relationship with financial inclusion. High income inequality is usually linked to uneven economic opportunities and marginalisation of the lower income class that are less likely to be banked (Evans and Alenoghena, 2017, Demirgüç-Kunt and Klapper, 2013, Rojas-Suarez, 2010). It is important to note in this context that empirical literature has provided evidence of both directions of causality between financial development and income inequality (Rojas-Suarez, 2010, Beck et al., 2007a). Our results show that GDP growth is not related to financial inclusion.

[25] In Models (3-5) we omit log GDP per capita due to its high correlation with other variables of interest.

Turning to the banking conditions, we find that higher concentration and competition in the banking system are associated with higher financial inclusion. The positive relationship between concentration as a structural measure of the banking system and financial inclusion can be due to the ability of large banks in concentrated markets to reduce their costs through economies of scale and thus afford investment in information acquisition for lower income or riskier customers (Owen and Pereira, 2016). The negative relationship between Lerner index and the financial inclusion index highlights the importance of competition in advancing financial inclusion as banks with lower market power tend to be more innovative and cautious in terms of the quality of financial services. This is consistent with the findings of Love and Martínez Pería (2014).

Interestingly, the results show that financial inclusion is positively associated with the capital regulatory index. Capital regulatory index can be interpreted as a proxy for bank stability, and higher stability in the banking system increases customers' trust in the system and leads to higher financial inclusion. Although the empirical literature focuses on the impact of financial inclusion on banks' stability, there is also a feedback effect from stability on inclusion because stable properly regulated financial systems are more attractive to potential customers (Rahman, 2014). Similarly, we find a positive relationship between financial freedom and financial inclusion, which shows that independent and efficient banks tend to provide more convenient and inclusive financial services (Rojas-Suarez, 2010). In other words, financial inclusion can be improved by proper regulation but without limiting the freedom of financial institutions in providing efficient and convenient financial services.

We find no relationship between 'polity', our chosen democracy measure, and financial inclusion. On the other hand, the results show a positive and significant relationship between technology measured by individuals using the internet and financial inclusion (Honohan, 2008). Technology is being used to introduce convenient financial services and rapidly expand access,

especially in developing countries, such as mobile accounts in Kenya (van Oudheusden et al., 2015). Other countries also report using digital technology to lower barriers to account ownership, such as biometric identification in India that helped individuals that lack proof of identity to own a bank account(Demirguc-Kunt et al., 2018).

Looking at the social factors, the results are consistent with our expectations. The education index is positively associated with financial inclusion. This finding highlights the importance of literacy in advancing financial inclusion as the use of financial services requires a certain level of financial knowledge and trust in the banking system (Allen et al., 2012).

The relationship between financial inclusion and age dependency ratio is negative and significant suggesting that a country with higher proportion of people that do not earn any income tend to have lower levels of financial inclusion (Park and Mercado JR, 2018a, Honohan, 2008). Finally, the human development index, which is a broader measure of social development, has a positive association with financial inclusion. A higher human development is observed in countries where people have long and healthy life, are knowledgeable, and have a decent standard of living, and hence have a higher chances of being included in the financial system (Kabakova and Plaksenkov, 2018).

Table 4.5: Financial inclusion and country characteristics

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
L. Bank concentration (Deposits)		0.0009**	0.0008*	0.0008**	0.0010**	0.0009**	0.0009**
		(2.33)	(2.02)	(2.09)	(2.17)	(2.21)	(2.16)
L. Lerner index		-0.0667**	-0.0661**	-0.0768**	-0.0683**	-0.0551*	-0.0718**
		(-2.23)	(-2.13)	(-2.46)	(-2.05)	(-1.93)	(-2.40)
L. Capital regulatory index			0.0029	0.0067**	0.0058**	0.0048*	0.0046*
			(1.07)	(2.53)	(2.37)	(1.92)	(1.73)
L. Financial freedom			0.0018**	0.0029**	0.0022**	0.0025**	0.0019**
			(2.49)	(3.83)	(2.79)	(3.36)	(2.67)
L. Polity				-0.0029	-0.0054	-0.0048	-0.0063
				(-0.86)	(-1.08)	(-1.05)	(-1.50)
L. Individuals using the internet				0.0030**			
				(2.41)			
L. Education index					0.8356*		
					(1.77)		
L. Age dependency ratio						-0.0061*	
						(-1.90)	
L. Human development index							3.0057**
							(3.83)
L. Unemployment	-0.0019	-0.0036	-0.0033	-0.0050**	-0.0066**	-0.0048**	-0.0059**
	(-0.82)	(-1.58)	(-1.41)	(-2.69)	(-3.77)	(-2.43)	(-3.09)
L. Gini index	0.0005	-0.0014	-0.0025	-0.0062**	-0.0066**	-0.0045*	-0.0044*
	(0.14)	(-0.52)	(-0.81)	(-2.31)	(-2.32)	(-1.85)	(-1.70)
L. GDP growth	-0.0013	-0.0001	0.0002	0.0005	0.0008	0.0002	0.0001
	(-1.09)	(-0.10)	(0.13)	(0.32)	(0.67)	(0.11)	(0.07)
L. GDP per capita (log)	0.2557**	0.1841**	0.1622**				
	(4.16)	(3.87)	(3.72)				
Time fixed effects	yes	yes	yes	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes	yes	yes	yes
Clustering	yes	yes	yes	yes	yes	yes	yes
Observations	264	209	209	207	207	207	207
Adjusted R-squared (within)	0.410	0.411	0.446	0.421	0.401	0.412	0.412
F test	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: The table reports the regression results of estimating the relation between financial inclusion and different country characteristics. The dependent variable is the three-dimensional financial inclusion index. The independent variables are economic, banking, institutional, technological, and social country characteristics (all lagged by one year). The regressions are run on the full sample of 95 countries covering the period of 2004-2015. Robust t-statistics are reported under the coefficients in parentheses. Standard errors are clustered at the country level. *, **,*** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

4.5.3 Alternative proxies

In this section, we analyse the results derived from estimating Equation (4.5) using alternative measures for the banking conditions, institutional quality, and social factors. The results are reported in Table 4.6. In Model (1) we measure bank concentration in terms of assets rather than deposits to proxy for the banking system structure. In Models (2)-(3) we proxy the capital regulation using initial capital stringency and overall capital stringency. In Models (4)-(5) we add alternatively the independence of supervisory authority from the banking industry and the interest rate spread (measured as lending rate minus deposit rate) to the baseline equation. We also test for the financial system development in Models (6)-(7) where we add alternatively the stock market turnover ratio and the market capitalisation of listed domestic firms (% of GDP).

As for institutional quality, we replace the 'polity' measure with three measures alternatively: rule of law, government integrity, and regulatory quality in Models (8)-(10).[26] Finally, we test an alternative measure of social factors that is the gender inequality index in Model (11).[27] Similar to the previous test, all model specifications are estimated using ordinary least squares (OLS) with country and time fixed effects; in all regression estimations we use standard errors clustered at the country level.

Table 4.6 shows that the proxies of different factors used previously in the main analysis generally hold in this test. We find that bank concentration in terms of assets, carry the same sign and significance as deposits concentration and the coefficient of market power remains negative and significant (Owen and Pereira, 2016, Love and Martínez Pería, 2014). The results also show a positive and significant association between initial / overall capital stringency and the financial inclusion index suggesting that proper enforcement of capital regulation is important in advancing financial inclusion as suggested in the previous test using the capital regulatory index. Similarly,

[26] In Model (8) we omit the variable individuals using the internet due to high correlation with rule of law.
[27] In Model (11) we omit the income inequality measure (Gini index) due to high correlation with the gender inequality index.

using the independence of supervisory authority from the banking industry as an additional measure of banking regulation confirms the importance of proper supervision of financial institutions that is independent and protected by the legal system from the banking industry (Rahman, 2014). However, proper regulation should not be accompanied with limiting the scope of banking activities as financial systems that have high financial freedom are also characterised by high financial inclusion (Owen and Pereira, 2016). We find a negative and significant association between interest rate spread and the financial inclusion index. It is expected that as the lending rate becomes lower more customers will be motivated to borrow from financial institutions, and similarly as deposit rates become higher more customers will be motivated to deposit their money in a financial institution and this is especially true for low income customers (De Sousa, 2015). The country's level of financial development, as measured by the stock market turnover ratio and market capitalisation of listed domestic firms (%of GDP), is significantly and positively associated with financial inclusion (Demirgüç-Kunt and Klapper, 2013).

Results show a positive and significant association between alternative measures of institutional quality and financial inclusion. Improvements in institutional quality related to better rule of law, lower corruption (higher government integrity), and better regulatory quality are associated with improvements in the inclusivity of the financial system. This could be explained by an increased confidence in financial institutions when contracts are enforced and regulators policies are perceived as sound (Rojas-Suarez, 2010, Park and Mercado Jr, 2018b).

Last but not least, we find a negative relationship between financial inclusion and the gender inequality index that shows a relatively large coefficient. This indicates that high gender gaps in health, empowerment, and labour are associated with gaps in financial inclusion. It has been also found in the literature that there are large disparities between the genders in financial inclusion and gender norms can explain cross-country variation in access and usage of financial services (Demirgüç-Kunt et al., 2013).

Table 4.6: Financial inclusion and alternative measures of country characteristics

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)	Model (8)	Model (9)	Model (10)	Model (11)
L. Bank concentration (Deposits)		0.0008*	0.0009**	0.0009**	0.0008*	0.0007**	0.0007**	0.0010*	0.0009**	0.0009**	0.0010*
		(1.83)	(2.19)	(2.58)	(1.80)	(2.25)	(2.56)	(1.91)	(2.17)	(2.04)	(2.01)
L. Lerner index	-0.0788**	-0.0721**	-0.0805**	-0.0614**	-0.0604**	-0.0944**	-0.0463	-0.0554	-0.0756**	-0.0697**	-0.0586*
	(-2.59)	(-2.37)	(-2.59)	(-2.32)	(-2.70)	(-4.25)	(-1.50)	(-1.49)	(-2.41)	(-2.12)	(-1.99)
L. Capital regulatory index	0.0063**			0.0063**	0.0008	0.0062**	0.0070**	0.0029	0.0058**	0.0045*	0.0065**
	(2.39)			(2.31)	(0.15)	(2.21)	(2.76)	(1.07)	(2.14)	(1.92)	(2.57)
L. Financial freedom	0.0028**	0.0028**	0.0029**	0.0023**	0.0033**	0.0025**	0.0029**	0.0023**	0.0026**	0.0026**	0.0022**
	(3.37)	(3.58)	(3.62)	(3.21)	(4.89)	(3.17)	(3.94)	(2.79)	(3.31)	(3.66)	(3.95)
L. Polity	-0.0026	-0.0021	-0.0025	-0.0028	-0.0014	0.0006	-0.0045				-0.0026*
	(-0.73)	(-0.61)	(-0.77)	(-0.94)	(-0.58)	(0.53)	(-1.72)				(-1.83)
L. Individuals using the internet	0.0029**	0.0024*	0.0029**	0.0027**	0.0023	0.0030*	0.0025		0.0031**	0.0033**	0.0035**
	(2.31)	(1.92)	(2.37)	(2.06)	(1.48)	(1.87)	(1.40)		(2.38)	(2.68)	(2.33)
L. Unemployment	-0.0048**	-0.0047**	-0.0053**	-0.0057**	-0.0021	-0.0062**	-0.0080**	-0.0057**	-0.0046**	-0.0042**	-0.0069**
	(-2.52)	(-2.55)	(-2.70)	(-3.27)	(-0.48)	(-5.04)	(-5.35)	(-2.82)	(-2.69)	(-2.32)	(-3.72)
L. Gini index	-0.0064**	-0.0073**	-0.0069**	-0.0061**	-0.0074*	-0.0051*	-0.0056*	-0.0068**	-0.0055**	-0.0051*	
	(-2.34)	(-3.26)	(-2.45)	(-2.66)	(-1.98)	(-1.72)	(-1.72)	(-2.20)	(-2.10)	(-1.90)	
L. GDP growth	0.0003	0.0003	0.0004	0.0006	0.0014	0.0006	0.002	0.0007	0.0009	0.0002	-0.0001
	(0.24)	(0.24)	(0.27)	(0.43)	(0.76)	(0.36)	(1.20)	(0.45)	(0.69)	(0.14)	(-0.07)
L. bank concentration (assets)	0.0010*										
	(1.96)										
L. Initial capital stringency		0.0160*									
		(1.74)									
L. Overall capital stringency			0.0054*								
			(1.95)								
L. Independence of Supervisory Authority-Bank				0.0301*							
				(1.73)							
L. Interest rate spread					-0.0054**						
					(-2.35)						
L. Stock market turnover ratio						0.0004**					
						(3.37)					
L. Market capitalisation of firms							0.0006**				
							(2.87)				
L. Rule of law								0.0786**			
								(2.09)			
L. Government integrity									0.0026*		
									(1.97)		
L. Regulatory quality										0.0982**	
										(2.71)	
L. Gender inequality											-0.5796**
											(-2.17)
Time fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Clustering	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	202	207	207	207	140	171	141	209	209	209	287
Adjusted R-squared (within)	0.423	0.413	0.405	0.445	0.334	0.498	0.544	0.375	0.438	0.461	0.382
F test	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: The table reports the regression results of estimating the relation between financial inclusion and different country characteristics. The dependent variable is the financial inclusion index. The independent variables are economic, banking, institutional, technological, and social country characteristics (all lagged by one year). We use alternative proxies of banking conditions, institutional quality, and social factors. The regressions are run on the full sample of 95 countries covering the period of 2004-2015. Robust t-statistics are reported under the coefficients in parentheses. Standard errors are clustered at the country level. *, **,*** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

4.6 Conclusions

Financial inclusion is essential to inclusive development and can bring many benefits to the economy. Hence, it is important to have a measure of financial inclusion that is comparable across economies and time to be able to monitor progress. In this study we present a multidimensional financial inclusion index that covers the following aspects of financial inclusion: availability, accessibility, and usage of financial services across 95 countries over the period 2004-2015. We use a principal component analysis that provides proper weight assignment to six indicators of financial inclusion from the IMF Financial Access Survey.

Our preliminary analysis of the financial inclusion index shows an overall progress over the sample period, most markedly in the accessibility and usage dimensions, and to a lesser extent in the availability dimension. High and upper-middle income countries over-rank low and lower-middle income countries. European countries over-rank other regions. The SSA region ranks the lowest, while the BRIC countries collectively show a rapid growth in terms of financial inclusion.

We then use the financial inclusion index in a regression analysis to investigate the factors that explain the variation in financial inclusion across countries, with a special focus on banking conditions. Results show that banking systems that are highly competitive, concentrated, have proper enforcement of capital regulation, and have high financial freedom seem to be more inclusive. In addition to macro-economic indicators (income per capita, unemployment, and income inequality), the level of human development, education, gender inequality, institutional quality, and technology matters greatly in explaining the variation in financial inclusion across countries.

The main broad policy implication that can be derived from these empirical results is that enhancing financial inclusion requires improvements in a number of country-level conditions, particularly banking market competition and financial freedom regulations, institutional quality, as well as key social factors including advancing education, reducing gender inequalities, and utilising technology.

5 Conclusion

This thesis provides an in-depth examination of contemporary issues related to the financial sector and focuses on banks' capital, performance, and financial inclusion. Specifically it comprises three empirical essays on the determinants of bank capital structure, the relationship between financial inclusion and bank performance, and the factors that explain differences in financial inclusion.

The increased interest in bank capital after the recent financial crisis as a major factor in sustaining the banking system stability motivates the need to investigate banks' capital structure decisions. In the first empirical essay (Chapter 2) we analyse the capital structure determinants of the European Economic Area's listed commercial banks using bank-level data over the period 2005-2014. We extend the sample period to account for the impact of the global financial crisis and the Euro sovereign debt crisis and examine the relationship between bank equity capital and alternative types of risk including credit risk, liquidity risk, and reputational risk related to environmental, social, and governance (ESG) issues. Moreover, we analyse the impact of systemic size on banks' capital structure. Using panel data regression analysis with fixed effects, we find that equity capital is negatively associated with size and positively with profits, market-to-book ratio, market return volatility risk, and dividends. We also find that in the crisis period the positive effect of profitability and growth on the market capital ratio diminishes. In terms of alternative types of risk, our evidence points to a positive association between equity capital and banks' reputational risk related to ESG issues, and a negative association with liquidity risk. However, credit risk does not seem to significantly affect bank equity capital. Finally, it appears that large systemically important banks hold significantly lower equity capital. The findings suggest similarities between banks and non-financial firms in terms of the determinants of capital structure in which regulatory concerns are not the main driver for this decision. The results also suggest that bank size and important market-related

factors proxied by market return volatility risk and reputational risk play a crucial role in the decision.

In the second and third empirical essays the focus is shifted to another important contemporary policy issue that relates to the banking sector. Recent years have witnessed a global commitment to advancing financial inclusion as a key enabler for equal opportunity, reducing poverty, and economic growth. Banks play a crucial role in achieving the universal financial access target, hence it is important to investigate the relationship between financial inclusion, bank performance, and banking conditions that might be related to advancing financial inclusion.

Specifically, in the second empirical essay (Chapter 3), we investigate the link between bank performance, broadly defined to include stability (CAMEL-based performance), and financial inclusion at country level. We construct an aggregate index of banks' overall performance based on CAMEL ratios using principle component analysis for a global sample of countries for the period 2005-2014. Subsequently, we employ panel data regressions with fixed effects to examine the relationship between bank performance and financial inclusion measured by different indicators including: deposits to GDP, loans to GDP, number of borrowers from commercial banks, number of deposit accounts with commercial banks, and geographical outreach indicators including the number of ATMs and branches. Furthermore, we examine the relationship for different countries based on their income classification, distinguishing between high and low income countries, in addition to examining other country-specific conditions that underlie the link between financial inclusion and bank performance. We find that alternative financial inclusion measures provide different results in terms of the impact on bank performance, with bank performance negatively associated with credit deepening and positively with the number of ATMs. Moreover, we find a positive association between different indicators of financial inclusion and bank performance in low and lower middle income countries. Additionally, results show that banks operating in countries with lower level of inclusion, higher level of income equality, and higher capital stringency can achieve more gains from financial inclusion. These findings suggest that a number of factors should be taken into account

when promoting financial inclusion: from the type of financial service to the country's level of income, income equality, and, interestingly, banking sector capital stringency.

We further analyse financial inclusion in the third empirical essay (Chapter 4). Specifically, we construct a multidimensional financial inclusion index for a global sample of countries over the period 2004-2015 using principal component analysis (PCA). The index covers the following dimensions of financial inclusion: availability, accessibility, and usage. The indicators for the dimensions are obtained from the Financial Access Survey (FAS). First, the analysis of progress trends shows that the financial inclusion index has progressively increased over the 12 years under investigation, most markedly in the accessibility and usage dimensions. We also find high variation in financial inclusion across different countries and macro-regions. The average score of our financial inclusion index confirms that, as expected, the most inclusive systems are observed in developed countries (defined as high or upper-middle income). Specifically, European countries are on average in a stronger position in terms of financial inclusion than other regions, Sub-Saharan Africa region ranks the lowest, while the BRIC countries show a rapid increase in financial inclusion over the period (most markedly India and Brazil). Further, we employ panel regressions with fixed effects to investigate factors that explain high variation in financial inclusion across countries with a special focus on banking conditions. The empirical analysis suggests that higher banking system competition, concentration, financial freedom, and capital stringency are associated with higher financial inclusion. Additionally, financial inclusion seems to be positively associated with the national level of income, the level of human development, regulatory quality, and internet usage, and negatively related to gender inequality. These findings suggest that there is a need to prioritise improvements in a number of country-level conditions to achieve broader financial inclusion.

This study is subject to some limitations. First, the first empirical essay only examines the capital structure determinants of the European Economic Area's banks; the extent to which the results are applicable to other regions is still to be established. Second, in the second and third empirical essays we attempt to capture financial inclusion in a comprehensive manner, however due

to data availability we are unable to incorporate non-traditional financial services such as mobile accounts in the analysis. Although these indicators have been recently added in the Financial Access Survey (FAS), including them in the analysis would reduce the number of observations due to limited time series data. Third, the limited number of observations in the third empirical essay limits our ability to perform focused regional analyses investigating the determinants of financial inclusion by region.

Future research on banks' capital structure may further examine the relationship between reputational risk and bank capital. Reputational risk has recently attracted more attention due to its potential impact on banks' stability and performance and the increased importance of customer confidence as a major intangible asset for banks. Hence, more research is needed to investigate the impact of this type of risk on banks' capital and performance.

The research on financial inclusion could be further enhanced by incorporating additional measures and dimensions in constructing the financial inclusion index as more time-series data become available. Additionally, more empirical evidence on the impact of financial innovation (Fintech) and social indicators such as financial literacy and gender inequality on advancing financial inclusion would enrich the analysis and inform policy makers and providers of financial services on the products, practices, and technologies that can expand financial inclusion for different segments in the economy and in different countries.

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Appendix A: Access to and use of financial services indicators from the IMF's FAS

Geographical Outreach
1 Branches of commercial banks per 1,000 km²
2 Branches of credit unions and financial cooperatives per 1,000 km²
3 Branches of all MFIs per 1,000 km²
4 Branches of commercial banks per 100,000 adults
5 Branches of credit unions and financial cooperatives per 100,000 adults
6 Branches of all MFIs per 100,000 adults
7 Automated Teller Machines (ATMs) per 1,000 km²
8 Automated Teller Machines (ATMs) per 100,000 adults
9 Mobile money agent outlets: registered per 1,000 km²
10 Mobile money agent outlets: registered per 100,000 adults
11 Mobile money agent outlets: active per 1,000 km²
12 Mobile money agent outlets: active per 100,000 adults
Use of Financial Services
Account Holders
13 Depositors with commercial banks per 1,000 adults
14 Depositors with commercial banks: o/w SMEs (% of non-financial corps.)
15 Depositors with commercial banks: o/w households per 1,000 adults
16 Depositors with credit unions and financial cooperatives per 1,000 adults
17 Depositors and customers with all MFIs per 1,000 adults
18 Borrowers at commercial banks per 1,000 adults
19 Borrowers at commercial banks: o/w SMEs (% of non-financial corps.)
20 Borrowers at commercial banks: o/w households per 1,000 adults
21 Borrowers at credit unions and financial cooperatives per 1,000 adults
22 Borrowers at all MFIs per 1,000 adults
Number of Accounts
23 Deposit accounts with commercial banks per 1,000 adults

24 Deposit accounts with commercial banks: o/w SMEs (% of non-financial corps.)

25 Deposit accounts with commercial banks: o/w households per 1,000 adults

26 Deposit accounts with credit unions and financial cooperatives per 1,000 adults

27 Deposit and customer accounts with all MFIs per 1,000 adults

28 Loan accounts with commercial banks per 1,000 adults

29 Loan accounts with commercial banks: o/w households per 1,000 adults

30 Loan accounts with commercial banks: o/w SMEs (% of non-financial corps.)

31 Loan accounts with credit unions and financial cooperatives per 1,000 adults

32 Loan accounts with all MFIs per 1,000 adults

33 Mobile money transactions: number per 1,000 adults

34 Mobile money accounts: registered per 1,000 adults

35 Mobile money accounts: active per 1,000 adults

Volume of Accounts

36 Outstanding deposits with commercial banks (% of GDP)

37 Outstanding deposits with commercial banks: o/w SMEs (% of GDP)

38 Outstanding deposits with commercial banks: o/w households (% of GDP)

39 Outstanding deposits and acquired funds with all MFIs (% of GDP)

40 Outstanding deposits with credit unions and financial co-ops (% of GDP)

41 Outstanding loans with commercial banks (% of GDP)

42 Outstanding loans with commercial banks: o/w SMEs (% of GDP)

43 Outstanding loans with commercial banks: o/w households (% of GDP)

44 Outstanding loans with credit unions and financial co-ops (% of GDP)

45 Outstanding loans with all MFIs (% of GDP)

46 Mobile money balance value (% of GDP)

47 Mobile money transactions: value (% of GDP)

Source: International Monetary Fund. (2017). Financial Access Survey [Glossary]. Available from http://data.imf.org/?sk=E5DCAB7E-A5CA-4892-A6EA-598B5463A34C

Appendix B: Countries included in the sample and their income classification

Country	Income group
Albania	Upper middle income
Algeria	Upper middle income
Argentina	High income
Armenia	Lower middle income
Australia	High income
Austria	High income
Azerbaijan	Upper middle income
Bahrain	High income
Bangladesh	Lower middle income
Belarus	Upper middle income
Belgium	High income
Bhutan	Lower middle income
Bolivia	Lower middle income
Bosnia and Herzegovina	Upper middle income
Botswana	Upper middle income
Brazil	Upper middle income
Brunei Darussalam	High income
Bulgaria	Upper middle income
Burundi	Low income
Cambodia	Low income
Cameroon	Lower middle income
Canada	High income
Chile	High income
China	Upper middle income
Colombia	Upper middle income
Congo, Rep.	Lower middle income
Costa Rica	Upper middle income
Croatia	High income
Cyprus	High income
Czech Republic	High income
Denmark	High income
Djibouti	Lower middle income
Dominican Republic	Upper middle income
Ecuador	Upper middle income
Egypt, Arab Rep.	Lower middle income
El Salvador	Lower middle income
Estonia	High income
Finland	High income
France	High income
Gabon	Upper middle income
Georgia	Lower middle income
Germany	High income
Ghana	Lower middle income
Greece	High income
Grenada	Upper middle income
Guatemala	Lower middle income
Guinea	Low income
Honduras	Lower middle income
Hong Kong SAR, China	High income
Hungary	High income
Iceland	High income
India	Lower middle income
Indonesia	Lower middle income
Ireland	High income
Israel	High income
Italy	High income
Japan	High income
Jordan	Upper middle income
Kazakhstan	Upper middle income
Kenya	Lower middle income
Korea, Rep.	High income
Kuwait	High income
Kyrgyz Republic	Lower middle income
Latvia	High income
Lebanon	Upper middle income
Lesotho	Lower middle income

Lithuania	High income
Luxembourg	High income
Macao SAR, China	High income
Macedonia, FYR	Upper middle income
Malaysia	Upper middle income
Maldives	Upper middle income
Malta	High income
Mauritania	Lower middle income
Mauritius	Upper middle income
Mexico	Upper middle income
Moldova	Lower middle income
Morocco	Lower middle income
Mozambique	Low income
Namibia	Upper middle income
Netherlands	High income
New Zealand	High income
Nigeria	Lower middle income
Norway	High income
Oman	High income
Pakistan	Lower middle income
Panama	Upper middle income
Paraguay	Upper middle income
Peru	Upper middle income
Philippines	Lower middle income
Poland	High income
Portugal	High income
Qatar	High income
Romania	Upper middle income
Russian Federation	High income
Rwanda	Low income
Samoa	Lower middle income
Saudi Arabia	High income
Senegal	Lower middle income
Serbia	Upper middle income
Seychelles	High income
Sierra Leone	Low income
Singapore	High income
Slovak Republic	High income
Slovenia	High income
South Africa	Upper middle income
Spain	High income
Sri Lanka	Lower middle income
St. Vincent and the Grenadines	Upper middle income
Swaziland	Lower middle income
Sweden	High income
Switzerland	High income
Tajikistan	Lower middle income
Tanzania	Low income
Thailand	Upper middle income
Trinidad and Tobago	High income
Tunisia	Upper middle income
Turkey	Upper middle income
Turkmenistan	Upper middle income
Uganda	Low income
Ukraine	Lower middle income
United Arab Emirates	High income
United Kingdom	High income
United States	High income
Uruguay	High income
Uzbekistan	Lower middle income
Vanuatu	Lower middle income
Venezuela, RB	High income
Vietnam	Lower middle income
Yemen, Rep.	Lower middle income
Zambia	Lower middle income

Appendix C: Variable definitions

The table defines the variables used in the study and the source of the data.

Variables	Definition	Source
Bank performance		
Bank Performance Index (PI) %	An aggregate banking performance indicator at country level ranging from 0 to 100. Higher value indicates better performance.	Author's calculations
Profitability (ROA)%	Commercial banks' after-tax net income to yearly averaged total assets.	GFDD
Solvency (Regulatory capital to RWA)%	Regulatory capital to risk weighted assets: the capital adequacy of deposit takers. It is a ratio of total regulatory capital to its assets held, weighted according to risk of those assets.	GFDD
Asset quality (reciprocal of NPLs ratio)%	Gross loans to non-performing loans: ratio of total gross loans to defaulting loans.	GFDD
Liquidity (Liquidity ratio)%	Liquid assets to deposits and short-term funding: the ratio of the value of liquid assets (easily converted to cash) to short-term funding plus total deposits.	GFDD
Efficiency (reciprocal of CI ratio)%	Income to cost ratio: sum of net-interest revenue and other operating income to operating expenses of a bank.	GFDD
Financial inclusion		
Deposits to GDP%	Outstanding deposits with commercial banks as a % of GDP	FAS
Loans to GDP%	Outstanding loans from commercial banks as a % of GDP	FAS
Number of deposits	Number of deposit accounts with commercial banks per 1000 adults	FAS
Number of borrowers	Number of borrowers from commercial banks per 1000 adults	FAS
Control variables		
GDP growth%	Annual percentage change of gross domestic product	WDI
Inflation%	Annual percentage change of consumer prices	WDI
Lerner index%	A measure of market power in the banking market. It compares output pricing and marginal costs (as percentage).	GFDD
Population density	Population divided by land area in square kilometres.	WDI
High income dummy	Dummy variable that is equal to 1 if the country is classified by the World Bank as high income or upper middle income and 0 otherwise	Author's calculations
Low income dummy	Dummy variable that is equal to 1 if the country is classified by the World Bank as low income or lower middle income and 0 otherwise	Author's calculations

Appendix D: Performance index decomposition and financial inclusion

In this section we analyse the results derived from estimating Equation (3.2) replacing the performance index as the dependent variable with the variables used to construct the index. In other words, we test the relationship between the financial inclusion indicators and each measure of performance: profitability, solvency, asset quality, liquidity, and efficiency. The models are estimated using ordinary least squares (OLS) with country and time fixed effects; in all regression estimations we use standard errors clustered at the country level.

D.1 Financial inclusion and profitability

Table D.1 reports the results where the dependent variable is profitability measured by return on assets. Models (1)-(4) test the relationship between bank profitability and deposits to GDP, loans to GDP, number of deposits, and number of borrowers, respectively.

We find that financial inclusion as measured by banks' deposits to GDP, number of deposits, and number of borrowers has no significant effect on banks' profitability. Nonetheless, loans to GDP show a negative and statistically significant association with banks' profitability (Model 2). The literature provides three possible explanations for this negative relationship. First, credit to GDP (loans to GDP) also measures the development of the financial system in the country and higher development indicates higher competition in these developed economies. High competition might have an effect on lowering prices and in turn lowers bank profitability (Demirgüç-Kunt and Huizinga, 1999). Second, increased loans relative to GDP might indicate higher exposure to bad loans and hence lower profitability which in extreme cases can lead to a financial crisis. Demirgüç-Kunt and Detragiache (2005) also find that larger exposure of credit to the private sector increases banks' vulnerability that they explain by mismanagement of liberalisation. Finally, high inclusion in the financial system in terms of deposits or loans can be

expensive for banks due to the required operational costs, such as cost of monitoring, branches, and other transaction costs (Flamini et al., 2009).

Table D.1: Financial inclusion and bank profitability

	Model (1)	Model (2)	Model (3)	Model (4)
L. deposits to GDP	-0.0028 (-1.53)			
L. loans to GDP		-0.0045** (-3.60)		
L. number of deposits			0.0000 (0.13)	
L. number of borrowers				0.0003 (0.51)
GDP growth	0.0125** (4.18)	0.0103** (3.51)	0.0157** (3.55)	0.0125** (3.02)
Inflation	0.0057* (1.94)	0.0055** (2.14)	0.0055 (1.00)	0.0027 (0.91)
Lerner index	0.0145** (7.65)	0.0142** (7.72)	0.0134** (4.98)	0.0143** (4.85)
Population density	-0.0004** (-5.63)	-0.0003** (-6.28)	0.0044** (3.33)	-0.0004** (-2.35)
Time fixed effects	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes
Clustering	yes	yes	yes	yes
Observations	967	981	545	438
Adjusted R-squared	0.357	0.358	0.359	0.315

Note: The table reports the regression results of estimating the relation between financial inclusion and bank profitability. The dependent variable is the return on assets (ROA). The main independent variables are lagged financial inclusion indicators: (i) deposits to GDP, (ii) loans to GDP, (iii) number of deposits, and (iv) number of borrowers. Control variables include a set of country-specific characteristics: (i) GDP growth, (ii) inflation, (iii) Lerner index, and (iv) population density. The regressions are run on the full sample of 131 countries covering the period of 2005-2014. Robust t-statistics are reported under the coefficients in parentheses. Standard errors are clustered at the country level. *, **,*** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

D.2 Financial inclusion and solvency

Table D.2 reports the results where the dependent variable is bank solvency measured by regulatory capital to risk weighted assets and the financial inclusion is in turn measured by deposits to GDP, loans to GDP, number of deposits, and number of borrowers (Models (1)-(4), respectively) .

We find that deposits to GDP and number of deposits have no significant effect on banks' solvency (Models (1 and 3) of Table D.2). However, Models (2) and (4) show a significant negative association between Loans to GDP and number of borrowers, and banks' solvency. As performance indicators are inter-related, we can explain this result by the increased credit risk associated with extending credit to a larger number of borrowers. This type of inclusion expose banks to a higher level of adverse selection problems, this can be reflected in banks' earnings and equity capital negatively (Demirgüç-Kunt and Detragiache, 2005).

Table D.2: Financial inclusion and bank solvency

	Model (1)	**Model (2)**	**Model (3)**	**Model (4)**
L. deposits to GDP	0.0024 (1.14)			
L. loans to GDP		-0.0033* (-1.90)		
L. number of deposits			-0.0000 (-0.20)	
L. number of borrowers				-0.0014** (-3.77)
GDP growth	-0.0030 (-0.75)	-0.0026 (-0.66)	-0.0029 (-0.61)	-0.0021 (-0.42)
Inflation	-0.0022 (-0.47)	-0.0015 (-0.31)	0.0002 (0.04)	-0.0144** (-4.16)
Lerner index	0.0074** (3.68)	0.0066** (3.47)	0.0068** (2.04)	0.0046* (1.96)
Population density	0.0002* (1.80)	0.0004** (3.31)	0.0025 (1.12)	0.0007** (6.61)
Time fixed effects	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes
Clustering	yes	yes	yes	yes
Observations	750	767	453	357
Adjusted R-squared	0.262	0.275	0.295	0.328

Note: The table reports the regression results of estimating the relation between financial inclusion and bank solvency. The dependent variable is the regulatory capital to RWA. The main independent variables are lagged inclusion indicators: (i) deposits to GDP, (ii) loans to GDP, (iii) number of deposits, and (iv) number of borrowers. Control variables include a set of country-specific characteristics: (i) GDP growth, (ii) inflation, (iii) Lerner index, and (iv) population density. The regressions are run on the full sample of 131 countries covering the period of 2005-2014. Robust t-statistics are reported under the coefficients in parentheses. Standard errors are clustered at the country level. *, **,*** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

D.3 Financial inclusion and asset quality

Table D.3 reports the results where the dependent variable is banks' asset quality measured by gross loans to non-performing loans and the financial inclusion is in turn measured

by deposits to GDP, loans to GDP, number of deposits, and number of borrowers (Models (1)-(4), respectively).

We find that loans to GDP, number of deposits, and number of borrowers show no significant effect on banks' asset quality. However, we find a negative association between deposits to GDP and asset quality (Model (1)). A possible explanation for this finding is that banks' reliance on deposits is more expensive than other sources of funding (e.g., interbank loans), which in turn might motivate banks to invest in risky assets and hence increase their non-performing loans (Demirgüç-Kunt and Detragiache, 2005, Flamini et al., 2009). A high positive correlation between deposits and loans to GDP is often found in developed economies.

Table D.3: Financial inclusion and bank asset quality

	Model (1)	**Model (2)**	**Model (3)**	**Model (4)**
L. deposits to GDP	-0.0044**			
	(-2.03)			
L. loans to GDP		-0.0033		
		(-1.00)		
L. number of deposits			0.0001	
			(0.46)	
L. number of borrowers				0.0000
				(0.03)
GDP growth	0.0222**	0.0197**	0.0238**	0.0116*
	(5.44)	(4.63)	(3.79)	(1.74)
Inflation	0.0049	0.0047	0.0095	0.0029
	(1.36)	(1.38)	(1.54)	(0.84)
Lerner index	0.0043*	0.0039*	0.0047	0.0033
	(1.98)	(1.83)	(1.37)	(1.31)
population density	0.0009**	0.0011**	0.0032	0.0004**
	(3.81)	(3.70)	(1.12)	(2.53)
Time fixed effects	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes
Clustering	yes	yes	yes	yes
Observations	741	759	451	354
R-squared	0.3875	0.3760	0.3429	0.3895
Adjusted R-squared	0.274	0.262	0.203	0.241

Note: The table reports the regression results of estimating the relation between financial inclusion and bank asset quality. The dependent variable is the gross loans to NPLs. The main independent variables are lagged inclusion indicators: (i) deposits to GDP, (ii) loans to GDP, (iii) number of deposits, and (iv) number of borrowers. Control variables include a set of country-specific variables: (i) GDP growth, (ii) inflation, (iii) Lerner index, and (iv) population density. The regressions are run on the full sample of 131 countries covering the period of 2005-2014. Robust t-statistics are reported under the coefficients in parentheses. Standard errors are clustered at the country level. *, **,*** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

D.4 Financial inclusion and liquidity

Table D.4 reports the results where the dependent variable is liquidity measured by liquid assets to deposits and short-term funding. Models (1)-(4) include in turn our four financial inclusion indicators (deposits to GDP, loans to GDP, number of deposits, and number of borrowers, respectively). The results show that all the inclusion indicators examined have no significant effect on banks' liquidity.

Table D.4: Financial inclusion and bank liquidity

	Model (1)	**Model (2)**	**Model (3)**	**Model (4)**
L. deposits to GDP	-0.0016 (-1.15)			
L. loans to GDP		-0.0018 (-1.33)		
L. number of deposits			0.0001 (0.99)	
L. number of borrowers				-0.0002 (-0.45)
GDP growth	0.0023 (0.76)	0.0032 (1.04)	-0.0024 (-0.54)	0.0082* (1.85)
Inflation	-0.0023 (-0.63)	-0.0015 (-0.42)	-0.0093 (-1.49)	-0.0017 (-0.38)
Lerner index	0.0045** (2.57)	0.0047** (2.47)	0.0070** (2.26)	0.0058** (2.35)
population density	-0.0001 (-0.43)	-0.0001 (-0.69)	0.0019 (0.82)	-0.0004** (-2.64)
Time fixed effects	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes
Clustering	yes	yes	yes	yes
Observations	974	988	545	439
Adjusted R-squared	0.243	0.231	0.317	0.302

Note: The table reports the regression results of estimating the relation between financial inclusion and liquidity. The dependent variable is the liquid assets to deposits and short-term funding. The main independent variables are lagged inclusion indicators: (i) deposits to GDP, (ii) loans to GDP, (iii) number of deposits, and (iv) number of borrowers. Control variables include a set of country-specific characteristics: (i) GDP growth, (ii) inflation, (iii) Lerner index, and (iv) population density. The regressions are run on the full sample of 131 countries covering the period of 2005-2014. Robust t-statistics are reported under the coefficients in parentheses. Standard errors are clustered at the country level. *, **,*** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

D.5 Financial inclusion and efficiency

Table D.5 reports the results where the dependent variable is efficiency measured by the income to cost ratio and the financial inclusion is in turn measured by deposits to GDP, loans to GDP, number of deposits, and number of borrowers (Models (1)-(4), respectively).

Table D.5: Financial inclusion and bank efficiency

	Model (1)	Model (2)	Model (3)	Model (4)
L. deposits to GDP	-0.0008			
	(-0.49)			
L. loans to GDP		0.0011		
		(0.52)		
L. number of deposits			0.0002**	
			(2.16)	
L. number of borrowers				0.0004
				(1.12)
GDP growth	0.0036*	0.0034	0.0009	0.0068**
	(1.66)	(1.58)	(0.26)	(2.37)
Inflation	0.0052**	0.0054**	0.0080**	0.0019
	(2.15)	(2.23)	(2.27)	(0.75)
Lerner index	0.0134**	0.0125**	0.0166**	0.0108**
	(6.41)	(6.26)	(5.52)	(4.14)
population density	-0.0002**	-0.0002**	0.0017*	-0.0002*
	(-2.66)	(-3.30)	(1.71)	(-1.99)
Time fixed effects	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes
Clustering	yes	yes	yes	yes
Observations	973	987	544	439
Adjusted R-squared	0.465	0.456	0.554	0.525

Note: The table reports the regression results of estimating the relation between financial inclusion and efficiency. The dependent variable is the Income to cost ratio. The main independent variables are the inclusion indicators: (i) deposits to GDP, (ii) loans to GDP, (iii) number of deposits, and (iv) number of borrowers. Control variables include country-specific characteristics: (i) GDP growth, (ii) inflation, (iii) Lerner index, and (iv) population density. The regressions are run on the full sample of 131 countries covering the period of 2005-2014. Robust t-statistics are reported under the coefficients in parentheses. Standard errors are clustered at the country level. *, **,*** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

In Models (1), (2), and (4) we find that bank deposits to GDP, loans to GDP, and number of borrowers have no significant association with banks' efficiency. However, we find a positive and significant association between the number of deposits and banks' efficiency (Model (3)). In other words, an increase in the number of deposit accounts with commercial banks seems to have

a positive effect on banks' efficiency. This can be expected as banks can reach more depositors they can become more efficient by exploiting scale economies through their service platforms, branches, credit scoring systems, IT infrastructures, and expertise (De la Torre et al., 2010).

Appendix E: Literature review – Financial inclusion index

This table summarises the studies that construct a financial inclusion index through selected indicators.

Author (year)	Country	Dimensions	Methodology	Data	Year
Sarma (2008) and Sarma (2012)	Cross-country	Penetration	Distance based approach	World development indicators	2004 (in Sarma (2008))
		Availability		International financial statistics	2004-2010 (in Sarma (2012))
		Usage			
Chakravarty and Pal (2013)	India	Penetration	Axiomatic approach	Basic Statistical Returns of Scheduled Commercial Banks	1972-2009
		Accounts			
		Deposit/credit-income ratio		Reserve Bank of India	
Cámara and Tuesta (2014)	Cross-country	Usage	Principal component analysis	World Bank's Global Findex (2011)	2011
		Access		IMF's Financial Access Survey (FAS)	
		Barriers			
De Sousa (2015)	Cross-country	Traditional instruments	Principal component analysis	World Bank's Global Findex (2011)	2011
		Innovative instruments			
Mialou et al. (2017)	Cross-country	Outreach	Common factor analysis	IMF's Financial Access Survey (FAS)	2009-2012
		Usage			
(Park and Mercado JR, 2018a)	Cross-country	Availability	Distance based approach	World development indicators	Average value 2004-2012
		Usage			
Park and Mercado Jr (2018b)	Cross-country	Access	Principal component analysis	World Bank's Global Findex (2011) and (2014)	2011 and 2014
		Availability			
		Usage			

Appendix F: Variables definition and data sources

The table summarises the indicators used to construct the financial inclusion three dimensions and provides variables definition and data sources for the variables used in our empirical analysis.

Variables	Definition	Source
Financial inclusion dimensions		
Availability (Demographic)	Branches of commercial banks per 100,000 adults	FAS
	Automated Teller Machines (ATMs) per 100,000 adults	FAS
Accessibility	Deposit accounts with commercial banks per 1,000 adults	FAS
	Loan accounts with commercial banks per 1,000 adults	FAS
Usage	Bank deposits to GDP (%)	GFDD
	Domestic credit to private sector by banks (% of GDP)	GFDD
Dependent variables		
Financial inclusion Index (3Dim)	An aggregate financial inclusion indicator at country level ranging from 0 to 1. Higher value indicates higher inclusion. Includes three dimensions of financial inclusion: availability, access, and usage.	Author's calculations
Financial inclusion Index (2Dim)	An aggregate financial inclusion indicator at country level ranging from 0 to 1. Higher value indicates higher inclusion. Includes two dimensions of financial inclusion: availability and usage.	Author's calculations
Independent variables		
GDP growth	Annual percentage change of gross domestic product	WDI
Unemployment	Share of the labour force that is without work but available for and seeking employment. (% of total labour force)	WDI
GDP per capita	Gross domestic product divided by midyear population (Log).	WDI
Income inequality	Gini index measures the extent to which the distribution of income among individuals or households within an economy deviates from a perfectly equal distribution.	WDI
Bank concentration (Deposits)	The degree of concentration of deposits in the 5 largest banks.	Bank Regulation Surveys (Barth et al., 2012)
Lerner index	A measure of market power in the banking market. It compares output pricing and marginal costs (as percentage).	GFDD
Capital Regulatory Index	Sum of Overall Capital Stringency and Initial Capital Stringency. It ranges between 0-10.	Bank Regulation Surveys (Barth et al., 2012)
Financial freedom	An indicator of banking efficiency as well as a measure of independence from government control and interference in the financial sector. It ranges between 0-100.	Heritage
Polity	Measure of democracy. The POLITY score ranges from +10 (strongly democratic) to -10 (strongly autocratic).	The Centre for Systemic Peace
Individuals using the Internet (% of population)	Internet users are individuals who have used the Internet (from any location) in the last 3 months. The Internet can be used via a computer, mobile phone, personal digital assistant, games machine, digital TV etc.	WDI

Education index	An average of mean years of schooling (of adults) and expected years of schooling (of children), both expressed as an index obtained by scaling with the corresponding maxima. It ranges between 0-1.	UN human developments reports
Age dependency ratio	The ratio of dependents (people younger than 15 or older than 64) to the working-age population (those ages 15-64). (% of working-age population)	WDI
Human development index (HDI)	Summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living. It ranges between 0-1.	UN human developments reports
Alternative tests		
Bank concentration (Assets)	Assets of five largest banks as a share of total commercial banking assets.	Bank Regulation Surveys (Barth et al., 2012)
Initial Capital Stringency	Whether certain funds may be used to initially capitalise a bank and whether they are officially.	Bank Regulation Surveys (Barth et al., 2012)
Overall Capital Stringency	Whether the capital requirement reflects certain risk elements and deducts certain market value losses from capital before minimum capital adequacy is determined.	Bank Regulation Surveys (Barth et al., 2012)
Independence of Supervisory Authority-Bank	The degree to which the supervisory authority is protected by the legal system from the banking industry.	Bank Regulation Surveys (Barth et al., 2012)
Interest rate spread (lending rate minus deposit rate, %)	Interest rate spread is the interest rate charged by banks on loans to private sector customers minus the interest rate paid by commercial or similar banks for demand, time, or savings deposits.	WDI
Stock market turnover ratio (%)	Ratio of the value of total shares traded to average real market capitalisation.	GFDD
Market capitalisation of listed domestic companies (% of GDP)	The share price times the number of shares outstanding for listed domestic companies.	WDI
Rule of Law	It captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.	WGI
Government integrity	Derived by averaging scores for the following factors, all of which are weighted equally: public trust in politicians, irregular payments and bribes, transparency of government policymaking, absence of corruption, perceptions of corruption, and governmental and civil service transparency.	Heritage
Regulatory Quality	Captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.	WGI
Gender Inequality Index	The index reflects gender-based disadvantage in three dimensions; reproductive health, empowerment and the labour market. It ranges from 0, where women and men fare equally, to 1, where one gender fares as poorly as possible in all measured dimensions.	UN human developments reports

Appendix G: Correlations

The table reports key correlations for the variables used in our main empirical analysis.

	Financial inclusion Index	**GDP growth**	**Unemployment**	**GDP per capita**	**Income inequality**	**Bank concentration (Deposits)**	**Lerner index**	**Capital Regulatory Index**	**Financial freedom**	**Polity**	**Individuals using the Internet**	**Education index**	**Age dependency**
Financial inclusion Index	1												
GDP growth	-0.24***	1											
Unemployment	0.13***	-0.07***	1										
GDP per capita	0.70***	-0.15***	-0.26***	1									
Income inequality	-0.37***	0.17***	-0.04	-0.42***	1								
Bank concentration (Deposits)	-0.22***	-0.02	0.07**	-0.12***	-0.08**	1							
Lerner index	-0.01	0.09***	0.01	-0.05**	0.02	0.05*	1						
Capital Regulatory Index	0.06	-0.07***	0	-0.02	-0.04	-0.08***	-0.01	1					
Financial freedom	0.55***	-0.12***	-0.01	0.52***	-0.20***	-0.03	-0.09***	-0.10***	1				
Polity	0.51***	-0.19***	0.12***	0.24***	-0.02	-0.12***	-0.22***	0.03	0.51***	1			
Individuals using the Internet	0.80***	-0.28***	-0.10***	0.76***	-0.49***	-0.08***	-0.09***	0.05**	0.55***	0.35***	1		
Education index	0.73***	-0.21***	-0.07***	0.62***	-0.50***	-0.09***	-0.08***	0.01	0.51***	0.40***	0.81***	1	
Age dependency	-0.65***	0.12***	0.13***	-0.47***	0.36***	0.13***	0.01	-0.03	-0.34***	-0.14***	-0.65***	-0.75***	1
Human development index (HDI)	0.81***	-0.20***	-0.12***	0.70***	-0.45***	-0.11***	-0.07***	0	0.53***	0.35***	0.84***	0.95***	-0.82***

Appendix H: Principal component analysis results – Two-dimensional index

The table reports the computed weights for each indicator in the sub-indices and each sub-index in our two-dimensional financial inclusion index (excluding the accessibility dimension).

Indices	Indicators	Normalised weight
Availability	Branches of commercial banks per 100,000 adults	0.632
	Automated Teller Machines (ATMs) per 100,000 adults	0.368
Usage	Bank deposits to GDP (%)	0.416
	Domestic credit to private sector by banks (% of GDP)	0.584
Financial inclusion index	Availability	0.582
	Usage	0.418

Appendix I: Two-dimensional financial inclusion index ranking

The table reports the average financial inclusion index by country over the period 2004-2015 for 173 countries. The countries are ranked from the most inclusive (highest index score) to the least inclusive (lowest index score).

Country	Index mean	Rank	Country	Index mean	Rank	Country	Index mean	Rank
Luxembourg	0.920	1	Vanuatu	0.276	61	Pakistan	0.099	121
Spain	0.916	2	Czech Republic	0.275	62	Cambodia	0.096	122
Portugal	0.821	3	Kuwait	0.274	63	Swaziland	0.092	123
Cyprus	0.776	4	Guatemala	0.274	64	Kenya	0.092	124
Switzerland	0.731	5	St. Vincent and the Grenadines	0.267	65	Libya	0.089	125
Iceland	0.716	6	Macedonia	0.263	66	Togo	0.088	126
Canada	0.688	7	Morocco	0.260	67	Senegal	0.088	127
Hong Kong (China)	0.666	8	Lithuania	0.259	68	Solomon Islands	0.084	128
Japan	0.640	9	Sao Tome and Principe	0.259	69	Angola	0.078	129
Republic of Korea	0.618	10	United Arab Emirates	0.259	70	Algeria	0.078	130
Bulgaria	0.617	11	Hungary	0.253	71	Nigeria	0.075	131
Australia	0.601	12	Qatar	0.248	72	Ghana	0.068	132
Denmark	0.597	13	South Africa	0.248	73	Mauritania	0.068	133
Italy	0.587	14	Turkey	0.247	74	Kyrgyz Republic	0.067	134
Macao (China)	0.531	15	Costa Rica	0.244	75	Cote d'Ivoire	0.065	135
United States	0.529	16	Tonga	0.231	76	Mozambique	0.065	136
Ireland	0.529	17	Tunisia	0.230	77	Benin	0.065	137
Malta	0.527	18	Albania	0.223	78	Mali	0.063	138
New Zealand	0.524	19	Samoa	0.222	79	Haiti	0.061	139
France	0.515	20	Honduras	0.221	80	Papua New Guinea	0.061	140
Greece	0.495	21	Namibia	0.219	81	Lao People's Dem	0.059	141
Lebanon	0.482	22	Fiji	0.219	82	Syrian Arab Republic	0.059	142
Mongolia	0.478	23	Georgia	0.217	83	Timor-Leste	0.058	143
Slovenia	0.447	24	Kosovo, Republic	0.215	84	Burkina Faso	0.057	144
Bahamas, The	0.446	25	Ukraine	0.198	85	Gabon	0.055	145
Croatia	0.442	26	Vietnam	0.194	86	Lesotho	0.054	146
Netherlands	0.435	27	Trinidad and Tobago	0.192	87	Liberia	0.051	147
Colombia	0.422	28	El Salvador	0.184	88	Tajikistan	0.049	148
Germany	0.410	29	Nepal	0.182	89	Ethiopia	0.047	149
Austria	0.405	30	Uruguay	0.178	90	Zambia	0.046	150
Grenada	0.399	31	Venezuela	0.178	91	Rwanda	0.046	151
Israel	0.394	32	Saudi Arabia	0.178	92	Myanmar	0.045	152
Montenegro	0.384	33	Armenia	0.177	93	Comoros	0.043	153
Sweden	0.380	34	India	0.177	94	Burundi	0.042	154

Russian Federation	0.376	35	Sri Lanka	0.169	95	Iraq	0.041	155
Thailand	0.366	36	Bolivia	0.166	96	Tanzania	0.040	156
Malaysia	0.364	37	Bhutan	0.166	97	Uganda	0.034	157
Singapore	0.360	38	Maldives	0.161	98	Guinea-Bissau	0.033	158
Brazil	0.356	39	Mexico	0.160	99	Sudan	0.033	159
St. Lucia	0.356	40	Suriname	0.157	100	Malawi	0.031	160
Mauritius	0.349	41	West Bank and Gaza	0.156	101	Madagascar	0.028	161
China	0.344	42	Ecuador	0.153	102	Cameroon	0.028	162
Latvia	0.341	43	Kazakhstan	0.153	103	Yemen, Republic	0.028	163
Estonia	0.341	44	Paraguay	0.152	104	Equatorial Guinea	0.027	164
Panama	0.338	45	Moldova	0.148	105	Republic of Congo	0.027	165
Barbados	0.334	46	Indonesia	0.143	106	Niger	0.027	166
Serbia, Republic	0.327	47	Philippines	0.141	107	Sierra Leone	0.024	167
Belgium	0.324	48	Argentina	0.141	108	Afghanistan	0.022	168
Romania	0.324	49	Guyana	0.140	109	Guinea	0.018	169
Cabo Verde	0.317	50	Micronesia	0.136	110	Central African	0.013	170
Norway	0.316	51	Botswana	0.135	111	South Sudan	0.009	171
Bosnia and Herzegovina	0.314	52	Egypt	0.132	112	Congo (Democratic Rep)	0.008	172
Poland	0.314	53	Dominican Republic	0.129	113	Chad	0.005	173
Slovak Republic	0.303	54	Peru	0.128	114			
Belize	0.302	55	Jamaica	0.125	115			
Brunei Darussalam	0.300	56	Bangladesh	0.122	116			
Jordan	0.294	57	Azerbaijan	0.117	117			
Finland	0.288	58	Djibouti	0.109	118			
Chile	0.286	59	Belarus	0.107	119			
Iran	0.281	60	Nicaragua	0.103	120			