Financial Inclusion in Islamic vs. Non-Islamic Countries, FinTech and Bank Competition

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ABBREVIATIONS

ATM - Automated Teller Machine

BCP - Basel Core Principles

BEEPS - Business Environment and Enterprise Performance Survey

CGAP - Consultative Group to Assist the Poor

CPI - Consumer Price Index

FAS - Financial Access Survey

FEF - Faser Economic Freedom

ETA - Equity To Asset Ratio

FinTech - Financial Technology

FII - Financial Inclusion Index

FSB - Financial Stability Board

GCCC - Gulf Cooperation Council countries

GDP - Gross Domestic Product

GFD - Global Findex Development

GFDD - Global Financial Development Database

GFI- Global FinTech Index

GMM - Generalized Method of Moments

GNI - Gross National Income

GPFI - Global Partnership for Financial Inclusion

HDI - Human Development Index

IT - Information Technologies

IMF - International Monetary Fund

MENA - Middle East and North Africa

OECD - The Organisation for Economic Co-operation and Development

OIC - Organisation of Islamic Cooperation

OLS - Ordinary Least Squares

PCA - Principal Component Analysis

ROA - Return On Assets

PSTN - public switched telephone network

SMEs - Small and Medium Enterprises

SMS - Short Message Service

SWIID - Standardized World Income Inequality Database

UN - United Nations

UN SDGs - United Nation’s Sustainable Development Goals

WBL - Women Business and Law

WDI - World Bank Development Indicators

WGI - Worldwide Governance Indicators

ABSTRACT

This thesis consists of three empirical papers on contemporary issues associated with factors that explain differences in financial inclusion. In particular the focus is on the determinants of financial inclusion and differences in account ownership according to gender, Financial Technology (FinTech) and bank competition and stability.

The first empirical chapter examines the determinants of financial inclusion across Islamic and non-Islamic countries measured as differences in account ownership with a focus on gender differences from 2011 to 2017. This chapter investigates the patterns of financial inclusion and considers potential determinants of financial inclusion across five dimensions: macroeconomic, social, institutional, technological, and banking. The main findings suggest that most of our chosen determinants (non-discrimination against women, human development index, gender inequality, government integrity, mobile subscription, and individuals using the internet) are important drivers of financial inclusion across the full sample. Focusing on differences in determinants of financial inclusion across male and female account ownership in Islamic and non-Islamic countries, we find that GDP per capita positively influences male and female account ownership in non-Islamic countries.

The second empirical chapter investigates the relationship between FinTech and FI using a global dataset of 46 countries over the period 2007-2019. Results demonstrate that FinTech strongly improves financial inclusion. In addition, the effects of FinTech on financial inclusion appear stronger in countries with relatively low levels of economic development, low levels of income inequality and high levels of FinTech.

The third empirical chapter explores the association between financial inclusion and bank stability taking into the account the effect of bank competition. We use a sample of 241 banks in Middle East and North Africa countries (MENA) countries for the period 2012-2021. We

construct a country-level index of financial inclusion using Principal Component Analysis (PCA). Our evidence illustrates a positive and significant relationship between financial inclusion and bank stability in MENA countries. Our results also suggest that high market power (measured using the Lerner index) is positively associated with bank stability. In addition, our result also indicates that bank competition only improves financial inclusion strategies that involve credit growth.

Chapter 1

1.1 Introduction

This thesis covers three main topics associated with financial inclusion, that is, the access to useful and affordable financial services that meet the needs of all individuals and businesses within the economy

The first empirical chapter investigates the determinants of financial inclusion across Islamic and non-Islamic countries with a focus on the gender gap. The second empirical chapter explores the relationship between FinTech and financial inclusion in developed versus developing countries. The third and final empirical chapter examines the relationship between financial inclusion and bank stability in MENA countries, examining in particular the interaction effect of competition on the relationship between financial inclusion and bank stability. The study also constructs a financial inclusion index and offers an investigation on the progress of financial inclusion and the most current trends.

A well-functioning financial system supports economic activity through savings, credit, payments, and risk management products for people (Demirgüç-Kunt and Klapper, 2012). These functions have been shown to exert robust, independent and positive effects on economic growth (Demirgüç-Kunt and Maksimovic, 1998; Levine and Zervos, 1998; Beck and Levine, 2004). Financial institutions perform these functions by reducing information asymmetries, providing liquidity, and lowering transaction costs to channel savings towards the productive sectors of the economy (Rajan and Zingales, 1998; Demirgüç-Kunt et al., 2008).

Given the important role that financial institutions and systems play in economic activities, it is vital that all people regardless of their social and economic status have access and can use financial products and services, that is, that they are financially included. Financial inclusion refers to the ability of individuals and businesses to access useful and affordable financial products and services that meet their needs, such as loans, insurance, and pension. The World Bank has highlighted that financial inclusion can help achieve eight of the seventeen United Nation's Sustainable Development Goals (UN SDGs) including reducing poverty and promoting gender equality.[1] The increased access to and use of financial services in developing countries and by women is, in turn, expected to enhance economic security and prosperity, decrease income inequality, and maintain financial stability (Trivelli et al., 2018). Financial markets can thrive when financial systems become more inclusive and may have a greater impact on monetary, fiscal, macro-prudential, and macro-structural policies (Sahay and Cihak, 2018).

Despite the importance of financial inclusion, around 1.4 billion people worldwide are identified as "unbanked", that is, they do not own a formal transaction account, a crucial measure of financial inclusion (World Bank, 2021). Socio-cultural and institutional factors, including the role of religion, can act as obstacles to financial inclusion, particularly for some groups, such as women. In addition, the literature suggests that Muslims are less likely to own an account and save at a formal financial institution compared to non-Muslims, with religious reasons being possible strong motives for their decisions (Okumus, 2005; Bhattacharaya and Wolde, 2010; Lee et al., 2011; Demirgüc-Kunt and Klapper, 2013; Sani et al., 2016). In this regard, an inclusive financial system allows broader access to financial services, without any obstacles, and benefits poor people and other disadvantaged groups (Demirgüç-Kunt and Klapper, 2012). Financial inclusion is displayed in three main dimensions including (i) access to financial services, (ii)

[1] The SDGs were adopted in 2015 by the United Nations and they are a collection of 17 'global goals' aimed at ending poverty, protecting the planet, and ensuring prosperity of all people by 2030 (https://sdgs.un.org/).

usage of financial services, and (iii) quality of product and service delivery (Global Partnership for Financial Inclusion (GPFI), 2016).

In the absence of an inclusive financial system, less wealthy individuals would have to rely on their limited savings and informal mechanisms for loans to finance their day-to-day personal needs and protect themselves against uneven cash flows, seasonal income and emergencies. In addition, those financially excluded are forced to depend on money lenders who charge higher interest rates than banks and may require tangible assets as collateral in times of crisis (Demirgüç-Kunt et al., 2012). The implications of a less inclusive economy are slower growth and persistent inequalities. Given its important role, regional organisations, national governments, and policymakers have prioritised financial inclusion as a strategy to reduce poverty and inequality. These efforts have led to remarkable progress in financial inclusion in the last couple of decades. For instance, the World Bank's Global Financial Index (Global Findex) Report 2021 revealed that account ownership (that is, bank and mobile money accounts) as a percentage of the global population has increased from 51% to 76% between 2011 and 2021.

An issue that impacts the level of financial inclusion is the gender gap. In many countries, there exists a gender gap particularly in relation to access to and usage of financial services. For instance, Demirguc-Kunt et al. (2018) report that 72% of men and 65% of women have a bank account ownership globally, while Chen et al. (2021) estimate about an 8% gender gap between males (29%) and females (21%) in the use of FinTech products and services. Similarly, Fanta and Mutsonziwa (2016) note that the gender gap between account usage is estimated to be wider relative to account ownership. Nevertheless, the ease of access and use of FinTech can increase the formalisation of women in financial services as well as protect and educate them about fraud and unfair transactions (Sioson and Kim, 2019). For instance, Suri and Jack (2016) show that the use of mobile money in Kenya (known as M-pesa) by women increase their consumption and their work prospect.

The recent increase in account ownership in developed countries in Sub-Saharan Africa is driven by a range of factors including FinTech (mobile money technology) and increased gender participation among others. According to the Financial Stability Board (FSB, 2019) FinTech refers to "technologically enabled financial innovation that could result in new business models, applications, processes or products with an associated material effect on financial markets and institutions, and the provision of financial services." FinTech should reduce the search cost of matching transacting parties, achieve economies of scale in gathering and using large data, reduce the cost of information transmission and reduce verification costs (Thakor, 2020; Philippon, 2019). Over the past few decades, financial innovation has opened-up new delivery channels, financial products and services, and providers have pushed the boundaries to financial access and increased the bankable and banked population in developing countries. This growth in financial innovation, largely driven by mobile money technology, enabled these countries to bypass the need for traditional banking models (brick-and-mortar branches) and make substantial improvements in financial inclusion (Beck, 2020).

Another aspect of financial inclusion that has generated interest is whether financial intermediaries also benefit from its impact in a similar way to households. It is argued that banks have relatively superior skills and technical capacity which can be used in offering financial services to the unbanked at a lower cost, without compromising their soundness. Further, banks in an inclusive financial system can reduce their overall risk exposure to wholesale funding volatility by diversifying their retail deposits (Ahamed and Mallick, 2019). Another angle of interest is how competition affects the financial inclusion and bank stability nexus. Broadly, competition is expected to drive down bank market power by increasing innovation and efficiency and hence reducing the cost per unit. However, another school of thought is that competition can be detrimental to financial inclusion by reducing the need for relationship-

building and the use of soft information, which in turn, exacerbate financial exclusion (Petersen and Rajan, 1995; Dell'Ariccia and Marquez, 2004; Agarwal and Ben-Davies, 2018).

1.2 Aims and Contributions of the Thesis

The first empirical chapter examines the determinants of financial inclusion across Islamic and non-Islamic countries and the differences in this effect on male and female account ownership. This study considers a wide range of potential determinants of financial inclusion across five dimensions, that is, macroeconomic, social, institutional, technological, and banking. The data on financial inclusion is drawn from the Global Findex database to examine its relationship with the determinants mentioned above using an OLS regression with country and year-fixed effects for a sample of 157 Islamic and non-Islamic countries over the period 2011-2017. Our results show that overall financial inclusion is relatively low in our sample countries and significantly lower for women in Islamic countries. We find that macroeconomic, social, institutional, technological, and banking factors are among the potential determinants of financial inclusion. Specifically, the results show that non-discrimination against women in employment, human development, and gender inequality have positive and significant associations with account ownership (the measure of financial inclusion). Our findings also indicate that GDP per capita (macroeconomic factor), non-discrimination against women in employment, human development index, gender inequality (social factors), government integrity (institutional factors), mobile subscriptions and individuals using the internet (technological factors), and bank competition measured with the Boone indicator (banking factor) are all important determinants of financial inclusion across Islamic and non-Islamic countries and across male and female account ownership. These results are useful for policymakers, especially in relation to enabling access to internet coverage and mobile subscriptions, particularly in less developed countries. Likewise, Islamic regions should adapt their banking systems and establish separate units that provide good

training in sharia-compliant financial instruments that could encourage self-excluded individuals due to their religious beliefs to participate in the financial system.

Previous studies attempt to address the determinants of financial inclusion, however, research on the gender gap in financial inclusion across Islamic versus non-Islamic countries is limited. Our study contributes to this literature by adding an overall exploratory analysis on financial inclusion across Islamic and non-Islamic countries and by considering the gender gap as an important variable across a global sample of countries. Moreover, we demonstrate the importance of specific country-level characteristics such as GDP, non-discrimination against women in employment, mobile phone subscriptions, individuals using the internet and gender inequality index, in enhancing financial inclusion by analysing a broad range of factors that could influence the level of financial inclusion across Islamic and non-Islamic countries.

The **second empirical chapter** investigates the relationship between financial technology (FinTech) and financial inclusion. In doing so, we also consider the effects of FinTech on financial inclusion based on country-level income (High GDP vs Low GDP), income inequality (High Gini vs Low Gini), and financial technology adoption (High Fintech vs Low Fintech). To examine the association between FinTech and financial inclusion, we use country-level data for 46 countries over the period 2008-2019. We collect the data for FinTech and financial inclusion from the IMF's Financial Access Survey (FAS). FinTech measures include the number of registered mobile money accounts per 1000 adults and the number of mobile money and internet banking transactions per 1000 adults. The measures of financial inclusion are the number of debit cards per 1000 adults and the number of credit cards per 1000 adults. Using OLS regression with country and year-fixed effects, we find that FinTech is positively and significantly associated with financial inclusion and suggest that the former improves the latter. Second, we find that the positive association between FinTech and financial inclusion is stronger in low GDP countries

compared to high GDP counterparts in our sample. This suggests that financial services in low GDP countries potentially draw in the unbanked population who are often excluded from the traditional banking sector. Further, the effect of FinTech on financial inclusion is higher in countries with high adoption of FinTech relative to those with low adoption of FinTech. The results suggest that policymakers should focus on enhancing the adoption of FinTech, especially in developing countries where access to financial services is still relatively low. FinTech provides easier access to financial services and represents a credible alternative to traditional banking channels. This paper contributes to the existing literature in several ways. Firstly, while the previous literature mainly focused on individual countries in assessing the relationship between FinTech and financial inclusion level (Hughes and Lonie, 2007; Mas, 2009; Demombynes and Thegeya, 2012; Gosavi 2018), we adopted a cross-country approach. Secondly, most studies focus on either cross-sectional data or World Bank Global Findex data that is released every three years. However, in this study, we make use of the FAS database that provides yearly data on FinTech. Furthermore, novel to this paper, we provide further analysis by exploring the relationship between FinTech and financial inclusion, distinguishing between countries with high or low income (GDP), income inequality, and financial technology adoption.

In the **third empirical chapter**, we investigate the effect of financial inclusion and banking sector competition on the stability of banks in the Middle East North Africa (MENA) countries. As first step in the empirical analysis, we attempt to establish if there is a relationship between financial inclusion and bank stability in our sample countries. Next, we examine the interacting effect of banking competition and financial inclusion on bank stability in MENA countries. The sample is composed of 1,361 bank-year observations for 241 MENA banks for the period from 2012 -2021. We combine data from several sources. Our bank-level data comes from BankFocus database; financial inclusion measures (access, depth, and credit growth) are taken from IMF's Financial Access Survey (FAS) and the Global Financial Development Database (GFDD). Using

the measures of financial inclusion (that is, access and depth) we construct a country-level financial inclusion index using the principal component analysis method.[2] We also construct the Lerner index (market power) as a proxy for (lack of) banking market competition. Bank stability is measured using the well-known Z-score (Laeven and Levine, 2009; Demirguc-Kunt and Huizinga, 2010; Beck et al., 2013) and the standard deviation of return on asset. Bank stability is regressed against the country-level measures of financial inclusion and competition using an OLS regression model with bank, country and year fixed effects. Our results suggest that financial inclusion is positively and significantly related to bank stability. Specifically, we find that the depth of financial inclusion (ratio of loans and deposits to GDP) and credit growth (ratio of private credit to GDP) are positively related to bank stability. The results also reveal that bank competition (measured using the Lerner index) is also positively related to bank stability. On the interacting effect of banking sector competition and financial inclusion, the evidence indicates that banking competition only improves the credit growth dimension of financial inclusion but not the access and depth dimensions. The results provide important insights for policymakers and regulators of the financial systems in the MENA countries, especially on the effect of financial liberalisation on the health of the financial sector. As our results indicate that a less competitive banking sector is not necessarily a bad thing. A less competitive banking sector can ensure that banks enhance their customer relations by exploiting existing relationships, which in turn scan draw in the opaque customers. The paper contributes to the literature in several ways. The study, to the best of our knowledge, is the first to examine how bank competition and financial inclusion affect bank stability in the MENA region. Given the recent progress financial development in the MENA region, the study provides some meaningful insights on these changes

[2] The access or availability dimension of financial inclusion covers both demographic and geographic measures. The demographic measures are (i) the number of bank branches per 1000 adults, and (ii) the number of ATMs per 100,000 adults, while the geographic measures are (iii) the number of bank branches per 1000 km2 and (iv) the number of ATMs per 100 km2. The depth dimension of financial inclusion is measured using Bank deposits and loans as a percentage of GDP.

(financial inclusion and competition) are shaping bank stability. Second, we contribute to the growing literature on competition, financial inclusion, and bank stability (Beck et al., 2013; Ahamed and Mallick, 2019). By focusing on the MENA region, our study provides depth to complement the cross-country evidence in prior studies.

1.3 Structure of the thesis

The remainder of the thesis is organised as follows. Chapter 2 presents the first empirical paper on financial inclusion and focuses on the differences across Islamic and non-Islamic countries and the issue of the gender gap. Additionally, the study attempts to investigate country-specific factors that explain differences in the level of financial inclusion across Islamic and non-Islamic countries, including macroeconomic, social, institutional, technological, and banking.

Chapter 3 provides the second empirical paper which focuses on studying the relationship between financial inclusion and FinTech. Specifically, we investigate whether the relationship is different across countries with different levels of economic development, income inequality, and high/low FinTech countries. Chapter 4 presents the third empirical paper that investigates the relationship between financial inclusion and bank stability in the MENA region. Moreover, it examines the interacting effect of competition on the relationship between financial inclusion and bank stability. Lastly, Chapter 5 concludes the thesis and offers an overview of the empirical papers, considers some limitations, and proposes some avenues for future research.

Chapter 2

Financial Inclusion and the Gender Gap across Islamic and Non-Islamic Countries

Abstract

Using the World Bank's Global Findex database, we provide an exploratory analysis of the patterns of financial inclusion and the gender gap among 56 Islamic and 101 non-Islamic countries during the period 2011 to 2017. We show that financial inclusion is still relatively low in our sample, but it is particularly challenging in the sampled Islamic countries and for women. Our study also suggests that macroeconomic (GDP per capita), social (non-discrimination, human development index, gender inequality), institutional (government integrity), technological (mobile subscription and individuals using the internet), and banking factors (Boone indicator) are important determinants of financial inclusion in Islamic countries compared to their non-Islamic counterparts. Further analysis of financial inclusion across male and female account ownership reveals disparities in the determinants of financial inclusion, especially, the social factors. Overall, the findings suggest that improvements in macroeconomic, social, institutional, and technological factors should enhance financial inclusion, especially for women in Islamic countries.

2.1 Introduction

Financial inclusion refers to the ability of individuals and businesses to access useful and affordable financial products and services that meet their needs, such as loans, insurance, and pension. The World Bank has highlighted that financial inclusion can help achieve eight of the seventeen United Nations Sustainable Development Goals (UN SDGs) including reducing

poverty and promoting gender equality. An increase in access and the use of financial services in developing countries, especially by women, is expected to enhance economic security and prosperity, decrease income inequality, and maintain financial stability (Trivelli et al., 2018). As such, an inclusive financial system is likely to have a greater impact on monetary, fiscal, macro-prudential, and macro-structural policies (Sahay and Cihak, 2018).

Despite the importance of financial inclusion, around 1.4 billion people worldwide are identified as "unbanked", that is, they do not own a formal transaction account, a crucial measure of financial inclusion (World Bank, 2021). Though a myriad of reasons has been offered for the low financial inclusion of this group, socio-cultural factors like religion and the gender gap are seen as te main obstacles to financial inclusion. The literature suggests that Muslims are less likely to own an account and save at a formal financial institution compared to non-Muslims, with religious reasons being possible strong motives for their decisions (Okumus, 2005; Bhattacharya and Wolde, 2010; Lee et al., 2011; Demirgüc-Kunt et al., 2013; Sani et al., 2016).

The study examines the determinants of financial inclusion with a specific focus on Islamic versus non-Islamic countries and differences in account ownership according to gender. The chapter explores the patterns of financial inclusion and considers potential determinants of financial inclusion across five dimensions: macroeconomic, social, institutional, technological, and banking. We sample 56 Islamic and 101 non-Islamic countries over the period 2011 to 2017 that are covered in the World Bank's Global Findex database.[3] The findings shed some light on the determinants of financial inclusion across our sample. Our data indicates that financial inclusion, proxied by "account ownership", is lower for females (under 60% as of 2017), but

[3] The Global Financial Inclusion (Global Findex) database is the world's most comprehensive source of data on saving, borrowing, making payments, and managing risks among adults. The data set has been published every three years since 2011; it is gathered from more than 150,000 adults in over 140 economies which are part of nationally representative surveys (see https://globalfindex.worldbank.org/).

much lower in Islamic countries (about 40% as of 2017). First, our baseline regression suggests that most of our determinants (non-discrimination against women in employment, human development index, gender inequality, government integrity, mobile subscriptions, and individuals using the internet) are important drivers of financial inclusion across the full sample. Secondly, examining differences between Islamic and non-Islamic countries, we find that social factors (non-discrimination, human development index, and gender inequality), institutional (government integrity), and technological factors (mobile subscription and individuals using the internet) affect account ownership across both Islamic and non-Islamic countries. Furthermore, we find that the Boone indicator (a measure of the degree of competition in the banking sector) and GDP per capita only influence financial inclusion in non-Islamic countries. Third, focusing on differences in determinants of financial inclusion across male and female account ownership in Islamic and non-Islamic countries, our findings reveal that GDP per capita positively influences male and female account ownership but only in non-Islamic countries. We also find that improvement in non-discrimination against women and human development index positively influence the proportion of female account ownership in Islamic and non-Islamic countries, while gender inequality decreases female financial inclusion. Furthermore, our results suggest that mobile phone subscriptions and the number of individuals using the internet are also important drivers of male and female account ownership across Islamic and non-Islamic countries. For the banking factors, we find that the Boone indicator (a measure of lack of competition) is negatively and significantly related to financial inclusion across non-Islamic countries. These results are the same across male and female account ownership in these countries. On the other hand, we find a positive but insignificant relation between the Boone indicator and financial inclusion in Islamic countries. Nonetheless, only male account ownership is positively and significantly related to financial inclusion in Islamic countries.

This chapter contributes to the existing literature on financial inclusion by considering a cross-country analysis of Islamic and non-Islamic countries, and a wide range of determinants across economic, social, technological, institutional, and banking dimensions to identify the factors that drive financial inclusion. As novel to the extant literature, we examine gender differences in the determinants of financial inclusion differentiating between Islamic and non-Islamic countries. Given that gender gaps are more pronounced in Islamic countries, our study provides useful evidence to support ongoing reforms in these countries aimed at integrating more women into economic activities, which in turn, will increase their demand for financial services and inclusion. Policymakers should consider the reasons behind the financial exclusion and the gender gap across Islamic and non-Islamic regions evidenced by this study and develop new policies that speed up financial inclusion such as providing larger access to internet coverage, easy mobile subscriptions, essential financial literacy courses in schools, and raise awareness about the existing financial exclusion and the recurrent biases.

The chapter is structured as follows. Section 2.2 reviews the relevant literature on financial inclusion and gender gap across Islamic and non-Islamic countries. Section 2.3 discusses the empirical framework, that is, the sample data, variables and econometrics approach used in this study. Section 2.4 discusses the results and Section 2.5 concludes the chapter and discusses policy implications and recommendations.

2.2 Literature Review

This literature review is organised in three parts: the first section reviews recent literature on determinants of financial inclusion. In the second section, we summarise the studies that investigate financial inclusion in relation to Islamic finance, whereas in the third section we discuss selected studies about financial inclusion and gender gap.

2.2.1 Determinants of Financial Inclusion

The determinants of financial inclusion have been studied both at individual level (e.g., Allen et al., 2016; Fungáčová and Weill, 2015; Kostov et al., 2015) and, more often, at country level (e.g., Beck et al., 2007; Honohan, 2008; Rojas-Suarez, 2010; Ardic et al., 2011; Allen et al., 2016; Demirgüç-Kunt et al., 2013; Owen and Pereira, 2018; Park and Mercado, 2018a,b; Kabakova and Plaksenkov, 2018).

Individual-level factors that have been shown to positively correlate with access to formal financial services include education, wealth and income, employment, age, urbanity, marital status, financial literacy, and business experience. In terms of gender, unsurprisingly, the evidence collected in the surveyed studies shows that men are typically more likely to be financially included, while women tend to be excluded, often due to lack of official identification and the widespread use of shared accounts with family members which in turn leads to women's higher usage of 'informal' financial services. Allen et al. (2016) evaluate individual characteristics on a global scale by using the 2012 World Bank Global Findex Database. They show that the possibility of owning an account with a formal financial institution is higher for educated, wealthy, employed, and married individuals. Individuals sharing these characteristics also have a higher probability of saving at a formal financial institution. Similarly, the likelihood of formal borrowing for wealthier, older, educated, and married men increases over time.

Fungáčová Weill (2015) also use the Global Findex database to investigate the level and determinants of financial inclusion in China. Results reveal that financial inclusion, measured by the number of people having formal account and formal saving, is much more developed in China than in the other leading emerging market economies. They also find that more educated, wealthier, and older men are more likely to be included in the financial system. Furthermore, women are less likely to be included financially due to the lack of documentation or due to sharing an account with another family member. The elderly, particularly, are more concerned

about the lack of funds, distance as well as the religious motive has weak impact on financial exclusion in China.

Another finding they highlight is that education and income impact the option of formal and informal credit. However, education in China does not result in higher formal credit. Women appear to be discriminated against, as they do not replace informal credits with formal credit.

Kostov et al. (2015) studied South Africa's "Mzansi" accounts to evaluate the role of the behavioural decision process of households, based on 2007 Finscope South Africa dataset collected from 3900 households by interviews. The study uses 102 variables, grouped into: literacy, financial education and financial perception, understanding financial terms, and targets for financial advice. The findings show that financial literacy and aspirations are important decision-making factors.

In a more recent study, Nokulunga and Klara (2023) examine financial inclusion in the BRICS countries.[4] Specifically, the authors studied the potential disparity in financial inclusion for households in the formal and informal access to financial services. Using the 2021 individual-level Global Findex database, the authors estimated a regression tree and probit model to examine how a range of determinants including gender, age, education, income level, and occupation affect financial inclusion. Their findings revealed that education and income level are positively associated with financial inclusion. They also find that the effect of education and income on financial inclusion are noticeable for those who use formal financial services.

At the country level, among the main variables that have been found to positively affect financial inclusion are economic development, institutional factors (such as the rule of law and governance indicators), the extent of mobile phone penetration, legal rights, bank competition, and social development. In contrast, the variables that tend to associate negatively with access to finance and financial services typically include macro-economic instability, inflation volatility, banking

[4] BRICS refer to Brazil, Russia, India, China

system inefficiency and banking market concentration, overhead costs, inadequate technology, low political development, income inequality, regulatory constraints, and weak legal systems. Interestingly, population density is found to be both positively and negatively associated with financial inclusion. This is presumably the result of the differences in obstacles to accessing financial services across low and high income countries. The latter countries, despite their population density, can provide a greater access to banking services because of their more advanced economic systems compared to low income countries. Overall, the findings of most studies reviewed suggest that low income countries require better access to financial intermediaries and technological infrastructure to enable better financial inclusion.

To this end, Beck et al. (2007) estimate the outreach of the financial sector and examine its determinants across 99 countries. The study applies aggregated data for penetration of the geographic and demographic branch and ATMs, as well as other usage factors such as loan and deposit numbers. The findings show that determinants like economic development, institutional environment, sharing of credit information, and physical infrastructure are positively linked to measures of outreach and depth. The authors examine the outreach indicators of firm financing restrictions, and their results prove that there are fewer obstacles in obtaining financing in countries with higher financial outreach.

Honohan (2008) estimates the percentage of the adult population using commercial bank account information, microfinance institutions, and survey data for 162 countries. The study also explores which country-level characteristics enable greater access to finance. The research shows that it is more important in the first place to tackle the issue of having access to financial intermediaries in low income countries than accounting for how much financial assets they have. The study also illustrates a strong positive relationship between indicators of governance, mobile phone penetration and financial access, but a negative one with income inequality despite its limited

explanation for absolute poverty. However, there is a negative and significant association between population density, age dependence, financial access and agricultural production.

Similarly, the barriers to financial access across countries has been examined by Rojas-Suarez (2010), particularly in the emerging countries like Brazil, India and South Africa over the period 1999-2007. The study applies Weighted Least Squares to evaluate the impact of country-level barriers and deficiencies on the financial access. These barriers are categorised as macroeconomic, socioeconomic, regulatory, and financial sector-related barriers. The author finds that social, macroeconomic, institutional and regulatory factors are strongly connected to financial access. The findings of the study suggest that high GDP growth volatility, higher income inequality, high regulatory constraints, social underdevelopment, and weak legal systems substantially discourage financial inclusion. However, the outcomes are unrelated to bank efficiency, banking market concentration, and loan portfolio quality. The author also highlights that there are significant differences in financial access barriers between middle-income countries and low income countries, emerging powers and developed countries.

Ardic et al. (2011) measure the relationship between the number of deposit/loan penetration accounts and country characteristics by using the IMF Financial Access database. It assesses the worldwide number of unbanked adults and analyses ways of accessing financial services around the world. The authors find that deposit penetration is positively and significantly associated with GDP per capita, population density, number of landline and mobile users, number of branches, strength of legal rights index, and competition. In addition, loan penetration is also positively associated with GDP per capita, creditors' rights, branch penetration, physical infrastructure and credit information and negatively with banking sector concentration and inflation.

Moreover, Allen et al. (2016) also examine the determinants of financial inclusion among 123 countries. The Global Findex database (2011) is used in the study to estimate the financial inclusion as deposit account ownership. The results suggest that higher financial inclusion is

associated with greater political stability, better legal rights and lower costs of opening and using bank accounts.

Demirgüç-Kunt et al. (2013) examine financial inclusion across 148 countries for the year 2011 by using Global Findex database. The study reports country-level barriers to financial inclusion, including formal features of the financial system, socioeconomic variables, and macroeconomic factors. A positive association is found between account penetration and social development related to education and health. In contrast, they indicate a negative association between financial inclusion and macroeconomic instability estimated by inflation volatility, the inefficiency of the banking system measured by the banking system concentration, and overhead costs to total assets. The authors underline the significant gap in financial inclusion between low income, lower-middle income and bottom-middle income countries. This gap can be explained by the differences in economic inequality among these countries. They also report a positive association between the inequality in the use of formal accounts and the value of the Gini index regardless of the country's level of income.

Owen and Pereira (2018) study the role of the banking structure in the outreach of financial systems across a large panel of countries. They use data from an unbalanced panel of 83 countries over the period of 2004-2013. The results show that countries where regulations allow engagement in broader financial activities have greater financial inclusion, and that greater bank concentration positively associates with financial inclusion.

Park and Mercado (2018a) examine the factors affecting financial inclusion and evaluate the impact of financial inclusion on poverty and income inequality for 176 economies including 37 developing countries in Asia. The findings show that demographic characteristics, income per capita, and rule of law significantly affect financial inclusion. However, literacy and primary education completion significantly increase financial inclusion only in the full sample, and not for the Asian sample. The results also show that financial inclusion for the full sample is

significantly associated with income inequality levels and lower poverty, whereas there is no association between financial inclusion and income inequality in developing countries in Asia.

Park and Mercado (2018b) evaluate the cross-country impact of financial inclusion on income inequality and poverty by using a cross-sectional approach. They introduce a new index of financial inclusion for 151 economies. The study uses the Global Findex database and employs the principal component analysis to calculate weights for aggregating nine indicators of access, availability, and usage. The results show that the poverty rate is significantly lower in high and middle high income economies with a high level of financial inclusion, whereas there is no such relationship for middle-low and low income economies.

Kabakova and Plaksenkov (2018) evaluate country-level factors that enable financial inclusion using a sample of 43 developing and low income countries. They consider different factors that are categorised into socio-demographic, economic, technological and political development dimensions. The study measures the access to financial services by the percentage of population with a formal banking account. The results demonstrate that there are three configurations of factors causing 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. Ahmad et al. (2023) also investigate the effect of mobile money and information communication technology (ICT) on financial inclusion in different for Sub-Saharan Africa countries. The authors constructed a panel data of 146 countries spanning 22 years and employed the Solow growth model to explore the link between mobile money, ICT, financial inclusion and economic growth. Specifically, the authors compared the direct effect of mobile money and ICT on economic growth and their indirect effect through financial inclusion. Using their growth model, the authors first estimated the relationship between mobile money and ICT without financial inclusion as an explanatory variable and subsequently with financial

inclusion as an explanatory variable. They find that for Sub-Saharan African countries, income was the main determinant of financial inclusion but not the rest of the sample. They also find that mobile money has a positive but reducing effect on financial inclusion for Sub-Saharan African countries. Further, the positive relationship between mobile money and financial inclusion remained unchanged for Sub-Saharan African countries even after controlling for non-linear and interaction effects.

In a nutshell, there are many studies that have focused on the determinants of financial inclusion across low income, developing and high income countries. In this section, we have organised our discussion in terms of individual then country-level factors. Individual determinants that are shown to positively correlate with accessing formal financial services such as account ownership, saving, and borrowing, include the following: education, wealth and income, employment, age, urbanity, separated or married marital status, financial literacy, and business experience. In terms of gender, however, findings show that men are more likely to be financially included, while women are usually more excluded due to the lack of documentation and sharing an account with family members, which leads to females' higher usage of informal financial services. At the country level, the main variables that positively affect financial inclusion are: economic development, institutional environment such as the rule of law and governance indicators, mobile phone penetration, GDP per capita, legal rights, competition, political stability, and social development. On the other hand, the variables that associate negatively with access to finance and bank services are mainly: macroeconomic instability, inflation volatility, inefficiency in the banking system and bank concentration, overhead cost, absence of technological and political development, income inequality, regulatory constraints, and weak law. Interestingly, the effect of population density has been reported to be both positive and negative for financial inclusion. This is presumably the result of the differences in obstacles to accessing financial services across low income and high income countries. These latter countries, despite their population density,

can still manage to provide high access to banking services because of their better economic system compared to low income countries with a dense population. The findings show that low income countries require more access to financial intermediaries to enable financial inclusion. The next section reviews studies that have examined the relationship between Islamic banking and financial inclusion.

2.2.2 Islamic Banking and Financial Inclusion

Background

Over the past four decades or so, Islamic banking and finance have been growing fast, providing a variety of financial products and services, which eventually spread even in non-Islamic countries. Islamic banking is based and governed by the values and principles of Islamic sharia. Compared to conventional banks, Islamic banks are interest-free, and depositors are considered as investors (Casu et al.,2021). Islamic banking finance Riba defined as interest, Gharar (uncertainty, deception, and ambiguity), and sinful activities such as gambling and alcoholic drinks are prohibited. Islamic banking finance is based on principles that date back to Islam's foundations in the 7th century, though banks have only started offering Islamic financial services since the 1960s Abedifar et al., (2014). The principles of Islamic banking finance significantly emphasize social justice, through Zakat, which is obligatory, and Qard Al-Hassan (interest-free lending, benevolent lending), and profit-loss and sharing. Therefore, Islamic banks operate under risk-sharing arrangements that allow for performing transactions without charging interest. Some of the peculiar contracts applied in Islamic banking are *mudaraba, musharaka, muzaraa, musaqa, murabaha,* and other Iqbal and Mirakhor, (2012) The most widespread contracts are mudaraba and musharaka. A mudaraba contract is an equity-based time deposit that is based on a profit-and-loss sharing mechanism. A musharaka contract is the second form of equity-supported financing, but in contrast to mudaraba, musharaka requires a contribution of funds of

all parties who are involved in the transaction. In order to avoid contradictions with the sharia, products have been developed that avoid the notion of interest and suggest a risk-sharing. Among the common spread Islamic financing services are loans between a bank and its debtors, which assume a strict profit-loss sharing, that is, a risk sharing between a bank and a client. According to this type of contract, *mudaraba*, profits are divided between a bank and a client at a predefined ratio, whereas losses are totally carried by the bank, that is, the entrepreneur is imposed by limited liabilities Turk-Ariss, (2010). At the same time, the entrepreneur has the total control over the business while investment activities including the partnership of other participants, have to be negotiated with the bank. The other type is *musharaka* contract, according to which the bank takes part in a project as one of several investors having equal rights to the others, while financial outcomes are shared between all partners.

One of the main mechanisms of Islamic finance in supporting financial inclusion is its continuous aim at promoting charity among the rich and the circulation of money to bridge the gap between the different social classes; it is based on risk-sharing principles whereby lenders and borrowers share the outcome of the business or asset being financed, whether profit or loss. As pointed out by Beck et al. (2020), this system helps stabilise the boom-bust cycles in the economy, creating a more just and equitable society, because the distribution of profit and loss is a function of the risks borne by each agent. According to Ahmed et al. (2015), Islamic finance shows evidence of becoming a vital part of the global financial system. It contributes towards coping with the problems of low economic growth and poverty in low income countries by providing access to financial services that help the poor households and facilitate self-development, and micro-enterprises.

Existing studies examine the role of Islamic finance and the Islamic-compliant financial products and services in improving the broader financial inclusion among Muslim groups (e.g., Mohieldin et al., 2012; Morrissey, 2012; Demirgüc-Kunt et al., 2013; Elzahi, 2015; Naceur et al., 2015;

Bose et al., 2016; Leon and Weill, 2016; Usman and Tasmin, 2016), while others focus on the effect of religious beliefs on using financial services (Ghoul, 2011; Onakoya and Onakoya, 2014; Zulkhibri, 2016).

Okumus (2005) addresses the theoretical and practical aspects of the Islamic banking sector in Turkey. The survey of 161 respondents attempts to examine customers' awareness and satisfaction towards products and services of the Islamic banking system. The study reveals that the importance of religious belief among Muslims is one of the major factors behind the preference of using Islamic banking products and services rather than the traditional banks. Bhattacharya and Wolde (2010) find that weak growth in the Middle East and North African countries (MENA) is found to be the result of the lack of access to credit. In addition, the accessibility of financial services might not encourage financial inclusion, as some people might exclude themselves because of their religious stance against interests and cultural circumstances. Lee et al. (2011) evaluate different factors that influence customers' decision to use Islamic banking services in Pakistan. The study states that the religious beliefs are considered one of the most significant reasons among Muslim customers for preferring Islamic banking services, which caused a lower level of access. Likewise, Sain et al. (2016) explore the nature of financial inclusion in Australia, particularly among the Muslim minority. The study reports that financial exclusion is still a problem among Muslims in Australia, and there is a lack of information about financial exclusion according to religious or ethnicity groups. The main reason for Muslims to be financially excluded is due to their religious beliefs, since Islamic teaching forbids Riba (interest) that is commonly practised in the traditional banking system. The level of awareness in Australia regarding Islamic finance products and services is still limited. The lack of Islamic financial services and products is also a contributing factor in financial exclusion among Muslims.

Furthermore, Morrissey (2012) investigates the effect of Islamic banks on the financial outcome for Gulf Cooperation Council (GCC) countries. The results show a positive impact of Islamic banks on private savings in the countries that have a large Muslim population. Demirguc-Kunt et al. (2014) examine the impact of Islamic finance on the financial inclusion by using a sample of 64 economies. The study finds that adult Muslims are less likely to own an account and save in a formal financial institution compared to non-Muslim adults. At the same time, their study finds that Muslims are less likely to use banking services that do not comply with Islamic rules in some regions which causes a barrier for them compared to non-Muslim. Consequently, the lack of access to Islamic law services and products could be one of the main reasons behind having low banking penetration, which has an impact on the financial inclusion, specifically in MENA countries where the level of access to financial services is the lowest in the world (Ghoul, 2011).

Mohieldin et al. (2012) observe that Islamic finance has been developing rapidly in the last few years, thanks to its micro-financing services such as risk-sharing, that plays an important role in supporting small and big corporates, particularly in the wake of financial crises. The authors argue that such mechanisms can decrease poverty and mitigate inequality in the Organisation of Islamic Cooperation (OIC)[5] member countries where Islamic banks operate. They also suggest that a significant role in fighting poverty and increasing the level of financial inclusion should be given to policy-makers who should use these instruments for development of the regulatory and financial infrastructure for improving the economic environment in Muslim-dominant countries. According to the World Bank Global Financial Development Report (2014), there is a significant influence of Islamic banks on the financial access of households and small and medium-scale firms. The report finds a positive association between the presence of Islamic banks and the percentage of firms, which is significant in the OIC countries. Additionally, a positive impact on

[5] The OIC currently has 56 members, located mainly in North Africa, the Middle East, and South Asia. For the full list of these countries, see the appendices.

operations of small-scaled firms is observed when the number of Islamic financial institutions increases.

Onakoya and Onakoya (2014) find a positive influence of promoting Islamic banks on enhancing financial inclusion. A specific characteristic of this study is taking Nigeria as a specific case study, compared to the majority of authors who investigate different aspects of Islamic finance across countries of the Arab world. A survey is conducted to find whether Islamic finance as an instrument of financial inclusion can contribute to fighting poverty. The authors reveal that despite an increase in religious manifestations, religion does not play a significant role in the development of Islamic finance in the country. The researchers also argue that a proper framework of financial and monetary policies is required to turn Islamic banks into a powerful instrument of economic development that can positively affect poverty mitigation in Nigeria.

The positive influence of Islamic banks on financial inclusion is also documented by Elzahi (2015). This study examines the extent to which Islamic microfinance would better contribute to reducing poverty in Muslim communities. The paper focuses mostly on microfinance services and highlights that Islamic finance operates the same way as traditional microfinance organisations, as it focuses on low income groups. The results show that Islamic microfinance follows conventional banks by attempting to enhance financial inclusion with a range of Islamic social tools including *Sadaqah, Zakah and waqf*. These instruments are aimed at providing the poorest with cash to meet their most urgent needs before giving them a loan. Naceur et al. (2015) use the ordinary least squares method to explore the relationship between the rise of Islamic banks and financial inclusion in Muslim country-members of the OIC. The authors show the values of different indicators of financial inclusion are lower for those countries. A large percentage of excluded individuals exhibit religious motives for not using bank accounts. Taking into account these results, the authors suggest that Islamic banks might be a powerful tool for increasing financial inclusion in these countries. Yet, the use of financial instruments is revealed

to be at a very low level although physical access to that service is shown to be growing at high rates. The results of the regression analysis reveal a positive relationship between the development of Islamic banks and the provision of credit to households and to firms for financing investments, which evidences the positive impact of Islamic banks in promoting financial inclusion in Muslim countries.

Zulkhibri (2016) examines financial inclusion in the Middle East region. The results show that many individuals and firms are still financially excluded despite the growth in Islamic finance. The study proposes that Islamic instruments such as *awqaf*, *qard-al-hassan*, *sadaqa*, and *zakah* can help bring financial services to more than 40 million people who are financially excluded[6]. Additionally, the study by Usman and Tasmin (2016) evidences a large increase in the financial inclusion through the positive impact of Islamic finance. The findings show that Islamic microfinance is a comprehensive approach, which can enhance human empowerment, well-being, and education and increase income among Muslim societies.

Leon and Weill (2018) examine the role of Islamic banks in improving access to credit in developing and emerging economies. They use probit regression to examines the influence of banking development on credit availability on a number of variables including the preference of Islamic banks for a sample of 15,309 firms from 52 countries over the period 2000-2005. The data on Islamic banking presence are obtained from a unique database IFIRST (Islamic Finance Recording and Sizing Tool) and firm-level variables are obtained from the World Bank Enterprise Survey. The results of the panel data analysis illustrate that Islamic banks cannot promote financial inclusion significantly compared to their counterparts. On the contrary, the

[6] In Islamic finance, qard al-hassan is essentially a non-rewarding (interest-free) loan that is provided on a goodwill basis to those who need financial assistance, in line with sharia rules that dictate that interest (riba) payments are not permissible; waqf is a charitable endowment that typically involves assets that are donated for being held in trust, with no intention of reclaiming them, for charitable causes that are socially beneficial; and zakat refers to an obligatory contribution or tax which is prescribed by Islam on all Muslim people having wealth above an exemption limit at a rate fixed by the sharia.

contribution of Islamic banks is proven positive when the number of conventional banks is limited.

Bose et al. (2016) study the financial inclusion disclosure in Bangladesh banks over the period from 2001 to 2013. They find that Islamic banking is positively associated with disclosure of financial inclusion activities. Specifically, they reveal that banks with Islamic operations (charity, interest-free, risk-sharing, etc.) in Bangladesh are more engaged in financial inclusion activities compared to conventional banks. The results of this study illustrate a positive association between the level of financial inclusion and the size of banks, institutional investors, growth opportunities measured as the ratio of market value of equity to book value of equity, and religion when banking firm has an Islamic banking operation. However, the firms' age and female directors are negatively associated with the level of financial inclusion disclosures.

Akhtar et al. (2020) also explore the relationship between financial inclusion and Islamic banking efficiency. Using a panel data of 24 Pakistani banks between 2007 and 2014, the authors examine if financial inclusion can promote the efficiency of Islamic banks. Their empirical analysis using a probit regression revealed that technical efficiency and deposit growth rate of Islamic banks are positively associated with financial inclusion in Pakistan. The authors also show that trade, population growth rate and GDP per capita are important determinants of financial inclusion in Pakistan.

In contrast to earlier evidence, Khmous and Besim (2020) show that Islamic banking can reduce financial inclusion related to account ownership and access to credit. Using data from the 2014 Global Findex Report, the authors examine the link between Islamic banking (percentage of total asset of Islamic banks to total asset of the banking sector) from MENA countries and a range of determinants including Islamic banking. Their empirical analysis reveal that an increase in the share Islamic banking assets decreases the probability of owning a formal bank account and obtaining a formal credit. According to the authors, the negative relation between Islamic

banking and financial inclusion could be attributable to its relatively high cost and unattractiveness to some customers compared to traditional banking. Further, they also show that the relation between Islamic banking and financial inclusion in lower in high income countries compared to middle income countries.

Overall, studies on Islamic banking and finance are relatively limited, and most of them have been carried out over the past ten years or so. The majority report a positive relationship between Islamic finance and financial inclusion. This is often related to the unique micro-financial qualities of the Islamic banking system that ensures sharing risks in investments, providing support to small businesses and larger firms as well as loans to the poor, and reducing the level of social inequality through Islamic products like *qard al-hassan, waqf,* and *zakat*. Despite this positive impact on financial inclusion in the Muslim majority-countries, many Muslim adults are financially excluded either because of their religious stance on accounts in traditional banks that do not comply with sharia law (for instance, providing interest), or due to a lack or unawareness of Islamic services and products provided in their regions.

2.2.3 Financial Inclusion and The Gender Gap

In this section, we review selected studies which look at the relationship between access to finance and the gender gap at the individual and country level. There are many reasons why women's access to finance is essential in the contemporary world. There is evidence, starting from the early 2000s, that women's access is lower than that for men across many countries; this reflects social inequality and gender discrimination prevalent in the economic sphere (Staveren, 2001). Cheston and Kuhn (2002) illustrate the essential value of women's equal access to finance and its potential as an instrument to increase their socio-economic and political security and engagement. In most countries, large gaps in levels of access between men and women reflect the fact that financial inclusion is also linked to gender. By 2010, across developing countries

and across all income groups, only 37 % of females had a formal bank account at a financial institution compared to 46 % of males (Allen et al., 2016).

Klasen and Lamanna (2009) investigate the impact of the gender gap on economic growth in MENA and South Asia region over the extended period 1960 to 2000. The study, using cross-country and panel regressions, shows a weak economic growth due to the gender gap in education and employment. Muravyev et al. (2009) estimate gender discrimination against entrepreneurs by using BEEPS's Business Environment and Enterprise Performance Survey and show that females are less likely to get financed from a formal financial organisation. The authors also point out that countries with more developed financial sectors have a lower level of gender discrimination compared to the underdeveloped economies. Aterido et al. (2013) address the gender gap in financial inclusion in nine African countries at the individual level by using FinMark Trust (Finscope) survey. The results of the study show that women have a lower use of formal financial services due to differences in income, formal employment, education, and household leadership.

Furthermore, Demirguc-Kunt et al. (2013) examine the gender gap and financial inclusion, at an individual and country level across 98 developing countries using the Global Findex database. The study uses multivariate regression analysis to explore gender differences in the use of financial services. The data highlight that there is a substantial gender gap in account ownership, formal savings and formal credit. The possibility of being excluded financially is higher for women. The results show that women are less likely to own an account, borrow, save and use the full range of financial services due to the legal restrictions on women's right to hold a property, work or head the household, lower financial literacy, lack of business experience, and higher difficulties in presenting collateral.

Aterido et al. (2013) examine the issue of gender gap in nine African countries and the findings surprisingly demonstrate that there is no gender discrimination. Their study applies multivariate

regression and probit regressions. The gender gap in Africa appears to be associated with women's participation outside the financial sector; women appear to be discriminated in other economic aspects, such as formal employment, within the household and education. The study also concludes that due to gender differences, women are more likely to report the lack of income or a formal job as reasons for not being banked.

Swamy (2014) uses difference-in-difference estimator approach with Panel Least Squares and Generalized Methods to examine financial inclusion and impact on women empowerment. It aims to investigate how the participation in financial inclusion through microfinance programmes increase women's influence over economic resources and economic decision-making among the poor households of India. The research includes all regions of India and collects data from the period of 2007-2012. The results show that financial inclusion can boost women's financial empowerment, and their decisions at a family-level highly contribute to increasing economic growth.

Another work by Gonzales et al. (2015) use fixed-effects panel regressions to examine the gender gap and access to finance. The results of this study suggest that mitigating gender inequality by balancing the economic playing field between men and women could go a long way towards reducing the income distribution inequality. Furthermore, Hakuna et al. (2016) use a large global panel over the last two decades and find that significant continuous growth for low income countries can be delivered by more progress in reducing the gender and income inequality. Sahay et al. (2018) examine the linkages between financial inclusion and economic growth, by applying cross-country OLS. The data are obtained from World Bank's Global Findex database and IMF's Financial Access Survey. Results suggest that the gender gap in account holdings is persistently high in some regions, while some countries also show greater income inequality.

Delechat et al. (2018) assess which factors improve financial inclusion by separating between structural factors, policies, and individual characteristics, with a particular focus on female

financial inclusion. They use OLS to highlight potential determinants of financial inclusion across more than 140,000 individuals and the data are collected from the World Bank's Findex database. The authors find that greater financial inclusion for women is strongly associated with greater access to basic economic rights and good legislative protection against harassment.

More recently, Adegbite and Machethe (2020) examine financial inclusion and the gender gap (FIGG) in Nigeria. The study uses a mixed method review from Global Findex Database (2011, 2014, 2017) and Nigeria's CGAP Smallholder Household Survey (2016) and opt for both quantitative and qualitative analysis. The results show that there is a significant increase in FIGG in Nigeria's smallholder agriculture and the country at large and that socio-economic, institutional, legal and regulatory factors are all major causes of this gender gap in FI. Women are the most affected and most vulnerable.

Koomson et al. (2020) conduct a natural experiment to evaluate the impact of financial literacy in bridging the gender gap in financial inclusion. Using a randomised control trial involving 1500 respondents from a developing country (Ghana), the authors randomly allocated 105 male and 195 female into the treatment group, with the remaining sample (1200 respondents) allocated to the control group. The treatment groups (male and female) were provided training on financial literacy, while the control group were not offered this training. Measuring the impact of financial literacy training across the gender groups via a regression model, they find that female that female beneficiaries from the financial literacy training are 8.5% more likely to open an account with a financial institution, compared to non-participants (control group). The authors interpreted this impact to be due the gender gap in financial inclusion, which the financial literacy training helped in bridging. Further, the authors find that the female participant were less likely to intensify their current level of financial inclusion compared to the male counterpart due to pre-existing gender gaps in accessing financial inclusion. Similarly, Sarkar et al. (2023) also explore the gender dimension of financial inclusion in India. The authors postulate that though financial inclusion

has improved across broad, there still exist a significant gap between men and women. To test this claim, the authors use data on 739 women and 663 men in India drawn from the Global Findex Database for India and the propensity score matching to control for selection bias. They find that despite a general improvement in financial inclusion across the sample, the usage of accounts by women for borrowing, saving and financial resilience purposes were significantly lower than their male counterparts, which confirms the existence of a gender disparity in financial inclusion.

Chen et al. (2023) explore whether fintech help in bridging the financial inclusion gap between men and women. Drawing participants EY Fintech Adoption Survey, the authors related gender (female dummy) with fintech adoption (the use of Fintech entrant in the last six month. They find that women are less likely to use fintech product than men (between 8.4% to 5.2%) even after control for country differences. After accounting for the different product types offered by fintech in their regression the difference in the likelihood of usage reduced to 1.1%. Further, the authors examined the difference in attitude towards Fintech across gender, by examining their risk across several issues. In this regard, they find that women are more likely to be concerned about their security of the transactions than men, but less likely to adopt fintech products and services. Focusing on Peer-to-Peer lending Gonzalez (2022) examine if this form of fintech promotes pro-social direct lending, especially for women. The author uses a quasi-natural experiment of 663 participants to determine if there are disparity in male and female applicants on a peer-to-peer lending platform. Specifically, applicants were sorted based on similar characteristics, except their gender. They find that male lenders reported higher confidence in their financial literacy and loan applications with collateral than their female counterparts. They also find that cash collateral reassurance only increases lending to female. Further, the study finds that higher perception of their own financial literacy increases investor confidence in lending to female borrowers.

Overall, the literature uses both individual-level characteristics and country-level data. The latter covers both under-developed, mainly African and South Asian regions, and developed countries. All studies find that women generally have less access to financial services than men, because of social inequality, differences in education, employment and income, household leadership, as well as the legal restriction on women's rights. In this context, the study of Aterido et al. (2013) finds quite surprising results, as the authors report no gender discrimination in African countries, although one might expect that the countries would reflect a larger gender gap and a weaker economic growth. Another important point to notice is that these studies have used various methods in their analysis, including OLS, multivariate regression, and probit model. Similarly, data have been collected from different sources depending on the initial objective, using mainly surveys such as Global Findex and Financial Access Survey.

These studies, although looking at financial inclusion and the importance of Islamic banking in general, do not address the gender gap across both Islamic and non-Islamic countries in terms of financial inclusion. Our study contributes to the above-mentioned literature by adding a comprehensive overall view on financial inclusion across Islamic and non-Islamic countries and by considering the gender gap as an important variable in our analysis along with a wide spectrum of variables across many countries.

A number of studies have examined the relationship between access to finance and gender, either at individual-level characteristics or country-level data. The latter covers both less developed, mainly African and South Asian regions, and developed countries. These studies have used various methods in their analysis, including OLS, multivariate, and probability models. Similarly, data have been collected from different sources depending on the initial objective, including surveys such as the Global Findex and the Financial Access Survey (FAS) that was launched in 2009 by the International Monetary Fund.

The vast majority of studies find that women generally have less access to financial services than men, because of social inequality, differences in education, employment and income, and legal restrictions on women's rights. The gender gap has proven to be one of the reasons behind the weak economic growth in many regions, particularly the less developed ones (e.g., Klasen and Lamanna, 2009; Muravyev et al., 2009; Demirgüc-Kunt et al., 2013; Gonzales et al., 2015; Hakuna et al., 2016; Sahayet et al., 2018; Delechat et al., 2018; Adegbite and Machethe, 2020). The literature suggests that providing an equal access to financial services for women is tied to providing them with more legislative protection against discrimination in the workplace and/or at the family level.

The above-mentioned studies, however, do not address the gender gap in financial inclusion across Islamic and non-Islamic countries. Our study contributes to this literature by adding an overall exploratory view on financial inclusion across Islamic and non-Islamic countries and by considering the gender gap as an important variable in our analysis along with a wide spectrum of factors across a large sample of countries.

In the following section, we present our empirical framework by describing the data, variables, and determinants of financial inclusion examined in this study, the specification of our empirical model.

2.3 Data and Variables

2.3.1 Data

This study relies on a cross-country sample of 157 countries over the period 2011-2017. The sample comprises 101 non-Islamic countries and 56 Islamic countries that are members of the Organisation of Islamic Cooperation (OIC) and represents Muslim-majority countries. The number of Islamic countries in our sample is relatively low due to their limited financial inclusion data. The list of countries in our sample is provided in Appendix 2A. The data for the study

comes from several sources. The data on our financial inclusion measure, "*Account ownership*", are collected from the Global Findex database which is published every three years since 2011. Following Sha'ban et al. (2020) approach, we replace the missing years (that is, 2012, 2013, 2015, and 2016) with the data from the respective preceding year. The macroeconomic and technological factors are obtained from the World Bank's World Development Indicators. Social factors are obtained from the Human Development Index (HDI), UN Reports and the World Bank's Women Business and Law (WBL)database. The institutional factors are taken from the Fraser Institute and the Heritage Foundation, while the banking factors are drawn from the World Bank's Global Financial Development (GFD) database. We winsorise all variables at 1% level at the top and bottom of the distribution to mitigate the influence of the outliers. Appendix 2B presents the study variables, their definition, source, and the expected relationship they have with the dependent variable.

2.3.2 Identification of Variables

This research attempts to: (1) explore the dimensions of financial inclusion across five factors, that is, macroeconomic, technological, social, institutional, and banking; (2) test the differences in the determinants of financial inclusion across Islamic and non-Islamic countries; and (3) investigate the gender differences in the determinants of financial inclusion across Islamic and non-Islamic countries.

Financial inclusion can be measured across three dimensions, that is, access, usage, and quality. Access indicators reflect 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. Usage indicators measure the depth of use of financial services and products (such as the number of accounts, transactions, and electronic payments). Quality indicators explore the extent to which the financial products and services provided meet customers' needs and understanding.

The present study uses account ownership, an access indicator, as the main measure of financial inclusion.

Account Ownership

Account ownership is a crucial measure of financial inclusion because any formal financial service is established through an account (Demirgüç-Kunt et al., 2015). It measures whether an individual has an account either at a formal financial institution or through a mobile money provider (Findex, 2017). The Global Findex database (2014, 2017) reports that the percentage of individuals who own an account at a formal financial institution has increased from 51% in 2011 to 62% and 69% in 2014 and 2017 respectively.

As discussed in the previous literature, the obstacles to financial inclusion associated with religious, cultural and social factors (Demirgüç-Kunt et al., 2008; Demirgüç-Kunt et al., 2015; Allen et al., 2016). For example, more than 25% of unbanked adults in Morocco and Tunisia report religious reasons when asked about their lack of use of financial services (Demirgüç-Kunt et al., 2015). Other barriers can cover cases of gender discrimination, lack of information, product features, and price barriers (Alhassan, 2019). Demirgüç-Kunt et al. (2015) indicate that Islamic countries in the MENA region have lower levels of financial inclusion measured by formal account ownership, formal savings accounts, and formal credit accounts.

To the best of our knowledge, there are no studies that have considered the gender differences in account ownership across Islamic and non-Islamic countries. Though some studies (e.g., Allen et al., 2016; Aterido et al., 2013; Demirgüc-Kunt et al., 2013; Kostov et al., 2015; Fungáčová and Weill, 2015) examine financial inclusion and its determinants among Islamic and non-Islamic countries, they do not account for the differences between males and females' account ownership at a country level.

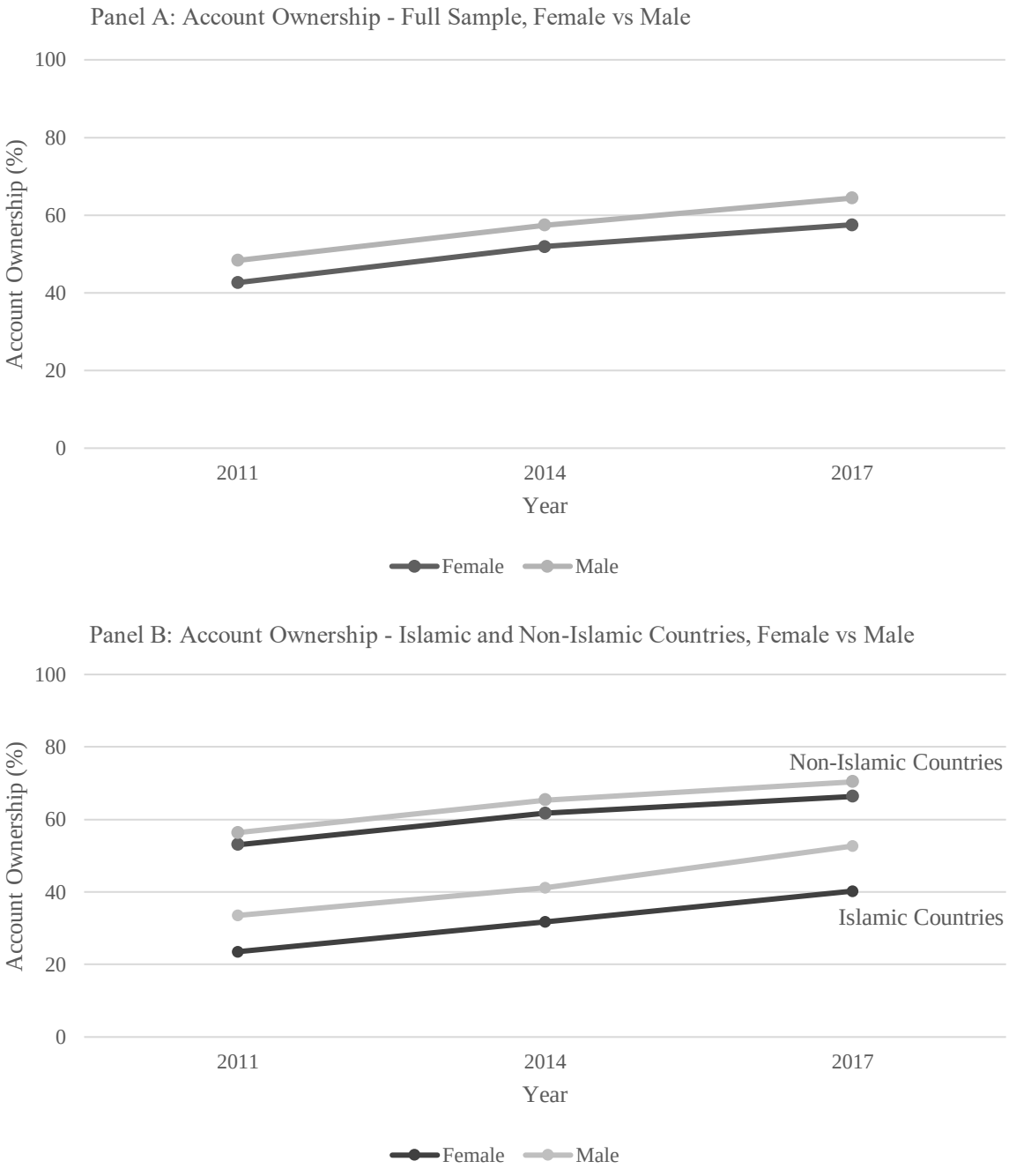
The Global Findex database provides data on the account ownership at the country level and disaggregates this along the gender classification (male and female). Specifically, the database

provides an overall score on account ownership for each country and disaggregate this across male and female account ownership as well. In line with prior studies (Demirgüç -Kunt et al., 2013; Demirgüç-Kunt et al., 2019; Abokyi, 2023), we measure gender gap as the difference in male and female account ownership. This measure has the advantage of capturing the disproportionate exclusion of women from accessing and using financial services (Fouejieu et al., 2020).

Figure 2.1 shows the gender gap in account ownership for the full sample (Panel A) and across Islamic and non-Islamic countries (Panel B). First, both panel A and B show that account ownership has increased over the sample period. Second, there is a persistent gender gap in account ownership across the sample. Third, the gender gap in account ownership is particularly wider for Islamic countries relative to non-Islamic countries. The observed gender gap in financial inclusion can be explained by voluntary barriers. Voluntary barriers often refer to religious and cultural reasons, as well as social circumstances where the need for an account is absent (Demirgüç-Kunt et al., 2015; Allen et al., 2016). Involuntary barriers can include cases of gender discrimination, lack of information and understanding of product features, as well as price barriers (Alhassan, 2019).

Figure 2.1 also updates and confirms the results of a previous study by Demirgüç-Kunt et al. (2014) that documents large differences in financial inclusion in terms of gender and suggests that gender norms can explain cross-country disparity in access and usage of financial services. Moreover, the rate increase in account ownership is higher in Islamic countries when compared to non-Islamic countries and shows that financial inclusion grows at a faster pace in Islamic countries. These results are related closely to the case of India where male financial inclusion was around 20 percentage points greater than females in 2014. However, this gender gap has shrunk to 6 points by 2017, because of strong government participation in improving account ownership through biometric identification cards (Demirguc-Kunt et al., 2018).

Figure 2.1 Gender Gap in Account Ownership (Adults with an Account, per cent): Islamic vs Non-Islamic Countries



Note: This figure illustrates the trends in account ownership by gender for the full sample (Panel A) and for Islamic vs Non-Islamic countries (Panel B) in year 2011, 2014, and 2017. Source: Adapted from Global Findex Database 2017 and authors' calculations.

Further, we provide an outline of the potential determinants of financial inclusion examined in our empirical analysis. These are categorised into five dimensions: macroeconomic, social, institutional technological and banking factors.

Macroeconomic Factors:

All things being equal, the growth of the economy should be associated with higher financial inclusion, and therefore greater account ownership. Accordingly, we use GDP per capita (in the logarithm form) and inflation to measure the economic conditions of the sample countries. We expect people in countries with higher GDP per capita to own more bank accounts and contribute to the financial system relative to their counterparts in countries with low GDP per capita (Chithra and Selvan, 2013; Sarma and Pais, 2011, Ardic et al., 2011).

Inflation reflects instability in economic market prices, which impacts both the access to and demand for banking and financial services, leading to an expected negative relationship with financial inclusion (Allen et al., 2016, Sha'ban et al., 2020). However, Evans and Adeoye (2016) find that the effect of inflation on financial inclusion can be insignificant. Therefore, it is important to re-examine the relationship between inflation and financial inclusion at a global level.

Social Factors:

The structure of the social system of a country can influence its economic and political stability, which in turn can influence financial decisions at the individual and group level. Proxies for social systems include non-discrimination against women in employment, human development index (HDI), and gender inequality. Regarding gender discrimination, legal restrictions that women face in the job market can negatively affect account ownership (Demirguc-Kunt, Klapper and Singer, 2013). On the other hand, we expect non-discrimination against women to be

positively associated with higher financial inclusion. With regards to HDI, increased access to education, health and improved living standards are expected to positively influence financial inclusion (Kabakova and Plaksenkov, 2018).

Institutional Factors:

With regards to institutional factors, we use two potential determinants of financial inclusion, namely government integrity and regulation. Government integrity refers to the transparency of policies both in the public and private sectors. Broadly, we expect a positive relationship between institutional factors and account ownership (Sha'ban et al., 2020).

Regulation can be good and bad for the growth and development of the financial system. The growth of the financial system can be largely driven by the governance system and the consistency of banking regulations. A well-functioning financial regulation can promote the development of the financial market (Rojas-Suarez, 2010). However, aspects of banking regulations, such as capital adequacy requirements can also limit banks' ability to provide financial services, especially to the poorer segment of the population, which in turn, can reduce financial inclusion (Chen and Divanbeigi, 2019; Anarfo and Abor, 2020).

Technological Factors:

Technological infrastructure such as mobiles and information technology play an important role in facilitating access to and raising awareness about financial services and inclusion. Likewise, technological advancements, across urban and rural areas, reflect good financial infrastructure and economic growth; their usage is crucial for financial inclusion and creates better and quicker opportunities for banks and customers. We employ two variables in this category, that is, mobile subscriptions and individuals using the internet. Mobile subscriptions facilitate access to bank accounts and use of financial services (Honohan, 2008; Ardic et al., 2011; Demirguc-Kunt et al., 2018; Alhassan, 2019). Nonetheless, mobile subscriptions do not necessarily mean having a bank account, because the latter is determined by attitudes towards the service (Chaouali, et al., 2017).

Similarly, internet usage is an indicator of good infrastructure services and is also assumed to enhance financial inclusion (Kabakova and Plaksenkov, 2018 and Sha'ban et al., 2020).

Banking Factors:

Three proxies of bank competition and market structure (bank concentration, the Lerner index and the Boone indicator) are used to examine the effect of bank competition on financial inclusion. First, bank concentration refers to the share of deposits of the five largest banks in the banking system. The extant literature provides mixed evidence on the effect of bank concentration on financial inclusion. For instance, Demirgüç-Kunt and Klapper (2013) find that bank concentration is negatively correlated with the indicators of financial inclusion, whereas Owen and Pereira (2018), on the other hand, find that it can enhance financial inclusion. Bank concentration is a crude measure of banking competition and assumes that higher concentration reflects higher competition. A limitation of banking concentration as a measure of competitiveness is that it is one-dimensional and does not capture all the dynamics of banking competition. Owen and Pereira (2018) emphasise that a highly concentrated banking sector can still be contestable. Nonetheless, banking concentration provides a measure of competition that is linked to market structure. Second, the Lerner index is used to measure market power in the banking sector. It is defined as the difference between output prices and marginal costs. We conjecture that the higher value of the Lerner index reflects lower bank competition, which in turn, induces lower financial inclusion (Owen and Pereira, 2018). This is because banks in highly competitive markets have less power and therefore less control of profit margins, resulting in them reaching out for more customers to accelerate performance. Third, the Boone indicator is the elasticity of profits to marginal costs (Owen and Pereira, 2018). This refers to the ability of the bank to control the market power and profit margin. Therefore, we assume that the higher is the competition, reflected by a low Boone indicator, the greater is financial inclusion.

2.3.3 Descriptive Statistics

Table 2.1 reports the descriptive statistics for the main variables over the full sample. The mean for *Account ownership* is around 51.7 % which suggests that more than half of respondents declare having an account at a financial institution. There is a wide disparity in financial inclusion across countries. For instance, account ownership, ranges from just under 100% for countries such as Denmark (99.92%) and Canada (99.81%) to only 3.30% (3.81%) in the Central African Republic (Cambodia). Account ownership is significantly lower for women (around 48.72 %) compared to their male counterparts (around 54.53 %) with a gap of 5.81 per cent. The highest female account ownership is observed in Norway (100 %) whereas the lowest in the Republic of Yemen (around 1.67 %). With respect to the independent variables, we highlight the extreme disparity between, Norway the country with the highest percentage of individuals using internet (96.36%), and Niger the country with the lowest percentage (1.38%).

Table 2.1 Descriptive Statistics

Variables	Obs	Mean	Std. Dev.	Min	Max
Financial inclusion					
Account ownership	991	51.65	31.11	3.30	99.92
Account ownership (F)	991	48.72	32.17	1.67	100.00
Account ownership (M)	991	54.53	30.47	3.19	100.00
Macro-economic factors					
GDP per capita (log)	984	8.65	1.46	5.76	11.35
Inflation	952	4.71	5.82	-1.54	36.91
Social factors					
Non-discrimination	962	0.78	0.41	0.00	1.00
Gender inequality	884	0.36	0.19	0.04	0.71
Human development index	957	0.71	0.16	0.37	0.94
Institutional factors					
Government integrity	961	41.63	20.97	8.00	93.00
Regulation	906	7.01	1.00	4.12	9.13
Banking factors					
Market concentration (CR5)	921	63.22	18.69	23.02	100.00
Market power index (Lerner)	386	0.31	0.15	0.01	1.13
(Lack of) competition (Boone)	537	0.80	7.19	-1.61	63.03
Technological factors					
Individuals using internet (per cent)	984	45.73	28.99	1.38	96.36
Mobile subscriptions (ml)	984	55.36	165.19	0.52	1190.25

Note: The table presents summary statistics for the full sample over the period from 2011-2017. All variables are winsorized at 1% level. We categorise the variables into five groups: social, banking, economic, institutional, and technological factors. Obs. represents the number of observations, Std.Dev. stands for the yearly standard deviation of the variables. Mean is the arithmetic average of each variable; Min is the minimum value of each variable; Max is the maximum value of each variable.

Table 2.2 reports the correlation between our financial inclusion indicator (account ownership, aggregate and by gender) and the selected indicators described in Appendix 2B that capture a variety of macro-economic, social, institutional, banking, and technological factors. We find that financial inclusion is positively correlated with GDP per capita, human development, non-discrimination against women in employment, regulation, government integrity, and internet usage, but negatively correlated with inflation and gender inequality. These relationships hold for both aggregate and female and male account ownership.

Table 2.2 Correlation Matrix

Variables	Account ownership	Account ownership (F)	Account ownership (M)	GDP per capita (log)	Inflation	Human development index	Gender inequality	Non-discrimination	Regulation	Government integrity	Market concentration (CR5)	Market power index (Lerner)	(Lack of) competition (Boone)	Individuals using internet (per cent)	Mobile subscriptions (ml)
Account ownership	1.000														
Account ownership (F)	0.992***	1.000													
Account ownership (M)	0.992***	0.968***	1.000												
GDP per capita (log)	0.830***	0.820***	0.824***	1.000											
Inflation	-0.293***	-0.296***	-0.286***	-0.336***	1.000										
Human development index	0.843***	0.836***	0.835***	0.940***	-0.302***	1.000									
Gender inequality	-0.734***	-0.744***	-0.713***	-0.747***	0.282***	-0.798***	1.000								
Non-discrimination	0.174***	0.197***	0.150***	0.208***	-0.154***	0.238***	-0.278***	1.000							
Regulation	0.540***	0.545***	0.523***	0.531***	-0.410***	0.527***	-0.538***	0.152***	1.000						
Government integrity	0.747***	0.746***	0.734***	0.763***	-0.357***	0.705***	-0.639***	0.174***	0.628***	1.000					
Market concentration (CR5)	0.000	0.019	-0.021	-0.008	-0.054*	-0.076**	0.025	0.050	0.105***	0.182***	1.000				
Market power index (Lerner)	-0.043	-0.079	-0.012	0.039	-0.036	-0.031	0.130**	-0.274***	0.084*	0.024	0.111**	1.000			
(Lack of) competition (Boone)	-0.014	-0.044	0.019	-0.013	-0.011	0.035	0.048	-0.210***	-0.203***	-0.044	-0.182***	0.127**	1.000		
Individuals using internet (per cent)	0.820***	0.812***	0.812***	0.891***	-0.335***	0.911***	-0.784***	0.245***	0.544***	0.736***	-0.020	-0.062	-0.040	1.000	
Mobile subscriptions (ml)	0.046	0.030	0.063**	-0.036	0.027	0.027	0.039	-0.015	-0.099***	-0.025	-0.290***	-0.038	-0.006	-0.059*	1.000

Note: The table reports correlation coefficients for the variables used in the study. *** p<0.01, ** p<0.05, * p<0.1. See Appendix 2B for variable definitions and data sources.

To examine whether significant differences exist between the variables under analysis in Islamic and non-Islamic countries, we first run a difference in means test for all variables. Table 2.3 shows the differences in means tests between the non-Islamic and Islamic countries using a difference-in-means test (*t*-test).

Table 2.3 Islamic and Non-Islamic Countries: Differences in Means

	Islamic countries		Non-Islamic countries		Difference in means	*t*-statistic
	Obs	Mean	Obs	Mean		
Financial inclusion						
Account ownership	336	34.44	655	60.45	-26.01***	-13.54
Account ownership (F)	336	29.25	655	58.70	-29.45***	-15.12
Account ownership (M)	336	39.33	655	62.30	-22.96***	-12.01
Macro-economic factors						
GDP per capita (log)	333	8.00	651	8.98	-0.98***	-8.45
Inflation	312	5.13	640	5.32	-0.19	-0.22
Social factors						
Non-discrimination	316	0.62	646	0.85	-0.22***	-8.09
Gender inequality	295	0.44	589	0.31	0.13***	10.71
Human development index	319	0.63	638	0.75	-0.12***	-11.88
Institutional factors						
Government integrity	323	31.39	638	46.80	-15.40***	-11.44
Regulation	290	6.68	616	7.15	-0.46***	-6.47
Banking market conditions						
Market concentration (CR5)	301	62.83	620	63.23	-0.39	-0.29
Market power index (Lerner)	125	0.32	261	0.30	0.02	1.54
(Lack of) competition (Boone)	191	2.41	346	-0.60	3.01***	3.80
Technological factors						
Individuals using internet (per cent)	336	34.54	648	51.53	-16.98***	-9.06
Mobile subscriptions (ml)	336	37.35	648	64.71	-27.35***	-3.22

Note: The table presents the mean and number of observations for the variables under analysis separately in sub-samples of Islamic and non-Islamic countries. Data covers the period from 2011 to 2017. We categorise the variables into five groups: social, banking, economic, institutional, and technological factors. We report the difference in means, calculated as the difference between Islamic countries and non-Islamic countries, as well as the t-statistics for the difference in means. *, **, *** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

Table 2.3 shows that account ownership among Islamic countries accounts for approximately one third (34%, 336 observations) of the whole sample of account ownership data (991 observations). We observe a significant difference in account ownership between the two sub-samples, with 60.45% of respondents in non-Islamic countries reporting having an account compared to just 34.44% in Islamic countries. Men across both country groups tend to have a greater level of account ownership compared to women. However, the gender gap is considerably higher in Islamic countries, amounting to approximately 10% compared to about 5% in non-Islamic countries. With respect to our independent variables, we note that mobile subscriptions and internet usage are almost two times larger in non-Islamic countries. Similarly, all indices measuring institutional aspects show higher values in non-Islamic countries.

Looking at the factors that might be driving the gap in financial inclusion between Islamic and non-Islamic countries, we find pronounced differences across the five dimensions examined. Specifically, we find that Islamic countries tend to have a lower level of economic development as evidenced by their lower GDP per capita. In the social aspect, they appear to be lagging in promoting human development, achieving gender equality, and mandating non-discrimination against women in employment. Similarly, the indicators of institutional environment including regulation, and government integrity show significantly lower values in Islamic countries. Among the banking factors, competition appears to be significantly lower in Islamic countries whereas concentration and market power do not show significant differences across the two groups of countries. With respect to technology, we find significantly lower internet usage and mobile subscriptions in Islamic countries. This is despite the considerable advances seen in many Islamic countries, such as the introduction and rapid adoption of M-Pesa accounts in Kenya (Jack and Suri, 2011; Mbiti and Weil, 2015).

2.3.4 Empirical Model

The baseline model includes twelve determinants of financial inclusion that are categorised into five groups (see Appendix 2B). We apply an ordinary least squares (OLS) regression with country and year fixed effects, to examine the determinants of financial inclusion. Specifically, we estimate the following regression model:

$$FI_{c,t} = \alpha + \beta_1 CLC_{c,t-1} + C_c + C_t + \varepsilon_{c,t} \quad (2.1)$$

In equation (2.1), $FI_{c,t}$ represents an indicator of financial inclusion in country *c* at time t, which is proxied through account ownership. Account ownership measures the percentage of respondents who report having an account at a bank or another type of financial institution. $CLC_{c,t-1}$ is a vector of one-period lagged explanatory variables detailed in Appendix 2B that are selected as proxies for country-level characteristics and grouped into macroeconomic factors (GDP per capita (log) and Inflation); technological indicators (Individuals using internet and Mobile subscriptions); social factors (non-discrimination against women employment, Human development index and Gender inequality); institutional factors (Regulation and Government integrity); and banking factors (Market concentration (CR5), Market power index (Lerner) and (Lack of) competition indicator (Boone)); The model includes country and time fixed effects ($C_c$and C_t respectively) while $\varepsilon_{c,t}$ is the error term. To control for potential endogeneity issues, all independent variables are lagged by one period. Further, to control for serial correlation and heteroscedasticity in the error term, standard errors are clustered at the country level (Petersen, 2009).

Some of the variables within the same group or across factor groups tend to correlate with each other. For example, HDI is highly correlated with individuals using internet.[7] Therefore, these

[7] Table 2.3 shows the correlation coefficients for all the variables used in the study.

variables are not included in the same regression model to avoid multicollinearity. We use the rule of thumb to not include independent variables whose pairwise correlations exceed ± 0.8 (Kalnins, A., 2018).

To test for the differences in the determinants of financial inclusion across Islamic and non-Islamic countries, we introduce interaction terms in our baseline model from equation (2.1).

$$FI_{c,t} = \alpha + \beta_1 CLC_{c,t-1} \times Islamic_{c,t-1} + \beta_2 CLC_{c,t-1} \times NonIslamic_{c,t-1} + C_c + C_t + \varepsilon_{c,t} \quad (2.2)$$

where $Islamic_{c,t}$ is a dummy variable that takes the value of 1 if the country is member of the OIC organisation, and 0 otherwise.

To test for gender differences in the determinants of financial inclusion across Islamic and non-Islamic countries, we use the following models:

$$FI\ (F)_{c,t} = \alpha + \beta_1 CLC_{c,t-1} \times Islamic_{c,t-1} + \beta_2 CLC_{c,t-1} \times NonIslamic_{c,t-1} + C_c + C_t + \varepsilon_{c,t} \quad (2.3)$$

$$FI_{c,t}(M) = \alpha + \beta_1 CLC_{c,t-1} \times Islamic_{c,t-1} + \beta_2 CLC_{c,t-1} \times NonIslamic_{c,t-1} + C_c + C_t + \varepsilon_{c,t} \quad (2.4)$$

where $FI(F)_{c,t}$and $FI(M)_{c,t}$ measure the percentage of males and females, respectively, who report having an account at a bank or another type of financial institution.

2.4 Empirical Results

2.4.1 Baseline Estimation Results

In this section, we analyse the results of the baseline model estimation that examines the determinants of financial inclusion by estimating equation (2.1). The results are presented in Table 2.4. Across models (1) to (6) we regress the financial inclusion variable on social, technological, institutional, banking and macroeconomic factors.

For the social factors, we find that non-discrimination against women in employment and the human development index score are both positively related to account ownership, while gender inequality has a negative relation. In Model (2), for instance, the result indicates that an improvement (increase) in non-discrimination against women in employment leads to an increase in account ownership. Similarly, human development is positively related with account ownership across the sample of countries under investigation. The positive correlation between HDI and account ownership suggests that human development in terms of health, education and standard of living is strongly associated with financial inclusion. These results support the work of Demirguc-Kunt et al. (2013) who also examined the relation between non-discrimination and financial inclusion by using individual characteristics. Different to the latter study, we use data at the country level over a more recent time span. We also show, in Model (3), that a unit increase in the gender inequality index (which correspond to a reduction in gender inequality) leads to a decrease in account ownership by 0.046% and is statistically significant at the 1% level. These results support the work of Klapper et al. (2012) who note that the education component of the human development index has a link with financial literacy, which has been shown to be related to the ability of consumers to make informed financial decisions. However, in our study, we confirm the influence of social factors at the country level, rather than at the individual level as in the work of Klapper et al., (2012). Taken together, our baseline results indicate that all

variables related to social factors are significant determinants of financial inclusion across the sample of countries examined.

Exploring estimation results relating to institutional factors presented in Model (4), we find that government integrity is positively associated with a country's account ownership, relationship which is statistically significant at the 1% level. The coefficient suggests that a one unit improvement in this measure increases account ownership by 0.40%. The second institutional variable explored is regulation which covers three components - credit market regulations, labour market regulations, and business regulations and does not appear to have a significant relationship with financial inclusion.

The regression coefficients of technological factors, reported in Model (5), indicate a significant positive relationship of technology with financial inclusion. For instance, we show that one million additional mobile subscriptions increase account ownership by 0.07%. The coefficient remains significant in Model (6) when we control for banking factors. Similarly, we find that a 1% increase in the individuals using the internet leads to an increase in account ownership across the sampled countries by 0.27% in Model (5) and 0.22% in Model (6). These results support the notion that increasing the use of technology will improve access to financial services for the wider population. This has been shown to be particularly true in developing countries, such as Kenya where the prevalence of mobile M-Pesa accounts has increased financial inclusion considerably (Demirgüç-Kunt, et al., 2015) and India where biometric identification allowed people to open bank accounts without proof of identity (Demirguc-Kunt et al., 2018).

Regulation is negatively related to account ownership in Table 2.4. The coefficients on regulation are statistically insignificant except in Model (5) where we observe a weak significance. The results suggest that regulation is not a key determinant of account ownership in our sample.

We do not observe any significant relationship between banking factors and account ownership across our sampled countries, Similarly, the macroeconomic factors do not have any significant effect on financial inclusion in our sample.

Overall, our baseline results indicate that the most important drivers of financial inclusion are represented by social factors (non-discrimination against women in employment, human development index, and gender inequality), institutional factors (government integrity), and technological factors (number of mobile subscriptions and percentage of individuals using internet). In contrast, banking market conditions do not appear to be significantly associated with financial inclusion.

Table 2.4 Baseline Regression Analysis for Account Ownership

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
Non-discrimination against women employment		2.312**	2.860**	2.112*	2.426	3.772**
		(1.040)	(1.416)	(1.187)	(2.037)	(1.560)
Gender inequality			-0.046***			
			-0.009			
Human development index		0.189***		0.172**		
		(0.071)		(0.068)		
Mobile subscriptions (ml)					0.069***	0.049***
					(0.021)	(0.016)
Individuals using internet (per cent)					0.272***	0.220*
					(0.060)	(0.117)
Government Integrity				0.403***	0.372***	-0.077
				(0.088)	(0.083)	(0.212)
Regulation				-1.379	-1.748*	-1.891
				(0.991)	(1.017)	(1.619)
Market concentration (CR5)						-0.129
						(0.089)
Market power index (Lerner)						0.165
						(8.566)
(Lack of) competition (Boone)						-0.768
						(0.507)
GDP per capita (log)	3.360		2.673			
	(3.185)		(3.001)			
Inflation	0.002	-0.011	-0.016	-0.021	-0.054	-0.115
	(0.080)	(0.078)	(0.081)	(0.089)	(0.083)	(0.151)
Constant	24.24	-81.85	45.91*	-77.54	33.79***	63.09***
	(27.74)	(50.91)	(25.39)	(48.25)	(9.351)	(18.40)
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Number of clusters (country)	146	140	132	129	130	95
Observations	802	766	710	722	728	350
Adjusted R-squared (within)	0.003	0.031	0.040	0.076	0.121	0.051

Note: The table reports the regression results of equation (2.1) estimating the determinants of financial inclusion by applying ordinary least squares (OLS) regression with country and year fixed effects. The dependent variable is account ownership. Explanatory variables are Inflation, GDP per capita (log), Non-discrimination, Human development index, Gender inequality, Regulation, Government integrity, Mobile subscriptions (ml), and Individuals using internet (per cent), Market concentration (CR5) Market power index (Lerner), and (Lack of) competition (Boone),). The regressions are run on the full sample of countries covering the period of 2011-2017. Standard errors are clustered at the country level. *, **, *** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

2.4.2 The Determinants of Financial Inclusion across Islamic and non-Islamic Countries

To test for differences in the determinants of financial inclusion between Islamic and non-Islamic countries, we create interaction terms between all the independent variables and the dummy variables identifying Islamic and non-Islamic countries. The regression results are reported in Table 2.5.

For social factors, we find that non-discrimination against women in employment is positively related to account ownership in Islamic countries (Models 3-6), with the coefficient significant at the 1% level. For non-Islamic countries, we do not find a significant relationship between non-discrimination against women in employment and account ownership; we observe one exception in Model (5) where the relationship appears negative and statistically significant. Largely, the results suggest that non-discrimination against women in employment is not a significant determinant of account ownership in non-Islamic countries. We also find that the gender inequality index is negatively associated with account ownership but only statistically significant for Islamic countries (Model 3). This indicates that an increase in gender inequality (in terms of health, empowerment, and labour) is likely to decrease account ownership in Islamic countries. By and large, the results suggest that the effects of non-discrimination and gender inequality on account ownership in our baseline models (Table 2.4) are mainly driven by Islamic countries.

Our findings of a negative association between gender inequality and account ownership support ongoing reforms and legislations in Islamic countries that aim to empower and integrate more women into economic and productive activities (see World Bank (2020) and Hamel and Dexter (2021)). This result implies that increased participation of women in economic activities is likely to increase the demand for financial services, hence more account ownership. We also find that the relationship between the human development index and account ownership is positive and statistically significant across both Islamic and non-Islamic countries. The results suggest that both Islamic and non-Islamic countries improve financial inclusion through improvements in

human development outcomes, with a stronger effect on financial inclusion being observed in Islamic countries. The UNDP Human Development Report in 2006 documented wide variation in human development across Islamic countries, with Kuwait, the highest ranked Islamic country, at 34 and Niger the lowest ranked Islamic country placing 177 out of 177 countries. (Amr et al., 2008). Similarly, the World Bank 2020 Human Capital Index shows an improvement in human capital development across Islamic countries, especially in United Arab Emirates.

Focusing on the technological factors, we find a positive relation between mobile subscriptions (per million adults) and account ownership; however, the interaction term results, presented in Models (5) and (6), indicate that mobile subscriptions are only statistically significant for non-Islamic countries. We also find, in Model (5), a positive and significant relation between individuals using the internet and account ownership in both Islamic and non-Islamic countries, which is consistent with our baseline results. Broadly, the results suggest that mobile phone subscriptions and internet usage improve financial inclusion. Taken together, our findings are consistent with recent studies by El-Zoghbi et al. (2016) and Demirguc-Kunt et al. (2018) that have shown that sharia-complaint financial products and mobile phone penetration in Islamic countries have enhanced financial inclusion.

With regards to institutional factors, our results indicate that government integrity is positively associated with account ownership in Islamic and non-Islamic countries. Once more, these results, suggest that the impact of government integrity (lower corruption, improvement in rule of law) on financial inclusion is likely to improve financial inclusion in both Islamic and non-Islamic countries, with a stronger effect found for Islamic countries compared to non-Islamic countries. Similar to our baseline results, regulation does not show a significant impact on financial inclusion across either Islamic or non-Islamic countries.

Turning to banking factors, we find that the Boone indicator is the only factor that is significantly related to account ownership, albeit for non-Islamic countries. This suggests that as competition

in the banking sector deteriorates (equivalent to an increase in the Boone indicator), access to financial services reduces. This result is consistent with the mainstream view in the finance literature that increased competition delivers better value for customers, through enhanced access to financial services (Claessens and Klingebiel, 2001; Petersen and Rajan, 1995). Sha'ban et al. (2020) reveal that higher competition in the banking sector (a lower Boone indicator) is associated with higher financial inclusion. Our study is different from Shaban et al. (2020) because it considers a cross-country analysis of financial inclusion across Islamic and non-Islamic countries.

Finally, the results for the macroeconomic factors indicate that GDP per capita is positively and significantly associated with financial inclusion in non-Islamic countries. We expect GDP per capita to positively influence account ownership, as people in countries with higher income tend to be more financially integrated (Sha'ban et al., 2020; Owen and Pereira, 2018). For Islamic countries, the coefficient on GDP per capita is negative but statistically insignificant. Inflation, on the other hand, is insignificant across all the specifications in Table 2.5, in line with the baseline results reported in Table 2.4.

Table 2.5 Regression Analysis for Account Ownership - Islamic and Non-Islamic Countries

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
Non-discrimination*Islamic		1.055	3.916***	3.154**	5.028***	6.130***
		(1.366)	(1.227)	(1.330)	(0.977)	(1.630)
Non-discrimination* Non-Islamic		2.511	2.294	0.255	-1.673**	1.640
		(1.812)	(2.051)	(0.591)	(0.733)	(1.098)
Gender inequality*Islamic			-0.047***			
			(0.011)			
Gender inequality*Non-Islamic			-0.037			
			(0.032)			
Human development index*Islamic		0.240***		0.195**		
		(0.082)		(0.074)		
Human development index*Non-Islamic		0.157*		0.159**		
		(0.081)		(0.079)		
Mobile subscriptions (ml)*Islamic					0.069	0.082
					(0.042)	(0.075)
Mobile subscriptions (ml)*Non-Islamic					0.069***	0.042***
					(0.024)	(0.010)
Individuals using internet (per cent)*Islamic					0.260***	0.208
					(0.079)	(0.150)
Individuals using internet (per cent)* Non-Islamic					0.267***	0.187
					(0.073)	(0.153)
Government integrity*Islamic				0.525***	0.543***	-0.072
				(0.178)	(0.194)	(0.516)
Government integrity*Non-Islamic				0.354***	0.320***	-0.131
				(0.095)	(0.085)	(0.231)
Regulation*Islamic				-0.225	-1.343	-0.128
				(1.787)	(1.693)	(2.531)
Regulation* Non-Islamic				-1.810	-1.835	-2.486
				(1.330)	(1.367)	(2.110)
Market concentration (CR5)*Islamic						-0.144
						(0.153)
Market concentration (CR5)*Non-Islamic						-0.124
						(0.111)
Market power index (Lerner)*Islamic						14.27
						(12.63)
Market power index (Lerner)*Non-Islamic						-5.888
						(10.40)
(Lack of) competition (Boone)*Islamic						0.929
						(1.510)
(Lack of) competition (Boone)*Non-Islamic						-0.949**
GDP per capita (log)*Islamic	-2.974		-2.884			
	(4.944)		(4.107)			
GDP per capita (log)*Non-Islamic	8.647**		7.744**			
	(3.740)		(3.796)			
Inflation*Islamic	-0.108	0.015	-0.083	-0.083	-0.132	-0.111
	(0.134)	(0.107)	(0.140)	(0.151)	(0.155)	(0.230)
Inflation*Non-Islamic	0.095	-0.031	0.058	0.023	-0.000	-0.091
	(0.117)	(0.114)	(0.119)	(0.110)	(0.103)	(0.224)
Constant	9.084	-75.94	27.71	-74.11	35.53***	64.36***
	(28.06)	(52.76)	(26.15)	(49.83)	(9.312)	(18.53)
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Number of clusters (country)	146	140	132	129	130	95
Observations	802	766	710	722	728	350
Adjusted R-squared (within)	0.017	0.035	0.052	0.084	0.128	0.066

Note: The table reports the regression results of equation (2.2) testing the determinants of financial inclusion and the country-level factors by applying ordinary least squares (OLS) regression with country and year fixed effects while distinguishing between Islamic and non-Islamic countries. We create an interaction term of each determinant of financial inclusion with Islamic and non-Islamic countries respectively. A country is captured as Islamic if it is a member of the Organization of Islamic Cooperation (OIC), and otherwise classified as non-Islamic. The dependent variable is account ownership. The regressions are run on the full sample of countries covering the period of 2011-2017. Standard errors are clustered at the country level. *, **, *** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

2.4.3 The Determinants of Financial Inclusion in Islamic and Non-Islamic Countries - Differences According to Gender

2.4.3.1 Female Account Ownership

In this section, we explore how the factors examined earlier influence separately female and male financial inclusion in Islamic and non-Islamic countries. In our regression specification, we distinguish between male and female account ownership across our sample countries. Though gender differences in financial inclusion have been explored in prior studies, our study, to the best of our knowledge, is the first to analyse this relationship in the context of Islamic and non-Islamic countries.

Specifically, we compare our results for female account ownership (Table 2.6) and male account ownership (Table 2.7) to that of Islamic vs non-Islamic countries (Table 2.5) to identify differences and similarities across the gender groups. On the social factors, we find that an increase in non-discrimination against women in employment and human development index are positively associated with female account ownership in both Islamic and non-Islamic countries in our sample. The coefficients, as expected, are relatively large in magnitude: we find that a one unit increase in the measure of non-discrimination increases female account ownership by 3.7% to 6.2% across the Islamic countries in our sample. We also find qualitatively similar coefficients (3% to 4.8%) concerning the impact of non-discrimination on financial inclusion in non-Islamic countries. These results indicate a wider impact of non-discrimination of women in employment on female financial inclusion across both Islamic and non-Islamic countries, whereas when exploring financial inclusion independent of gender (see Table 2.5) we find that non-discrimination only affects account ownership in Islamic countries. Given that women tend to face discrimination in employment, especially in Islamic countries (Gouda and Potrafke, 2016), our findings suggest that ongoing reforms and interventions to enhance female employment opportunities globally should accelerate also female account ownership in both Islamic and non-

Islamic countries. Like the results in Table 2.5, we also find that gender inequality (in terms of reproductive health, empowerment, and labour market) is negatively and significantly related to female account ownership only in Islamic countries. Furthermore, the coefficient on the relationship between human development and female account ownership is positive and significant across Islamic and non-Islamic countries. Nonetheless, the magnitude and statistical significance of the coefficients on human development suggest that these effects are much stronger in Islamic countries. For example, the result in Model (2) suggests that a unit increase in the human development index is likely to lead to a 0.29% increase in female account ownership for Islamic countries relative to a 0.16% increase in non-Islamic countries. This suggests that human development in Islamic countries is likely to have stronger influence on female account ownership. This result also re-emphasises the work of Sha'ban et al. (2020) who show that better access to health, labour market, and the empowerment of women leads to greater financial inclusion.

For technological factors, we find that the coefficients on individuals using the internet are positive and significantly related to female account ownership across the two groups of countries. The magnitude of the coefficients also suggests that internet usage is likely to have its greatest influence in Islamic countries. Though mobile phone subscriptions are also positively related to female account ownership, it is statistically significant only in non-Islamic countries. Mobile phone subscriptions and the internet offer alternative financial mediums for women and unbanked population to carry out crucial financial transactions like payment processing and transfer of funds at a relatively lower cost. In fact, the OECD notes that mobile-based accounts can play an important role in closing the gender gap in access and use of financial services (OECD, 2018).

The results reported in Table 2.6 indicate a positive relationship between government integrity and female account ownership for both Islamic and non-Islamic countries, albeit weakly

significant for the former. This weak significance of the coefficient on government integrity for Islamic countries can, in part, be explained by the lower participation of women in governance and politics (Hern, 2017), and is more pervasive in Islamic countries (Krause, 2013).

As with the results in Table 2.5, the Boone indicator is the only banking factor that is significantly related to female account ownership. The negative coefficient on this variable suggests that as banking sector competition deteriorates (an increase in the Boone indicator), female account ownership will reduce in non-Islamic countries. This finding is in line with the mainstream literature which suggests that banking competition is positively associated with financial inclusion. However, the Lerner index and market power index are not significantly related to female account ownership. The results presented in Table 2.6 (Models 1 and 3) reveal that an increase in GDP per capita is associated to an increase female account ownership in non-Islamic countries, consistent with our Table 2.5 results. We also that GDP per capita does not seem to drive female account ownership in Islamic countries, except in Model (3) where we report a negative but weakly significant coefficient on GDP per capita. The coefficients on inflation are statistically insignificant across all specifications, similarly to the Table 2.5 results.

For macroeconomic factors the results reveal that an increase in GDP per capita is associated to an increase female account ownership in non-Islamic countries, consistent with our Table 2.5 results. We also that GDP per capita does not seem to drive female account ownership in Islamic countries, except in Model (3) where we report a negative but weakly significant coefficient on GDP per capita. The coefficients on inflation are statistically insignificant across all specifications, similarly to the Table 2.5 results.

Table 2.6 Regression Results – Female Account Ownership

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
Non-discrimination*Islamic		1.562	5.621**	3.722*	6.229***	5.230**
		(1.868)	(2.650)	(2.087)	(1.568)	(2.212)
Non-discrimination* Non-Islamic		4.452***	4.034***	3.004***	0.895	4.767***
		(1.199)	(1.357)	(0.616)	(0.764)	(1.101)
Gender inequality*Islamic			-0.096***			
			(0.007)			
Gender inequality*Non-Islamic			-0.047			
			(0.034)			
Human development index*Islamic		0.286***		0.259***		
		(0.095)		(0.092)		
Human development index*Non-Islamic		0.161*		0.157*		
		(0.089)		(0.089)		
Mobile subscriptions (ml)*Islamic					0.053	0.066
					(0.0730)	(0.103)
Mobile subscriptions (ml)*Non-Islamic					0.087***	0.050***
					(0.028)	(0.011)
Individuals using internet (per cent)*Islamic					0.366***	0.294
					(0.125)	(0.225)
Individuals using internet (per cent)* Non-Islamic					0.285***	0.174
					(0.0748)	(0.145)
Government integrity*Islamic				0.349*	0.373*	-0.169
				(0.208)	(0.223)	(0.497)
Government integrity* Non-Islamic				0.290***	0.249***	-0.295
				(0.101)	(0.0930)	(0.239)
Regulation*Islamic				-0.727	-2.205	-1.274
				(2.611)	(2.429)	(2.802)
Regulation*Non-Islamic				-1.760	-1.816	-1.902
				(1.300)	(1.324)	(2.047)
						(0.186)
Market concentration (CR5) * Non-Islamic						-0.0744
						(0.108)
Market power index (Lerner)*Islamic						15.26
						(14.31)
Market power index (Lerner)* Non-Islamic						-8.744
						(11.08)
(Lack of) competition (Boone)*Islamic						-2.306
						(1.950)
(Lack of) competition (Boone)* Non-Islamic						-1.208***
						(0.393)
GDP per capita (log)*Islamic		-6.757		-7.192*		
		(5.502)		(3.980)		
GDP per capita (log)*Non-Islamic		8.117**		6.597*		
		(3.977)		(4.010)		
Inflation*Islamic		-0.092	0.063	-0.041	-0.031	-0.090	-0.058
		(0.130)	(0.107)	(0.132)	(0.149)	(0.148)	(0.195)
Inflation*Non-Islamic		0.094	-0.044	0.023	0.007	-0.010	-0.084
		(0.124)	(0.119)	(0.118)	(0.117)	(0.103)	(0.227)

Constant	19.32 (30.50)	-91.24 (57.85)	50.93* (28.20)	-85.86 (55.02)	34.49*** (10.35)	67.57*** (19.54)
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Number of clusters (country)	146	140	132	129	130	95
Observations	802	766	710	722	728	350
Adjusted R-squared (within)	0.019	0.045	0.140	0.074	0.130	0.074

Note: The table reports the regression results of equation (2.3) testing for gender differences in the determinants of financial inclusion by applying ordinary least squares (OLS) regression with country and year fixed effects, while distinguishing between Islamic and non-Islamic countries. We create an interaction term of each determinant of financial inclusion with Islamic and non-Islamic countries respectively. A country is captured as Islamic if it is a member of the Organization of Islamic Cooperation (OIC), and otherwise classified as non-Islamic. The dependent variable is Female account ownership. The regressions are run on the full sample countries covering the period of 2011-2017. Standard errors are clustered at the country level. *, **, *** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively

2.4.3.2 Male Account Ownership

Table 2.7 reports the results of the determinants of male account ownership in Islamic and non-Islamic countries. We find that GDP per capita is positively and significantly related to male account ownership in non-Islamic, but not in Islamic countries.

Regarding our social factors, results in Table 2.7 suggest that non-discrimination against women in employment is positively related to male account ownership in Islamic countries (Models 5 and 6 only), but negatively correlated in non-Islamic countries (Models 4 and 5). The positive association between non-discrimination of women in employment and male account ownership for Islamic countries can be due to the complementary effect of women participation in economic activities. In other words, an improvement in employment opportunities for women is likely to boost overall productivity along the value chain, which in turn, will boost demand for financial services across the population. On the other hand, the negative relationship between non-discrimination against women and male account ownership in non-Islamic countries remains a puzzle, which requires further analysis in future research. We also find that the human development index is positively associated with male account ownership in both Islamic and non-Islamic countries confirming our earlier results which indicate that countries that improve the capabilities of their human resources are likely to increase financial inclusion and vice versa. Further, gender inequality does not impact male account ownership in both Islamic and non-Islamic countries.

On the technological factors, we find that mobile phone subscriptions are positively and significantly related to male account ownership in both groups of countries. Comparing Table 2.7 with Tables 2.5 and 2.6, we highlight that in Islamic countries mobile phone subscriptions only significantly influence male account ownership, but not female account ownership in Islamic countries. However, throughout all the models, mobile phone subscriptions influence male account ownership in both Islamic and non-Islamic countries. On the other hand, the results

on individuals using the internet show a positive relation with male account ownership across Islamic and non-Islamic countries but significant only in the case of the latter.

Same as with the female account ownership results (section 2.4.3.2), we find that government integrity is positively and significantly related to male account ownership across Islamic and non-Islamic countries, but regulation is not statistically significant.

Regarding the banking factors, we find that the Boone indicator is positively associated with male account ownership in Islamic countries but negative in non-Islamic countries. The positive coefficient of the Boone indicator for Islamic countries suggests that a less competitive financial system drives male account ownership in these countries. On the other hand, a negative coefficient of the Boone indicator for non-Islamic countries suggests that banking sector competition increases the proportion of male account ownership in these countries. The rest of the banking factors are not significantly related to male account ownership.

On the macroeconomic factors, we find that male account ownership is only positive and statistically significant in non-Islamic countries. This finding is in line with the notion that high income levels should improve the level of financial inclusion (Owen and Pereira, 2018). Inflation like in previous results is insignificantly related to male account ownership.

Table 2.7 Regression Results – Male Account Ownership

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
Non-discrimination*Islamic		-0.753	0.852	1.063	2.320**	3.651**
		(2.866)	(1.648)	(1.845)	(1.116)	(1.601)
Non-discrimination* Non-Islamic		0.540	0.516	-2.527***	-4.307***	-1.614
		(2.521)	(2.822)	(0.623)	(0.795)	(1.208)
Gender inequality*Islamic			-0.003			
			(0.018)			
Gender inequality*Non-Islamic			-0.031			
			(0.033)			
Human development index*Islamic		0.192*		0.132		
		(0.100)		(0.095)		
Human development index*Non-Islamic		0.161**		0.167**		
		(0.079)		(0.075)		
Mobile subscriptions (ml)*Islamic					0.086**	0.100
					(0.035)	(0.069)
Mobile subscriptions (ml)*Non-Islamic					0.051**	0.034**
					(0.021)	(0.013)
Individuals using internet (per cent)*Islamic					0.141	0.091
					(0.091)	(0.173)
Individuals using internet (per cent)* Non-Islamic					0.250***	0.208
					(0.0814)	(0.174)
Government integrity*Islamic				0.675***	0.697***	-0.205
				(0.210)	(0.231)	(0.513)
Government integrity*Non-Islamic				0.423***	0.397***	0.043
				(0.097)	(0.085)	(0.241)
Regulation*Islamic				0.308	-0.439	1.681
				(1.796)	(1.784)	(2.312)
Regulation*Non-Islamic				-1.880	-1.868	-3.036
				(1.438)	(1.485)	(2.410)
Market concentration (CR5)*Islamic						-0.065
						(0.177)
Market concentration (CR5)*Non-Islamic						-0.175
						(0.129)
Market power index (Lerner)*Islamic						12.91
						(12.67)
Market power index (Lerner)*Non-Islamic						-2.560
						(10.26)
(Lack of) competition (Boone)*Islamic						3.857***
						(1.304)
(Lack of) competition (Boone)* Non-Islamic						-0.667*
						(0.368)
GDP per capita (log)*Islamic	0.840		1.441			
	(5.119)		(5.074)			
GDP per capita (log)*Non-Islamic	9.302**		9.011**			
	(3.782)		(3.897)			
Inflation*Islamic	-0.137	-0.0510	-0.140	-0.151	-0.192	-0.182
	(0.156)	(0.125)	(0.162)	(0.179)	(0.178)	(0.288)
Inflation*Non-Islamic	0.090	-0.019	0.088	0.037	0.005	-0.103
	(0.120)	(0.120)	(0.129)	(0.117)	(0.115)	(0.239)

Constant	-2.007 (28.41)	-63.97 (54.06)	5.318 (27.93)	-65.64 (50.50)	36.89*** (9.971)	62.98*** (19.84)
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Number of clusters (country)	146	140	132	129	130	95
Observations	802	766	710	722	728	350
Adjusted R-squared(within)	0.016	0.022	0.020	0.082	0.108	0.059

Note: The table reports the regression results of equation (2.4) testing for gender differences in the determinants of financial inclusion by applying ordinary least squares (OLS) regression with country and year fixed effects, while distinguishing between Islamic and non-Islamic countries. We create an interaction term of each determinant of financial inclusion with Islamic and non-Islamic countries respectively. A country is captured as Islamic if it is a member of the Organization of Islamic Cooperation (OIC), and otherwise classified as non-Islamic. The dependent variable is Male account ownership. The regressions are run on the full sample countries covering the period of 2011-2017. Standard errors are clustered at the country level. *, **, *** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

2.5 Conclusion and Policy Implications

This chapter examines the cross-country determinants of financial inclusion captured by account ownership across 157 Islamic and non-Islamic countries. We first estimate a baseline regression model for the determinants (macroeconomic, social, institutional, technological, and banking) of financial inclusion for our sampled countries. Next, we re-estimate the baseline model across Islamic and non-Islamic countries. Further, we also consider the how the determinants of financial inclusion in Islamic and non-Islamic countries vary across male and female account ownership. Our baseline results reveal that non-discrimination against women in employment, human development, and gender inequality have a positive and significant relation with account ownership. The findings concerning the social factors underscore the importance of social inclusion (especially the involvement of women in economic activities) in achieving financial inclusion and development. All things being equal, countries that promote women empowerment and social inclusion are more likely to enhance financial inclusion, which in turn, translate into improved access to financial services (savings and loans) and productivity. We also show that government integrity, mobile phone subscriptions, and the percentage of individuals using the internet positively influence account ownership across our sample.

Splitting the sample into Islamic and non-Islamic countries, we identified some interesting variations from the baseline results. For the social factors, the results indicate that they have a positive association with financial inclusion across Islamic and non-Islamic countries. We also find that human development index and gender inequality have a stronger effect on account ownership in Islamic relative to non-Islamic countries. As discussed in the previous paragraph, the impact of financial inclusion can affect the real economy through access to enhanced financial services and investment opportunities. By bridging gender inequality gaps in Islamic countries, productivity and output can be increased, which in turn translates into higher income and

wellbeing. Furthermore, we find that the percentage of individuals using the internet positively influences account ownership in both Islamic and non-Islamic countries. On the other hand, mobile phone subscriptions affect account ownership only in non-Islamic countries. Technology has been an enabler of financial inclusion in recent decades especially in developing and emerging market economies. Technology often allows these countries to bypass the cost and structural rigidities of a traditional banking setting and open up new avenue of financial services for otherwise financially excluded segment of the market. By enhancing their technology factors countries (especially Islamic countries) are able to improve the productivity and living standard of their citizens through financial services.

For our banking factors, we find that the Boone indicator is negatively related to financial inclusion in non-Islamic countries and suggest that the lack of competition in the banking sector should reduce the level of financial inclusion in these countries.

Exploring female and male financial inclusion across Islamic and non-Islamic countries, we find that GDP per capita is positively and significantly related to both male and female account ownership in non-Islamic countries but has a negative association in the case of female account ownership in Islamic countries. We show that non-discrimination against women in employment is positively and significantly related to female account ownership in Islamic countries suggesting that issues of discrimination are less prevalent in non-Islamic countries. Further, we find human development index is positively associated with account ownership (male and female) in Islamic and non-Islamic countries. Our results also show that higher gender inequality negatively affects female account ownership in Islamic countries. Turning to the institutional factors, we find that government integrity matters and plays a vital role in driving female and male account ownership in both Islamic and non-Islamic countries. The magnitude of the coefficient also suggests that these effects are larger for Islamic rather than non-Islamic countries.

For technological factors, we find that mobile phone subscriptions are positively and significantly related to male and female accounts ownership in non-Islamic countries. We also find that the percentage of individuals using the internet is positively related to female account ownership in Islamic and non-Islamic countries. Male account ownership on the other hand, is only positively and significantly related to individuals using the internet in non-Islamic countries.

We also find that the Boone indicator (banking factor) is inversely and significantly related to female account ownership in non-Islamic countries. For male account ownership, we find a positive relationship with the Boone indicator for Islamic countries, but a negative relationship for non-Islamic countries.

Based on the results of our study we propose several recommendations for policymakers and financial institutions. To promote financial inclusion, national governments and policy makers in less developed countries should prioritise information technology infrastructure development to enhance access to internet coverage and mobile network subscriptions, particularly. Part of this strategy should include creating an enabling environment for private sector investment to thrive, to promote investment in critical sectors of the economy. Similarly, Islamic regions should promote financial literacy training in sharia-compliant financial instruments to encourage and re-connect the individuals self-excluded due to their religious reasons. Furthermore, governments should reform and improve their legal and regulatory regime to promote responsible banking and competition. Finally, public education can play a crucial role in increasing awareness among young individuals about financial skills and providing the necessary literacy training. Our findings demonstrate that financial inclusion is unevenly distributed between Islamic and non-Islamic. However, we do not provide any reasons for these differences, an area future studies can help shed more lights on. Specifically, future studies focusing on Islamic countries can further explore the factors that impede financial inclusion, especially for women.

References

Abedifar, P., Molyneux, P. & Tarazi, A. 2013. Risk in Islamic banking. *Review of Finance*, 17, 6, 2035-2096.

Adegbite, O. O., & Machethe, C. L. 2020. Bridging the financial inclusion gender gap in smallholder agriculture in Nigeria: An untapped potential for sustainable development. *World Development*, *127*, 104755.

Abokyi, E., 2023. Effects of remittances on financial inclusion gender gap in developing countries. Research in Economics, 77(1), pp.1-24.

Ahmad, A.H., Green, C. and Jiang, F., 2020. Mobile money, financial inclusion and development: A review with reference to African experience. Journal of economic surveys, 34(4), pp.753-792.

Ahmed, H., Mohieldin, M., Verbeek, J. and Aboulmagd, F. 2015. On the sustainable development goals and the role of Islamic finance. World Bank Policy Research Working Paper, 7266.

Alhassan, A. A. 2019. *Three essays on financial inclusion in Africa and the Middle East*. Doctoral dissertation. The University of Waikato.

Allen, F., Demirgüç -Kunt, A., Klapper, L. and Peria, M.S.M., 2016. The foundations of financial inclusion: Understanding ownership and use of formal accounts. *Journal of financial Intermediation*, 27,pp.1-30.

Amr, H., Marshall, K., and Mogahed, D., 2008. Human development in the Muslim World. Saban Center for Middle East Policy at the Brookings Institution, 200 (8), 1–36.

Anarfo, E. B., & Abor, J. Y. 2020. Financial regulation and financial inclusion in Sub-Saharan Africa: Does financial stability play a moderating role? *Research in International Business and Finance*, *51*, 101070.

Ardic, O.P., Heimann, M. and Mylenko, N., 2011. Access to financial services and the financial inclusion agenda around the world: a cross-country analysis with a new data set. *The World Bank.*

Ariss, R.T., 2010. Competitive conditions in Islamic and conventional banking: A global perspective. *Review of Financial Economics*, 19(3), pp.101-108

Aterido, R., Beck, T. and Iacovone, L., 2013. Access to finance in Sub-Saharan Africa: is there a gender gap? *World Development*, 47,102-120.

Beck, T., A. Demirg-Kunt, and Levine, R. 2007b. Finance, inequality and the poor, *Journal of Economic Growth* 12(1), 27–49.

Beck, T., A. Demirg-Kunt, A. & Peria, M. S. M. 2007a. Reaching out: Access to and use of banking services across countries. *Journal of Financial Economics*, 85, 234-266.

Beck, T., Iqbal, Z. and Mutlu, R. 2020 “Do Islamic Banks Contribute to Risk Sharing?". "Chapter 13: Handbook of Analytical Studies in Islamic Finance and Economics, edited by Iqbal Z., Akin T., Maghrebi N. and A. Mirakhor, Berlin, Boston: De Gruyter Oldenbourg, pp. 293-318.

Beck, T. and Levine, R., 2004. Stock markets, banks, and growth: Panel evidence. *Journal of Banking & Finance*, 28(3), pp.423-442.

Bhattacharya, M. R., and Wolde, H. 2010. Constraints on Growth in the MENA Region. *International Monetary Fund*, 10-30.

Bose, S., Bhattacharyya, A., and Islam, S. 2016. Dynamics of firm-level financial inclusion: Empirical evidence from an emerging economy. *Journal of Banking and finance Law and Practice*, 22(1), 47-68.

Casu, B., Girardone, C. and Molyneux, P., 2021. *Introduction to banking.* 3rd Ed. Pearson Education.

Chaouali, W., Souiden, N. and Ladhari, R., 2017. Explaining adoption of mobile banking with the theory of trying, general self-confidence, and cynicism. *Journal of Retailing and Consumer Services*, 35, pp.57-67.

Chen, R., & Divanbeigi, R. 2019. Can Regulation Promote Financial Inclusion? *World Bank Policy Research Working Paper*, (8711).

Chen, S., Doerr, S., Frost, J., Gambacorta, L. and Shin, H.S., 2021. The fintech gender gap. BIS Working Papers, No 931. Available at < https://www.bis.org/publ/work931.htm> (Accessed at 10 September 2022).

Chen, S., Doerr, S., Frost, J., Gambacorta, L. and Shin, H.S., 2023. The fintech gender gap. Journal of Financial Intermediation, 54, p.101026.

Cheston, S. and Kuhn, L., 2002. Empowering women through microfinance. Draft, Opportunity International, 64, pp.1-64.

Chithra, N. and Selvam, M., 2013. Determinants of financial inclusion: An empirical study on the inter-state variations in India. Available at SSRN 2296096

Claessens, S. and Klingebiel, D., 2001. Competition and scope of activities in financial services. *The World Bank Research Observer*, 16(1), pp.19-40.

Delechat, M. C. C., Newiak, M. M., Xu, R., Yang, M. F., & Aslan, G. 2018. *What is driving women’s financial inclusion across countries?* International Monetary Fund.

Demirgüç-Kunt, A., Beck, T., Honohan, P., 2008. Finance for all?: Policies and pitfalls in expanding access. World Bank Publications, The World Bank, Washington, DC.

Demirgüç-Kunt, A. and Klapper, L.F., 2012. Financial inclusion in Africa: an overview. World Bank Policy Research Working Paper, (6088).

Demirgüç-Kunt, A., Klapper, L. and Randall, D., 2014. Islamic finance and financial inclusion:Measuring use of and demand for formal financial services among Muslim adults. *Review of Middle East Economics and Finance*, 10(2), pp.177-218.

Demirgüç -Kunt, A. and Klapper, L. and Singer, D. 2013. Financial inclusion and legal discrimination against women: evidence from developing countries. Policy Research Working Paper no WPS 6416 World Bank, Washington DC.

Demirgüç-Kunt, A., Klapper, L., Singer, D. and Ansar, S., 2018. The Global Findex Database 2017: Measuring financial inclusion and the fintech revolution. World Bank Publications.

Demirgüç-Kunt, A., Klapper, L.F., Singer, D. and Van Oudheusden, P., 2015. The global findex database 2014: Measuring financial inclusion around the world. World Bank Policy Research Working Paper,(7255).

Demirgüç-Kunt, A. and Maksimovic, V., 1998. Law, finance, and firm growth. *The journal of finance*, 53(6), pp.2107-2137.

Demirgüç-Kunt, A., Hu, B. and Klapper, L., 2019. Financial inclusion in the Europe and Central Asia region: Recent trends and a research agenda. World Bank Policy Research Working Paper, (8830).

Elzahi,, A.E., 2015. Islamic microfinance: Moving beyond financial inclusion (No. 1435-11). The Islamic Research and Teaching Institute (IRTI).

El-Zoghbi, M., Karlan, D., Osman, A. and Shammout, N., 2016. Understanding Demand for Sharia-Compliant Loans (No. 24569). The World Bank Group.

Evans, O. & Adeoye, B. 2016. Determinants of financial inclusion in Africa: A dynamic panel data approach. *University of Mauritius Research Journal (22*).

Fanta, A.B. and Mutsonziwa, K., 2016. Gender and financial inclusion. Policy research paper, (01), p.1.

Fouejieu, A., Sahay, R., Cihak, M. and Chen, S., 2020. Financial inclusion and inequality: A cross-country analysis. The Journal of International Trade & Economic Development, 29(8), pp.1018-1048.

Global Partnership for Financial Inclusion (2016) G20 Financial Inclusion Indicators. rep. Global Partnership for Financial Inclusion. Available at: https://www.gpfi.org/news/g20-financial-inclusion-indicators (Accessed: September 15, 2022).

Fungáčová, Z. and Weill, L., 2015. Understanding financial inclusion in China. *China Economic Review*, 34, pp.196-206.

Ghoul, W. A. 2011. The Dilemma Facing Islamic Finance and Lessons Learned from the Global Financial Crisis. Journal of Islamic Economics, Banking and Finance. 7, 57-76.

Gonzalez, L., 2023. Doing well while doing good? Gender effects in pro-social peer-to-peer lending. Managerial Finance, 49(4), pp.661-678.

Gonzales, M.C., Jain-Chandra, M.S., Kochhar, M.K., Newiak, M.M. and Zeinullayev, M.T., 2015. *Catalyst for change: empowering women and tackling income inequality*. International Monetary Fund.

Gouda, M. and Potrafke, N., 2016. Gender equality in Muslim-majority countries. *Economic Systems*, 40(4), pp.683-698.

Hakuna, M.D.S., Hussain, M.M., Newiak, M.M., Thakoor, V. and Yang, M.F., 2016. Inequality, gender gaps and economic growth: Comparative evidence for sub-Saharan Africa. International Monetary Fund.

Hamel, I., and Dexter, G. 2021. ('UAE: The sky is the limit for gender reform). Available at: https://blogs.worldbank.org/arabvoices/gender-reforms-united-arab-emirates

Hern, E., 2017. The Trouble with Institutions: How Women's Policy Machineries Can Undermine Women's Mass Participation. *Politics & Gender*, *13*(3), pp.405-431.

Honohan, P. 2008. Cross-Country Variation in Household Access to Financial Services, *Journal of Banking and Finance*, 32(11), 2493–2500.

Iqbal, Z. and Mirakhor, A., 2012. Financial inclusion: Islamic finance perspective. *Journal of Islamic Business and management*, 2(1).

Jack, W. and Suri, T., 2011. Mobile money: The economics of M-PESA (No. w16721). National Bureau of Economic Research.

Kabakova, O. and Plaksenkov, E., 2018. Analysis of factors affecting financial inclusion: Ecosystem view. *Journal of Business Research*, 89, 198-205.

Khmous, D.F. and Besim, M., 2020. Impact of Islamic banking share on financial inclusion: evidence from MENA. International Journal of Islamic and Middle Eastern Finance and Management, 13(4), pp.655-673.

Kalnins, A., 2018. Multicollinearity: How common factors cause Type 1 errors in multivariate regression. *Strategic Management Journal*, 39(8), pp.2362-2385.

Klasen, S. and Lamanna, F., 2009. The impact of gender inequality in education and employment on economic growth: new evidence for a panel of countries. *Feminist economics*, 15(3), 91-132.

Klapper, L.F., Lusardi, A. and Panos, G.A., 2012. Financial literacy and the financial crisis (No. w17930). National Bureau of Economic Research.

Koomson, I., Villano, R.A. and Hadley, D., 2020. Intensifying financial inclusion through the provision of financial literacy training: a gendered perspective. Applied Economics, 52(4), pp.375-387.

Kostov, P., Arun, T. and Annim, S., 2015. Access to financial services: The case of the 'Mzansi' account in South Africa. *Review of Development Finance*, 5(1), 34-42.

Krause, W., 2013. Gender and participation in the Arab Gulf. In The transformation of the Gulf (pp. 105-124). Routledge.

Lee, K. & Ullah, S. 2011. Customers' attitude toward Islamic Banking in Pakistan. *International Journal of Islamic and Middle Eastern Finance and Management,* 4 (2),131-145.

Leon, F. and Weill, L., 2018. Islamic banking development and access to credit. *Pacific-Basin Finance Journal*, 52, pp.54-69.

Levine, R. and Zervos, S., 1998. Stock markets, banks, and economic growth. *American economic review*,pp.537-558.

Mbiti, I. and Weil, D.N., 2015. Mobile banking: The impact of M-Pesa in Kenya. In African successes, Volume III: Modernization and development (pp. 247-293). University of Chicago Press.

Mohieldin, M., Rostom, A., Mohieldin, M., Fu, X. and Iqbal, Z., 2011. *The role of Islamic finance in enhancing financial inclusion in Organization of Islamic Cooperation (OIC) countries*. Washington, DC: World Bank

Morrissey, R. 2012. Effects of Islamic banking on Financial Market Outcomes in GCC Countries and Iran. *Cornell International Affairs Review*, 6(1).

Muravyev, A., Dorothea S. and Oleksandr T., 2009. Entrepreneurs' gender and financial constraints:Evidence from international data. *Journal of Comparative Economics*, 37, 270-86.

Naceur, S. B., Barajas, A., and Massara, A. 2015. Can Islamic banking increase financial inclusion? IMF Working Paper WP, 15-31.

Nokulunga, M. and Klara, M., 2023. Determinants of using formal vs informal financial sector in BRICS group. Finance Research Letters, p.103956.

Okumus, H., 2005. Interest-free banking in Turkey: a study of customer satisfaction and bank selection criteria. *Journal of Economic Cooperation*, *26*(4), pp.51-86.

Onakoya, A.B. and Onakoya, A.O., 2014. Alternative Financial Inclusion Strategy: Islamic Expectations from Ogun Sub-National Government, Nigeria. *Singaporean Journal of Business, Economics and Management Studies*, 51(1448), 1-12.

Owen, A.L. and Pereira, J.M., 2018. Bank concentration, competition, and financial inclusion. *Review of development finance*, *8*(1), pp.1-17.

Park, C.Y. and Mercado, R., 2018. Financial inclusion: New measurement and cross-country impact assessment. Available at SSRN 3199427

Park, C.Y. And Mercado Jr, R., 2018b. Financial inclusion, poverty, and income inequality. The Singapore Economic Review, 63(01), pp.185-206.

Petersen, M. A. 2009. Estimating standard errors in finance panel data sets: Comparing approaches. *The Review of Financial Studies*, 22, 435-480.

Petersen, M.A. and Rajan, R.G., 1995. The effect of credit market competition on lending relationships. *The Quarterly Journal of Economics*, 110(2), pp.407-443.

Rojas-Suarez, L., 2010. Access to financial services in emerging powers: Facts, obstacles and recommendations. Obstacles and Recommendations (March 2010).

Sahay, M.R. and Cihak, M.M., 2018. Women in Finance: A Case for Closing Gaps. *International Monetary Fund*.

Sain, M.R.M., Rahman, M.M. and Khanam, R., 2018. Financial exclusion and the role of Islamic finance in Australia: A case study in Queensland. Australasian Accounting, *Business and Finance Journal*, 12(4), pp.23-42.

Sain, M.R.M., Rahman, M.M. and Khanam, R., 2016. Financial exclusion in Australia: can Islamic finance minimise the problem?. Australasian Accounting, Business and Finance Journal, 10(3), pp.89-104.

Sarkar, S., Nair, S. and Rao, M.V.V., 2022. Exploring the Gender Dimension in Financial Inclusion in India: Insights from the Global Findex Database. Journal of Development Policy and Practice, p.24551333221141570.

Sarma, M. & Pais, J., 2011. Financial inclusion and development. *Journal of international development 23*(5), 613-628.

Sha'ban, M., Girardone, C. and Sarkisyan, A., 2020. Cross-country variation in financial inclusion: a global perspective. *The European Journal of Finance*, 26(4-5), 319-340.

Staveren, I. V. 2001. Gender biases in finance. *Gender & Development*, *9*(1), 9-17.

Swamy, V., 2014. Financial inclusion, gender dimension, and economic impact on poor households. World development, 56, pp.1-15.

Trivelli, C., Invest, B.I.D., Marincioni, M., Pels, F.J. and Di Tella, E.N.I., 2018. Financial inclusión for women: a way forward. Gender economic equity: An imperative for the G20, p.88.

Usman, A. S., and Tasmin, R. 2016. The Role of Islamic Micro-finance in Enhancing Human Development in Muslim Countries. *Journal of Islamic Finance*, 5(1), 53-62.

World Bank, 2015. How to measure financial inclusion. Brief. Available online: https://www.worldbank.org/en/topic/financialinclusion/brief/how-to-measure-financial-inclusion

World Bank, 2015. Saudi women rising up in business in line with Vision 2030. Brief. Available online:https://www.worldbank.org/en/news/feature/2020/03/11/saudi-women-rising-up-in-business-in-line-with-vision-2030

World Bank. 2020. The Human Capital Index 2020 Update: Human Capital in the Time of COVID-19. World Bank, Washington, DC. World Bank.

https:// https://openknowledge.worldbank.org/handle/10986/34432

Zulkhibri, M., 2016. Financial inclusion, financial inclusion policy and Islamic finance. *Macroeconomics and Finance in Emerging Market Economies*, 9(3), 303-320.

Appendix 2A: List of Islamic and Non-Islamic countries

	Country	Group		Country	Group		Country	Group		Country	Group
1	Afghanistan	Islamic	41	Djibouti	Islamic	81	Lesotho	Non-Islamic	121	Saudi Arabia	Islamic
2	Albania	Islamic	42	Dominican Republic	Non-Islamic	82	Liberia	Non-Islamic	122	Senegal	Islamic
3	Algeria	Islamic	43	Ecuador	Non-Islamic	83	Libya	Islamic	123	Serbia	Non-Islamic
4	Angola	Non-Islamic	44	Egypt, Arab Rep.	Islamic	84	Lithuania	Non-Islamic	124	Sierra Leone	Islamic
5	Argentina	Non-Islamic	45	El Salvador	Non-Islamic	85	Luxembourg	Non-Islamic	125	Singapore	Non-Islamic
6	Armenia	Non-Islamic	46	Estonia	Non-Islamic	86	Madagascar	Non-Islamic	126	Slovak Republic	Non-Islamic
7	Australia	Non-Islamic	47	Eswatini	Non-Islamic	87	Malawi	Non-Islamic	127	Slovenia	Non-Islamic
8	Austria	Non-Islamic	48	Ethiopia	Non-Islamic	88	Malaysia	Islamic	128	Somalia	Islamic
9	Azerbaijan	Islamic	49	Finland	Non-Islamic	89	Mali	Islamic	129	South Africa	Non-Islamic
10	Bahrain	Islamic	50	France	Non-Islamic	90	Malta	Non-Islamic	130	South Asia	Non-Islamic
11	Bangladesh	Islamic	51	Gabon	Islamic	91	Mauritania	Islamic	131	Suriname	Islamic
12	Belarus	Non-Islamic	52	Georgia	Non-Islamic	92	Maldives	Islamic	132	Spain	Non-Islamic
13	Belgium	Non-Islamic	53	Germany	Non-Islamic	93	Mexico	Non-Islamic	133	Sri Lanka	Non-Islamic
14	Belize	Non-Islamic	54	Ghana	Non-Islamic	94	Moldova	Non-Islamic	134	Sudan	Islamic
15	Benin	Islamic	55	Greece	Non-Islamic	95	Mongolia	Non-Islamic	135	Sweden	Non-Islamic
16	Bhutan	Non-Islamic	56	Gambia	Islamic	96	Montenegro	Non-Islamic	136	Switzerland	Non-Islamic
17	Bolivia	Non-Islamic	57	Guinea	Islamic	97	Morocco	Islamic	137	Syrian	Non-Islamic
18	Brunei	Islamic	58	Guinea-Bissau	Islamic	98	Mozambique	Islamic	138	Tajikistan	Islamic
19	Botswana	Non-Islamic	59	Guyana	Islamic	99	Myanmar	Non-Islamic	139	Tanzania	Non-Islamic
20	Brazil	Non-Islamic	60	Hong Kong SAR, China	Non-Islamic	100	Namibia	Non-Islamic	140	Thailand	Non-Islamic
21	Bulgaria	Non-Islamic	61	Hungary	Non-Islamic	101	Nepal	Non-Islamic	141	Togo	Islamic
22	Burkina Faso	Islamic	62	India	Non-Islamic	102	Netherlands	Non-Islamic	142	Tunisia	Islamic
23	Burundi	Non-Islamic	63	Indonesia	Islamic	103	New Zealand	Non-Islamic	143	Turkey	Islamic
24	Cambodia	Non-Islamic	64	Iran, Islamic Rep.	Islamic	104	Nicaragua	Non-Islamic	144	Turkmenistan	Islamic
25	Cameroon	Islamic	65	Iraq	Islamic	105	Niger	Islamic	145	Uganda	Islamic
26	Canada	Non-Islamic	66	Ireland	Non-Islamic	106	Nigeria	Islamic	146	Ukraine	Non-Islamic
27	Central African Republic	Non-Islamic	67	Israel	Non-Islamic	107	Norway	Non-Islamic	147	United Arab Emirates	Islamic
28	Chad	Islamic	68	Italy	Non-Islamic	108	Oman	Islamic	148	United Kingdom	Non-Islamic
29	Chile	Non-Islamic	69	Jamaica	Non-Islamic	109	Pakistan	Islamic	149	United States	Non-Islamic
30	China	Non-Islamic	70	Japan	Non-Islamic	110	Panama	Non-Islamic	150	Uruguay	Non-Islamic
31	Colombia	Non-Islamic	71	Jordan	Islamic	111	Paraguay	Non-Islamic	151	Uzbekistan	Islamic
32	Comoros	Islamic	72	Kazakhstan	Islamic	112	Peru	Non-Islamic	152	Venezuela, RB	Non-Islamic
33	Congo, Dem. Rep.	Non-Islamic	73	Kenya	Non-Islamic	113	Philippines	Non-Islamic	153	Vietnam	Non-Islamic
34	Congo, Rep.	Non-Islamic	74	Korea, Rep.	Non-Islamic	114	Poland	Non-Islamic	154	West Bank and Gaza	Islamic
35	Costa Rica	Non-Islamic	75	Kosovo	Non-Islamic	115	Portugal	Non-Islamic	155	Yemen, Rep.	Islamic
36	Cote d'Ivoire	Islamic	76	Kuwait	Islamic	116	Puerto Rico	Non-Islamic	156	Zambia	Non-Islamic
37	Croatia	Non-Islamic	77	Kyrgyz Republic	Islamic	117	Qatar	Islamic	157	Zimbabwe	Non-Islamic
38	Cyprus	Non-Islamic	78	Lao PDR	Non-Islamic	118	Romania	Non-Islamic			
39	Czech Republic	Non-Islamic	79	Latvia	Non-Islamic	119	Russian Federation	Non-Islamic			
40	Denmark	Non-Islamic	80	Lebanon	Islamic	120	Rwanda	Non-Islamic			

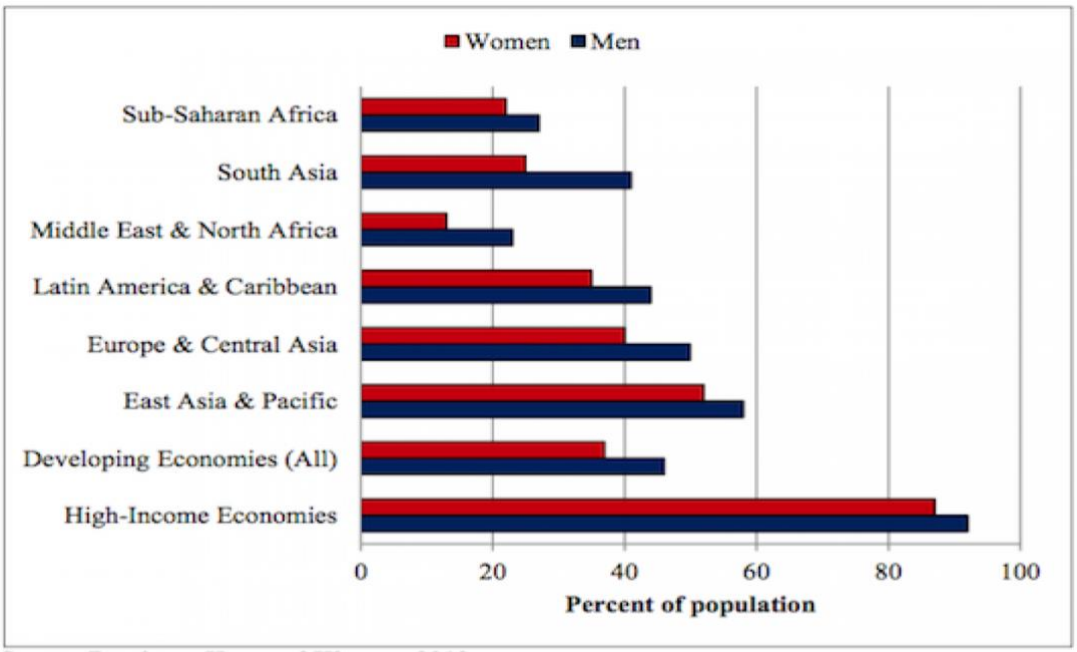
Note: The table presents the list of countries included in the sample and their classification into Islamic and non-Islamic countries. A country is classified as Islamic if it is a member of the Organisation of Islamic Cooperation (OIC), and Non-Islamic otherwise.

Appendix 2B: Variable Definitions

Variable	Description	Source	Expected relationship
Financial inclusion			
Account ownership	Percentage of respondents who report having an account at a financial institution. It is an indicator of financial inclusion.	Global Findex (World Bank)	
Account ownership (F)	Percentage of female respondents who report having an account at a financial institution.	Global Findex (World Bank)	
Account ownership (M)	Percentage of male respondents who report having an account at a financial institution.	Global Findex (World Bank)	
Macro-economic factors			
GDP per capita (log)	Gross domestic product divided by mid-year population (natural logarithm).	World Development Indicators (World Bank)	+
Inflation	Annual percentage change in average consumer price index.	World Development Indicators (World Bank)	–
Social factors			
Non-discrimination against women employment	Non-discrimination against women in employment based on whether the law mandates non-discrimination. It takes values of 0 or 1, where 0 indicates that the law does not prohibit discrimination in employment based on gender and 1 indicates that the law prohibits discrimination.	Women, Business and the Law (World Bank)	+
Gender inequality	The index reflects gender-based disadvantage in three dimensions: reproductive health, empowerment, and labour market. It ranges between 0 and 1, where 0 indicates perfect gender equality (i.e., that women fare equally in comparison to men) and 1 indicates perfect gender inequality (i.e., women fare poorly in comparison to men).	UN Human Development Report	+
Human development index	Human development index that summarises average achievement in key dimensions of human development: health, knowledge, and standard of living. It ranges between 0 and 1, where higher values indicate higher human development.	UN Human Development Reports	+
Institutional factors			
Government integrity	Average score for the following factors: public trust in politicians, irregular payments and bribes, transparency of government policymaking, absence of corruption, perceptions of corruption, and governmental and civil policy transparency (all weighted equally). It ranges between 0 and 100, where higher values indicate higher government integrity.	Heritage Foundation	–
Regulation	Regulation covers three components: credit market regulations, labor market regulations, and business regulations. It ranges between 0 and 10, where 0 indicates weak regulation and 10 indicates strong regulation.	Fraser Institute	+/-
Technological factors			
Mobile subscriptions (ml)	Subscriptions to a public mobile telephone service that provides access to the PSTN using cellular technology.	World Development Indicators (World Bank)	+
Individuals using internet (per cent)	Individuals who have used the Internet (from any location) in the last 3 months (per cent of population). The Internet can be used via a computer, mobile phone, personal digital assistant, games machine, digital TV, etc.	World Development Indicators (World Bank)	+
Banking factors			
Market concentration (CR5)	The degree of concentration of deposits in the 5 largest banks (CR5).	Global Financial Development (World Bank)	+/-
Market power index (Lerner)	A measure of market power in the banking market. It is defined as the difference between output prices and marginal costs (relative to prices).	Global Financial Development (World Bank)	–
(Lack of) competition indicator (Boone)	A measure of degree of competition based on profit-efficiency in the banking market. It is calculated as the elasticity of profits to marginal costs. An increase in the Boone indicator implies a deterioration of the competitive conduct of financial intermediaries.	Global Financial Development (World Bank)	–

Note: The table presents the variables used in the analysis in the first column, their definition in the second column, the data source in the third column, and the expected relationship with financial inclusion.

Appendix 2C: Account Ownership by Gender



Account ownership across the world, by gender (sourced from Demirguc-Kunt and Klapper, 2013: page 32

Chapter 3

FinTech-Financial Inclusion Relationship across the Economic Scale

Abstract

This paper examines the relationship between financial technology (FinTech) and financial inclusion using the International Monetary Fund's Financial Access Survey (FAS) database for 46 developed and developing countries over the period 2008-2019. Using OLS estimations with time and country fixed effects, this study first investigates the extent to which FinTech proxied by the number of registered mobile money accounts affects financial inclusion. We further examine how the FinTech-financial inclusion relationship differs across countries with different levels of economic development as measured by their GDP, income inequality proxied by the Gini index, and FinTech. Results show that FinTech strongly improves financial inclusion in all estimations. In addition, the positive effects of FinTech on financial inclusion are stronger in countries with lower levels of economic development, low levels of income inequality and high levels of FinTech. Results are robust to using alternative FinTech and financial inclusion measures. In terms of policy implications, we advise that developing countries continue investing in mobile technology infrastructure to improve population-wide access to financial services.

3.1 Introduction

Financial inclusion has often been associated with increased economic development across the globe and the availability of affordable, accessible, and relevant financial services, can generate significant economic boosts for emerging and frontier markets and could also increase banking revenues by US$200b (EY, 2018).

According to the World Bank's Global Findex 2021 report, despite the potential gains from financial inclusion, 1.4 billion people around the world remain unbanked and potentially excluded from the financial system. Nonetheless, recent advances in financial technology (FinTech hereafter) represent a good opportunity to improve financial inclusion by engaging more people with banking institutions through increased usage of mobile money technology.

FinTech is the use of different Information Technologies (IT) by financial institutions to improve service quality, data security, and mobile applications. According to the Financial Stability Board (FSB), FinTech is technologically enabled innovation in financial markets and institutions, and the provision of financial services, that can result in new business models, applications, processes, or products (FSB, 2019).

Mobile financial services are seen as a crucial type of FinTech with a strong potential to bridge the gap between the banking system and unbanked adults, ultimately helping improve income equality and overcome financial exclusion (Andrianaivo and Kpodar, 2012; Soriano, 2017; Demirgüç-Kunt et al, 2018; Demir et.al, 2022; Sadok, 2021). Put differently, mobile banking has the potential to increase access to banking services by reaching people living in rural areas (Jack and Suri 2011). Gosavi (2018) observes that opening mobile money accounts is hassle-free compared to opening bank accounts. That is why banks, due to their limited geographical presence and strict governmental regulations particularly in less developed countries, are increasingly teaming up with mobile money service providers or companies to boost their business and increase the number of their customers.

The present study employs a specific measure of FinTech, namely the number of registered mobile money accounts per 1,000 adults, due to the widespread presence of mobile money

transactions particularly in emerging and developing countries. Since the first service was launched in the Philippines in 2001, mobile money services have increased dramatically and are now a mainstream tool for financial inclusion, especially in low income countries. In terms of geographical reach, Africa and Asia have witnessed the greatest increase in digital payments, led by East Africa, China, and India. As a result of using mobile money, FinTech has helped to significantly reduce the cost of remittance in many countries, for example by 50 per cent in Africa (Global System for Mobile Association GSMA 2016, based on Remittance Prices Worldwide database from World Bank). Currently, Sub-Saharan Africa accounts for more than two-thirds of global mobile money transactions, and the market for mobile money is witnessing significant growth, particularly pioneering service providers such as Safaricom M-Pesa in Kenya, Econet EcoCash in Zimbabwe (GSMA, 2020). Similarly, transaction volumes and mobile active accounts in Asia have grown strongly in 2019 by around 30 million accounts in East Asia and the Pacific alone. Moreover, most of the other regions around the world also demonstrate the increasing demand for digital financial transitions.

Notably, COVID-19 has highlighted in many ways the importance of FinTech for financial inclusion across the world. With the pandemic impacting many businesses, most jobs, transactions, and exchanges moved to an online form to reduce human interaction and increase safety measures for individuals and enterprises. Digital financial services, therefore, turned the crisis into an opportunity and encouraged many previously unbanked people to create accounts and join the financial system. Similarly, FinTech has become indispensable both for individuals and for firms enabling more access to digital transactions and transfers, helping governments provide funds for unemployed citizens, promoting financial literacy, maintaining economic activity, and protecting customers. Similar points have also been raised by Sahay et al. (2020) and Arunachalam et al. (2020) and Ozili (2020).

Despite this fast-growing trend of using mobile money, there is a lack of studies specifically examining the relationship between financial inclusion and FinTech. Therefore, our study aims to examine the impact of FinTech in promoting financial inclusion across a global sample of countries both in developed and developing economies. Beck et al. (2015) observed that the development of cost-effective mobile-based innovations, such as mobile money, could expand access to traditional banking systems to reach the unbanked. The main form of this service is the usage of mobile phones for money transactions like transfers, payments, and purchase of products. FinTech provides ample opportunities for growth and financial inclusion, but it is not without its risks. Some of the services provided by FinTech are payment and settlement services, credit, deposit, and capital raising, and investment management services (Cornelli et al.,2021). These services overcome some of the restrictions of the traditional banking system such as geographical barriers and the need to physically go to a bank branch for simple transactions by providing an easy access to digital and mobile wallets, mobile points of sale and peer to peer transfers. All these services are accessed from mobile applications with digitized versions of credits and debit cards. Transfers completed using FinTech are cheaper and faster compared to those completed through traditional banks, as by serving customers online FinTech providers have lower operating costs, particularly in cases of foreign currency exchanges. The risks, on the other hand, include issues such as operational risks, technology failure, human error, and fraud (Cornelli et al.,2021).

Using FAS and World Bank data, we study the impact of FinTech on financial inclusion across 46 countries around the world, exploring multiple aspects of financial inclusion (such as debit and credit cards) and FinTech (such as the number of registered mobile accounts and number of mobile and internet banking transactions). In terms of empirical methodology, we employ an OLS regression and control for country and time fixed effects spanning the period between 2008-2019. Further, we look at any effects of FinTech on financial inclusion occurring in low GDP, high inequality, and high FinTech countries.

Our results indicate that: (i) FinTech has a positive and statistically significant association with financial inclusion; (ii) FinTech has an effect on financial inclusion in low income countries; (iii) the effect of FinTech on financial inclusion is higher in countries with high FinTech adoption. Our results are robust to using alternative measures of financial inclusion (the number of credit cards per 1000 adults) and FinTech (the number of mobile and internet banking transactions).

This study contributes to the existing literature in several ways. Firstly, unlike prior studies that focused on individual countries in measuring the relationship between FinTech and financial inclusion level (see for example, Hughes and Lonie, 2007; Mas, 2009; Demombynes and Thegeya, 2012; Gosavi 2018), we adopted a cross-country approach. This allows us to examine this relationship across countries that differ considerably in terms of income, culture, societal factors, legislation, and income inequality. In addition, existing studies tend to be context-specific with limitations on data generalisations and implications for financial inclusion (see for example Demir et al., 2022). In this study, we take an approach where we explore multiple facets of FinTech and financial inclusion across several countries and years providing a more general view on the FinTech – financial inclusion relationship.[8] Importantly, most studies focus either on cross-sectional data or only on World Bank Global Findex data that is released every three years, whereas in this study we make use of the FAS database that provides yearly data on FinTech and financial inclusion between 2008 and 2019, providing us with a much more detailed view on the trends emerging in FI and FinTech throughout time. Additionally, novel to this paper, we provide further analysis by exploring the financial inclusion and FinTech relationship distinguishing between countries with a high or low level of economic development, income inequality, and financial technology adoption.

[8] See for example Demir et al. (2022) who studied this relationship but only for selected countries and cross-sectionally, without exploring the dynamics of this effect in time.

The paper is organised as follows. Section 3.2 reviews the relevant literature on FinTech and financial inclusion along with the hypotheses. Section 3.3 describes the data, variables, as well as the empirical framework used. Section 3.4 presents and discusses our regression results. The final section concludes the paper with a summary and sheds light on policy implications and recommendations.

3.2 Literature Review

3.2.1 FinTech and Financial Inclusion: An Overview of The Literature

FinTech refers to new technologies adopted by financial institutions, covering data security and privacy, service delivery, applications and management (Gai et al., 2018). Its main aim is to improve customers experience and service quality of financial institutions through the use of information and technology services such as mobile applications (Berg et al., 2022). Traditionally, access to financial services and products was mainly through banks. Nevertheless, the advances made in technology nowadays make it easy to provide access to financial services even for non-financial institutions like mobile companies (Demirguc-Kunt et al., 2018). Accordingly, unbanked people are facilitated through these technological innovations to easily access and use the financial services becoming increasingly available across all countries (World Bank, 2018). Despite relatively few studies specifically examining the impact of FinTech on financial inclusion, the existing literature provides evidence that information technologies and FinTech are vital channels through which people are financially included (Jack and Suri, 2011; Mbiti and Weil, 2015; Ghosh 2016; Govasi 2018; Tchamyou, et al., 2019 Berg et al., 2022). Similarly, mobile phone penetration is essential in enhancing financial inclusion both within and across countries (Andrianaivo and Kpodar 2012; Ghosh 2016). Furthermore, mobile finance has also been found to positively influence financial inclusion of SMEs (small and mid-size enterprises) through the access it provides to bank credit (Govasi 2018). As mentioned in Section 3.1, this has increased even more during the pandemic due to the high demand on contactless

payments and digital transfers. In the following, I summarise some important findings, first for individual countries then at the across-country level.

3.2.1.1. Selected Single-Country Studies

Jack and Suri (2011) examine the impact of mobile money transfer services on the economy of Kenya at a household level, using two surveys in 2008 and 2009. The authors examine the effects of M-Pesa accounts, a mobile-based money transfer service, on a range of household socioeconomic characteristics. Their findings show that the usage of this financial service is improved significantly between the two survey rounds (from 43% to 70%) for the wealthy and poor, rural and urban sections of the population. Although M-Pesa does not replace traditional bank accounts or cover all payment mechanisms, it provides a significant tool that enhances financial services for both banked and unbanked individuals. Some of its main positive benefits include facilitating trade through paying bills and goods and transport, providing a safe saving mechanism for households, facilitating transactions between households and businesses, enhancing the investment in both human and physical capital, and allowing more efficient risk sharing. At a macroeconomic level, it also plays an important role in the money supply, inflation and bank regulations. In fact, users report that it is safe, fast, cheap, reliable, and largely useful in their daily life. Following the same line of thought, Mbiti and Weil (2015) employ panel data between 2006 and 2009 derived from financial access surveys in Kenya; the study examines M-Pesa service from different perspectives to explore it usages, benefits and characteristics in Kenya. The authors use multiple sources of data, such as: microlevel survey data, transaction data from M-Pesa agents, price data from money transfer companies, aggregate data from Safaricom (mobile network operator company), and the Central Bank of Kenya. The main services that M-Pesa offer are ‘deposit, transfer, withdraw’, with transferring money from one individual to another being the most highly used service among participants. Firm-level results show that introducing M-Pesa led to price decreases of competitor companies, while increasing the demand for banking products and services. At an individual-

level, the most likely individuals to use M-Pesa are those with the following characteristics: males, urban, banked, educated, wealthy, and those employed in the nonfarm sectors. Thus, despite the important progress that M-Pesa is making, access to it is still restricted to privileged individuals. Similarly, at a macro-level, M-Pesa has a significant effect on the economic growth directly through increasing access to funds and indirectly by enhancing savings and bank rates. Ouma et al. (2017) makes a similar argument in their study which proposes that individuals who use mobile financial services are likely to save more than those who do not. The study investigates whether mobile phone adoption has helped promote financial inclusion by using survey level data from Kenya for 2013. The empirical findings from a logit model and OLS regression indicate that both bank integrated mobile phone savings and basic mobile phone savings stored in the phone have improved or increased due to using mobile financial services. In a recent study in India, Ghosh (2016) looks at the effect of mobile phone penetration on economic growth across some major Indian states, using longitudinal data from 2001 until 2012 at a national level, shedding light on whether financial inclusion plays a role in channelling the effect of mobile penetration on economic growth. The author use the system Generalized Method of Moments (GMM) estimation procedure and panel data. Data covers macro-economic data (GDP), mobile-related data (i.e., number of cellular and number of internet subscribers), financial inclusion data (i.e., geographic access, demographic access, loan accounts per capita, deposit accounts per capita, loan-income ratio, deposit-income ratio), and state-specific data (roads per 1000 square kilometres, number of post offices). Results show that mobile penetration has a strong positive impact on economic growth, particularly for the use of loans and deposit accounts, indicating that a 10% increase in mobile penetration is associated with a 0.9% improvement in economic growth.

Seng and Lay (2018) investigate the relationship between financial technology and financial inclusion in Cambodia in 2017. FinTech is measured through the use of mobile phones, while the financial inclusion is proxied by the loan outstanding (microfinance) taken by households

in Cambodia. The study relies on primary data derived from national survey involving 7,801 households across 25 provinces in the country. Applying a propensity score matching technique, the study reveals that mobile phones have a significant impact in encouraging households to take credit from microfinance institutions. In other words, the study demonstrates a positive relationship between financial technology and financial inclusion.

Jagtiani and Lemieux (2017) investigate whether financial technology firms can expand credit to consumers who previously lacked access to credit in the United States during the period 2010-2016. The dependent variable in the study is financial inclusion, which is approximated by credit access. Two indicators are utilised to represent credit access, namely, the total number of bank accounts and the total loan volumes. Furthermore, the independent variables include number of FinTech firm branches, percentage change in branches, unemployment rate, and year dummy variables. Using a panel regression estimation approach, the study demonstrates that financial technology can expand credit in underserved areas, which are areas with low access to credit and fewer bank branches. Therefore, the study also confirms a positive association between financial technology and households' credit access in underserved areas in the United States.

More recently, Myeni et al. (2020) assess the factors that contribute to mobile money use and its implications on financial inclusion using the propensity score matching method (PSM). The data are collected from the FInScope Consumer Survey in Eswatini in 2014. The authors find that individuals with higher education, living in urban areas and entrepreneurial skills are more likely to report the use of mobile money services. In addition, the results show that individuals using mobile money accounts are more likely to own a bank account with formal financial institutions.

Yang and Zhang (2022) also examined the relationship between fintech adoption and financial inclusion in China. The authors argue that fintech adoption can alleviate consumption inequality by increasing consumption for households who typically consume less. The authors proxied financial inclusion and fintech adoption, using the household-level consumption data and regional fintech adoption respectively. Using consumption data from the China Family Panel

Series, which covers 162 counties in 25 provinces and city-level measure of fintech adoption, the authors examine a series of regression to explore the relationship between Fintech adoption and financial inclusion (proxied with consumption). They findings indicate a positive and significant association between household consumption (aggregated at the city-level) and fintech adoption. This finding is robust to different econometric specification and additional controls (household head and regional development) in their model. The findings also indicate that an increase in Fintech adoption can increase household consumption by as much as 30%. Further, Luo et al. (2022) also examine the effect of fintech innovation on household consumption in China. The authors postulate that fintech can help in reduce asymmetric information and transaction cost, which in turn increases household consumption, promote entrepreneurship and employment. Using survey data on household characteristics from the China Family Panel Studies and the Digital Inclusive Financial Index by the Peking University and Ant Financial Services Group, covering the period 2011 to 2020, the authors examined the link between fintech innovation and household consumption in China using a panel data regression approach. They find that fintech has a positive effect on household consumption. The positive association between fintech and household consumption remained positive using the GMM approach. Further, the authors interacted their financial inclusion index with entrepreneurship and unemployment to examine whether fintech increase household consumption through these channels. In this regard, they find a positive relation between their interactions terms and household consumption and confirms that entrepreneurship and employment are channels through which fintech innovation affect household consumption.

Similarly, Maskara et al. (2021) examine the relationship between fintech and financial inclusion using peer-to-peer lending data in the US. The authors assume that fintech firms add value operating in areas that are underserved by traditional financial institutions. In this regard, they argued that peer-to peer lending platforms can serve these deprived communities because they do not face any geographical barriers. To test their hypotheses, the authors use credit data from

Lending Club, a leading peer-to-peer lender in the US. Specifically the authors test whether rural areas are less likely to participate in peer-to-peer lending and whether the absence of traditional financial institutions increases the likelihood of using these fintech platforms. Further the authors test how the presence and proximity to traditional financial institutions (banks and credit unions) affect the usage of peer to peer lending platforms. Their findings indicate that the uptake of peer-to-peer lending is generally low in rural areas unless they do not have a bank or credit union and demonstrate that these fintech providers are alternative source of financing for those neglected by the traditional financial institution. They also find that in urban areas where there has been an increase in banks and credit unions, there is a corresponding increase in peer-to-peer lending. However, for area where banks and credit union do not exist prior, the introduction of these traditional finance providers is associated with low uptake of peer-to-peer lending, which confirms the substitutability of the these financing sources.

Yue et al. (2022) on the other hand, examine the consequences of fintech and whether it leads to financial distress. The authors argue in their hypotheses that the widespread adoption of digital finance increases access to credit, which in turn, increases overall consumption. The increased consumption subsequently lead to an increase in debt accumulation which increases debt distress. Using data from China Household Finance Survey for the years 2013, 2015, 2017 and 2019, the authors developed a digital finance index and subcomponents of depth and usage of digital financial service and household characteristics including a dummy variables to capture household debt (financial distress), the authors estimated the relationship between digital fintech adoption and financial inclusion using panel fixed effect regression. Their findings indicate that an increase in digital finance adoption is positively and significantly related to the likelihood of household getting a loan or credit facility. They also find that an improvement in digital financial index is associated with an increase in household consumption and marginal propensity to consume by about 27% and 4% respectively. Furthermore the authors show that an increase in

their digital finance index increases the likelihood of household falling into financial distress by about 2.9%.

3.2.1.2. Selected Cross-Country Studies

In a recent study, Demir et al., (2022) investigate the interrelationship between Fintech, financial inclusion and income inequality across 140 countries for 2011, 2014 and 2017. The dependent variable in their study, income inequality, is measured as the Gini coefficient (see Beck et al., 2007; Jauch and Watzka, 2016).[9] FinTech is treated as an independent variable and proxied by the use of mobile phones to pay bills (Asongu and Odhiambo, 2018; Asongu and Nwachukwu, 2018). The study also includes financial inclusion as an independent variable in the model, which is approximated by a range of variables that is; (i) the ratio of the adult population having account at formal financial institutions; (ii) the ratio of the adult population having saving account at formal financial institutions; (iii) the ratio of the adult population having credit at formal financial institutions. Their regression model results show that Fintech has a positive and significant effect on financial inclusion. In addition, they also show that FinTech and financial inclusion significantly reduce income inequality in their study.

Andrianaivo and Kpodar (2012) study the impact of mobile phone development on the economic growth rates across 44 African countries from 1988 to 2007 using the System (GMM), through financial inclusion. They measure mobile development using mobile penetration rate (i.e., number of mobile phone subscribers divided by the total population), as well as the cost of local mobile rates (i.e., phone diffusion). Financial inclusion is measured by the number of deposits or loans per head taking into consideration different types of financial intermediaries such as formal commercial banks, microfinance institutions and cooperative state institutions. The study shows that mobile phone diffusion reduces transaction costs, increases access to credit and deposit facilities, facilitates financial transfers, helps rural development and provides better chances for

[9] The Gini coefficient measures the extent of income distributed among individuals or households varies from a perfectly equal distribution. The value ranges from 0 (perfect equality) to 100 (perfect inequality) (World Bank Database).

an increased access to financial services, narrowing down financial exclusion in African countries. Results also show that higher mobile phone penetration correlates with higher real GDP per capita and higher access to loans and deposits in Africa. They also find that mobile phones are used as substitutes for landline phones rather than complementary devices in the region. Moreover, mobile phone penetration reinforces the positive relation between financial inclusion and economic growth, with this effect being stronger across regions where mobile financial services are available and accessible.

The effect of mobile money on financial inclusion is not only limited to households. Gosavi (2018) found that the adoption of mobile money at the firm level can help mitigate the barrier to access financial services. Using the 2013 World Bank's Enterprise Surveys Program dataset for for Eastern Sub-Saharan African countries (that is Kenya, Tanzania, Uganda, and Zambia) and an ordered-probit model, the author shows that firms that use mobile money are more likely to obtain loans and lines of credit relative to their counterparts without access to these services. They also find that firms that use mobile money services tend to be more productive. Overall, the adoption of mobile money services increase access to financial services and can make firms more efficient in their operations.

Lyons et al. (2021) also investigate the relationship between financial technology and financial inclusion in the post-COVID pandemic period (year 2020) at global scale covering the 16 largest emerging countries. FinTech is approximated by Global FinTech Index (GFI), while financial inclusion is approximated by savings, borrowing and remittances. The GFI consists of three dimensions, namely, the quantity, the quality and the environment. To understand the relationship between financial technology and financial inclusion, the Probit regression is applied. The dependent variable in the model is financial inclusion indicators (i.e., actual deposit/balance), while the independent variables include GFI score and vulnerable group. The latter consists of some control variables such as age, gender, education and income. The study

demonstrates that FinTech has a significant impact on financial inclusion improvement across the 16 countries sample.

Hondula (2022a) also examine the relationship between fintech and financial inclusion using a panel of 78 countries for the period 2013 to 2019. The author attempts to determine if fintech platforms are substitute to traditional banks and financial institutions. Matching credit offered by traditional banks and credits for 78 countries, the authors estimate if there is a mutual relationship between bank credit and fintech lending employing a two stage least square that controls for reverse causality and simultaneity bias. The empirical results revealed that fintech lending is positively related to bank lending which demonstrate a complementary relationship. This result is observed for credit extended to households and small and medium enterprises. The author however, find that fintech lending act as a substitute to traditional lending in concentrated banking sector. They also find that markets characterised by banks with high margins and lending rates are likely to experience substitution of loans by fintech platforms. Further, they show that in markets with high non-performing loans and credit rationing by traditional financing institutions, loans are more likely to be substituted by fintech platforms to fill in the lending gaps. Although all these studies show a strong positive impact of technology on the banking system and the level of financial inclusion in poor countries where people own mobiles, they are some limited in scope, because they focus on a specific technologies and financial products or a few countries. Some of the studies are largely based on survey data for individual countries, or a cross-section of countries, which does not allow for causal inferences. Overall, there are relatively few studies looking at the impact of FinTech and mobile finance on financial inclusion, hence, our interest to examine this relationship and to explore which aspects of FinTech are most important for promoting financial inclusion across countries and across samples of high/low GDP, high/low income inequality.

Apeti (2022) focusing mobile money fintech examine its relationship with the volatility of household consumption. The authors argue that mobile money can smoothen consumption

through financial inclusion and remittances channel by increasing access to financial services, encouraging savings and micro-insurance services. To test these conjectures, the authors utilise an annual panel of 76 countries for the year 1990 – 2019 and an entropy balance methodology, which allowed them compare mobile money and non-mobile money countries that are observationally similar, after controlling for country and time fixed effects. Their findings reveal that mobile money usage is positively associated with household consumption, which in turn, has a positive effect on standard of living. When related to consumption volatility, they find that a 1% increase in mobile money adoption causes a the level of consumption volatility to reduce by about 1.15 to 1.66%.

Similarly, Hondula (2023) also examine if fintech and big techs lenders support financial inclusion by reducing bank interest margin. The author arguer that by offering targeted solutions and serving the unbanked segments of the economy, fintech can add value and provide competition to traditional banks. To test these conjectures, the author related the volume of fintech and big tech lending to bank interest margin using a sample consisting of 91 countries over the period 2013 to 2019. Using a panel regression methodology, they find a negative and significant relationship between fintech lending and bank interest margin suggesting the growth in credit offered by fintech and big tech drives downward banks interest margin. The magnitude of reduction in the net interest margin was estimated to be 11.9%. These results remain negative and statistically significant after controlling for endogeneity using generalised method of moment and two-stage least squares method.

3.2.2 FinTech and Income Inequality: An Overview

Information and communication technology can have an important role in limiting unequal income distribution especially among developing countries. The usage of mobile phones is rapidly increasing around the globe offering more opportunities for reducing income inequality for the poor. FinTech provides help to easily access financial and governmental services. This positive effect of FinTech or the use of mobile phones on income inequality is supported by

Asongu and Le Roux (2017). The authors use a panel of 49 Sub-Saharan countries from 2000-2012 and Tobit regression methodology and find that mobile and internet usage have a positive impact on financial inclusion. In addition, another individual country study conducted by Aker and Mbiti (2010) show a positive effect of mobile phone coverage and usage on the quality of agricultural, educational and health services. Similarly, Zhang et al., (2018) find that FinTech seems to reduce the rural-urban income gap in China. However, Asongu (2015) find a negative relationship between mobile penetration and income inequality in a case of 52 African countries. Asongu and Odhiambo (2019) similarly confirm the previous results with a negative relation between mobile, internet and broadband penetration and inequality across a sample 48 countries. Further, Asongu and Nwachukwu (2018) examine the impact of mobile banking on development (including inequality and poverty) through using the proxy of the use of mobiles to pay bills or send and receive money in a cross-section of 93 countries. The results show a significant negative relationship between the use of mobile and income inequality but only in upper and middle income countries. Overall, the relationship between FinTech and income inequality is not a clear cut. The link between them is positive in some countries and negative in other countries. FinTech does not necessarily help reducing inequality, particularly when we consider individual countries and other economic variables.

More recent studies (Frost et al., 2022; Hondula, 2022) on the relationship between fintech and inequality through financial inclusion have generally affirmed prior findings of a positive relationship. For instance, Frost et al. (2022) examines how financial development and fintech can affect financial wealth inequality using a survey data (Survey of Household Income and Wealth) from the Bank of Italy. They find that both financial development (number of branches) and fintech (use of remote banking) have a positive impact on financial wealth of households. They also observe a positive effect of financial development and fintech on financial wealth across all deciles of their wealth distribution, with stronger effect for those at the top of the distribution. However, they find that the magnitude of the gap between those at the top end and

bottom end of the distribution reduced for the latter years of the sample. Similarly, Hondula (2022b) investigates the effect of fintech and big tech credits on income inequality using a panel of 78 countries. The author argues that fintech and big tech enable underserved households and businesses to gain access to credit, which in turn, promote productivity and participation in the economy, and hence a reduction in poverty. Testing this conjecture using a panel of 78 countries from 2013 to 2019, they find a negative relation between tech credit and inequality (measured using the Gini coefficient). They also find that the relationship between tech credit and inequality is positive in countries with low financial inclusion but negative in countries with high financial inclusion.

To summarise the relationships between the three variables - FinTech, financial inclusion and income inequality - we present a short overview here. Based on the previous literature on financial inclusion, income inequality and FinTech, it is possible to identify some initial patterns. First, the relationship between financial inclusion and income inequality seems to depend on the typical aspects of financial inclusion (for instance access to financial services) as well as the type of banking services or proxies of financial inclusion used (e.g., account ownership, payments, saving, or insurance). The limited literature on the type of financial services and technologies used suggest that new research would need to incorporate different measures of financial inclusion across different countries to extend on the previous findings. Second, the existing literature either looks at the link between financial inclusion and income inequality or the link between FinTech and income inequality but does not attempt to bring the three dimensions together and look at how they interact to influence financial inclusion and equality across both under-developed, developing and developed countries (Demir et al., 2020). FinTech might have an indirect effect on income distribution through financial inclusion. In other words, financial inclusion might reduce income inequality through the use of technology and mobile finance to bring the poor section of the population closer to banking services. Similarly, high levels of inequality can hinder the access to and use of FinTech and so further enlarge the gap between the

rich and the poor in terms of financial inclusion. Thirdly, the interrelationship between FinTech, financial inclusion and income inequality appears to vary across regions and countries depending on their economic status and institutional development.

Though these studies add to our understanding of how FinTech can increase financial inclusion and reduce income equalities, the evidence is somewhat mixed. While some studies find that FinTech and financial inclusion can reduce income inequality in high income economies, other studies also highlight a weak significance in this relationship for low income countries. Specifically, Demir et al. (2022) note that the low significance across low income countries is attributable to the lack of good infrastructure, basic financial literacy and customer-oriented regulations, which in turn, prevents the population in these countries from accessing and using the available financial services. Unlike prior studies (Hughes and Lonie, 2007; Mas and Morawczynski; 2009; Demombynes and Thegeya, 2012; Gosavi 2018) that focused on individual countries), this study adopts a cross-country approach by estimating the relationship between FinTech and financial inclusion across countries with different socio-economic characteristics. This approach allows us to capture the effect of country differences (income, culture, societal factors, legislation, and income inequality) on the relationship between FinTech and financial inclusion. Additionally, we explore how the relationship between FinTech, and financial inclusion is influenced by differences in economic development, income equality and FinTech adoption.

This study adds to our understanding of the role of FinTech in reducing financial exclusion and income disparities. However, the fact that most of the studies find that reducing income inequality through financial inclusion and the use of technology is more significant among high income economies, more policies and research should be placed to address how to make banking services and technology more accessible to provide an inclusive development for the poor and low income people. Demir et al. (2020), furthermore, rightly argue that its low significance across low income countries goes back to the lack of good infrastructure, basic financial literacy and

customer-oriented regulations which prevents the population from accessing and using the available financial services.

In the following section, we present our empirical framework by identifying the variables of financial inclusion and FinTech examined in this study, the specification of our empirical model and data description.

3.2.3 Hypotheses

There are four hypotheses we set for our study. The first derives from the observations from both single-country studies (e.g., Jack and Suri, 2011; Seng and Lay, 2018), as well as cross-country studies (e.g., Gosavi, 2018; Lyons et al., 2021) which suggest a positive relationship between mobile money and financial inclusion. With recent improvements deriving from the use of technology, FinTech is seen as a crucial enabler of financial inclusion; and adaption of mobile financial services which is a type of FinTech could have the greatest opportunity to bring the unbanked into the financial system (Demir, 2020). Therefore, our first hypothesis can be described as follows:

H1: FinTech usage positively associates with financial inclusion across all countries.

Second, mobile money is considered a useful tool especially in developing countries among societal groups for which financial services are inaccessible, unaffordable or unsuitable. Mobile money usage is an alternative to the costly traditional banking infrastructure, mainly due to low interest rates and high and wide range of fees, which can be used to create and complement the pathway to financial services in remote and poor areas where financial inclusion is often low.

Due to weak banking infrastructure and low level of financial penetration, alternative and low cost mobile money services are more prevalent in low income countries. We expect the adoption of FinTech to be higher in low income countries compared to developed countries. Financial inclusion differs considerably across countries and income levels, yet income has been identified

as a significant predictor of financial inclusion, particularly in low GDP countries (Evans 2016; Sarma and Pais 2011). In developed countries, mobile money schemes are rare due to highly efficient electronic payment systems, including cards, and most people have access to banks (Evans and Pirchio, 2014). Therefore, our second hypothesis can be formulated as follows:

H2. The positive association between FinTech and financial inclusion is higher in low GDP countries than in high GDP countries.

The third hypothesis is that in countries with high income inequality many individuals from underprivileged backgrounds do not have access to financial services, particularly through the usage of FinTech. The extant literature on the relationship between income inequality and financial inclusion suggests access to finance can reduce poverty. The reduction in poverty comes about because improved access to finance enhances education and economic opportunities (Banerjee and Newman 1993; Galor and Zeira, 1993). In line with this, individuals from countries with high income inequality will have less access to financial services, while in countries with low income inequality, we expect most population to have equal access to financial services.

The stronger impact of FinTech on financial inclusion in low income inequality countries can be explained by the fact that these latter have also lower economic growth which may affect the attractiveness of FinTech companies to join the respective markets, thus reducing the overall level of adoption of FinTech products and services in these countries. In turn, the reduced adoption of FinTech in these countries would not impact financial inclusion comparatively as much as in low income inequality countries.

High income inequality has negative economic consequences for people in the lower spectrum of the inequality divide. According to the UN United “Nations Shaping our Future 2020” report, high income inequality is likely to derail economic growth by discouraging skills accumulation, establishing uncertainty and insecurity, undermining trust in institutions and government,

increasing social conflict and stress and causing violence and conflicts.[10] Thus, our third hypothesis is formulated as:

H3: The positive association between FinTech and financial inclusion is higher in low income inequality countries.

The fourth hypothesis we put forward is that in countries where people are more likely to have adopted mobile services and mobile technology, the impact of FinTech on financial inclusion will be stronger. Andrianaivo and Kpodar (2012) propose that information and communication technologies (ICT) development can enhance growth through employment and government revenue generation and better financial inclusion and therefore financial development. We expect that countries with high FinTech adoption will have more financial inclusive system compared to those with low technology penetration or adaption. For instance, Andrianaivo and Kpodar (2012) show that mobile phone penetration can positively impact economic growth through its effects on financial inclusion. Thus, our fourth hypothesis is described as follows:

H4: The positive association between FinTech and financial inclusion is higher in high FinTech adoption countries.

3.3 Data and Empirical Framework

3.3.1 Data and Descriptive Statistics

We collect country-level data on FinTech and financial inclusion indicators from the International Monetary Fund's Financial Access Survey (FAS) database. The FAS database provides a supply-sided dataset on access to and use of financial services (including FinTech) across 168 countries from 2004 onwards. It covers variables such as (i) the number of registered mobile money accounts per 1000 adults, (ii) the number of mobile money and internet banking

[10] https://www.un.org/en/un75/inequality-bridging-divide

transactions per 1000 adults, (iii) the number of debit cards per 1000 adults, and (iv) the number of credit cards per 1000 adults, among others. For the purpose of this study, we focus on FinTech and financial inclusion measures which are only available from 2008 onwards. Our control variables (GDP per capita, trade, inflation, enrolment in secondary school) are drawn from the World Bank's World Development Indicators (WDI) database.

Our initial sample is composed of all countries covered in the FAS database. We then restrict the sample to countries for which there is complete information on FinTech and financial inclusion. The FAS database provides yearly data on FinTech variables from 2008 until 2019. One constraint of the dataset is the lack of availability of FinTech data for several countries in certain years. After the matching and filtering process, our data set covers 46 countries between 2008 and 2019.

3.3.2 Identifying the Variables

3.3.2.1 Dependent Variable: Financial Inclusion

Financial inclusion, in this study, is proxied by the number of debit cards per 1000 adults (number of debit cards). This measure is a widely used measure of financial inclusion (see Sahay et al., 2020, Ozili, 2018, Jagtiani and Lemieux, 2017). This proxy for financial inclusion is chosen because of data availability for alternative measures financial inclusion across the sample countries. For robustness purposes, we also use the number of credit cards per 1000 adults (number of credit cards) as an alternative measure for financial inclusion.

3.3.2.2 Independent Variables: FinTech

We use two main measures of FinTech: (i) the number of registered mobile money accounts and (ii) the number of mobile and internet banking transactions. The number of registered mobile money accounts per 1,000 adults is from the IMF's Financial Access Survey (FAS) database. Mobile money account according to the IMF FAS database is an account registered mobile money service provider that is primarily accessed using a mobile phone and can be used

for basic financial transactions, including peer-to-peer transfers, bill payments, merchant payments and international remittances. This indicator has been used in previous studies such as Espinosa et al. (2020) and Chhabra (2021). In the robustness section, we also use the number of mobile and internet transactions per 1000 adults as an alternative measure of FinTech.

It is instructive to note that information asymmetry is more pervasive with mobile money lending relative to traditional lending provided through credit cards. In the case of the latter, credit provision is preceded by rigorous credit references, through extensive use of data, which reduces the level of information asymmetry between the lender and the borrower. However, this is not the case in mobile money transactions, where the transaction is completely online, and the lender may have little to no information on the borrower except their mobile number and account. As a result, when mobile money is used to provide loans there is uncertainty about whether the borrower will repay or not. For instance, in Kenya, more than 2 million people were reported to the Kenya credit referencing bureau for defaulting on loans taken through mobile money (Francis et al., 2017). Nonetheless, Björkegren and Grissen (2018) note that the use of mobile money as a medium for offering loans can create information asymmetry due to the lack of data on borrowers in developing countries, where the service is prevalent. The authors also note that lenders in these environments have adopted alternative data to generate credit scores to manage credit risk. These alternative data, such as mobile money usage, the pattern of calls, top-ups and mobility, provide behavioural data that can be used to predict repayment (Björkegren, 2010; Björkegren and Grissen, 2020).

3.3.2.3 Control Variables: World Bank Development Indicators

In line with recent studies, we control for a set of factors that are associated with the level of financial inclusion. These control variables include GDP per capita, trade, inflation, and secondary school enrolment.

GDP per capita is considered the most significant factor in financial inclusion literature (Sarma and Pais 2011, Lenka and Barik 2018). High income is directly linked to higher access to financial services, and the increase in GDP per capita has a significant positive impact on credit and savings (Kumar, 2011). In other words, individuals in high income countries are expected to be more financially included (Owen and Pereira, 2018).

Trade refers to the sum of exports and imports as a share of GDP and measures a country's openness. Trade boosts the economy and is likely to increase demand for financial services, among others. Hajilee and Niroomand (2019) note that as a country's financial system develops and becomes more inclusive, the level of trade openness is also likely to increase. Nonetheless, as a country increases its trade with the rest of the world (openness), there is a high likelihood that financial services demand will increase as a result, which can positively affect the level of financial inclusion.

Inflation according to the World Bank's World Development Indicators refers to the "annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly." Thus, we control for inflation as the purchasing power of money can significantly influence the level of financial inclusion in a country, given that it erodes the real value of income. This implies that countries with high inflation are also likely to experience low financial inclusion, as the value of savings and purchasing power reduces (Allen et al., 2014; Rojas-Suarez and Amado, 2014; Evans and Adeoye, 2016).

Enrolment in secondary school education based in the World Development Indicator definition is the ratio of the number of students enrolled in secondary education regardless of age by the population of the age group which officially corresponds to secondary education and multiplied by 100. The educational level of individuals often contributes to their involvement in the financial system of their country. Low levels of education in general and financial knowledge in particular lead to a lack of interest in financial services and savings through debit cards. Secondary

education, however, helps raising knowledge among the young people about the financial markets and the importance of banking services, specifically on different insurance schemes, investments, deposit accounts and credit facilities (Beck, et al., 2007; Demir et al., 2022).

Appendix 3A presents definitions of the variables used, their sources, and the expected relationship with financial inclusion.

3.3.3 Descriptive Statistics and Correlation Matrix

Table 3.1 presents the summary statistics of the dataset used for the empirical analysis. Focusing on the key dependent variables, we note that the number of debit cards observed in our sample is 894.71 per 1000 adults. This is notable as, on average, there is just under one debit card for each adult. The highest number of debit cards is found in Turkey in 2019 and stands at 2631 per 1000 of adults, while the lowest number of debit cards is observed for Myanmar in 2014 at 7 per 1000 of adults. Comparing the number of debit cards with the number of credit cards, we note that the mean number of credit cards is considerably lower, standing at 321.51 credit cards per 1000 adults, with the highest number of credit cards per adult observed in Luxembourg, while the smallest number of credit cards is again found in Myanmar. We also note that the number of debit cards held per person is more dispersed across countries compared to credit cards (standard deviations of 623 and 390 respectively).

Investigating our main measure of the FinTech variable, we find that the average number of registered mobile money accounts stands at 408.49 per 1000 adults with a standard deviation of 540.72. The minimum and maximum number of registered mobile money accounts were 0.26 and 3,269.67, observed in Myanmar and Panama, respectively. For the second measure of FinTech used in the study, that is, the number of mobile and internet banking transactions per 1000 adults, we find that the average number of transactions are 32,335.95 per 1000 adults, with a standard deviation of 40,569.97. This indicates that, on average, every year, an individual conducted an internet or mobile banking transaction around 32 times. Interestingly, the highest yearly value of mobile and internet transactions per 1000 adults is seen in Zimbabwe, followed

by Uganda, Ghana and Kenya, highlighting the large adoption of FinTech in West Africa. At the same time, the lowest number of mobile and internet banking transactions is observed in Sudan evidencing the large disparities in terms of FinTech adoption between African countries.

For our control variables, we find that the average GDP per capita stands at US $11,625.50, with the highest GDP per capita of $96944.09 observed in Norway and the lowest GDP per capita of $411.55 observed in Malawi. The average inflation for the sample is approximately 4% with a standard deviation of 4.28, while school enrolment (secondary) is 83.36%. We also find that trade (as a percentage of GDP) is 82.57% for the sampled countries with a standard deviation of 36.38%.

Table 3.1 Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max	Median
Financial inclusion variables						
Number of debit cards per 1,000 adults	599	894.71	622.70	6.97	2459.68	821.857
Number of credit cards per 1,000 adults	593	321.51	390.21	0.02	1603.46	179.6902
FinTech variables						
Number of registered mobile money accounts per 1,000 adults	457	408.49	540.72	0.26	3269.67	183.0958
Number of mobile and internet banking transactions per 1,000 adults	510	32335.95	40569.97	0.45	201552.90	13306.26
Number of mobile money transactions per 1,000 adults	451	8186.975	14869.72	0.1859	82864.56	1495.30
Control variables						
GDP per capita (current US dollars units**)**	853	11625.50	18602.30	411.55	96944.09	4581.739
Inflation, consumer prices (annual %)	829	4.02	4.28	-1.57	23.56	3.03
School enrolment, secondary (% gross)	577	83.36	28.77	18.20	153.96	89.07
Trade (% of GDP)	828	82.57	36.38	22.77	184.69	76.36

Note: The table reports the descriptive statistics of the variables used throughout our analysis. Obs. represents the number of observations, Std.Dev. stands for the yearly standard deviation of the variables. Mean is the average value of each variable; Min is the minimum value of each variable; Max is the maximum value of each variable. Yearly data between 2008-2019 collected from the World Bank World Development Indicators and International Monetary Fund Financial Access Survey. Appendix 3A provides the definitions and sources of the variables used in the study.

The correlation matrix for the variables employed in our analysis is presented in Table 3.2. Pairwise correlations between independent variables do not typically exceed +/- 0.55, thus avoiding any potential multicollinearity

Table 3.2 Correlation Matrix

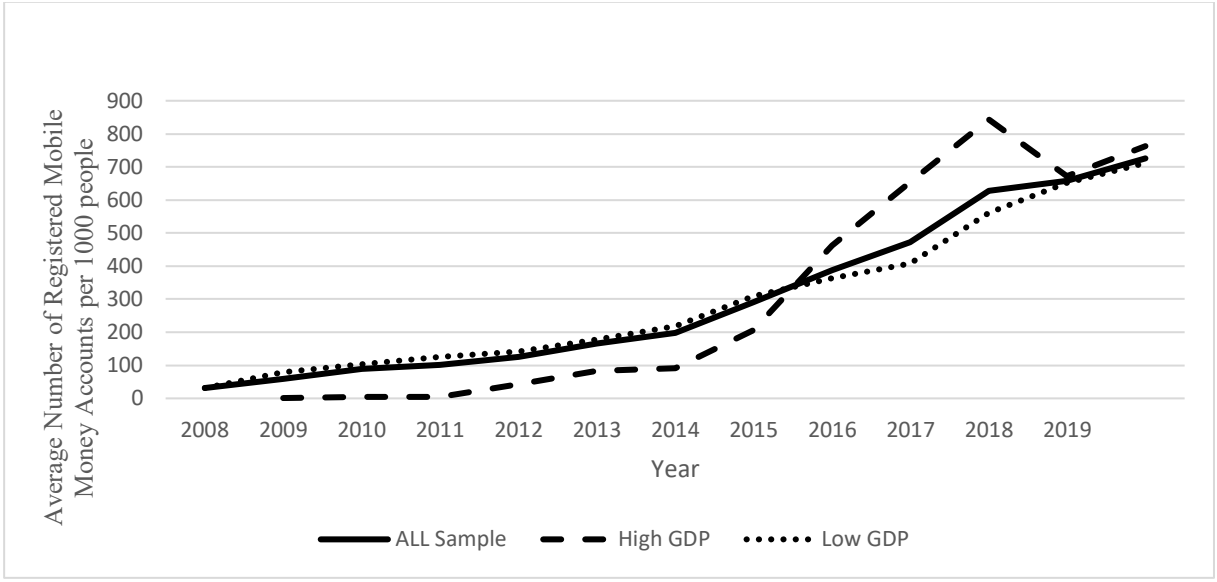
	Number of Credit Cards per 1,000 adults	Number of Debit Cards per 1,000 adults	Number of registered mobile money accounts per 1,000 adults	Number of mobile and internet banking transaction per 1,000 adults	GDP per capita	Inflation	School enrolment, secondary (% gross)	Trade (% of GDP)
Number of credit cards per 1,000 adults	1.000							
Number of debit cards per 1,000 adults	0.675* 0.000	1.000						
Number of registered mobile money accounts per 1,000 adults(log)	0.312* 0.000	0.071 0.288	1.000					
Number of mobile and internet banking transaction per 1,000 adults(log)	0.332* 0.000	0.346* 0.000	0.278* 0.001	1.000				
GDP per capita (log)	0.697* 0.000	0.5327* 0.000	-0.003 0.948	0.485* 0.000	1.000			
Inflation	-0.201* 0.000	-0.223* 0.000	-0.095* 0.044	-0.230* 0.000	-0.262* 0.000	1.000		
School enrolment, secondary (% gross)	0.492* 0.000	0.685* 0.000	-0.013 0.837	0.514* 0.000	0.551* 0.000	-0.288* 0.000	1.000	
Trade (% of GDP)	0.011 0.794	0.274* 0.000	-0.026 0.588	0.183* 0.000	0.270* 0.000	-0.272* 0.000	0.373* 0.000	1.000

Note: Table 3.2 reports correlation coefficients for dependents and independents variables for financial inclusion and FinTech indicators respectively. *, **, *** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively

Further, we split the sample into high and low GDP countries based on their average GDP for the sample period 2008 – 2019. Specifically, we first estimate the average GDP for each country over the sample period. Then we group the countries based on the distribution of the average GDP from the lowest to highest. We classify a country as high GDP if it is in the top half of the distribution of average GDP and low GDP if it falls in the lower half of the average GDP distribution.

Figure 3.1 displays the average number of registered mobile money accounts per 1000 adults over time, while also differentiating between high and low GDP countries. We find that the average number of registered mobile money accounts has increased consistently throughout the years. The rate of growth in FinTech usage observed in high GDP countries has improved considerably after to 2014, is higher for low income countries, but has dropped after 2017 most likely as technology adoption matured. The trends seen in Figure 3.1 can also be explained through the relatively large number of mobile payments per 1,000 adults that were processed in Sub-Saharan countries such as Ghana and Kenya, while in developed high income countries there was a greater diversity of means of payment (e.g., credit cards, cash, bank transfers, etc.). However, the adoption of mobile payments/money accounts in high GDP countries has increased after 2014. Perhaps a further reason for the slow growth in high income countries is due to security concerns relating to providing personal financial information and adoption of technology in developed countries at the initial stage, however, as the industry matures, people in high income countries become more comfortable in using mobile technology. This stands in contrast to the trend observed for low GDP countries which is constantly increasing as more people gain access to FinTech.

Figure 3.1: Average Number of Registered Mobile Money Accounts Over Time: Full Sample and Countries with High and Low GDP Per Capita

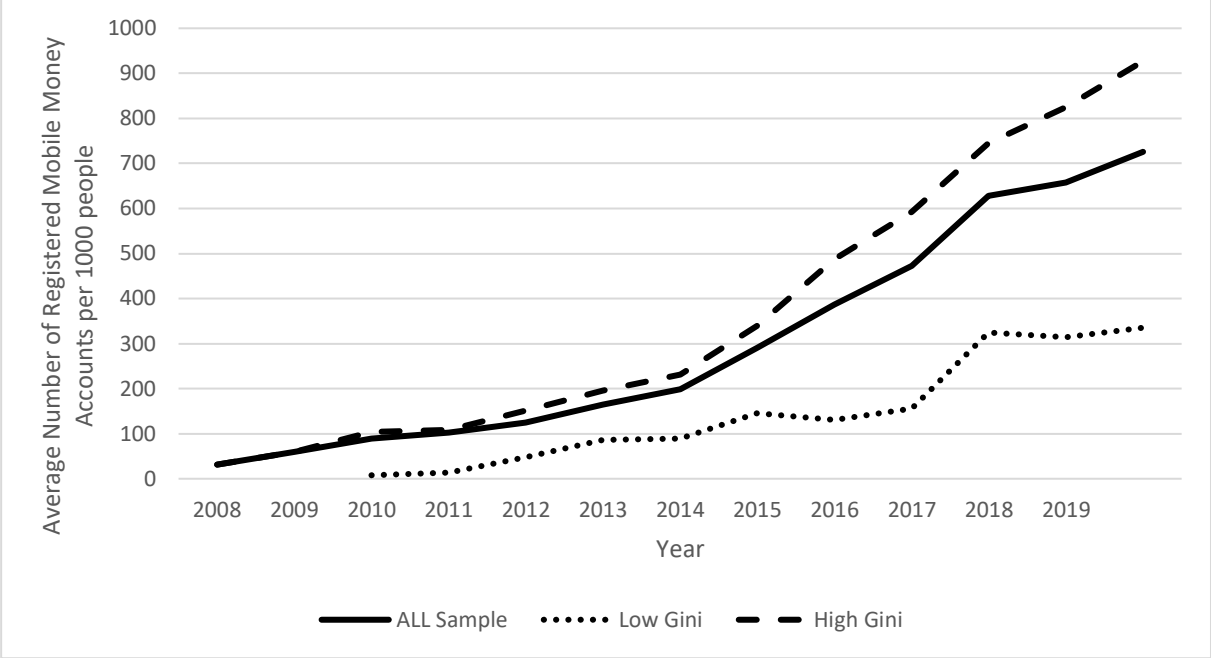


Note: The figure presents the pattern in FinTech (the number of registered mobile money accounts) across the sample period (2008 – 2019). We plot the measure of FinTech for (i) the full sample; (ii) high GPD countries; and (iii) low GDP countries. A high GDP country is one whose average GDP is in the upper half of the sample GDP distribution, while a Low GDP country is one whose GDP per capita is below the sample average GDP distribution.

Figure 3.2 further shows how FinTech adoption is increasing throughout time, as well as between countries with high income inequality and low income inequality countries (based on Gini coefficient).[11] Countries with high income inequality show a relatively high access to mobile money accounts compared to countries where income inequality is low.

[11]The Gini coefficient measures how income distributed among individuals or households varies from a perfectly equal distribution. The value ranges from 0 (perfect equality) to 100 (perfect inequality) (World Bank Database). The Gini coefficient is measured by first plotting a Lorenz curve of the cumulative percentage of total income received against the cumulative number of recipients, from the poorest to the richest individual or household. Countries with high income inequality are Saudi Arabia, Qatar, Turkey, Gabon among others, while those with low income inequality include the likes of Sweden, Norway, Belgium and Australia. The Gini coefficient is taken from the World Income Inequality Database (SWIID).

Figure 3.2: Average Number of Registered Mobile Money Accounts Over Time: Full Sample and Countries with High and Low Income Inequality

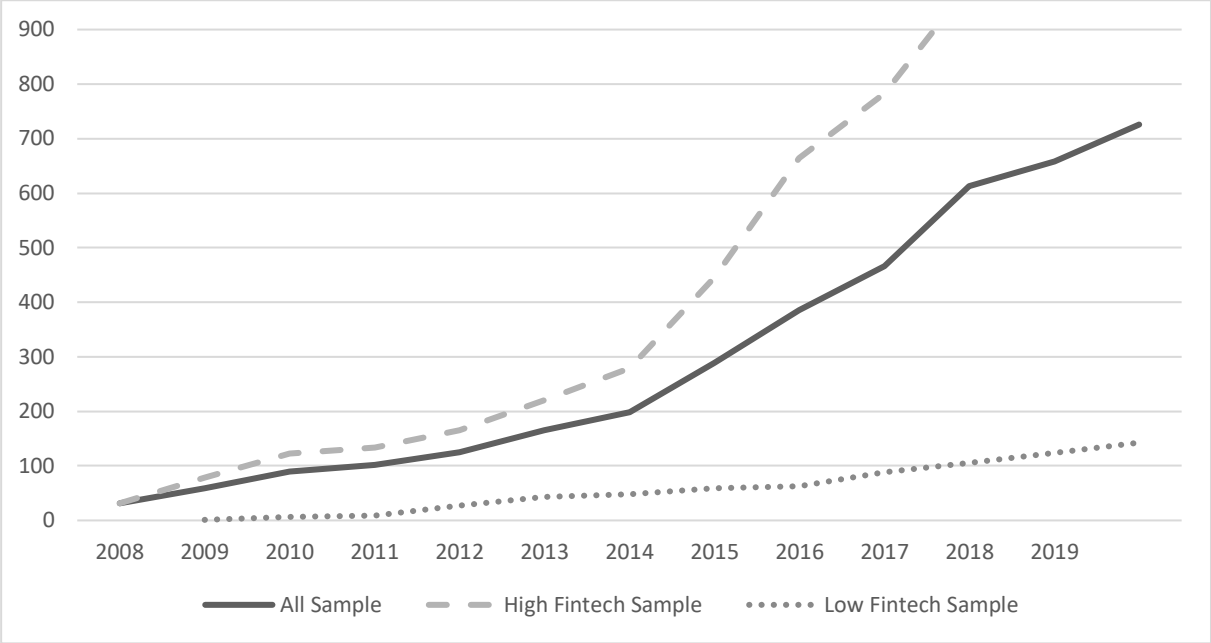


Note: The figure presents the pattern in FinTech (the number of registered mobile money accounts) across the sample period (2008 – 2019). We plot the measure of FinTech for (i) the full sample; (ii) high Gini countries; and (iii) low Gini countries A high Gini country is one whose average Gini coefficient is in the upper half of the sample Gini coefficient distribution, while a low Gini country is one whose Gini coefficient is below the sample average Gini coefficient distribution.

Figure 3.3 shows the average number of registered mobile money accounts per 1000 adults across high and low FinTech countries over the period 2008-2019.[12] FinTech is increasing across the board throughout our sample period. We also find that the gap in FinTech usage between high and low FinTech countries has been widening, particularly from year 2013 onwards. In 2019, high FinTech countries have approximately a 9-times higher number of registered mobile money accounts compared to low FinTech countries.

[12] We classified countries into high FinTech and low FinTech countries based on the average number of registered mobile money accounts per 1000 of adults for the full sample. Specifically, we estimate an average number of registered mobile money accounts per 1000 adults for the full sample (all countries together) and each country in the sample. Countries with higher than the full sample's average number of registered mobile money accounts are classified as high FinTech countries, while those with lower than the full sample's average number of registered mobile money accounts are classified as low Fintech countries.

Figure 3.3: Average Number of Registered Mobile Money Accounts: Full Sample and Countries with High and Low FinTech



Note: The figure presents the pattern in FinTech (the number of registered mobile money accounts) across the sample period (2008 – 2019). We plot the measure of FinTech for (i) the full sample; (ii) high FinTech countries; and (iii) low FinTech countries. A high FinTech country is one whose average registered mobile money account is in the upper half of the sample average registered mobile money account distribution, while a low FinTech country is one whose average registered mobile money account is below the sample average registered mobile money account distribution.

3.3.4 Empirical Model and Regression Specifications

To examine the impact of FinTech usage on financial inclusion, we run three different regression models, presented below. Our baseline model is presented in equation (3.1) and explores the effect of FinTech on financial inclusion (testing the first hypothesis) while controlling for time and country-level effects.

$$FI_{c,t} = \alpha + \beta_1 \times FinTech_{c,t-1} + \beta_2 \times \Sigma X_{c,t-1} + C_c + C_t + \varepsilon_{c,t} \quad (3.1)$$

In the baseline model, the dependent variable, $FI_{c,t}$, represents the number of debit cards per 1,000 adults in country *c* and year t. $Fintech_{c,t-1}$ denotes the FinTech variable proxied by the number of registered mobile money accounts per 1,000 adults. $\Sigma X_{c,t-1}$ serves as a set of control variables including: the log GDP per capita (*GDPpc*), trade (*TRADE*), secondary school enrolment (*SCHOOL*), and inflation (*CPI*). The model includes country and time fixed effects

($C_c$andC_t respectively). $\varepsilon_{c,t}$ is the error term. Time and year country fixed effects are used to account for heterogeneity. To reduce the potential bias to our results due to reverse causality and simultaneity, all the independent variables are lagged by one year (Luo et al., 2022). In line with Honohan (2008) we argue that endogeneity is not likely to be a problem when one is explaining income inequality.[13]As a result, we do not explicitly control for endogeneity using an instrumental variable approach. The standard errors are also clustered at the country level to reduce heteroskedasticty. The model is estimated using ordinary least squares (OLS).

In the second model (testing the second hypothesis), we sort countries 'High GDP' and 'Low GDP' countries based on the average GDP per capita of each country over the sample period relative to the sample's average GDP per capita. We then augment the baseline regression to incorporate an interaction term between the FinTech indicator (lagged by one year) and a dummy variable identifying the low GDP countries ($Dummy\_Low\_GDP_{c,t-1}$). The second model is depicted in equation (3.2). This specification allows us to explore the effect of FinTech on financial inclusion distinguishing between high and low income countries.

$$FI_{c,t} = \alpha + \beta_1 \times FinTech_{c,t-1} + \beta_2 \times FinTech_{c,t-1} \times Dummy\_Low\_GDP_{c,t-1} + \beta_3 \times \Sigma X_{c,t-1} + C_c + C_t + \varepsilon_{c,t} \quad (3.2)$$

To construct our third model (testing our third hypothesis), we augment the baseline regression to incorporate an interaction term between the FinTech indicator (lagged by one year) and a dummy variable identifying the countries displaying high income inequality ($Dummy\_High\_GINI_{c,t-1}$). The third model is presented in equation (3.3). This specification tests whether the impact of FinTech on financial inclusion is different when we distinguish between countries with high and low income inequality.

[13] Bellamare et al (2017) have shown that using lagged independent variables may not completely alleviate endogeneity issues and only merely moves the channel through which endogeneity affects causal inferences. As a result, an instrumental variable approach is recommended for future studies.

$$FI_{c,t} = \alpha + \beta_1 \times FinTech_{c,t-1} + \beta_2 \times FinTech_{c,t-1} \times Dummy\_High\_GINI_{c,t-1} + \beta_3 \times \Sigma X_{c,t-1} + C_c + C_t + \varepsilon_{c,t} \quad (3.3)$$

In equation (3.4), we expand the baseline regression by including an interaction term between the FinTech indicator and the dummy variable identifying high FinTech countries ($Dummy\_High\_FinTech_{c,t-1}$). This specification allows us to investigate the effect of FinTech on financial inclusion distinguishing between high and low FinTech countries.

$$FI_{c,t} = \alpha + \beta_1 \times FinTech_{c,t-1} + \beta_2 \times FinTech_{c,t-1} \times Dummy\_High\_Fintech_{c,t-1} + \beta_3 \times \Sigma X_{c,t-1} + C_c + C_t + \varepsilon_{c,t} \quad (3.4)$$

3.4 Empirical Results

3.4.1 FinTech and Financial Inclusion

Table 3.3 presents the regression results of the baseline model estimation. All models are estimated on the full sample using ordinary least squares (OLS) with country and time fixed effects, as specified by equation (3.1). In the first Column, the number of debit cards per 1,000 adults is regressed on the FinTech indicator only, while in Columns (2), (3) and (4) we estimate the impact of FinTech on financial inclusion while controlling for a series of variables known to impact financial inclusion. The results show that FinTech is positively related to financial inclusion, with the result being consistent throughout the specifications. The estimated FinTech coefficients imply that, on average, a 1% increase in number of registered mobile money account results in a 0.055% to 0.097% increase in the number of debit cards per adult in a country. This suggests that as a country deepens its financial technology adoption (through mobile money account ownership), the level of financial inclusion also increases. This finding supports the view that FinTech can drive financial inclusion by providing an alternative avenue for people who

were previously unbanked to access financial services (Beck, 2020). Notably, the magnitude of the coefficients increases after we control for country-level factors. These results provide support for our first hypothesis (Hypothesis 1) which states that FinTech usage is positively associated with FI across all countries. Our cross-country results are also in line with previous single-country studies (e.g., Mbiti and Weil, 2015; Gosavi, 2018) who also reported a positive relationship between FinTech and financial inclusion in Africa. Additionally, the results of this study are consistent with the cross-country study by Demir et al. (2022) who show that FinTech is a crucial driver for financial inclusion.

All control variables display the expected relations with financial inclusion but are insignificant except for GDP per capita and secondary school enrolment. In particular, we find that secondary school enrolment and GDP per capita are positive drivers of financial inclusion across our sample period. This finding is in line with Grohmann et al. (2018) who also report a significant relationship between financial literacy and financial inclusion. Next, we examine the association between FinTech and financial inclusion by identifying the effect of FinTech on financial inclusion in high and low GDP countries to test Hypothesis 2.

Table 3.3 Baseline Regression Analysis for Full Sample

VARIABLES	(1) Number of Debit Cards per 1,000 adults	(2) Number of Debit Cards per 1,000 adults	(3) Number of Debit Cards per 1,000 adults	(4) Number of Debit Cards per 1,000 adults
Number of registered mobile money accounts per 1,000 adults (log)	0.055**	0.057**	0.097***	0.081***
	(0.022)	(0.02)	(0.021)	(0.029)
GDP per capita (log)		0.163	0.525***	0.676**
		(0.190)	(0.187)	(0.257)
Trade (% of GDP)			0.002	0.005
			(0.002)	(0.004)
School enrolment, secondary (% gross)				0.028***
				(0.010)
Inflation				0.013
				(0.011)
Constant	5.237***	3.952***	0.851	-2.547
	(0.107)	(1.504)	(1.561)	(2.183)
Country fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Observations	204	204	197	124
Adjusted R-squared (within)	0.143	0.143	0.143	0.275

The table reports results of the baseline model examining the impact of FinTech on financial inclusion depicted in equation (3.1). The dependent variable is the Number of debit cards per 1,000 adults. The explanatory variables are: FinTech measured by the Number of registered mobile money accounts per 1,000 adults; GDP per capita; Trade (% of GDP); School enrolment, secondary (% gross), and Inflation. All explanatory variables are lagged by one year. A detailed description of the variables with sources of data is presented in Appendix 3A. Standard errors are reported in parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level, *denotes significance at the 10% level. Data are collected for World Bank WDI and International Monetary Fund FAS. Data span: 2008 – 2019.

3.4.2 High vs Low GDP Countries

In this section, we examine whether there are differences in the association between FinTech and financial inclusion based on the country's income. We augment our baseline model with an interaction term between the FinTech indicator and a dummy variable identifying low GDP countries, as presented in equation (3.2). The low GDP dummy variable is equal to one if the country is in the lower half of countries sorted by GDP per capita, and 0 otherwise.

Table 3.4 reports the results of estimating the effect of FinTech on financial inclusion, while including an interaction term capturing this effect in low GDP countries. Estimations use ordinary least square (OLS) with country and year fixed effects. Column (1) examines the effect of FinTech measured by the number of registered mobile money accounts per 1,000 adults and its interaction term with Low GDP country dummy on FI. In Columns (2), (3), (4) we investigate this relationship by adding to the model the control variables that are known determinants of financial inclusion.

The coefficients on the interaction term between FinTech and low GDP are positive and statistically significant at the 1% level across all model specifications. The result suggests that the positive impact of FinTech on financial inclusion is stronger in low GDP relative to their high GDP countries. The results support our second hypothesis (H2) which argues that mobile money technology can be an enabler of financial services. In low income countries, about half of the population send or received remittances using mobile phones in 2017 (Sahay et al., 2020) which indicates that there is scope for higher FinTech penetration with positive spill-over effects on financial inclusion. Our findings are in line with Evans and Pirchio (2014) who notes that mobile money schemes are not common in high income countries because they already have highly efficient banking and electronic payment systems in the latter countries. Consumers in high income countries, already have access to alternative electronic platforms that they use for basic financial transactions, peer-to-peer transfers, bill payments, and international remittances among others (Aron, 2018; Bar and Galperin, 2007). As a result, mobile money does not offer them any

opportunity to increase access to financial services as it would for low income countries where infrastructures are generally weak or non-existent. As expected, the control variables, show a significantly positive relationship of GDP per capita, trade and education with financial inclusion, in line with prior research of Owen and Pereira (2016), Turegano and Herrero (2018), Dabla-Norris et al., (2015), Beck, et al., (2007) and Demir et al., (2022). The results show that FinTech improves financial inclusion across all estimations, in line with the results from our baseline regression. As expected, the control variables, show a significantly positive relationship of GDP per capita, trade and education with financial inclusion, in line with prior research of Owen and Pereira (2016), Turegano and Herrero (2018), Dabla-Norris et al. (2015), Beck, Demirguc-Kunt and Levine (2007) and Demir et al. (2022).

Table 3.4 The Impact of FinTech on Financial Inclusion – Distinguishing between High and Low GDP Countries

VARIABLES	(1) Number of Debit Cards per 1,000 adults	(2) Number of Debit Cards per 1,000 adults	(3) Number of Debit Cards per 1,000 adults	(4) Number of Debit Cards per 1,000 adults
Number of registered mobile money accounts per 1,000 adults (log)	0.100***	0.100***	0.144***	0.178***
	(0.026)	(0.026)	(0.025)	(0.029)
Number of registered mobile money accounts (log)*Dummy Low GDP	0.106***	0.104***	0.112***	0.235***
	(0.034)	(0.035)	(0.032)	(0.038)
GDP per capita (log)		0.056	0.387**	0.461**
		(0.189)	(0.185)	(0.217)
Trade (% of GDP)			0.000	0.005*
			(0.002)	(0.003)
School enrolment, secondary (% gross)				0.035***
				(0.008)
Inflation				0.015
				(0.009)
Constant	5.159***	4.715***	1.982	-1.510
	(0.107)	(1.492)	(1.543)	(1.821)
Country fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Observations	204	204	197	124
Adjusted R-squared (within)	0.094	0.095	0.207	0.506

The table reports results of the model examining the impact of FinTech on financial inclusion depicted in equation (3.2). The dependent variable is the Number of debit cards per 1,000 adults. The explanatory variables are FinTech measured by the number of registered mobile money accounts per 1,000 adults, an interaction variable between FinTech and a dummy variable capturing low GDP countries (the dummy variable equals 1 if the respective country is in the top half of countries in terms of average GDP per capita throughout our sample), GDP per capita; Trade (% of GDP); School enrolment, secondary (% gross), and Inflation. All explanatory variables are lagged by one year. A detailed description of the variables with sources of data is presented in Appendix 3A. Standard errors are reported in parentheses. *** denotes significance at the 1% significance level, ** denotes significance at the 5% significance level, * denotes significance at the 10% level. Data are collected for World Bank WDI and International Monetary Fund FAS. Data span: 2008 – 2019.

3.4.3 High vs Low Income Inequality Countries

We now examine whether the effect of FinTech on financial inclusion is affected by the level of income inequality in the countries under investigation. To test this, we augment our baseline regression with an interaction term between the FinTech indicator and a dummy variable capturing high Gini index (high income inequality) countries, as presented in equation (3.3). The high Gini dummy variable is equal to one if the country is in the top half of sampled countries sorted by Gini index, and 0 otherwise. Column (1) investigates the relationship between FinTech and financial and the interaction term of FinTech with the high Gini income inequality dummy. Columns (2), (3) and (4) of Table 3.5 include control variables from our baseline model. Estimations are carried out using ordinary least square (OLS) with country and time fixed effects. Exploring the FinTech variable results first, we find that FinTech improves financial inclusion across all estimations, in line with previous findings.

The coefficient on the interaction term of FinTech and high income inequality countries are negative across Columns (1) - (4) of Table 3.5. The result supports our third hypothesis (H3) and indicates that the positive impact of FinTech on financial inclusion is reduced in countries with low income inequality. Hence, we conclude that while FinTech adoption generally improves financial inclusion across countries, it is more noticeable in low income inequality countries. This result could be attributed to the decreased ability of borrowers in high income inequality countries to repay credit as these countries have fewer equal opportunities and weaker social and economic conditions. This suggests that improvements in harmonising income could improve the positive effects of FinTech on financial inclusion. Further, our findings are also aligned with Demir et al. (2022) who show that financial inclusion is a key channel through which FinTech can reduce inequality. Like our baseline model, all the control variables have the expected signs.

Table 3.5 The Impact of FinTech on Financial Inclusion – Distinguishing between High and Low Gini Countries

VARIABLES	(1) Number of Debit Cards per 1,000 adults	(2) Number of Debit Cards per 1,000 adults	(3) Number of Debit Cards per 1,000 adults	(4) Number of Debit Cards per 1,000 adults
Number of registered mobile money accounts per 1,000 adults (log)	0.090***	0.089***	0.121***	0.129***
	(0.029)	(0.029)	(0.027)	(0.037)
Number of registered mobile money accounts(log) *Dummy High Gini	-0.068*	-0.064*	-0.049	-0.094**
	(0.037)	(0.038)	(0.035)	(0.046)
GDP per capita (log)		0.096	0.463**	0.633**
		(0.193)	(0.192)	(0.253)
Trade (% of GDP)			0.001	0.006
			(0.002)	(0.003)
School enrolment, secondary (% gross)				0.025**
				(0.010)
Inflation				0.013
				(0.011)
Constant	5.315***	4.553***	1.427	-1.952
	(0.114)	(1.537)	(1.611)	(2.159)
Country fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Observations	204	204	197	124
Adjusted R-squared (within)	0.060	0.062	0.154	0.312

The table reports the results of the model examining the impact of FinTech on financial inclusion depicted in equation (3.3). The dependent variable is the Number of debit cards per 1,000 adults. The explanatory variables are: FinTech measured by the Number of registered mobile money accounts per 1,000 adults, an interaction variable between FinTech and a dummy variable capturing high Gini index countries (the dummy variable equals 1 if the respective country is in the top half of countries in terms of average Gini index throughout our sample), GDP per capita; Trade (% of GDP); School enrolment, secondary (% gross), and Inflation. All explanatory variables are lagged by one year. A detailed description of the variables with sources of data is presented in Appendix 3A. Standard errors are reported in parentheses. *** denotes significance at the 1% significance level, ** denotes significance at the 5% significance level, * denotes significance at the 10% level. Data are collected for World Bank WDI and International Monetary Fund FAS. Data span: 2008 – 2019.

3.4.4 High vs Low FinTech Countries

Table 3.6 presents the results of estimating the effect of FinTech on financial inclusion by considering the sample countries' level of FinTech adoption. We do so by expanding our baseline model to include an interaction term capturing the effect of FinTech in countries characterised by high financial technology adoption. This model is shown in equation (3.4). The results show a positive effect of FinTech on financial inclusion. The interaction term between the registered mobile money accounts and the dummy variable capturing high FinTech countries, we find a positive coefficient in Columns (3) and (4). The coefficients on the interaction terms suggest that the positive impact of FinTech on financial inclusion is stronger for high FinTech countries. This finding confirms our fourth hypothesis (Hypothesis 4). It also provides support to prior results of Andrianaivo and Kpodar (2012) and Abor et al. (2018) who document a positive relationship between financial inclusion and mobile phone penetration in African countries.

All control variables show the expected relations with financial inclusion. We also find that secondary school enrolment and GDP per capita improve financial inclusion, as shown in Columns (3) and (4) of Table 3.6.

Table 3.6 The Impact of FinTech on Financial Inclusion – Distinguishing between High and Low Fintech Countries

VARIABLES	(1) Number of Debit Cards per 1,000 adults	(2) Number of Debit Cards per 1,000 adults	(3) Number of Debit Cards per 1,000 adults	(4) Number of Debit Cards per 1,000 adults
Number of registered mobile money accounts per 1,000 adults(log)	0.039*	0.041*	0.079***	0.056*
	(0.024)	(0.0243)	(0.022)	(0.030)
Number of registered mobile money accounts(log) * Dummy High FinTech	0.060	0.058	0.079**	0.121**
	(0.038)	(0.038)	(0.035)	(0.050)
GDP per capita		0.113	0.504***	0.471*
		(0.193)	(0.185)	(0.273)
Trade (% of GDP)			0.002	0.006
			(0.002)	(0.003)
School enrolment, secondary (% gross)				0.033***
				(0.010)
Inflation				0.013
				(0.009)
Constant	5.238***	4.215***	0.748	-1.533
	(0.108)	(1.515)	(1.542)	(2.214)
Country fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Observations	204	204	197	124
Adjusted R-squared (within)	0.052	0.054	0.173	0.328

The table reports the results of the model examining the impact of FinTech on financial inclusion depicted in equation (3.4). The dependent variable is the Number of debit cards per 1,000 adults. The explanatory variables are: FinTech measured by the Number of registered mobile money accounts per 1,000 adults, an interaction variable between FinTech and a dummy variable capturing high FinTech countries (the dummy variable equals 1 if the respective country is in the top half of countries in terms of average FinTech), GDP per capita; Trade (% of GDP); School enrolment, secondary (% gross), and Inflation. All explanatory variables are lagged by one year. A detailed description of the variables with sources of data is presented in Appendix 3A. Standard errors are reported in parentheses. *** denotes significance at the 1% significance level, ** denotes significance at the 5% significance level, * denotes significance at the 10% level. Data is collected for World Bank WDI and International Monetary Fund FAS. Data span: 2008 – 2019.

3.4.5 Robustness Tests

In this section we implement a number of robustness checks for our results. First, we use the number of credit cards per 1000 adults as an alternative measure of financial inclusion. We also utilise the number of mobile and internet banking transactions per 1000 adults as an alternative measure of FinTech. These variables allow us to examine whether alternative indicators of FinTech and financial inclusion affect the results reported in the previous section. To explore this, we re-estimate equations (1) - (4) using the number of credit cards per 1000 adults as dependent variable. As with the baseline model, in the robustness tests, we examine the impact of FinTech on financial inclusion using ordinary least square (OLS) estimations with country and year fixed effects. These results are reported in Table 3.7.

Overall, the results confirm our main findings indicating that FinTech plays a key role in enhancing financial inclusion. We find in Columns (1) and (2) strong evidence that FinTech (measured as the number of mobile money accounts and the number of mobile and internet banking transactions) is positively associated with the number of credit cards per 1000 adults. These results are generally in line with our baseline results and the first hypothesis (H1). Regarding the control variables, we find that trade, secondary school enrolment and GDP per capita are essential determinants of financial inclusion, particularly when using the number of registered mobile money accounts per 1,000 adults as a measure of FinTech.

Further, we examine the interacting effects between FinTech and three other factors, that is, (i) low GDP countries (Columns 3-4), (ii) high Gini countries (Columns 5-6), and (iii) high FinTech countries (Columns 7-8) countries. We find that the positive impact of Fintech on financial inclusion is stronger for low GDP countries. This finding is in line with the results in Section 3.4.2 and supports our second hypothesis. In line with our results in Section 3.4.3 which tests our third hypothesis, we find that the negative impact of FinTech on financial inclusion is stronger for high Gini countries. Unlike our main results for the third hypothesis, (where we document a strong positive and significant relationship between FinTech and financial inclusion for high FinTech countries), the result of the interaction between FinTech and high FinTech countries in

our robustness tests is negative and insignificant. This suggests that the negative effect of Fintech on financial inclusion (measured as the number of credit cards per 1000 adults) is not statistically different for high and low FinTech countries. This finding can be explained by the low credit card utilisation in developing and emerging market economies. Credit cards are short-term sources of finance and require an efficient and functioning credit referencing system. However, developing countries typically have limited credit referencing coverage for their population, which in turn, prevents the use of credit cards and other consumer lending services (Demirgüç et al., 2012; Togan-Egrican et al., 2012).

Table 3.7 The Impact of FinTech on Financial Inclusion: Alternative Measures

VARIABLES	Number of Credit	Number of Credit Cards	Number of Credit Cards	Number of Credit Cards	Number of Credit Cards	Number of Credit Cards	Number of Credit Cards	Number of Credit Cards
Fintech measures								
Number of registered mobile money accounts (log)	0.147**		0.328***		0.308***		0.215**	
	(0.063)		(0.067)		(0.076)		(0.094)	
Number of mobile and internet banking transactions (log)*		0.308***		0.334***		0.336***		0.377***
		(0.031)		(0.035)		(0.044)		(0.101)
Interaction terms								
Number of registered mobile money accounts(log)*Dummy Low GDP			0.431***					
			(0.089)					
Number of mobile and internet banking transactions(log)*Dummy Low GDP				0.065				
				(0.045)				
Number of registered mobile money accounts(log)*Dummy High Gini					-0.319***			
					(0.095)			
Number of mobile and internet banking transactions(log)*Dummy High Gini						-0.038		
						(0.043)		
Number of mobile registered mobile money accounts(log)*Dummy High FinTech							-0.001	
							(0.158)	
Number of mobile and internet banking transactions(log)*Dummy High FinTech								-0.064
								(0.088)
Control variables								
GDP per capita (log)	1.082*	0.197	0.471	0.193	0.999*	0.198	1.446	-0.002
	(0.609)	(0.159)	(0.552)	(0.158)	(0.572)	(0.159)	(0.926)	(0.588)
Trade (% of GDP)	0.024***	-0.000	0.024***	-0.001	0.027***	-0.001	0.035***	0.019**
	(0.009)	(0.002)	(0.007)	(0.002)	(0.008)	(0.002)	(0.012)	(0.007)
School enrolment, secondary (% gross)	0.039*	-0.002	0.052**	-0.002	0.028	-0.002	0.072**	-0.012*
	(0.022)	(0.002)	(0.019)	(0.002)	(0.021)	(0.002)	(0.032)	(0.006)
Inflation	-0.004	-0.002	-0.000	-0.002	-0.004	-0.002	0.005	-0.037**
	(0.024)	(0.007)	(0.021)	(0.007)	(0.022)	(0.007)	(0.030)	(0.018)
Constant	-	0.939	-7.37	1.232	-9.478*	0.825	-17.33**	0.581
	(5.122)	(1.652)	(4.578)	(1.660)	(4.828)	(1.657)	(7.464)	(4.913)
Country fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	121	330	121	330	121	330	119	83
Adjusted R-squared(within)	0.24	0.308	0.417	0.314	0.339	0.31	0.278	0.4058

The table reports results of the robustness test of the baseline model examining the impact of FinTech on financial inclusion depicted in equations (3.1), (3.2), (3.3), and (3.4). The dependent variable is the Number of credit cards per 1,000 adults. The explanatory variables are: FinTech measured by the Number of registered mobile money accounts per 1,000 adults, Number of mobile and internet banking transaction per 1,000 adults, an interaction variable between FinTech and a dummy variable capturing high GDP countries (the dummy variable equals 1 if the respective country is in the top half of countries in terms of average GDP per capita throughout our sample), an interaction variable between FinTech and a dummy variable capturing high Gini index countries (the dummy variable equals 1 if the respective country is in the top half of countries in terms of average Gini index throughout our sample) FinTech measured by the Number of registered mobile money accounts per 1,000 adults, an interaction variable between FinTech and a dummy variable capturing high fintech countries (the dummy variable equals 1 if the respective country is in the top half of countries in terms of average FinTech ,GDP per capita; Trade (% of GDP); School enrolment, secondary (% gross), and Inflation. All explanatory variables are lagged by one year. A detailed description of the variables with sources of data is presented in Appendix 3A. Standard errors are reported in parentheses. *** denotes significance at the 1% significance level, ** denotes significance at the 5% significance level, * denotes significance at the 10% level. Data is collected for World Bank WDI and International Monetary Fund FAS. Data span: 2008 – 2019.

3.5 Conclusion and Policy Implications

In this study, we examine the impact of FinTech on financial inclusion using a 46-country data set over the period 2008-2019 controlling for a set of country-specific variables. First, we hypothesise that FinTech (the number of registered mobile money accounts per 1000 adults) improves financial inclusion (the number of debit cards per 1000 adults), as FinTech is seen as a vital enabler of improving access and usage of financial products. Similarly, the adoption of mobile financial services which are one common proxy of FinTech could be one of the biggest breakthroughs in bringing unbanked adults into the financial system (Demir, 2022).

Second, we hypothesise that the association between FinTech and financial inclusion is stronger in low GDP countries, as it brings financial services to the unbanked population who do not have access to traditional banking mostly in low income countries. Third, we conjecture that the impact of FinTech on financial inclusion is higher in low income inequality countries, as in these countries economic growth tends to be higher attracting a higher use of FinTech services which in turn drives up financial inclusion (Banerjee and Newman, 1993; Galor and Zeira, 1993). In our final hypothesis, we posit that the influence of FinTech on financial inclusion is stronger in countries with greater FinTech adoption (Andrianaivo and Kpodar, 2012). To test these hypotheses, we use OLS regression including time and country fixed effects.

Overall, our results support the notion that FinTech improves financial inclusion, in line with our first hypothesis. We also find that FinTech has a positive effect on financial inclusion in low income countries, low Gini countries and high FinTech countries, supporting our second, third and fourth hypotheses.

Overall, we find robust evidence that FinTech promotes financial inclusion. In other words, there is a positive association between FinTech usage and access to financial services. Our results are robust to using alternative financial inclusion (number of credit cards per 1000 adults) and FinTech (number of mobile and internet banking transactions per 1000 adults) variables. Therefore, the use of FinTech is a pathway to financial inclusion, especially in low income countries, and it offers a cheap, reliable and accessible alternative to finance.

We recommend that policymakers in developing countries to prioritise reforms that enhance access to financial services, especially for the rural poor. This can be done by promoting the use of mobile financial based services like that of Safaricom company in Kenya (M-Pesa, SMS-based service) (Jack and Suri, 2011). As demonstrated in many developing countries, efficient mobile based financial based access can help leapfrog deficiencies with traditional financial service and help overcome socio-economic, educational or geographic challenges.

Similarly, low income countries such as those in Africa and south Asia should encourage investment in teclecommunication infrastructure to decrease the cost of communication support the poor to have an easier access to mobile phone services (Andrianaivo and Kpodar, 2012; Gosavi, 2018). Specifically, governments in developing countries should promote the adoption of mobile money services and encourage banks and other financial institutions to offer loans and short-term lending based on transaction data from mobile money usage, which in turn, will increase their use as a form of 'electronic-based creditworthiness' to promote economic growth.

We suggest that future studies utilising causal study methodologies like difference in difference and propensity score matching approach can explore the causal relationship between fintech

and financial inclusion as well as how inequality moderate this relationship. Furthe r future research can also explore the different dimensions of fintech and financial inclusion to deepen understanding of the nexus. For instance, future studies could explore the access, usage or depth dimension of fintech to shed light on which channel is likely to have a higher impact.

References

Abor, J.Y., Amidu, M. and Issahaku, H., 2018. Mobile telephony, financial inclusion and inclusive growth. Journal of African Business, 19(3), pp.430-453.

Aker, J.C. and Mbiti, I.M., 2010. Mobile phones and economic development in Africa. *Journal of economic Perspectives*, 24(3), pp.207-32.

Allen, F., Carletti, E., Cull, R., Qian, J.Q., Senbet, L. and Valenzuela, P., 2014. The African financial development and financial inclusion gaps. Journal of African economies, 23(5), pp.614-642.

Andrianaivo, M., and K. Kpodar. 2012. "Mobile Phones, Financial Inclusion, and Growth." *Review of Economics and Institutions*, 3 (2): 30.

Apeti, A.E., 2023. Household welfare in the digital age: Assessing the effect of mobile money on household consumption volatility in developing countries. World Development, 161, p.106110.

Aron, J., 2018. Mobile money and the economy: A review of the evidence. The World Bank Research Observer, 33(2), pp.135-188.

Arunachalam, R.S. and Crentsil, G.L., 2020, June. Financial Inclusion in the Era of COVID-19. In An Online Participative Conference For Central Bankers, Ministries of Finance, Financial Sector Development & Financial Inclusion Professionals, Commercial & Microfinance Bankers, NBFIs, DFIs, MFIs, Consultants, FINTECH & RegTech Companies, Investors, Ins.

Aslan, G., Deléchat, C., Newiak, M.M. and Yang, M.F., 2017. Inequality in financial inclusion and income inequality. International Monetary Fund.

Asongu, S. A. 2015. "The Impact of Mobile Phone Penetration on African Inequality." *International Journal of Social Economics*, 42 (8): 706–716.

Asongu, S. A., and S. Le Roux. 2017. "Enhancing ICT for Inclusive Human Development in Sub-Saharan Africa." *Technological Forecasting and Social Change*, 118: 44–54.

Asongu, S. A., and J. C. Nwachukwu. 2018. "Comparative Human Development Thresholds for Absolute and Relative Pro-poor Mobile Banking in Developing Countries." Information Technology & People 31 (1): 63–83.

Asongu, S. A., and N. M. Odhiambo. 2018. "Human Development Thresholds for Inclusive Mobile Banking in Developing Countries." *African Journal of Science, Technology, Innovation and Development*, 10 (6): 735–744.

Asongu, S.A. and Odhiambo, N.M., 2019. How enhancing information and communication technology has affected inequality in Africa for sustainable development: An empirical investigation. Sustainable Development, 27(4), pp.647-656.

Banerjee, A. V., and A. F. Newman. 1993. "Occupational Choice and the Process of Development." *Journal of Political Economy*, 101 (2): 274–298.

Bar, F. and Galperin, H. 2007 Wireless communication and development: micro and macro linkages. Information Technologies and International Development, 3(2), pp. 1–2.

Beck, T., Demirgüç-Kunt, A. and Levine, R., 2007. Finance, inequality and the poor. Journal of economic growth, 12(1), pp.27-49.

Beck, T., Pamuk, H., Ramrattan, R. and Uras, B., 2015. Mobile money, trade credit, and economic development: theory and evidence.

Beck, T., 2020. Fintech and financial inclusion: Opportunities and pitfalls (No. 1165). ADBI Working Paper Series.

Bellemare, M.F., Masaki, T. and Pepinsky, T.B., 2017. Lagged explanatory variables and the estimation of causal effect. The Journal of Politics, 79(3), pp.949-963.

Berg, T., Fuster, A. and Puri, M., 2022. Fintech lending. Annual Review of Financial Economics, 14, pp.187-207.

Björkegren, D., 2010. 'Big Data'for Development. Proceedings of the CEPR/AMID Summer School. Retrieved from http://dan. bjorkegren. com/files/CEPR_Bjorkegren. pdf.

Björkegren, D. and Grissen, D., 2020. Behavior revealed in mobile phone usage predicts credit repayment. The World Bank Economic Review, 34(3), pp.618-634.

Björkegren, D. and Grissen, D., 2018, May. The potential of digital credit to bank the poor. In AEA papers and proceedings (Vol. 108, pp. 68-71). 2014 Broadway, Suite 305, Nashville, TN 37203: American Economic Association.

Chhabra, E. 2021. Is Mobile Money Part of Money? Understanding the Trends and Measurement. *IMF Working Papers*, *2021*(177).

Cornelli, G., Doerr, S., Franco, L. and Frost, J., 2021. Funding for fintechs: patterns and drivers

Chinoda, T., & Mashamba, T. 2021. Fintech, financial inclusion and income inequality nexus in Africa. *Cogent Economics & Finance*, *9*(1), 1986926.

Dabla-Norris, M.E., Deng, Y., Ivanova, A., Karpowicz, M.I., Unsal, M.F., VanLeemput, E. and Wong, J., 2015. Financial inclusion: zooming in on Latin America. International Monetary Fund.

Dabla-Norris, M.E., Kochhar, M.K., Suphaphiphat, M.N., Ricka, M.F. and Tsounta, E., 2015c. Causes and consequences of income inequality: A global perspective. International Monetary Fund.

Dabla-Norris, M.E., Ji, Y., Townsend, R. and Unsal, D.F., 2015b. Identifying constraints to financial inclusion and their impact on GDP and inequality: A structural framework for policy (No. 15-22). International Monetary Fund.

Demir, A., Pesqué-Cela, V., Altunbas, Y. and Murinde, V., 2022. Fintech, financial inclusion and income inequality: a quantile regression approach. *The European Journal of Finance*, 28(1), pp.86-107.

Demirgüç-Kunt, A. and Klapper, L.F., 2012. Measuring financial inclusion: The global findex database. World bank policy research working paper, (602).

Demirgüç-Kunt, A., L. Klapper, D. Singer, S. Ansar, and J. Hess. 2018. The Global Findex Database 2017: Measuring Financial Inclusion and the FinTech Revolution. Washington, DC: The World Bank.

Beck, T., Demirgüç-Kunt, A. and Levine, R., 2007. Finance, inequality and the poor. Journal of economic growth, 12(1), pp.27-49.

Demombynes, G. and Thegeya, A., 2012. Kenya's mobile revolution and the promise of mobile savings. World Bank policy research working paper, (5988).

Espinosa-Vega, M. A., Shirono, M. K., Villanova, M. H. C., Chhabra, M., Das, M. B., & Fan, M. Y. (2020). *Measuring Financial Access: 10 Years of the IMF Financial Access Survey*. International Monetary Fund.

Evans, O. "Determinants of financial inclusion in Africa: A dynamic panel data approach." (2016): 310-336.

Evans, O. & Adeoye, B 2016. Determinants of Financial Inclusion in Africa: A Dynamic Panel Data Approach. University of Mauritius Reseach Journal, Vol (22)3

Evans, D.S. and Pirchio, A., 2014. An empirical examination of why mobile money schemes ignitein some developing countries but flounder in most. Review of Network Economics, 13(4), pp.397-451.

Ernst and Young 2018 report https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/banking-and-capital-markets/bcm-pdf/ey-innovation-in-financial-inclusion.pdf

Financial Stability Board 2019 https://www.fsb.org/work-of-the-fsb/financial-innovation-and-structural

Francis, E., Blumenstock, J. and Robinson, J., 2017. Digital credit: A snapshot of the current landscape and open research questions. CEGA White Paper, pp.1739-76.

Frost, J., Gambacorta, L. and Gambacorta, R., 2022. On the nexus between wealth inequality, financial development and financial technology. Journal of Economic Behavior & Organization, 202, pp.429-451.

Gai, K., Qiu, M. and Sun, X., 2018. A survey on FinTech. *Journal of Network and Computer Applications*, 103, pp.262-273.

Galor, O. and Zeira, J., 1993. Income distribution and macroeconomics. The review of economic studies, 60(1), pp.35-52.

Gebrehiwot, K. G., and Makina, D. 2019. Macroeconomic determinants of financial inclusion: Evidence using dynamic panel data analysis. In *Extending Financial Inclusion in Africa* (pp. 167-191). Academic Press.

Ghosh, S., 2016. Does mobile telephony spur growth? Evidence from Indian states. *Telecommunications Policy*, 40(10-11), pp.1020-1031.

Gosavi, A., 2018. Can mobile money help firms mitigate the problem of access to finance in Eastern sub-Saharan Africa?. *Journal of African Business*, 19(3), pp.343-360.

Grohmann, A., Klühs, T. and Menkhoff, L., 2018. Does financial literacy improve financial inclusion? Cross country evidence. *World Development*, 111, pp.84-96.

GSMA, 2016. The Mobile Economy Report. https://www.gsma.com/gsmaeurope/

GSMA, 2020. The Mobile Economy Report. https://www.gsma.com/gsmaeurope/

Hajilee, M. and Niroomand, F., 2019. On the link between financial market inclusion and trade openness: An asymmetric analysis. Economic Analysis and Policy, 62, pp.373-381.

Hodula, M., 2022a. Does Fintech credit substitute for traditional credit? Evidence from 78 countries. Finance Research Letters, 46, p.102469.

Hodula, M., 2022b. Fintech credit, big tech credit and income inequality. Finance Research Letters, 51, p.103387.

Hodula, M., 2023. Interest rates as a finance battleground? The rise of Fintech and big tech credit providers and bank interest margin. Finance Research Letters, 53, p.103685.

Honohan, P., 2008. Cross-country variation in household access to financial services. *Journal of Banking & Finance*, 32(11), pp.2493-2500.

Hughes, N. and Lonie, S., 2007. M-PESA: mobile money for the "unbanked" turning cellphones into 24-hour tellers in Kenya. Innovations: technology, governance, globalization, 2(1-2), pp.63-81.

Jack, W. and Suri, T., 2011. Mobile money: The economics of M-PESA (No. w16721). National Bureau of Economic Research.

Jagtiani, J. and Lemieux, C., 2017. Fintech lending: Financial inclusion, risk pricing, and alternative information. Risk Pricing, and Alternative Information (December 26, 2017).

Jauch, S. and Watzka, S., 2016. Financial development and income inequality: a panel data approach. Empirical Economics, 51(1), pp.291-314.

Kumar N (2011) Financial Inclusion and its determinants: Evidence from the state level empirical analysis in India. In: Proceedings of the 13th Annual Conference on Money and Finance in the Indian Economy. Indira Gandhi Institute of Development Research, Mumbai, India

Kumar, N. (2013). Financial inclusion and its determinants: evidence from India. *Journal of Financial Economic Policy*.

Lenka, S.K. and Barik, R., 2018. Has expansion of mobile phone and internet use spurred financial inclusion in the SAARC countries? *Financial Innovation*, 4(1), pp.1-19.

Luo, S., Sun, Y. and Zhou, R., 2022. Can fintech innovation promote household consumption? Evidence from China family panel studies. International Review of Financial Analysis, 82, p.102137.

Lyons, A.C. and Kass-Hanna, J., 2021. A multidimensional approach to defining and measuring financial literacy in the digital age. In The Routledge Handbook of Financial Literacy (pp. 61-76). Routledge.

Mas, I. and Morawczynski, O., 2009. Designing mobile money services: Lessons from M-PESA. innovations, 4(2).

Maskara, P.K., Kuvvet, E. and Chen, G., 2021. The role of P2P platforms in enhancing financial inclusion in the United States: An analysis of peer-to-peer lending across the rural–urban divide. Financial Management, 50(3), pp.747-774.

Mbiti, I. and Weil, D.N., 2015. Mobile banking: The impact of M-Pesa in Kenya. In African successes, Volume III: Modernization and development (pp. 247-293). University of Chicago Press

Mbiti, I. and Weil, D.N., 2015. Mobile banking: The impact of M-Pesa in Kenya. In African Successes, Volume III: Modernization and Development (pp. 247-293). University of Chicago Press.

Myeni, S., Makate, M., & Mahonye, N. (2020). Does mobile money promote financial inclusion in Eswatini?. *International Journal of Social Economics*.

Ouma, S. A., Odongo, T. M., & Were, M. (2017). Mobile financial services and financial inclusion: Is it a boon for savings mobilization?. *Review of development finance*, *7*(1), 29-35.

Owen, A. L., & Pereira, J. M. (2018). Bank concentration, competition, and financial inclusion. *Review of development finance*, *8*(1), 1-17.

Ozili, P. K. (2018). Impact of digital finance on financial inclusion and stability. *Borsa Istanbul Review*, *18*(4), 329-340.

Ozili, P.K., 2020. Covid-19 pandemic and economic crisis: The Nigerian experience and structural causes. Journal of Economic and Administrative Sciences.

Park, C.-Y., and R. Mercado. (2018). "Financial Inclusion, Poverty, and Income Inequality." *The Singapore Economic Review*, 63 (1): 185–206.

Philippon, T., 2019. On fintech and financial inclusion (No. w26330). National Bureau of Economic Research.

Potnis, D.D., Gaur, A. and Singh, J.B., 2020. Analysing slow growth of mobile money market in India using a market separation perspective. Information Technology for Development, 26(2), pp.369-393.

Rojas-Suarez, L. and Amado, M., 2014. Understanding Latin America's financial inclusion gap. Center for Global Development Working Paper, (367).

Sadok, H. (2021). How can inclusive growth be enabled from financial technology?. *International Journal of Business Performance Management*, *22*(2-3), 159-179.

Sahay, R., M. Čihák, P. N'Diaye, A. Barajas, S. Mitra, A. Kyobe, Y. Mooi, and R. Yousefi. 2015. "Financial Inclusion: Can it Meet Multiple Macroeconomic Goals?" IMF Staff Discussion Note 15/17.

Sahay, M.R., von Allmen, M.U.E., Lahreche, M.A., Khera, P., Ogawa, M.S., Bazarbash, M. and Beaton, M.K., 2020. The promise of fintech: Financial inclusion in the post COVID-19 era. International Monetary Fund.

Sarma, M., & Pais, J. (2011). Financial inclusion and development. *Journal of international development*, *23*(5), 613-628.

Seng, K. and Lay, S.H., 2018. Financial inclusion: Are mobile phones helpful in Cambodia. NBC Work-ing Paper Final

Sha'ban, M., Girardone, C., Sarkisyan, A., & Arun, T. (2021) On the Relationship between Financial Inclusion and Bank Performance. EMNES Working Paper No 52.

Sioson, E.P. and Kim, C.J., 2019. Closing the gender gap in financial inclusion through Fintech.

Soriano, M. A. (2017). Factors driving financial inclusion and financial performance in Fintech new ventures: An empirical study.

Suri, T. and Jack, W., 2016. The long-run poverty and gender impacts of mobile money. Science, 354(6317), pp.1288-1292

Tchamyou, V.S., Erreygers, G. and Cassimon, D., 2019. Inequality, ICT and financial access in Africa. *Technological Forecasting and Social Change*, 139, pp.169-184.

Thakor, A.V., (2020). Fintech and banking: What do we know? Journal of Financial Intermediation, 41, p.100833.

Togan-Egrican, A., English, C. and Klapper, L., 2012. Credit Cards and Formal Loans Rare in Developing Countries.

Turegano, D. M., & Herrero, A. G. (2018). Financial inclusion, rather than size, is the key to tackling income inequality. *The Singapore Economic Review*, *63*(01), 167-184.

UN United "Nations Shaping our Future 2020" report
https://www.un.org/en/un75/inequality-bridging-divide

World Bank. 2014. Global Financial Development Report 2014: Financial Inclusion. Washington, DC: World Bank.

Yang, T. and Zhang, X., 2022. FinTech adoption and financial inclusion: Evidence from household consumption in China. Journal of Banking & Finance, 145, p.106668.

Yue, P., Korkmaz, A.G., Yin, Z. and Zhou, H., 2022. The rise of digital finance: Financial inclusion or debt trap?. Finance Research Letters, 47, p.102604.

Zhang, X., J. Zhang, and Z. He. 2018. "Is FinTech Inclusive? Evidence from China's Household Survey Data." Paper presented at the 35th IARIW General Conference, Copenhagen, 20–25 August

Appendix 3A: Variable Definitions

Variable	Definition	Source	Expected Relationships with Financial Inclusion
***Dependent variables**: Financial Inclusion indicators*			
Log Number of debit cards per 1000 adults	A type of payment card which enables the holder to charge purchases directly to their account at a financial institution.	Financial Access Survey, International Monetary Fund	
Log Number of credit cards per 1000 adults	A type of payment card indicating that the holder has been granted a line of credit. It enables the holder to make purchases and/or withdraw cash up to a prearranged ceiling; the credit granted can be settled in full by the end of a specified period or can be settled in part, with the balance taken as extended credit.	Financial Access Survey, International Monetary Fund	
Independent Variables:			
FinTech Indicators:			
Log Number of registered mobile money accounts per 1,000 adults	An account registered with a resident mobile money service provider that is primarily accessed using a mobile phone and can be used for basic financial transactions, including peer-to-peer transfers, bill payments, merchant payments and international remittances.	Financial Access Survey, International Monetary Fund	+
Log Number of mobile and internet banking transactions (during reference year) per 1,000 adults	The total number of mobile and internet banking transactions carried out by resident nonfinancial corporations and individuals from the household sector during the reference year.	International Monetary Fund, Financial Access Survey	+
Control Variables			
Trade	The sum of exports and imports as a share of GDP	World Development Indicators, World Bank	+
Inflation	Inflation as defined by the consumer price index reveals the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly.	World Development Indicators, World Bank	+/-
Secondary school enrolment rate	School Enrolment, Secondary (% Gross) The ratio of the number of students enrolled in secondary education regardless of age by the population of the age group which officially corresponds to secondary education and multiplied by 100.	World Development Indicators, World Bank	+
Log GDP per capita	Gross domestic product divided by midyear population in logs i.e., it is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products.	World Development Indicators, World Bank	+

Note: The table presents the variables used in the study, their definition and measurement, data sources, and expected relationship with financial inclusion.

Chapter 4

Financial Inclusion, Bank Stability and Competition

Abstract

This paper investigates the relationship between financial inclusion, competition and bank stability using a sample of 241 banks (1,361 bank-year observations) operating in 15 MENA countries for the period 2012-2021. We first construct country-level indices of financial inclusion using principal component analysis (PCA) and relate these variables to bank stability measured using the Z-score and the standard deviation of returns. Subsequently, we construct the Lerner index to measure the direct and interacting effect (via financial inclusion) of bank competition on bank stability. Our evidence shows a positive and significant association between financial inclusion and bank stability in MENA countries. Our results also indicate that high market power (measured using the Lerner index) is positively associated with bank stability. Further, the results also reveal that bank competition improves financial inclusion strategies that involve credit growth but does not affect financial inclusion strategies related to the availability of credit. The results suggest that policymakers in developing countries should be cautious in opening the banking sector to competition, especially when asymmetric information is pervasive.

4.1 Introduction

Having access to and using financial services (financial inclusion) is a critical component of social and economic development. Financial inclusion can contribute to lowering income inequality and poverty, smoothing consumption (Beck et al., 2007; Burgess and Pande, 2005; Gertler et al., 2009), increasing savings (e.g., Aportela, 1999; Allen et al., 2016), enhancing employment (e.g., Prasad, 2010) and improving mental well-being (e.g., Karlan and Zinman, 2010; Angelucci et al., 2013). As a result, those excluded from the formal financial system are vulnerable to different types of risks, including social exclusion and missed business opportunities. Due to advancement in mobile telephony and financial technology (FinTech) in the last two decades, more people, especially in the middle and lower-income countries are now more financially included. For instance, The World Bank's Global Financial Index (Global Findex) Report 2021 revealed that account ownership (that is, bank and mobile money accounts) as a percentage of the global population increased from 51% to 76% between 2011 and 2021.

In line with the benefit of financial inclusion for households, there has been a debate on whether financial intermediaries (banks and financial institutions) also benefit from an inclusive financial system. Proponents of this view argue that banks can leverage their superior skills and technology capacity (Demirgüc-Kunt et al., 2008; Beck et al.,2011), to offer financial services to the unbanked at a lower cost, without increasing their risk exposure or fragility. It is also contended that banks in an inclusive financial system can reduce their exposure to wholesale funding, which in turn, reduces cyclical exposure stemming from this funding source (Ahamed and Mallick, 2019). Despite the potential for financial inclusion to improve the stability of banks through the diversification of loan portfolios and relationship lending, little is known about how competition moderate this relationship. Specifically, banks can explore their market power in less competitive markets to provide more credit to small firms and informationally opaque customers (Petersen and Rajan, 1995; Di Patti and Dell' Arricia; 1995). On the other hand, the mainstream perspective

on the effect of market power suggests that a less competitive banking sector should result in an increase in the cost of finance and a decrease in loan supply, which deprives small firms and informationally opaque customers (Berger and Hannan, 1998; Beck et al., 2004; Carbo-Valverde et al., 2009; Claessens and Laeven, 2005). In a recent study involving 2,635 banks from 86 countries over the period, 2004 to 2012, Ahamed and Mallick (2019) show that higher levels of financial inclusion can improve bank stability, especially those with higher customer deposits and lower marginal cost as well as those located in countries with stronger institutional qualities. The authors also show that the relationship between financial inclusion and bank stability is further strengthened when the banking industry exhibit higher market power (less competitive). Considering these opposing views, the present study explores the moderating effect of competition on the channel between financial inclusion and banking stability in the MENA region. Further, beyond the study by Ahamed and Mallick (2019), little is known about the relationship between financial inclusion and bank stability at the country or regional levels and how competition moderate this relationship. By focusing on the Middle East North Africa (MENA) regional blocks, this study intends provide additional evidence on the relationship between financial inclusion, competition and bank soundness.

The study contributes to the literature in at least two main ways. First, to the best of our knowledge, this study is the first to examine the moderating effect of competition on the relationship between financial inclusion and bank stability in the MENA region. Though Hakimi et al. (2022) show that a positive relationship exists between financial inclusion and bank-level stability in the MENA region, but do not examine the extent to which competition controls this relationship. By considering the role of competition in enhancing (or hampering) the financial inclusion-bank stability nexus, we extend their work by providing additional depth on the channels through which financial inclusion impacts banks stability. Second, we also contribute to the growing literature on bank competition, financial inclusion and bank stability (Beck et al.,

2013; Ahamed and Mallick, 2019). By focusing on the MENA region, our study provides depth to complement the cross-country evidence in prior studies. Specifically, we show that in regions where the banking sector is not competitive (like MENA) banks' can harness their market power to extend their services to otherwise financially excluded. Third we also contribute to the literature on bank stability. Following the 2007 financial crisis a lot of focus has shifted to banks soundness and sustainability (Berger et al., 2009; Laeven and Levine, 2009; Beck et al., 2013; Angriner et al., 2014). By exploring the potential role of competition, we extend this literature and provide additional insight from one of the regions (MENA) with the fastest growth in financial inclusion.

Our findings indicate that financial inclusion is positively and significantly related to bank-level soundness or stability. We also examined financial inclusion along three dimensions, that is (i) depth (the ratio of loans and deposits to GDP), (ii) credit growth (the ratio of private credit to GDP) and (iii) availability (an index of demographic and geographic measures of financial inclusion). Our findings indicate that only depth and credit growth measures of financial inclusion are significant determinants of bank stability in the MENA region. These results support the notion that extending financial services to the larger segment of the population has the positive benefit of improving banks' soundness by enhancing the diversification of their loan portfolios. Our results also indicate that high market power (measured using the Lerner index) is positively correlated with bank stability supports the information hypothesis which suggests that competitive banking sector can deteriorate the relationship between banks and its customer bank-customer-bank, which in turn, reduces access to financial services for opaque customers, thereby, increasing banks' risk exposure due to the loss of diversification benefit from having a diverse customer base. In addition, our results also suggest that the competition only enhances financial inclusion strategies that involve credit growth, but not for availability and depth dimension.

The rest of the chapter is organised as follows. Section 4.2 reviews the related literature and presents the testable hypotheses. Section 4.3 details the data, variables description and the econometric approaches employed, while Section 4.4 presents and discusses our empirical results. Section 4.5 summarises our findings and provides some policy implications.

4.2 Related Literature and Hypothesis

4.2.1 Financial Inclusion and Financial System Stability

Financial inclusion can have two opposing effects on the stability of the financial systems. On the one hand, financial inclusion can promote bank stability through the diversification of loan portfolios (Demirgüç-Kunt and Huizinga, 2010; Poghosyan and Čihak, 2011; Han and Melecky, 2013; Roengpitya et al., 2014; Danisman, and Tarazi, 2020) reduction in pro-cyclical risks through the diversification of banks' funding sources (Prasad, 2010) and support effective transmission of monetary policies (Karlan et al., 2014; Demirgüç-Kunt et al., 2017; Bachas et al., 2021). On the other hand, financial inclusion can increase the instability of the financial system by (i) decreasing the checks required by lenders in lending to new customers and (ii) encouraging lax credit policies (Danisman, and Tarazi, 2020; Khan 2011; Mehrotra and Yetman 2015; Cihak et al.,2016; Sahay et al. 2015; Rajan et al., 2015; Morgan and Zhang, 2017; López and Winkler, 2019).

Retail banking business models are often characterised as sluggish, insensitive to risk and a more stable source of long-term financing relative to wholesale and capital market-oriented banks (Calomiris and Kahn, 1991; Roengpitya et al., 2014; Demirgüç-Kunt and Huizinga, 2010). For instance, Demirgüç-Kunt and Huizinga (2010) show that banks' fragility increases with an increase in the share of non-deposit funding, while Roengpitya et al. (2014) also find that retail or commercial banking activities tend to have lower costs and more stable profits compared to those engaged in capital market activities. Similarly, financial inclusion strategies that increase the use of bank deposits can improve the funding base of banks in periods of financial distress

(Sahay et al., 2015). Specifically, Han and Melecky (2013) show that a 1% increase in the access to deposits is associated with about 0.4% reduction in the average withdrawal rate in period of financial crisis. Further, retail banking, especially lending to small and medium enterprises (SMEs), tends to reduce the volatility of the bank's loan portfolio through the reduction in the relative size of a single borrower (Danisman, and Tarazi, 2020). Further, by extending deposit facilities to the larger population, retail banks can attract many small retail deposits at a lower cost than wholesale funding, which in turn reduces their marginal cost (Ahamed and Mallick, 2019).

As such financial inclusion strategies that promote the diversification of banking funding channels such as increasing branch/ATM (Automated Teller Machine) penetration should also increase the stability of the financial system by attracting depositors from all income levels. Diversification is also beneficial in periods of a financial crisis since many depositors reduce the probability of a bank run (Han and Melecky, 2013; Poghosyan and Čihak, 2011). Therefore, bank stability increases when there is diversification of funding strategies correlated with financial inclusion in increasing deposits.

The reduction in pro-cyclical risk due to financial inclusion is also closely linked to the diversification benefits discussed above. Specifically, when banks' funding sources are more diversified, it reduces their reliance on the wholesale banking market for liquidity support. As a result, the deposit level within the population also increases the proportion of stable funding for banks, which in turn reduces the tendency of a cyclical shock to the financial sector in periods of economic crisis by decreasing the volatility of total assets (Han and Melecky, 2013). Similarly, financial inclusion through increased debit card usage can encourage adults to regularly check their account balance, which increases their trust in the financial system and is likely to reduce the probability of panic withdrawal in periods of economic downturn (Bachas et al., 2021)., Financial inclusion can also enhance the effectiveness of monetary policies by bringing more

individuals into the formal financial system. Further, financial inclusion related to increased access to credit for SMEs can also increase employment and increases savings, thus boosting local investment and stability of the financial sector (Prasad, 2010). Digital financial inclusion can also create financial records and credit history that are essential in assessing the credit quality of customers and help in allocating credit to customers based on their risk profile (Demirgüç-Kunt et al., 2017; Karlan et al., 2014).

On the other hand, financial inclusion strategies that involve credit extension without proper supervision can result in the loss of financial system stability (Danisman, and Tarazi, 2020). Rapid credit growth due to a reduction in the lending standards can increase banks risk taking, which in turn can pose systemic risk through contagion (Khan 2011; Mehrotra and Yetman 2015). All things being equal, we expect credit growth to lead to an increase in bank risk taking in countries where lending standards are lax. Support for this intuition comes from Cihak et al. (2016), who find that the relationship between financial inclusion and bank stability is bell shaped. They find that though the initial relationship between financial inclusion (measured as the share of borrowers in the adult population) and bank stability (bank Z-score) is positive, it tends to diverge depending on the countries' strength of banking supervision. Their findings indicate that countries with weaker banking supervision, that is, those with lower observation of the Basel Core Principles for Effective Banking Supervision (BCP), change to a negative relationship over time, while those with strong supervision (higher observation of BCP) tend to maintain the initial positive relationship. In line with this, Sahay et al. (2015) also find that financial inclusion that involves taking more systemic risks in seeking financial inclusion can hurt the stability of the financial system. Further, financial inclusion strategies that lead to an increase in the number of unregulated institutions offering financial services - shadow banking (institutions that provide financial services outside the purview of financial system regulators) can also pose significant risks to the stability of the entire financial system by underestimating

the true fragility of the financial system, especially in periods of economic downturn (De la Torre et al., 2013; Fungáˇcová and Weill, 2015).

Another strand of the literature focusing on credit extension to poorer and less creditworthy borrowers can compromise the stability of the financial system. Rajan et al. (2015), for example, note that the 2007 subprime crisis provides a good case for how "easy credit" as an income equality-reducing strategy can pose risk to the financial system by reducing the stability of the financial system. Recent studies (Morgan and Zhang, 2017; López and Winkler, 2019) support this notion. Using a sample of 1889 banks in 65 advanced and emerging market economies Morgan and Zhang (2017) examined the effect of mortgage lending on bank stability (measured using Z-score and non-performing loan ratio). Their findings reveal that though an increasing share of mortgage lending (typically between 49-68%) positively affects financial stability by lowering the probability of default by financial institution and reducing the ratio of non-performing loans in non-crisis periods, it can pose a significant risk for the sector if the growth rate of mortgage lending is above these thresholds (that is, higher than 68%). They also find that better regulation of the financial sector improves financial stability. López and Winkler (2019) also examine how financial inclusion affects the level of financial bust following a crisis. Using the 2007 financial crisis with data covering the period 2004 to 2017, they find that a higher borrower growth rate in the years that precede a crisis does not mitigate the effect of the crisis and potentially underlines the destabilising effect of credit booms. Nonetheless, they find that countries with more inclusive banking sectors experience lower sensitivity to credit busts in times of financial crisis.

The foregoing discussion indicates that the relationship between financial inclusion and bank stability is an ambiguous one and depends on the dimension of financial inclusion being examined. Specifically, financial inclusion can be measured by access to financial services, usage (reach) and depth. As such, access and depth of financial inclusion, for instance, can have

opposing effects on bank stability. Nonetheless, we argue that the positive effect of financial inclusion on bank stability should outweighs the negatives. For instance, in a region where financial inclusion strategies enables a simultaneous access to financial access (positive) and credit growth (negative), we expect the former to dominate due to its ability to significantly enhance portfolio diversification, which is enough to offset the negative impact of lax lending policie, and weak screening of borrowers associated with the latter.

The following hypotheses are derived.

H1: There is a positive relationship between financial inclusion and bank stability.

H2: Financial inclusion strategies that promote credit growth reduce bank stability.

4.2.2 Bank Competition, Financial Inclusion, and Stability of the Financial System

The degree of competition in the banking sector can have important implications for financial inclusion, especially regarding access and use of finance (Ahamed, 2016). The empirical relationship is however mixed with two hypotheses emerging in the literature, that is, traditional market power hypothesis and information hypothesis. The traditional market power hypothesis (Berger and Hannan, 1998; Beck et al., 2003; Beck et al., 2004; Carbo-Valverde et al., 2009; Claessens and Laeven, 2005; Ryan et al., 2014) proposes that competition in the banking sector leads to a reduction in the cost of finance and an increase in the loan supply, which increases the availability of credit. In a cross-country study Beck et al. (2003) show that bank concentration (less competition) increases a firm's obstacles and decreases their access to finance, with strong effects when there are restrictions on banking activities. Claessens and Laeven (2005), Carbo-Valverde et al. (2009) and Love and Pería, M.S., (2015) also show that a more competitive banking sector increases firm's access to finance.

An alternative view, the information hypothesis (Petersen and Rajan, 1995; Dell'Ariccia and Marquez, 2004; Agarwal and Ben-Davies, 2018) posits that competitive banking systems can

weaken the relationship between lenders (banks) and customers by discouraging banks investment in relationship lending. Petersen and Rajan (1995) in their seminal work argue that in a competitive credit market where creditors cannot hold equity claims, lenders cannot expect to share in the future rent of the firm and are likely to charge higher interest rates upfront, until uncertainties are resolved. They however note that lenders in a monopolistic market, lenders share in the future rent of borrowers and thus willing to extend credit by backloading interest rate over time and subsidsing in the case of young and distress firms. Thus, lenders in a less competitive market, smoothen out the interest rate by charging a lower than competitive rate when firms are young and a higher than competitive rate when they are mature. In a related study, Dell'Ariccia and Marquez (2004) find that when faced with greater competition from outside lenders, informed banks shift credit allocation to sectors where their competitors face the greatest adverse selection problems. To this extent, informed lenders continue to lend, but only to borrowers in less-captive sectors. Thus, competition can reduce overall borrowing, if the proportion of borrowers in the less-captive sectors is not large enough. Also, Owen and Pereira (2018) using a panel data of 83 countries across a 10-year period analyse the relationship between competition and financial inclusion. They show that a concentrated banking sector (less competition) is more likely to have increased access to deposit accounts and loans when there is limit on market power. Furthermore, Agarwal and Ben-Davies (2018) using a quasi-natural experiment of banks' loan officers engaged in loan prospecting, reveal that loan officers in a competitive credit market gave more weights to hard information in approving loans despite no change in the observable characteristics of borrowers.

Contrast the two perspectives discussed above, it is unclear how competition moderates the relationship between financial inclusion. In line with Petersen and Rajan (1994) and Di Patti and Dell'Ariccia (2004), it is reasonable to expect that banking sectors where higher market power exists (corresponding to lower competition) banks can increase access to credit by utilising the

information advantage that they obtain at the lower marginal cost. The ability of banks to utilise its market power to lend to young and distressed firms should also diversify their loan portfolios, which in turn, improves financial inclusion. In line with this discussion, the following hypotheses are proposed:

H3: High market power (low competition) improves bank stability through loan portfolio diversification.

H4: Competition moderates the positive relationship between financial inclusion and bank stability.

4.2.3 Financial Inclusion and Bank Stability in MENA Countries

Financial inclusion in the MENA region is characterised by low financial deepening, underdeveloped financial markets, limited secured transactions and access to finance (Emara, and El-Said, 2021). For example, a recent World Bank report indicates that the usage of the internet and digital tools like mobile money for payment services is very low considering the income levels in these countries (The World Bank, 2022). According to the Global Findex Report 2021, the proportion of the unbanked population is relatively lower in the MENA region.[14] The low level of financial inclusion in the MENA region is due to a number of factors including regulatory barriers, low digital technology adoption, and a low financial literacy level (Hakimi et al., 2022). It is estimated that increasing access to finance can create jobs for the 20 million young people who are anticipated to enter the labour force by 2025 (World Economic Forum, 2019). Similarly, digitalising the economies, including financial services, in the MENA region is expected to increase GDP per capita by 40% and reduce the long-term unemployment rate to low levels as well as increase female labour force participation to around 40% (The World Bank, 2022).

[14] According to Global Findex 2021, Account Ownership in Egypt is 73%, with 65% of these proportion without employment.

FinTech and digital innovation can help broaden access to finance and achieve greater financial inclusion. However, these innovations should be accompanied by a financial stability agenda aimed at ensuring that financial systems stay resilient, improving macroprudential supervision, strengthening bank governance, increasing bank capital, and implementing specific risk management and hedging strategies. However, there are limited empirical studies on the relationship between financial inclusion and bank stability. The only study to have examined the link between financial inclusion and financial system stability in MENA countries is Hakimi et al. (2022). Using a generalised method of moments approach, they find that a positive relationship exists between financial inclusion and bank-level stability. They further note that bank-level stability is sensitive to the level of non-performing loans, size and liquidity risk.

Banking Competition in MENA Countries

Countries in the MENA region have undertaken several reforms aimed at liberalising and promoting financial inclusion in recent decades. Some of these reforms include the introduction of universal banking status and a reduction in the government ownership of banks (Caporale et al., 2016). Similarly, there have been deregulations aimed at increasing the competitiveness of the banking sector, which is particularly evident in the decline of bank margins (Hassan, Sanchez et al., 2012; Lee, 2002). Several MENA countries have also experienced privatisation, and the entry of foreign banks' into the banking sector. The key objectives of these reforms are to improve the competitiveness, governance, and efficiency of the financial sector. Overall, a competitive and effective banking sector is expected to positively affect several macroeconomic indicators including growth. For instance, competition in the banking sector can reduce loan interest rate and encourage corporate investment, which in turn promotes economic growth (Levine et al., 2000; Levine, 2005; Mckinnon, 1973; Schumpeter, 1934).. Moussawi and Mansour (2022) in a recent study explored the relationship between competition, cost efficiency,

and bank stability in MENA countries. The authors use a sample of 222 commercial banks between 1999-2018 and a system GMM method to control for potential endogeneity between bank competition and stability. They find that competition positively affects cost efficiency and bank stability and suggests that increased competition allows banks to offer their services at a lower cost. 4.3 Data, Variables and Descriptive Statistics

4.3 Methodology and data

4.3.1 Data

To examine the relationship between bank stability and financial inclusion, we combine data from several sources. Our Bank-level data comes from BankFocus. BankFocus is a database provided by Bureau van Dijk and Fitch Ratings and provides detailed information on banks globally based on publicly available records. A range of filtering is carried out to arrive at our sample. First, we restrict the sample to banks located in the MENA region based on the World Bank's classification.[15] This initial search yields 910 banks and financial institutions. Second, we limit the sample size to commercial, cooperative banks and Islamic banks in these countries. Third, in line with previous studies (Beck et al., 2013; Ahamed, 2016), we exclude banks with less than 3 years of continuous observation given that the risk measure (Z-score) needs to be estimated over a rolling window. Fourth, we remove bank-year observations that do not have available data on the variables of interest. The final sample is 1,361 bank-year observations on 241 banks for the period 2012 -2021. Subsequently, we winsorise all the variables at the 1% level to deal with outliers in our sample.

The bank-specific data are then matched to various country-level databases that cover financial inclusion and macroeconomic performance. First, we utilise a range of financial inclusion

[15] https://www.worldbank.org/en/region/mena

measures from the IMF's Financial Access Survey (FAS) and the Global Financial Development Database (GFDD). Financial inclusion measures related to the (i) geographical distribution or availability of financial services, (ii) the growth of credit are taken from the FAS database, and (iii) the depth of financial inclusion is taken from the GFDD. We also include macroeconomic indicators to capture the impact of macroeconomic conditions on the stability of banks. The two measures employed the growth rate of GDP and GDP per capita are taken from the World Development Indicators Database. All the country-level measures are winsorised at the 99% level to deal with outliers in the sample. Filtering the bank-specific data and matching it with our country-level data yields a sample of 1,361 firm-year observations covering 241 banks located in 15 MENA countries. Appendix 4A provides the list and definition of these variables.

4.3.2 Measuring Bank Stability, Financial Inclusion and Competition

4.3.2.1 Measuring Bank Stability: The Z-score

To measure bank stability, we follow the approach of extant studies (Laeven and Levine, 2009; Demirguc-Kunt and Huizinga, 2010; Beck et al., 2013) by estimating the Z-score. The Z-score can be interpreted as the number of standard deviations that a bank's return on asset has to fall for it to become insolvent (Boyd and Runkle 1993). A higher value of the Z-score indicates a lower probability of insolvency and, thus, greater stability. The inverse Z-score can be considered as the probability of insolvency of banks if their profitability is normally distributed. The stability of a bank will increase when returns and capitalisation are high and decrease when returns are low.

The Z-score is calculated as

$$Z_{i,t} = \frac{ROA_{i,t} + ETA_{i,t}}{\sigma ROA_{i,t}} \qquad (4.1)$$

where ROA is the return on assets, ETA is the equity-to-asset ratio, and σROA is the standard deviation of return on asset. i and t represent cross-sectional (bank) and time (year) dimensions. To estimate the standard deviation of ROA we use a three-year rolling window to account for changes in the denominator for the Z-score. Time variation ensure that changes in the Z-score is only driven by changes in capital and profitability (Schaeck and Cihak, 2010). Further, the rolling window approach ensures that the Z-score is estimated over the same window length for all banks in the panel (Beck et al., 2013).[16]

For robustness purposes, we also use the natural logarithm of the volatility (standard deviation) of ROA as an alternative measure of bank stability. In line with Beck et al. (2013), we multiply $ln(\sigma ROA)$) by -1 so that an increase will account for an improvement in bank stability and is consistent with the Z-score interpretation.

4.3.2.2 Measuring Financial Inclusion

We use several measures to capture country-level financial inclusion in our sample. First, we construct indices (Financial Inclusion Index) using principal component analysis to capture geographic and depth dimensions of financial services. Second, we utilise measures that capture the growth of credit. Beck et al. (2007) use cross-country data to examine financial sector outreach and its determinants in order to assess the trends across both usage and outreach dimensions. Nevertheless, according to OECD (2008), with a composite indicator that combines many dimensional indicators public communications become easier and more useful in policy analysis.

[16] [16] To estimate the three-year rolling window standard deviation of ROA (σROA) for Bank A in 2010, we calculate the standard deviations of ROA over the years 2008, 2009 and 2010. Similarly, the 2011 σROA is computed as the standard deviation over the years 2009, 2010, and 2011.

Construction of The Financial Inclusion Index

In constructing our financial inclusion index, we follow the approaches of Amidžic et al. (2014), Ahamed and Mallick (2019) and Sha'ban et al. (2020) by utilising the availability (access) and depth dimensions of financial inclusion. Due to data unavailability on the usage dimension of financial inclusion for some of the countries in our sample, we could not include the deposit accounts and loan accounts in the construction of the Financial Inclusion Index. For the availability dimension, we use both demographic and geographic measures. The demographic measures include (i) the number of bank branches per 1000 adults and (ii) the number of ATMs per 100,000 adults, while the geographic measures are (iii) the number of bank branches per $1000km^2$ and (iv) the number of ATMs per $100km^2$. To measure the depth of financial inclusion, we use bank deposits and loans as a percentage of GDP. All the variables used in the estimation of the financial inclusion index are from the IMF's FAS and the World Bank's GFDD.

Principal Component Analysis

Financial inclusion can be measured in multiple dimensions, that is, access, usage, penetration and depth. Using only one of these dimensions does not provide a complete perspective of financial inclusion. Similarly, including all the measures can lead to multicollinearity due to the high correlation between these measures. Principal component analysis is a dimension reduction method that transforms the data into a coordinate system such that the greatest variance by any projection of the data comes to lie on the first coordinate (referred to as the principal component), the second greatest variation on the second component and so on (Bali et al., 2014). The PCA approach avoids the random assignment of weights but rather extracts a weight based on the distinct variations between the variables. This parametric approach has been used in prior studies (Park and Mercado, 2018; Ahamed and Mallick, 2019; Sha'ban et al., 2020) to construct financial inclusion and development indices.

From an initial set of *n* correlated variables, PCA derives an uncorrelated principal components (PC_i), with each component being a linear weighted combination of the original variables and components themselves orthogonal to each other.

PCA transformation is defined by a set of p-dimensional vectors of weight (or loadings) $w_{(k)}$= $(w_1, \dots, w_p)_{(k)}$ that maps each row vector $x_{(i)}$ of X to a new vector of principal component scores $\theta_{(i)} = \left(\theta_1, \dots \theta_p\right)_{(i)}$ is given by $\theta_{k(i)} = x_{(i)}.w_{(k)}$.

Thus:

$$PC_1 = w_{11}X_1 + w_{12}X_2 + \cdots + w_{1n}X_n$$

$$PC_2 = w_{21}X_1 + w_{22}X_2 + \cdots + w_{3n}X_n$$

$$PC_m = w_{m1}X_1 + w_{m2}X_2 + \cdots + w_{mn}X_n$$

where PC_1, PC_2,…, PC_m are the principal components; $W = \left[w_{ij}\right]$ for $i = (1,2, \dots, m)$ and $j = (1,2, \dots, n)$ are the component loadings or weights and $X = [X_1, X_2, \dots, X_n]$ are the original variables. The eigenvectors of the correlation matrix are analogous to the weight of each principal component and indicates the variance contribution of each principal component to original variables. Similarly, the eigenvalue is the variance for each principal component.

Prior to conducting the principal component analysis, the original variables were normalised to the values between 0 and 1 to deal with the different scale of measurement for the original series.[17] Table 4.1 shows the results of the principal component analysis we carried.

To construct our Financial Inclusion Index *(FII)*, the following equation is specified:

$$FII = \sum_{i=1}^{n} w_{ij}X_i \qquad (4.2)$$

[17] We normalise the series using the following equation: $X_n = (\frac{x - min_x}{max_x - min_x})$, where X_n is the normalised series, X is the variable of interest; min_x is the minimum value; max_x is the maximum value.

The PCA results for the availability index (Table 4.1 Panel A) show eigenvalues of the four principal components (PCs) as 2.46, 0.843, 0.631 and 0.06, with the first principal component (PC1) explaining approximately 61% of the variation between the variables. The eigenvalues on the PCs also reveal that only the PC1 has a value greater than one. In this regard, we will utilise only the PC1 with the assigned weights (eigenvectors) of 0.573, 0.418, 0.336 and 0.545, respectively. The availability index captures variables that measure access to financial services across geographic and demographic characteristics such as bank branches per 1000 adults, ATMs per 100,000 adults, bank branches per 1000km^2 and ATM per 100km^2 (see Ahamed and Mallick, 2019 for more details).

Specifically, the availability index is constructed as:

$$\begin{aligned} &Availability\ index_{i,t} \\ &\quad = 0.447 bank\ branches\ per\ 1000\ adults_{i,t} + 0.418\ ATMs\ per\ 100{,}000\ adults_{i,t} \\ &\quad + 0.546 bank\ branches\ per\ 1000 km^2{}_{i,t} + 0.573 ATMs\ per 100 km^2{}_{i,t} \end{aligned} \tag{4.3}$$

Next, we construct a composite financial inclusion index which incorporates (i) availability index (equation. 4.3) and (ii) the depth dimension (Deposit and Loans to GDP). The principal component analysis of these variables yields following weights:

$$\begin{aligned} &Financial\ Inclusion\ Index_{i,t} \\ &\quad = 0.707 * Availability\ index_{i,t} + 0.707 * Loans\ and\ Deposit\ to\ GDP_{i,t} \end{aligned} \tag{4.4}$$

In Table 4.1 Panel B we report the PCA results for the Financial Inclusion Index. The results indicate that eigenvalues for the principal components are 1.702 and 0.291. The variance on the first principal component is 85%. Given that only the PC1 has an eigenvalue of more than one, we construct the financial inclusion index with the weights of this PC.

Table 4.1 Principal Component Analysis for Financial Inclusion Index

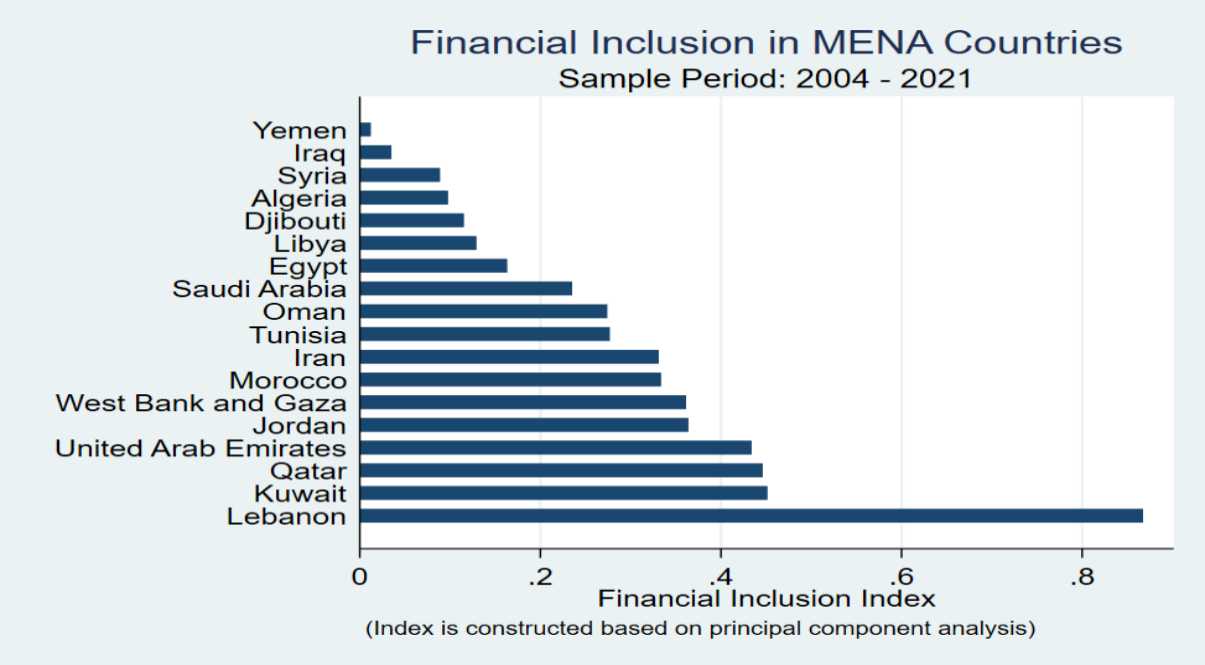
Panel A	PCA for availability index			
	PC1	PC2	PC3	PC4
Eigenvalues	2.46	0.843	0.631	0.061
% of variance	0.61	0.21	0.15	0.015
Variable				
Bank branches per 1000 adult	0.573	-0.304	-0.366	-0.666
ATMs per 100,000 adults	0.418	0.699	-0.491	0.309
bank branches per 1000km^2	0.446	0.378	0.781	-0.217
ATMs per 100km^2	0.545	-0.524	0.121	0.642
Panel B	PCA for Financial Inclusion Index			
	PC1	PC2		
Eigenvalues	1.702	0.291		
% of variance	0.854	0.145		
Availability index	0.707	0.707		
Loans and Deposit to GDP	0.707	0.707		

The table shows the principal component analysis results for the financial inclusion and the availability index.

Figure 4.1 illustrates the mean financial inclusion index by the countries in the sample. The figure indicates that Yemen and Iraq are the least financially inclusive countries in our sample, while Lebanon and Kuwait are the most financial inclusive countries in our sample. These rankings are largely consistent with that of Ahamed (2016) and Ahamed and Mallick (2019) as well as the data provided by the Global Partnership for Financial Inclusion (GPFI). [18]

[18] https://datatopics.worldbank.org/g20fidata/country/lebanon

Figure 4.1: Financial Inclusion Index by Country



Source: Author's estimation (Data: IMF FAS and World Bank GFDD).

For robustness purposes, we also utilise Domestic credit to the private sector (%GDP) as an alternative measure of financial inclusion.

4.3.2.3 Measuring Bank Competition: The Lerner index

The measures of bank competition can be differentiated into structural and non-structural measures. The structural measures include the Concentration ratio (CR) and the Herfindahl-Hirschman index (HHI). This group of measures analyse the conduct and performance of banks in the context of the market structure within which they operate. The main proposition of the structural measure is that the more concentrated a market is, the easier it is to collude and engage in uncompetitive behaviour. The CR typically measures the market share of the top firms (3, 5 or 10 firms) within an industry and ranges between 0 (competitive) to 1(uncompetitive). Similarly, Herfindahl-Hirschman index (HHI), a concentration measure of bank competition, requires data on the market share of all the banks in an industry. The index is estimated by summing the square of the market share of all banks in an industry. Like the concentration ratio, the HHI range from 0 to 1 for competitive to monopolists respectively. However, the HHI and

other concentration measures suffer from theoretical and empirical shortcoming. Proponents of HHI assumes that concentration leads to collusion, which in turn, increases bank profit and lower competition. However, studies by Baumol (1982) and Bernheim and Whiston (1990) have demonstrated that even with high market concentration, firms can behave competitively and cooperate, especially if the barriers to entry and exit are low. Further, barriers to entry may reflect efficiency, whereby more efficient firms gain a higher share of the market, which in turn increases the competition in the market (Peltzman, 1977). There are also practical issues on whether to define concentration at the local, regional or national level, with data availability often the main barrier in this regard. If it is the case banks compete locally and a national measure of competition is employed, the results can be misleading (Shaffer, 2004).

The non-structural measures (Lerner index, Panzer Rosse H-Statistics and Boone Indicator) makes no assumption about the market structure but rely on the banks microstructure and cost elements in defining competitiveness (Leon, 2015). The Panzar-Rosse (H-Statistics) model of banking competition, a non-structural measure of banking competition measures the transmission of prices on firms' revenue, where a weaker transmission is an indication of market power and vice versa. The model uses the H-Statistics to measure the competitive condition of a market. Specifically, the H Statistics is the sum of elasticities of all revenues with respect to the input prices and ranges from $-\infty$ to +1. A value close to +1 indicate competitive market and negative value indicate monopoly (Leon, 2015). A major strength of the H-Statistics is that it does not require stringent data and does not require specific market definition like the HHI index. However, several studies have found the sign on the H Statistics to be ambiguous at times, with negative signs reported for competitive markets and +1 for monopolistic markets (Shaffer 1983; Bikker et al., 2012; Shaffer and Spierdijk, 2013). Thus, higher values of the H-Statistics do not always mean lower competition. Further, there are interpretative issues regarding its continuous

nature with some studies reporting unambiguous results at higher values (Shaffer, 2004; Leon 2015).

Another measure of banking competition that is widely used in the finance literature is the Boone indicator. The Boone indicator is based on the notion that efficient firms are more highly rewarded in a competitive market, while their counterparts' inefficient firms are more harshly punished. Thus, there is reallocation of market share from less efficient firms to their efficient counterparts, which increases monotonically with the degree of competition (Leon, 2015). Consequently, the market share and profit for more efficient firms will increase while those of less efficient firms will decrease. The measure requires an estimation of the elasticity of profit to cost, which should be lower in more competitive market. However, a criticism of this measure is that it requires a ranking of all the banks in a country or region based on their efficiency levels. Like the Lerner index (discussed next) the Boone Indicator only focuses on one aspect of competition and does not recognise other dimension of competitiveness. Further, though the indicator is expected to be negative, there are instances where it is positive in the case of competition on quality, which in turn makes the measure ambiguous (Tabak et al., 2012).

The Lerner index measures the gap between firms price and marginal cost expressed as a percentage of price. Thus, the measure estimates the extent to which banks can increase their price beyond their marginal cost. Put differently, the Lerner index measures current and future profits because of pricing power. In a perfect competitive market, price should equal marginal cost but diverge in a non-competitive market. Thus, the Lerner index is explained as the inverse of competition; the higher the index value, the higher is the pricing power (low competitive market conditions), and vice versa. The main attraction of the Lerner index is that it measures competitiveness at the individual level and not at the industry or market level like the structural measures of competition. In other words, the Lerner index does not require a definition of the geographical market and unlike the market share or market concentration measures, it can be

estimated for every bank, for each year in the sample, conditional on having estimated price and marginal cost (Berger, 2009). Further, the Lerner index captures both pricing power on the asset and funding dimension of the banks market competitiveness (Carbó- Valverde et al., 2009; Beck et al., 2013). However, the Lerner Index is not without criticism. It has been criticised as pricing market power rather than a measure of competition and may not capture other aspects of competition (Stiglitz, 1987; Amir 2010). Further, it does not account for product substitution can overstate bank market power. Despite these shortcomings, the study utilises the Lerner index as it over comers the challenges posed by Panzer-Rosse H Statistics and the structural measures such as concentration ratio and HHI. The present study adopted the Lerner index as the measure of bank competition.

The Lerner index is constructed as follows:

$$Lerner_{i,t} = \frac{P_{i,t} - MC_{i,t}}{P_{i,t}} \qquad (4.5)$$

where $P_{i,t}$ is the price of total assets proxied by the ratio of total operating income (interest and non-interest income) to total assets for bank i at time t. $MC_{i,t}$ is the marginal cost of producing an additional unit of output for bank i at time t. The marginal cost is derived from a translog function using the stochastic frontier analysis (Appendix 4B).

4.3.3 Bank-Level and Macroeconomic Control Variables

We control for a range of bank-level characteristics and macroeconomic variables. For the bank-level measures, we proxy for bank liquidity using the ratio of total loans over total assets $(Loan\ Ratio)$(Ahamed and Mallick, 2019; Fang et al., 2014). To account for the effect of bank size, we use the natural logarithm of total assets $(Bank\ Size)$. This variable also captures that effect of the "too-big-to-fail" banks on the stability on the entire banking system. To account for

bank portfolio risk, we include the ratio of nonperforming loans over total assets ($Nonperforming\ Loans\ over\ Total\ Asset$). Further, due to the ambiguous effect of off-balance sheet activities, it is necessary to control for the for the level of diversification of banks using the ratio of non-interest income to total operating income ($Income\ Diversification$) that is likely to affect the stability of a bank and the banking system. We also include the ratio of total earnings asset over total assets ($Management\ Quality$) to capture measure how managers ability to maximise firm value given the assets at their disposal. Bank capital is also an important determinant of bank riskiness with well-capitalised banks often seen capitalised as less risky. We control for bank capital using the ratio of total equity over total assets ($Capitalisation$). Bank performance is highly correlated with the overall macroeconomic conditions due to the important role of financial intermediation in economic activities and growth. We include two macroeconomic variables, *GDP per capita* and *GDP growth*, to account for country-level income and economic growth, respectively.

4.4 Model Specifications

4.4.1 Financial Inclusion and Bank Stability

To examine the relationship between financial inclusion and bank stability, the following regression model is specified:

$$Bank\ stability_{i,j,t} = \alpha + \beta_1 FI_{j,t-1} + \beta_2 \sum_{n=1}^{6} X1_{i,j,t-1} + \beta_3 \sum_{n=1}^{2} X2_{j,t-1} + \gamma_t + \theta_i + v_j + \varepsilon_{i,j,t} \quad (4.6)$$

where the dependent variable $Bank\ stability_{i,j,t}$ is the Z-score or $-ln(sd(ROA))$ of bank i in country j at time t; $FI_{j,t-1}$ is the financial inclusion measures for country j at time $t-1$. Four measures of financial inclusion are employed in the study, that is, *Financial Inclusion Index, Availability Index, Loans and Deposit to GDP and Domestic Credit to the Private Sector to GDP*; $X_{1_{i,j,t-1}}$ is a vector of six bank-level controls for bank i in country j at time $t-1$ including *Loan Ratio, Bank Size, Nonperforming Loans over Total Asset, Income Diversification, Management Quality and Capitalisation;* $X_{2_{j,t-1}}$ is a vector of country-level macroeconomic controls for country j at time $t-1$ including *GDP per capita* and *GDP growth rate.* We lag all the independent variables by one year to control for potential endogeneity in our estimation. In addition, we include year (γ_t), bank (θ_i) and country (v_j) dummies to account for fixed effects. The year and country fixed effects absorb the impact of global factors on bank stability, while bank fixed effects control for bank-level variations; α, β_1, β_2 and β_3 are the coefficients to be estimated, while $\varepsilon_{i,j,t}$ is the error term. The estimation is carried out using an OLS regression with fixed effect and clustered at the year, bank and country level.

4.4.2 Competition, Financial Inclusion and Bank Stability

We also specify a regression model to estimate the effect of competition and financial inclusion on bank stability:

$$Bank\ stability_{i,j,t}$$

$$= \alpha + + \ \beta_1 FI_{j,t-1} + \beta_2 Lerner_{i,j,t} + \ \beta_3 FI_{j,t-1} * \ \beta_1 Lerner_{i,j,t} + \beta_2 \sum_{n=1}^{5} X_{1_{i,j,t-1}}$$

$$+ \beta_3 \sum_{n=1}^{2} X_{2_{j,t-1}} + \gamma_t + \theta_i + \ v_j$$

$$+ \varepsilon_{i,j,t} \qquad (4.7)$$

where *Lerner* is the Lerner index (market power) for bank i in country j at time t. We are interested in coefficients β_2 and β_3 that measure the effect of market power and its interacting effect on bank stability.

4.5 Empirical Results

4.5.1 Descriptive Statistics

Table 4.2 reports the descriptive statistics for the key variables used in the regression analysis. The mean value of bank stability, ln(Z-score), is 4.15 with a standard deviation of 1.14 which indicates that on average, ROA would have to fall by 4.15 of its standard deviation (in logarithmic terms) to wipe out bank equity.[19] The 25th percentile (p25) is 2.96, while the 75th percentile is 4.708. The negative logarithm of return (ROA) volatility is 1.33 on average with a standard deviation of 1.27, which suggests high variation in the distribution of this measure. The mean value for the Lerner index (our measure of competition) is 0.473 with a standard deviation (p75) of 0.473 (0.388).

The mean of the financial inclusion index is 0.47. However, the minimum value (p25) of 0.03 (0.217) suggests that some countries in our sample have a relatively low level of financial inclusion for the sample period. The availability dimension of financial inclusion also indicates

[19] The Z-score can be interpreted as the number of standard deviations by which returns would have to fall from the mean to wipe out all equity in the bank (Boyd and Runkle, 1993).

a mean of 0.71 with a standard deviation of 0.37. Similarly, loans and deposits as a percentage of GDP are approximately 51% across the sampled countries with a maximum value of 1. The p25 and p75 values are 0.29 and 0.54, respectively. The mean value on domestic credit to private sector (% of GDP) is 6.42. Overall, the results show substantial differences in the inclusiveness of financial systems across our sample of MENA countries. For the bank-specific variables, the results indicate that the mean of the loan ratio is 0.36; the log total assets (Bank Size) is 14.88; non-performing loans over total assets are 0.005; and income diversification is 0.475. For the country-level control, we find that domestic credit to GDP is approximately 64% with a standard deviation of 29% across the sample. The mean value for GDP growth and the log of GDP per capita are 1.765 and 9.62, respectively.

Table 4.2 Descriptive Statistics

	Obs.	Mean	Std.Dev	Min	P25	P75	Max
ln (Z Score)	1387	4.151	1.144	1.506	2.963	4.708	5.948
- ln (sd (ROA))	1387	1.334	1.269	-1.753	0.0719	1.950	3.377
FI Index	1387	0.467	0.235	0.031	0.217	0.506	1.000
Availability Index	1387	0.705	0.374	0.074	0.283	0.730	1.463
Loan and Deposit (%GDP)	1387	0.514	0.234	0.046	0.291	0.541	1.000
Lerner Index	1387	0.473	0.165	-0.338	0.388	0.595	0.021
Loan Ratio	1387	0.363	0.219	0.092	0.254	0.635	0.806
Bank Size (logs)	1387	14.881	1.98	11.089	13.226	16.536	17.846
Nonperforming Loans over Total Asset	1387	0.0058	0.0057	0.0011	0.0015	0.0080	0.0210
Income Diversification	1387	0.475	0.306	0.093	0.247	0.687	1.101
Management quality	1387	0.797	0.161	0.374	0.739	0.917	0.974
Capitalisation	1387	0.229	0.227	0.049	0.946	0.235	0.845
Domestic credit to private sector (% of GDP)	1387	64.424	29.056	2.476	44.290	85.548	138.858
GDP growth (%)	1387	1.761	3.625	-8.735	0.593	3.827	7.941
GDP per capita(log)	1387	9.621	0.997	7.883	8.336	10.300	11.351

Note: The table reports descriptive statistics for variables used in the analysis for the full sample of 15 MENA countries over the period 2012-2021. Definitions of the variables are provided in Appendix 4A.

Table 4.3 presents the mean values of the main variables (bank stability and financial inclusion) for the sample countries in this study. We find that the most stable banking system in the sample is in Lebanon with a Z-score (-ln (sd (ROA)) of 4.39 (1.94). On the other hand, Yemen has the lowest banking stability with an average Z-score (-ln (sd (ROA)) of 3.17(0.89). For the financial inclusion, we also find that Lebanon has the highest level of financial inclusion (0.92), followed by Kuwait (0.521) and Qatar (0.51). In contrast to Yemen (0.01), Iraq (0.04) and Algeria (0.11) have the lowest level of financial inclusion. In terms of the availability index, Lebanon and Kuwait have the highest values (1.475) and (0.935), whereas Yemen and Iraq have the lowest value of 0.03 and 0.06, respectively. Looking at the usage dimension, the results show that Lebanon has the highest level (0.90) whereas Yemen has the lowest (0.05). In terms of Loans and Further, we find that Lebanon, UAE and Jordan have the highest percentage of loans and deposits to GDP (90%, 61% and 55%, respectively).

Table 4.3 Bank Stability, Financial Inclusion and Its Dimensions across Countries

Country	ln(Z Score)	-ln(Sd (ROA))	FI Index	Availability Index	Loans and Deposits to GDP
Algeria	4.029	1.254	0.113	0.096	0.235
Djibouti	3.415	1.477	0.130	0.152	0.223
Egypt	3.631	0.796	0.181	0.180	0.324
Iraq	4.340	0.540	0.044	0.069	0.093
Jordan	4.124	1.222	0.367	0.426	0.548
Kuwait	3.597	0.344	0.521	0.935	0.428
Lebanon	4.393	1.942	0.922	1.475	0.900
Libya	3.411	1.113	0.166	0.161	0.305
Morocco	4.375	2.039	0.380	0.552	0.455
Oman	4.128	0.999	0.280	0.405	0.336
Qatar	4.300	1.389	0.514	0.794	0.551
Saudi Arabia	4.054	1.089	0.260	0.433	0.271
Tunisia	3.834	1.336	0.328	0.518	0.357
United Arab Emirates (UAE)	3.778	0.928	0.485	0.661	0.611
Yemen	3.170	0.894	0.016	0.036	0.052
Average/Total	3.810	0.973	0.375	0.375	0.432

Note: The table reports the value of bank stability, and financial inclusion index over the period 2012-2021, by the country for the full sample of 15 countries. Bank stability is the natural logarithm of Z-score. The financial inclusion index is constructed based on the availability index and depth dimensions. availability dimension is based on geographic and demographic Number

of ATM per 100km 2; Number of ATM per 100,000 adults; Bank branches per 1000 adults; Bank branches per 1000km. The depth Sum of outstanding loans and deposits as a percentage of GDP.

4.5.2 Correlation Analysis

Table 4.4 reports the correlation coefficients and their statistical significance for the independent variables used in this study. Overall, the data illustrate a negative correlation between financial inclusion variables and bank stability. However, this correlation is insignificant for the availability index. The results also show a positive correlation between GDP per capita and bank stability as well as domestic credit to GDP and bank stability. This indicates that countries with a higher income per capita are also likely to have a more stable banking sector. As expected, the variables of financial inclusion are positively correlated with each other. The correlations are mostly in line with those found in the empirical literature.

Table 4.4 Correlation Matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
ln (Z-score) (1)	1													
ln (Sd (ROA) (2)	0.899***	1												
FI-Index (3)	-0.066*	-0.006	1											
Availability index (4)	-0.050	-0.015	0.902***	1										
Loans and Deposit to GDP (5)	-0.066*	0.007	0.808***	0.475***	1									
Loan Ratio (6)	0.259***	0.399***	-0.0653*	-0.109***	0.015	1								
Bank Size (7)	0.209***	0.392***	0.224***	0.219***	0.158***	0.189***	1							
Nonperforming loans over total asset (10)	0.003	-0.384***	-0.105***	-0.0523	-0.143***	-0.422***	-0.493***	1						
Income Diversification (9)	-0.347***	-0.309***	0.213***	0.167***	0.205***	-0.0413	-0.0843**	0.0221	1					
Management Quality (10)	-0.085**	-0.142***	0.0168	0.0186	0.00897	-0.250***	-0.172***	0.135***	0.021	1				
Capitalisation (11)	0.132***	0.178***	0.195***	0.219***	0.0981**	0.428***	0.0915**	-0.146***	-0.008	-0.241***	1			
ln GDP per capita (12)	0.136***	0.120***	-0.145***	-0.0661*	-0.206***	0.0713*	0.0867**	-0.033	-0.122***	-0.0352	0.066*	1		
GDP growth (13)	-0.048	-0.095**	0.588***	0.653***	0.309***	-0.182***	0.297***	0.087**	0.110***	0.0303	0.138***	0.153***	1	
Domestic credit to GDP (14)	-0.102***	-0.0708*	0.409***	0.466***	0.199***	-0.240***	0.141***	-0.023	0.116***	0.0776*	-0.112***	-0.0287	0.426***	1

Note: The table presents key correlations for the variables used in our main empirical analysis. Definitions of the variables are provided in table (1). "* p<0.05** p<0.01 *** p

4.5.3 Relationship between Financial Inclusion and Bank Stability

To examine the relationship between bank stability and financial inclusion in MENA countries, we estimate equation (4.6) using an OLS regression with bank, country and year fixed effects. The results are summarised in Table 4.5. Columns (1) - (4) report the results of the regressing Z-score (our main bank stability measure) on the financial inclusion index, bank-specific characteristics, and country-level controls. Columns (5) – (8) reports the results of the regressing the inverse of the standard deviation of ROA (-ln (sd (ROA)) (our alternative measure of bank stability) on the financial inclusion, bank and country-level characteristics.

The coefficient on the financial inclusion index (Column 1) suggests a positive and statistically significant (at the 5% level) relationship with Z-score. The magnitude of the coefficient also implies that the relationship is economically significant. Given that we normalise the financial inclusion index to values between 0 and 1, the coefficient suggest that a one standard deviation increase the index (equivalent to 0.23 in Table 4.2) will lead to 3.7% (0.23*0.161) increase in the ln of Z-score. For instance, the coefficient on financial inclusion index in Column 1 of Table 4.5 suggests that banks in Algeria (the third lowest ranked country by our financial inclusion index) would improve their bank stability by 66% if they had the financial inclusion index of Kuwait (the third highest ranked country in terms of our financial inclusion index).[20] Banks would be able to generate adequate cheap retail deposits from a large clientele base through an inclusive financial sector. These results imply that financial inclusion in our study is driven mainly by the depth of financial inclusiveness (loans and deposits) rather than the access to these financial services. The coefficients on -ln (sd (ROA) in Columns (5) – (8) are similar in

[20] From Table 4.3, the financial inclusion index values for Algeria and Kuwait are 0.11 and 0.52. Multiply these index values by the estimated coefficient of the financial inclusion index in Table 4.5 yield 0.84 (0.52*1.61) and 0.18 (0.11*1.61). This difference between these predicted values 0.66 is reported as the potential improvement Algeria would have made if they had the financial inclusion of Kuwait.

magnitude and statistical significance to those reported in Columns (1) – (4). The results support our first hypothesis (H1) of a positive relationship between financial inclusion and bank stability. It thus supports the notion that inclusive financial services tend to enhance banking stability through a reduction in pro-cyclical risk (Han and Melecky, 2013; Ahamed and Mallick, 2019; Bachas et al., 2021). Further, the results support the notion that inclusive financial systems can reduce the volatility of banks' loan portfolios and the relative size of a single borrower (Danisman, and Tarazi, 2020).

Given that the index is composed of two main measures of financial inclusion, that is, availability (access) and depth dimension (equation 4.3), we also regress the Z-score on these two sub-components of financial inclusion. We find that availability dimension (access) is negatively related to Z-score, while loans and deposits to GDP (depth) are positively related to Z-score, but only significant in the case of the latter. For instance, the coefficient on financial inclusion in Column (3) suggests that a one unit increase in the ratio Loans and Deposits to GDP is associated with 1.31% increase bank stability (ln of Z-score).

A strand of the financial inclusion-bank stability literature suggests that strategies that promote aggressive credit growth can destabilise the financial system by increasing the riskiness of bank loan portfolio due to adverse selection and moral hazard problems (Morgan and Zhang, 2017; López and Winkler, 2019). To test this conjecture (H2), we proxy financial inclusion with the ratio of credit to the private sector to GDP. While the coefficients on financial inclusion (credit to the private sector to GDP ratio) in Columns (4) and (8) are negative, they are statistically insignificant. As such, we do not have enough evidence to support our second hypothesis (H2), which argues that financial inclusion strategies that increase credit growth are associated with reduced bank stability.

The bank-specific variables have the expected relationship with bank stability. For instance, we find that banks with a larger asset base (*Bank Size*), high equity (*Capitalisation)* and income

diversification are more likely to be more stable, while those with higher non-performing loans over total asset will tend to be less stable. The macroeconomic measures (GDP per capita and GDP growth) are positively related to financial inclusion but largely insignificant.

Table 4.5 Regression of Bank Stability on Financial Inclusion

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ln (Z-score)				-ln (sd (ROA)			
VARIABLES	FI index	Availability index	Loan and deposit (%GDP)	Private Credit to GDP	FI index	Availability index	Loan and deposit (%GDP)	Private Credit to GDP
Financial Inclusion	1.614**	-0.531	1.314***	-0.020	1.770***	-0.455	1.303***	-0.0170
	(0.681)	(0.469)	(0.328)	(0.014)	(0.664)	(0.458)	(0.321)	(0.014)
Loan Ratio	0.003	0.098	0.0197	0.558**	-0.169	-0.0740	-0.135	0.631**
	(0.272)	(0.27)	(0.267)	(0.250)	(0.266)	(0.268)	(0.261)	(0.249)
Bank Size	0.158**	0.182**	0.136*	0.187***	0.187***	0.213***	0.162**	0.229***
	(0.074)	(0.073)	(0.073)	(0.057)	(0.0724)	(0.0722)	(0.071)	(0.057)
Nonperforming Loans over Total Asset	-26.58***	-25.98***	-27.04***	-21.09***	-29.17***	-28.61***	-29.93***	-20.43***
	(6.175)	(6.197)	(6.069)	(5.705)	(6.026)	(6.053)	(5.925)	(5.682)
Income Diversification	0.005**	0.006***	0.004*	0.001	0.005**	0.006***	0.004*	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Management Quality	1.722***	1.886***	1.507***	1.457***	1.409***	1.592***	1.287***	1.154***
	(0.413)	(0.407)	(0.411)	(0.395)	(0.403)	(0.397)	(0.401)	(0.393)
Capitalisation	0.0146***	0.0155***	0.015***	0.012***	0.003	0.004	0.004	0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
GDP growth	0.011	0.0136	0.009	0.0177*	0.012	0.0137	0.008	0.0202**
	(0.011)	(0.011)	(0.010)	(0.010)	(0.011)	(0.011)	(0.010)	(0.009)
GDP per capita	0.027	0.03	0.028	0.019	0.027	0.032	0.03	0.023
	(0.95)	(1.04)	(0.98)	(0.69)	(1.00)	(1.15)	(1.12)	(0.83)
Constant	-0.421	0.246	0.199	0.185	-3.210***	-2.559**	-2.537**	-2.870***
	(1.197)	(1.228)	(1.178)	(0.929)	(1.168)	(1.200)	(1.150)	(0.925)
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Bank FE								
Constant	-0.421	0.246	0.199	0.185	-3.210***	-2.559**	-2.537**	-2.870***
	(1.197)	(1.228)	(1.178)	(0.929)	(1.168)	(1.200)	(1.150)	(0.925)
Observations	1,311	1,311	1,328	1,436	1,311	1,311	1,328	1,436
R-squared(within)	0.557	0.556	0.562	0.611	0.651	0.649	0.653	0.685

Note: The table reports the regression results of equation (4.6) estimating the relationship between bank stability and financial inclusion in MENA countries by applying ordinary least squares (OLS) regression with bank, country and year-fixed effects. All variables are averaged from 2012–2021. The dependent variable is the Z-score– defined as the sum of return-on-assets and equity ratio divided by the standard deviation of return-on-assets of each bank over past three years. We also use alternative bank stability proxy robustness tests i.e., the (-Sd (ROA) standard deviation of a bank's return-on-assets. The independent variables are: financial inclusion indices financial inclusion index, availability index and Loan and deposit (%GDP) and Private Credit to GDP respectively. Bank-level variables are: Loan ratio, Bank Size, Non-performing loans over total asset, Income Diversification, Management Quality, and Capitalisation. macroeconomic variables: GDP per capita and GDP growth respectively. The regressions are run on the full sample of MENA. countries covering the period of 2012-2021. Standard errors are clustered at the country level. *, **, *** indicate significance at 10 percent, 5 percent, and 1 percent levels, respectively.

4.5.4 Bank Competition and The Relationship between Bank Stability and Financial Inclusion

In the previous section, we show that financial inclusion is positively and significantly related to bank stability, that is, improvements in the access and use of formal financial services enhances the risk-taking behaviour of banks. Empirical evidence on this relationship between financial inclusion and bank stability is also mixed with two competing hypotheses, that is, the traditional market power hypothesis (Berger and Hannan, 1998; Beck et al., 2003; Beck et al., 2004; Carbo-Valverde et al., 2009) and information hypothesis (Petersen and Rajan, 1995; Dell'Ariccia and Marquez, 2004; Agarwal and Ben-Davies, 2018). While the traditional market power hypothesis argues that high competition should drive down marginal cost and improve access and usage of financial services, the information hypothesis suggests that competition reduces banks' incentives to use soft information which reduces financial intermediation, especially, in countries with high information asymmetry.

In this section, we examine the effect of competition and financial inclusion on bank stability in MENA countries. We do so by estimating the direct effect of the Lerner index (our measure of competition) and its moderating effect on the relationship between financial inclusion banks stability as specified in equation (4.7). The results are reported in Table 4.6. The coefficient on the Lerner index in Columns (1) and (3) suggest that there is a positive and significant relationship between Lerner index and the log of the Z-score. This suggests that an increase in market power (corresponding to a decrease in banking sector competitiveness) is likely to result in a more stable banking system. These findings are in line with the information hypothesis which posit that in a less competitive banking sector, banks utilise their market power to expand their services to customers, who would have likely been ignored in a competitive banking regime, resulting in a more diversified portfolio and enhanced stability. The findings are consistent with those of Petersen and Rajan (1995), Dell'Ariccia and Marquez (2004) and Agarwal and Ben-Davies (2018).

Next, we examine whether competition moderate the effect of financial inclusion on bank stability by exploring the interacting effects of Lerner index and our financial inclusion measures. Column (2) reports the results for the interaction between Lerner index and our financial inclusion index, while Column (4) reports the results for the interaction between Lerner index and private credit to GDP (credit growth dimension of financial inclusion. The coefficients on the interactions between (i) the Lerner index and FI index (Lerner index X FI Index) and (ii) the Lerner index and Private Credit to GDP (Lerner index X Private Credit to GDP) are both positive, but only significant in the latter. This result implies that an increase in credit growth (Private Credit to GDP) is likely to exert a more positive influence on the relationship between financial inclusion and bank stability. The intuition for this result comes from the notion that financial inclusion strategies related to credit provision can be value-creating by allowing banks to utilise their market power to reach attract more customers than they would in an ultra-competitive banking sector.

We also obtain similar results for the inverse of the standard deviation of ROA (-ln (sd (ROA)) as a measure of bank stability in Columns (5) to (8). Like the result for ln of Z-score, we find that the Lerner index is positively related to the standard deviation of ROA in Columns (5) and (7). Consistent with our earlier results, we also find that the Lerner index interacted with the financial inclusion index in Column (6) and private credit to GDP in Column (8) are positively related to bank stability but only significant in the latter. Taken together, our results largely support the fourth hypothesis (H4), but also indicate that the effect of competition on the relationship between financial inclusion and bank stability depends on the strategy of financial inclusion. Financial inclusion strategies involving increased access to bank branches and ATMs are not likely to improve bank stability. On the other hand, when financial inclusion strategies are related to credit growth (private credit to GDP) they are more likely to increase the stability of banks.

Table 4.6 Bank Stability, Competition, and Financial Inclusion

	ln(Z-Score)				-ln (sd (ROA))			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lerner Index	0.516**	-0.365	0.593***	-1.074*	0.600**	-0.201	0.722***	-0.806
	(0.243)	(0.585)	(0.227)	(0.566)	(0.270)	(0.614)	(0.242)	(0.619)
FI index	-1.162	-1.908			-0.917	-1.595		
	(1.670)	(1.625)			(1.794)	(1.739)		
Lerner Index X FI Index		2.057				1.869		
		(1.289)				(1.355)		
Private credit to GDP			-0.173**	-0.528***			-0.180**	-0.506***
			(0.073)	(0.132)			(0.0787)	(0.137)
Lerner Index X Private credit to GDP				0.983***				0.901***
				(0.302)				(0.325)
Bank Size	0.059	0.058	0.080	0.080	0.0598	0.059	0.106	0.106
	(0.090)	(0.090)	(0.072)	(0.071)	(0.124)	(0.124)	(0.084)	(0.084)
Nonperforming Loans over Total Asset	-26.34***	-25.75***	-29.64***	-29.55***	-28.20***	-27.66***	-31.09***	-31.00***
	(8.84)	(8.808)	(8.386)	(8.343)	(8.916)	(8.869)	(8.628)	(8.568)
Income Diversification	0.001	0.001	-0.001	-0.002	0.002	0.002	-0.002	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)
Management Quality	0.902*	0.873*	0.958*	0.932*	0.604	0.577	0.622	0.599
	(0.461)	(0.455)	(0.489)	(0.478)	(0.499)	(0.492)	(0.510)	(0.502)
Capitalisation	0.0105	0.010	0.0110*	0.0116*	0.001	0.001	-0.000	-0.000
	(0.006)	(0.006)	(0.006)	(0.0059)	(0.007)	(0.007)	(0.006)	(0.006)
GDP growth rate	-0.019	-0.020	-0.037**	-0.032**	-0.026*	-0.027*	-0.039**	-0.0349**
	(0.012)	(0.012)	(0.015)	(0.015)	(0.014)	(0.014)	(0.015)	(0.015)
GDP per capita	-0.240	-0.238	-0.184	-0.206	-0.108	-0.106	-0.098	-0.119
	(0.157)	(0.156)	(0.153)	(0.152)	(0.158)	(0.157)	(0.157)	(0.155)
Constant	6.081***	6.454***	5.123***	5.906***	1.964	2.303	0.913	1.631
	(1.324)	(1.339)	(1.458)	(1.429)	(1.627)	(1.629)	(1.526)	(1.484)
Observations	1,276	1,276	1,121	1,121	1,276	1,276	1,121	1,121
R-squared (within)	0.195	0.199	0.232	0.241	0.172	0.175	0.215	0.223
Number of Banks	357	357	319	319	357	357	319	319
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES

This table reports the results of the regression of competition and financial inclusion on bank stability in the MENA countries over the period 2012–2021. column (1) to (4) reports the results for the regression with Z-score as the dependent variable, while column (5) – (8) reports the result for sd (ROA) as the dependent variable. For the measures of financial index, we only focus on the financial inclusion index (FI Index) and Private Credit to GDP. ***, **, and * represent significance at the 1%, 5% and 10% level.

4.5.5 Robustness Test: Quantile Regression

To test for potential sensitivity of our observations across different groups (quantiles), we estimate a quantile regression. Quantile regressions are robust to non-normality in the error terms and outliers (Ahamed and Mallick, 2019).

Table 4.7 reports the results of the quantile regression estimates of the relationship between Z-score and financial inclusion. The results show that as the Z-score changes across quantiles (0.2 to 0.5) the estimates of the financial inclusion index do not vary significantly. Specifically, the coefficients across Columns (2) to (5) range between 2.195 and 2.473, which in turn indicates minimal variation between these quantiles. We also find that the coefficient on the financial inclusion index in quantile 0.8 (3.333) and 0.9 (3.909) is significant and higher than that observed in the lower quantile. On the other hand, we find that the estimate of the relationship between bank stability and financial inclusion is not significant for the quantiles up to 0.1 and between quantile 0.6 and 0.7. We conduct an F-test to test for equality of the slope across the quantiles, which is reported below in Table 4.7. Specifically, we test for four slope equalities, that is, 0.1 vs 0.9, 0.2 vs. 0.8, 0.3 vs 0.7, and 0.4 vs 0.6. The results for the p-values of the F-test are all greater than 0.100 suggesting that the null hypothesis of the equality of the slope across these quantiles cannot be rejected.

Table 4.7 Quantile Regression of Bank Stability on Financial Inclusion

Quantiles	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Financial Inclusion	2.002	2.434**	2.473***	2.195***	2.345***	1.341	1.986	3.333*	3.909**
	(1.297)	(1.221)	(0.864)	(0.680)	(0.887)	(1.721)	(1.475)	(2.012)	(1.827)
Loan Ratio	1.943***	1.702***	1.398***	1.070***	1.008***	1.109***	0.948***	1.176***	0.697**
	(0.455)	(0.312)	(0.300)	(0.240)	(0.251)	(0.298)	(0.348)	(0.414)	(0.297)
Bank Size	0.129***	0.168***	0.181***	0.159***	0.137***	0.166***	0.179***	0.154***	0.046
	(0.028)	(0.041)	(0.045)	(0.027)	(0.030)	(0.042)	(0.045)	(0.050)	(0.032)
Nonperforming Loans over Total Asset	-44.30***	-48.92***	-54.41***	-60.25***	-60.55***	-52.83***	-42.78***	-32.70**	-29.03**
	(14.51)	(11.72)	(11.42)	(8.196)	(10.26)	(8.198)	(14.49)	(13.26)	(12.88)
Income Diversification	-0.002	-0.002	-0.001	-0.002	-0.001	-0.001	-0.002	-0.002	-0.004**
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)
Management Quality	0.804**	1.706***	1.568**	1.440***	1.286**	1.463**	1.571**	0.559	0.179
	(0.370)	(0.488)	(0.707)	(0.509)	(0.592)	(0.626)	(0.732)	(0.704)	(0.560)
Capitalisation	0.017***	0.016***	0.018***	0.018***	0.016***	0.022***	0.020***	0.018***	0.009**
	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.006)	(0.004)	(0.004)
GDP growth	0.032	0.038**	0.030*	0.013	0.018	0.005	-0.007	0.010	0.006
	(0.022)	(0.019)	(0.015)	(0.023)	(0.017)	(0.025)	(0.021)	(0.020)	(0.017)
GDP per capita	-0.051	-0.062	-0.015	0.013	0.005	0.024	-0.004	0.036	0.024
	(0.053)	(0.040)	(0.034)	(0.042)	(0.037)	(0.033)	(0.037)	(0.052)	(0.034)
Constant	-0.182	-1.238	-1.602	-1.381*	-0.626	-1.929*	-1.932	-1.009	1.365
	(0.974)	(1.289)	(1.160)	(0.834)	(0.764)	(1.003)	(1.274)	(1.165)	(0.988)
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observation	1,111	1,111	1,111	1,111	1,111	1,111	1,111	1,111	1,111

Cross-equation hypothesis test	Quantile	F- statistics	P-value
Equality of slope estimates across different quantiles	0.10 vs. 0.90	1.09	0.297
Equality of slope estimates across different quantiles	0.20 vs. 0.80	0.25	0.614
Equality of slope estimates across different quantiles	0.30 vs 0.70	0.06	0.803
Equality of slope estimates across different quantiles	0.40 vs 0.60	0.38	0.535

This table reports the results of the quantile regression estimates of the relationship between financial inclusion and Z-score across MENA countries over the period of 2012-2021 across the 10^{th} quantile (0.1) to the 90^{th} quantile (0.9). The standard errors are estimated using the bootstrapping approach. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively.

4.6 Conclusion and Policy Implications

An inclusive financial system can enhance the livelihood of people and supports families and businesses to plan and better manage unforeseen circumstances. Similarly, financial inclusion can support the stability of the financial system by providing avenues for diversification of loan portfolios, reducing procyclical risks and supporting the effective implementation of monetary policies. Nonetheless, it can also be an avenue for financial fragility if financial inclusion decreases the due diligence on new borrowers and alters the lending policies of banks and other financial institutions. Furthermore, it is thought that the competitiveness of the financial sector can either enhance or impair the relationship between financial inclusion and bank stability with two opposing hypotheses emerging in the literature. First, the traditional market power hypothesis argues that competition should drive down marginal cost, which in turn should drive down the cost of financial services and hence more financial inclusion. The information hypothesis, on the other hand, posits that increased competition weakens the relationship between banks and customers by discouraging investment. This exacerbates asymmetric information and reduces access to financial services for the less privileged and poor who are likely to be financially opaque.

Using a sample of 1361 bank-year observations for 241 banks in 15 MENA countries for the period 2012-2021, this study examines (i) the relationship between financial inclusion and bank stability and (ii) the interacting effect of competition on the relationship between financial inclusion and bank stability. First, we construct a country-level index of financial inclusion using principal component analysis. Our index covers two main aspects of financial inclusion, that is, access to financial services (availability) and the depth of financial inclusion. Second, we construct two bank-level measures of stability, that is, the Z-score defined as the ratio of return on asset (ROA) plus the ratio of equity to asset (ETA) over the standard deviation of (ROA).

We also construct the Lerner index as a proxy for banking market competition (market power) to further explore the relationship between financial inclusion and bank stability. We regress the bank-level stability on the country-level financial inclusion and bank competition using an OLS regression with bank-specific and country-level controls and fixed effects.

Our results show that a positive and significant relationship exists between financial inclusion and bank stability. We also find that the depth (the ratio of loans and deposits to GDP) and credit growth (ratio of private credit to GDP) dimensions of financial inclusion are significant drivers of the positive relationship, while access or availability dimension does not affect bank stability in the MENA countries. The results support the notion that extending financial services to the larger segment of the population has the positive benefit of improving banks riskiness by enhancing the diversification of their portfolios. Our results also indicate that high market power (measured using the Lerner index) is positively correlated with bank stability and support the information hypothesis which suggests that a competitive banking sector can inhibit bank-customer relationship building, which in turn reduces access to financially opaque customers and thus increases banks' risk exposure due to the loss of diversification benefit from a diversified customer base. In addition, our results also suggest that the competition only enhances financial inclusion strategies that involve credit growth, but not for availability and depth dimensions.

Overall, our results support the notion that financial inclusion can enable sustainable growth at the household and country level. The positive association between financial inclusion and bank stability suggests that by including a large segment of the population in the financial system the banking sector soundness improves due to the diversification benefits on their loan portfolios. Our result also underlines the need for policy makers and regulators to be careful about liberalising their financial sector. As our findings suggest, high market power (low competitiveness) is not necessarily a negative notion. By exploiting these market powers, banks in countries with high information asymmetry like MENA countries can build relationships with

their customers by exploiting existing relationship which can draw in opaque customers, a situation that is less likely in a highly competitive banking sector. Thus, we edge policy makers to be cautious in implementing reforms aimed at improving competitiveness of the banking sector. We advise that such initiatives should be preceded by thorough review of existing market structure and power to ensure that these reforms do not lead to unintended consequences. Future research can explore the potential endogenous link between financial inclusion and bank stability. With a good instrument for the relationship between financial inclusion and bank stability, future studies further enhance our findings and provide more depth on our findings.

References

Agarwal, S. and Ben-David, I., 2018. Loan prospecting and the loss of soft information. Journal of Financial Economics, 129(3), pp.608-628

Ahamed, M.M. and Mallick, S.K., 2019. Is financial inclusion good for bank stability? International evidence. Journal of Economic Behavior & Organization, 157, pp.403-427.

Ahamed, M.M. 2016. Essays on bank profitability, stability and efficiency: the impact of financial inclusion and bank competition. Ph.D. thesis, Queen Mary University of London.

Allen, F., Carletti, E., Cull, R., Senbet, L., Valenzuela, P., 2014. The African financial development and financial inclusion gaps. J. Afr. Econ. 23, 614–642.

Allen, F., Demirguc-Kunt, A., Klapper, L., Peria, M.S.M., 2016. The foundations of financial inclusion: Understanding ownership and use of formal accounts. Journal of Financial Intermediation

Amidžic, G., Massara, M.A. and Mialou, A., 2014. Assessing countries' financial inclusion standing-A new composite index. International Monetary Fund.

Amir, R., 2003. Market structure, scale economies and industry performance. SSRNAngelucci, M., Karlan, D., Zinman, J., 2013. Win some lose some? Evidence from a randomized microcredit program placement experiment by Compartamos Banco. National Bureau of Economic Research

Anginer, D., Demirguc-Kunt, A. and Zhu, M., 2014. How does competition affect bank systemic risk?. Journal of financial Intermediation, 23(1), pp.1-26.

Aportela, F., 1999. Effect of Financial Access on Savings by Low-Income People.

Bachas, P., Gertler, P., Higgins, S. and Seira, E., 2021. How debit cards enable the poor to save more. *The Journal of Finance*, *76*(4), pp.1913-1957.

Bali, T.G., Brown, S.J. and Caglayan, M.O., 2014. Macroeconomic risk and hedge fund returns. Journal of Financial Economics, 114(1), pp.1-19.

Baumol, W.J., 1982. Contestable markets: an uprising in the theory of industry structure. American economic review, 72(1), pp.1-15.

Beck, T., De Jonghe, O., Schepens, G., 2013. Bank competition and stability: cross-country heterogeneity. J. Financial Intermediation 22, 218–244.

Beck, T., Demirgüç-Kunt, A. and Levine, R., 2007. Finance, inequality and the poor. Journal of economic growth, 12(1), pp.27-49.

Beck, T., Demirguc-Kunt, A. and Peria, M.S.M., 2007. Reaching out: Access to and use of banking services across countries. Journal of financial economics, 85(1), pp.234-266.

Beck, T., Demirgüç-Kunt, A. and Pería, M.S.M., 2011. Bank financing for SMEs: Evidence across countries and bank ownership types. *Journal of Financial Services Research*, *39*(1), pp.35-54.

Beck, T., Demirgüç-Kunt, A., Levine, R., 2003. Law, endowments, and finance. Journal of Financial Economics 70, 137-181

Beck, T., Demirgüç-Kunt, A., Maksimovic, V., 2004. Bank competition and access to finance: International evidence. Journal of Money, Credit, and Banking 36, 627-648

Berger, A.N., Klapper, L.F., Turk-Ariss, R., 2009. Bank competition and financial stability. Journal of Financial Services Research 35, 99-118.

Berger, A.N., Hannan, T.H., 1989. The price-concentration relationship in banking. The Review of Economics and Statistics, 291-299.

Bernheim, B.D. and Whinston, M.D., 1990. Multimarket contact and collusive behavior. The RAND Journal of Economics, pp.1-26.

Bikker, J.A., Shaffer, S. and Spierdijk, L., 2012. Assessing competition with the Panzar-Rosse model: The role of scale, costs, and equilibrium. Review of Economics and Statistics, 94(4), pp.1025-1044.

Boyd, J.H. and Prescott, E.C., 1986. Financial intermediary-coalitions. Journal of Economic theory, 38(2), pp.211-232.

Boyd, J.H. and Runkle, D.E., 1993. Size and performance of banking firms: Testing the predictions of theory. *Journal of monetary economics*, *31*(1), pp.47-67.

Burgess, R., Pande, R., 2005. Do Rural Banks Matter? Evidence from the Indian Social Banking Experiment. The American Economic Review 95, 780-795

Calomiris, C.W. and Kahn, C.M., 1991. The role of demandable debt in structuring optimal banking arrangements. The American Economic Review, pp.497-513

Caporale, G.M., Lodh, S. and Nandy, M., 2017. The performance of banks in the MENA region during the global financial crisis. Research in International Business and Finance, 42, pp.583-590.

Carbó-Valverde, S., Rodriguez-Fernandez, F., Udell, G.F., 2009. Bank Market Power and SME Financing Constraints. Review of Finance 13, 309-340

Čihák, M., Mare, D.S. and Melecky, M., 2016. The nexus of financial inclusion and financial stability: A study of trade-offs and synergies. World Bank Policy Research Working Paper, (7722).

Claessens, S. and Laeven, L., 2005. Financial dependence, banking sector competition, and economic growth. Journal of the European Economic Association, 3(1), pp.179-207.

Danisman, G.O. and Tarazi, A., 2020. Financial inclusion and bank stability: Evidence from Europe. The European Journal of Finance, 26(18), pp.1842-1855.

De la Torre, A., Yeyati, E.L. and Pienknagura, S., 2013. Latin America and the Caribbean as Tailwinds Recede: In Search of Higher Growth (LAC Semiannual Report, April 2013). World Bank Publications.

Dell'Ariccia, G. and Marquez, R., 2004. Information and bank credit allocation. Journal of financial Economics, 72(1), pp.185-214.

Demirgüç-Kunt, A. and Huizinga, H., 2010. Bank activity and funding strategies: The impact on risk and returns. Journal of Financial Economics, 98(3), pp.626-650.

Demirgüç-Kunt, A. and Singer, D., 2017. Financial inclusion and inclusive growth: A review of recent empirical evidence. World Bank Policy Research Working Paper, (8040).

Demirgüç-Kunt Beck, T. and Honohan, P., 2008. Finance for all?: Policies and pitfalls in expanding access. World Bank.

Di Patti, E.B. and Dell'Ariccia, G., 2004. Bank competition and firm creation. Journal of Money, Credit and Banking, pp.225-251.

Diamond, D.W., 1984. Financial intermediation and delegated monitoring. The Review of Economic Studies 51, 393-414

El Moussawi, C. and Mansour, R., 2022. Competition, cost efficiency and stability of banks in the MENA region. The Quarterly Review of Economics and Finance, 84, pp.143-170.

Emara, N. and El Said, A., 2021. Financial inclusion and economic growth: The role of governance in selected MENA countries. International Review of Economics & Finance, 75, pp.34-54.

Fang, Y., Hasan, I., Marton, K., 2014. Institutional development and bank stability: evidence from transition countries. J. Bank. Finance 39, 160–176.

Fungáčová, Z. and Weill, L., 2015. Understanding financial inclusion in China. China Economic Review, 34, pp.196-206.

Gertler, P., Levine, D.I. and Moretti, E., 2009. Do microfinance programs help families insure consumption against illness?. Health economics, 18(3), pp.257-273.

Hakimi, A., Boussaada, R. and Karmani, M., 2022. Are financial inclusion and bank stability friends or enemies? Evidence from MENA banks. Applied Economics, 54(21), pp.2473-2489.

Han, R. and Melecky, M., 2013. Financial inclusion for financial stability: Access to bank deposits and the growth of deposits in the global financial crisis. World Bank policy research working paper, (6577).

Hassan, M.K., Sanchez, B., Ngene, G.M. and Ashraf, A., 2012. Financial liberalization and foreign bank entry on the domestic banking performance in MENA countries. African Development Review, 24(3), pp.195-207

Karlan, D., Ratan, A.L. and Zinman, J., 2014. Savings by and for the Poor: A Research Review and Agenda. Review of Income and Wealth, 60(1), pp.36-78.

Karlan, D., Zinman, J., 2010. Expanding credit access: Using randomized supply decisions to estimate the impacts. Review of Financial Studies 23, 433-464.

Khan, H.R., 2011. Financial inclusion and financial stability: are they two sides of the same coin. Address by Shri HR Khan, Deputy Governor of the Reserve Bank of India, at BANCON, pp.1-12.

Laeven, L., Levine, R., 2009. Bank governance, regulation and risk taking. J. Financial Econ. 93, 259–275.

Lee, J.K., 2002. Financial liberalization and foreign bank entry in MENA. World Bank, pp.1-59.

Leon, F., 2015. Measuring competition in banking: A critical review of methods. CERDI Working papers, (halshs-01015794).

Levine, R., Loayza, N. and Beck, T., 2000. Financial intermediation and growth: Causality and causes. Journal of monetary Economics, 46(1), pp.31-77.

Levine, R., 2005. Finance and growth: theory and evidence. Handbook of economic growth, 1, pp.865-934.

López, T. and Winkler, A., 2019. Does financial inclusion mitigate credit boom-bust cycles?. Journal of Financial Stability, 43, pp.116-129.

Love, I. and Martínez Pería, M.S., 2015. How bank competition affects firms' access to finance. The World Bank Economic Review, 29(3), pp.413-448.

McKinnon, R.I., 1973. Money and capital in economic development (Washington, DC: Brookings Institution, 1973). McKinnonMoney and Capital in Economic Development1973.

Mehrotra, A.N. and Yetman, J., 2015. Financial inclusion-issues for central banks. BIS Quarterly Review March.

Morgan, P.J. and Zhang, Y., 2017. Mortgage lending, banking crises, and financial stability in Asia and Europe. Asia Europe Journal, 15(4), pp.463-482.

El Moussawi, C. and Mansour, R., 2022. Competition, cost efficiency and stability of banks in the MENA region. The Quarterly Review of Economics and Finance, 84, pp.143-170.

OECD, 2008. Handbook on Constructing Composite Indicators: Methodology and User

Owen, A.L. and Pereira, J.M., 2018. Bank concentration, competition, and financial inclusion. Review of development finance, 8(1), pp.1-17.

Park, C.Y. and Mercado, R.V., 2021. Financial inclusion: New measurement and cross-country impact assessment 1. In Financial Inclusion in Asia and Beyond (pp. 98-128). Routledge.

Peltzman, S., 1977. The gains and losses from industrial concentration. The Journal of Law and Economics, 20(2), pp.229-263.

Petersen, M.A. and Rajan, R.G., 1994. The benefits of lending relationships: Evidence from small business data. *The journal of finance*, *49*(1), pp.3-37.

Poghosyan, T. and Čihak, M., 2011. Determinants of bank distress in Europe: Evidence from a new data set. Journal of Financial Services Research, 40(3), pp.163-184.

Prasad, E.S., 2010. Financial sector regulation and reforms in emerging markets: An overview.

Petersen, M.A. and Rajan, R.G., 1995. The effect of credit market competition on lending relationships. The Quarterly Journal of Economics, 110(2), pp.407-443.

Rajan, R.G., 2015. Fault lines-how hidden fractures still threaten the World Economy, ISBN: 978-93-5029-173-3. Journal of Business Thought, pp.137-139.

Roengpitya, R., Tarashev, N.A., Tsatsaronis, K., 2014. Bank business models. BIS Q. Rev., 55–65.

Ryan, R.M., O'Toole, C.M., McCann, F., 2014. Does bank market power affect SME financing constraints? Journal of Banking & Finance.

Tabak, B.M., Fazio, D.M. and Cajueiro, D.O., 2012. The relationship between banking market competition and risk-taking: Do size and capitalization matter?. Journal of Banking & Finance, 36(12), pp.3366-3381.

Sahay, M.R., Cihak, M., N'Diaye, M.P., Barajas, M.A., Mitra, M.S., Kyobe, M.A., Mooi, M. and Yousefi, M.R., 2015. Financial inclusion: can it meet multiple macroeconomic goals?. International Monetary Fund

Schaeck, K. and Čihák, M., 2010. Competition, efficiency, and soundness in banking: An industrial organization perspective. European banking center discussion Paper, (2010-20S).

Schumpeter, J.A. and Nichol, A.J., 1934. Robinson's economics of imperfect competition. Journal of political economy, 42(2), pp.249-259.

Sha'ban, M., Girardone, C. and Sarkisyan, A., 2020. Cross-country variation in financial inclusion: a global perspective. The European Journal of Finance, 26(4-5), pp.319-340.

Shaffer, S., 1983. The Rosse-Panzar statistic and the Lerner index in the short run. Economics Letters, 11(1-2), pp.175-178.

Shaffer, S., 2004. Patterns of competition in banking. Journal of economics and business, 56(4), pp.287-313.

Shaffer, S. and Spierdijk, L., 2013. Duopoly conduct and the 185anzer-rosse revenue test. University of Wyoming and University of Groningen mimeograph.

Sharpe, S.A., 1990. Asymmetric information, bank lending, and implicit contracts: A stylized model of customer relationships. The Journal of Finance 45, 1069-1087

Stiglitz, J.E., 1987. Competition and the number of firms in a market: Are duopolies more competitive than atomistic markets?. Journal of political Economy, 95(5), pp.1041-1061.

World Bank 2022. The Global Findex Database 2021: Financial Inclusion, Digital Payments, and Resilience in the Age of COVID-19. [online] Available at: <https://www.worldbank.org/en/topic/financialinclusion/overview#:~:text=Financial%20inclusion%20means%20that%20individuals,a%20responsible%20and%20sustainable%20way.> [Accessed 15 July 2022].

World Bank. 2022. *Financial Inclusion: Financial inclusion is a key enabler to reducing poverty and boosting prosperity*. [Online] [Accessed 20 July 2022]. Available from https://www.worldbank.org/en/topic/financialinclusion/overview#:~:text=Financial%20inclusion%20means%20that%20individuals,a%20responsible%20and%20sustainable%20way.

World Economic Forum, 2019: https://www3.weforum.org/docs/WEF_Future_of_Jobs.pdf.

World Bank. 2022. *Financial Inclusion: Financial inclusion is a key enabler to reducing poverty and boosting prosperity*. [Online] [Accessed 20 July 2022]. Available from <https://www.worldbank.org/en/topic/financialinclusion/overview#:~:text=Financial%20inclusion%20means%20that%20individuals,a%20responsible%20and%20sustainable%20way.

Appendix 4A: Variable Definitions

Variable	Definition	Source
Dependent variables		
ln (Z-score)	Natural logarithm of the sum of return on average asset (ROA) and equity over total asset divided by the 3-year standard deviation (rolling window) of ROA.	Bank Focus
ln (Sd (ROA)	Natural logarithm of the Standard deviation of ROA multiplied by -1	Bank Focus
Financial inclusion measures (Country level data)		
FI-Index	Financial inclusion index constructed using principal component analysis (PCA) of availability and usage measures of financial inclusion.	Author's calculation (Data: Financial Access Survey-IMF)
Availability index	Availability dimension of financial inclusion measured using PCA of four variables (Number of ATM per 100km 2; Number of ATM per 100,000 adults; Bank branches per 1000 adults; Bank branches per 1000km2).	Author's calculation (Data: Financial Access Survey-IMF)
Depth dimension Loan and deposit (%GDP)	Sum of outstanding loans and deposits as a percentage of GDP	Global Financial Development Database (GFDD).
Bank level variables		
Loan Ratio	Total performing loans over total assets	Bank Focus
Bank Size	Natural logarithm of total asset	Bank Focus
Non-performing loans	Total loan loss over total asset	Bank Focus
Income Diversification	Non-interest income over operating income	Bank Focus
Management Quality	Total earning assets over total assets	Bank Focus
Capitalisation	Total equity over total asset	Bank Focus
Lerner index	Bank level measure of competition (market power) using stochastic frontier analysis assuming full efficiency with higher value indicator low competition in the banking sector	Author's calculation (Data Bank Focus)
Country level data		
ln GDP per capita	Gross domestic product divided by mid-year population	World Development Indicators-World Bank
GDP growth	Annual percentage change of gross domestic product (US current)	World Development Indicators-World Bank
Domestic credit to GDP	Domestic credit to private sector refers to financial resources provided to the private sector.	Global Financial Development Database (GFDD)

Note: The table defines the variables used in the analysis and data sources.

Appendix 4B: Stochastic Frontier Analysis

In estimating the marginal cost for the Lerner Index, we follow the approach of prior studies (Berger et al. 2009; Koetter et al., 2012; Beck et al., 2013; Ahamed and Mallick, 2019) by modelling the total cost of running the bank as a function of aggregate outputs (Q_{it}). The translog total cost function is specified for bank $i = 1, \dots, N$ at time $t = 1, \dots, T$, as:

$$lnTOC_{it} = \beta_0 + \sum_{j=1}^{3} B_j \ln w_{j,i,t} + \gamma_1 lnQ_{it} + \delta lnZ_{it} + \sum_{j=1}^{3} \left(\frac{\tau_j}{2}\right) lnw_{j,it}^2 + \sum_{j}^{3}\sum_{k}^{3} \eta_{jk} \ln w_{j,i,t} \ln w_{k,i,t} + \left(\frac{\theta}{2}\right) lnQ_{it}^2 + \sum_{j=1}^{3} \lambda_j \ln w_{j,i,t}\ lnQ_{it} + \sum_{j=1}^{2} \rho_k\, trend^k + \sum_{j=1}^{3} \varepsilon_j\, w_{j,i,t}\, trend + \omega_1 lnQ_{it} trend + \varepsilon_{it} \quad (4.B1)$$

where TOC_{it} is the total operating cost (total operating expenses); Q_{it} represents the bank's output or total asset for bank i at time t; $w_{j,i,t}$ $(j = 1,2,3)$ are the input prices. The three input prices capture; the price of funds (total interest paid on deposits/total deposits) (w_1), the price of labour (labour cost/number of employees) (w_2), and the price of capital (total operating costs fewer labour costs/total asset (w_3) of bank for bank i at time t; Z_{it} is total equity of bank i at time t; $trend$ is the time trend to capture technology. We impose homogeneity of degree 1 on input prices by dividing all factor prices and TOC_{it} by w_1. equation 4.B1 is estimated using the stochastic frontier analysis.

The marginal cost is then calculated as the first derivative equation 4.B1 with respect to Q_{it}

$$MC_{it} = \frac{\partial TOC_{it}}{Q_{it}} = \frac{C_{it}}{Q_{it}}\left[\gamma_1 + \theta_1\ lnQ_{it} + \sum_{j=1}^{3} \lambda_j \ln w_{j,i,t} + \omega_1\ trend\right] \qquad (4.B1)$$

Chapter 5

Conclusion

This thesis examines the determinants of financial inclusion across (Islamic and non-Islamic), gender gap, FinTech, bank competition and stability. Specifically, the thesis is composed of three empirical chapters with a focus on (i) the factors that explain differences in financial inclusion across Islamic and non-Islamic countries and the gender gap; (ii) the role of FinTech on financial inclusion; and (iii) how bank competition and financial inclusion affect the stability (soundness) of banks.

The World Bank and development institutions have emphasised that increasing financial inclusion is crucial for decreasing poverty and boosting economic growth. Providing access to financial services and products for disadvantaged groups has numerous advantages, including improved resource allocation, better social and political stability, and greater innovation. In the first empirical paper (Chapter 2), we investigate whether country-specific characteristics can explain the differences in financial inclusion across Islamic and non-Islamic countries. The study employs OLS regressions with country and year fixed effects using a sample of 157 Islamic and non-Islamic countries from 2011 to 2017. The findings indicate that GDP per capita (macroeconomic factor), non-discrimination, human development index, and gender inequality (social factors), government integrity (institutional factor), mobile subscriptions and percentage of individuals using the internet (technological factors), and the Boone indicator (banking factor) are important determinants of financial inclusion across Islamic and non-Islamic countries and across male and female account ownership.

These results are useful for policymakers, especially regarding enhanced access to internet coverage and mobile subscriptions. Likewise, Islamic regions can make their banking system

more inclusive by promoting the use of sharia-compliant financial instruments, which in turn can encourage individuals self-excluded due to their religious reasons to participate in the financial system.

Mobile financial services, a key FinTech segment with the potential to bridge the gap between the banking system and unbanked adults, has become an important channel of financial intermediation, especially in developing countries. In the second empirical paper (Chapter 3), we examine the link between country-level FinTech and financial inclusion. We use a sample of 46 countries for the period 2008-2019 and OLS regressions with country and time-fixed effects to measure the effect of FinTech on financial inclusion in low GDP, high inequality, and high FinTech countries. Our findings reveal that: (i) FinTech has a positive and statistically significant link with financial inclusion; (ii) FinTech affects the level of financial inclusion in low income countries; (iii) FinTech negatively affects financial inclusion in high income countries; and (iv) the effect of FinTech on financial inclusion is higher in countries with high FinTech adoption. Our results are robust to using alternative measures of financial inclusion (the number of credit cards per 1000 adults) and FinTech (the number of mobile and internet banking transactions). These results suggest that FinTech adoption should be accelerated to promote financial inclusion, especially in developing countries where access to financial services is still low and mobile money services are low-cost alternatives for the unbanked population.

When the financial system is more inclusive, this offers banks the opportunity to diversify lending and funding, while enabling a stronger connection with clients who were earlier excluded from the formal financial system. However, increasing access to financial services for low income groups is seen to be risky, due to information asymmetry and credit risk. This phenomenon has led to questions of whether financial inclusion complements or impairs bank stability. In the third empirical paper (Chapter 4), we explore these issues by investigating the

relationship between financial inclusion and bank stability, as well as the role of bank competition in moderating this relationship. The study utilises data on 1,361 bank-year observations on 241 MENA banks for the period 2012-2021. First, we construct a country-level index of financial inclusion using principal component analysis. Second, we construct bank-level measures of stability using the Z-score. We also construct the Lerner index (market power) as a proxy for banking market competition. We estimate the relationship between financial inclusion, competition and bank stability using an OLS regression with bank, country and year fixed effects. The results show that financial inclusion is positively and significantly associated with bank-level soundness or stability. Our findings also suggest that high market power (measured using the Lerner index) is positively correlated with bank stability.

This study is subject to some limitations. Firstly, the sample of Islamic countries for the first empirical chapter is restricted to those Islamic countries for which there is available data on the determinants of financial inclusion. In addition, given the multidimensional nature of financial inclusion, the study intended to capture financial inclusion in a comprehensive manner; however, the choice of the measure of financial inclusion in the chapter was limited by the availability of consistent data. Secondly, we attempt to examine the effect of FinTech on financial inclusion in the second empirical paper focusing on different levels of income, income inequality, and FinTech adoption. However, there is limited data on FinTech, especially for developing countries, which in turn restricts the sample countries to 46 with a significant variation in the observations across the countries. As such, our results can potentially be biased by missing observations for some of the countries as well as those that were excluded. Finally, in our third empirical paper, we focus on MENA countries in examining the association between bank stability, competition and financial inclusion. Similar to the other empirical chapters, bank-level data are missing for many banks in this region or available only for a limited number of years. These restrictions reduce the sampled banks from around 600 to 245 (about 40%).

The research on financial inclusion can be improved by considering additional measures and dimensions when constructing the financial inclusion index. Future research on the effect of FinTech on financial inclusion may be complemented by examining women's access to mobile money services across different demographic groups and challenges such as social norms and regulations that could financially exclude women in some countries.